# Th9x

MANUAL EURGLE TH9X NG

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|---|---|---|
| Version: | V1.1 | |
| | V1.2 | Firmware r46 |
| | V1.3 | Firmware r59 |
| ©2010 | Thomas Husterer | |

# Contents

# 1 Introduction

The remote control Eurgle th9x, also sold under some other labels like Imax, Turborix or Turnigy manufactured by FlySky is a very low cost 2.4GHz radio with impressive hardware-features but with a less convincing firmware.
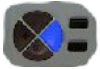
# 2 Performance

- 16 model memories
- two stage mixer allows any combination of input-channels to form output signals
- adjustable signal delay for each mixer line even with different values for up and down movement
- 4 pitch curves with 5 or 9 nodes
- dynamic memory management
- servo reverse feature and tunable servo range limits
- expo and dual rate features
- tunable battery warning
- support for display lightening (hardware upgrade necessary)
- trainer mode with selectable channel behaviour
- stick calibration
- timer with three modes
- option-switches for several features.

# 3 Menu structure

## 3.1 Basic concepts

*six buttons are available for operator interface.*

| key | | function |
|---|---|---|
| | *key left* | ➡ *move to previous menu*<br>➡ *ore move cursor left, or decrease a value* |
| | *key right* | ➡ *move to next menu*<br>➡ *or move cursor right or increase a value* |
| | *key up* | ➡ *move cursor up*<br>➡ *or increase a value* |
| | *key down* | ➡ *move cursor down*<br>➡ *or decrease a value* |
| | *key menu* | ➡ *open a submenu*<br>➡ *or confirm an action* |
| | *key exit* | ➡ *exit current menu and return to the calling menu. This is onlyvalid when the cursor is positioned at the top right edge*<br>➡ *else move the cursor to the top right edge* |
| *LONG* | *key exit* | ➡ *return immediately to the uppermost screen* |

- ▪ Key can be pressed short or long or very long and each time another action can be triggered
- ▪ Most actions appear immediately after a sort key-press.
- ▪ When a key is pressed for long time, then an action is repeated
- ▪ In some cases a long-time keypress is required to trigger the action. This behaviour is used for preventing unintentional operations in the opi.

■ There is no undo functionality. If you change a value or remove something by mistake then you have to re-edit the former values manually.

■ Attention!! Values are stored to the EEPROM-Memory with a short time-delay after the last keypress. The storage procedure is announced by some buzzer-beeps

## 3.2 Main screen
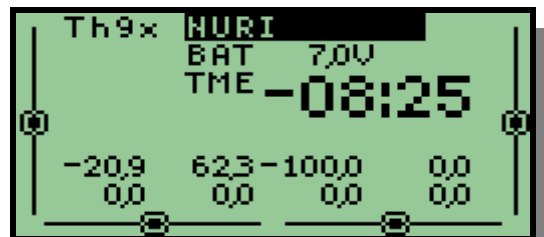


Screen contents:

■ the current model name (NURI)

■ a cursor selection either at Th9x or at the model name

■ the battery voltage (6.9V)

■ the remaining timer value

■ the output values by numbers..

■ ..or in a grafical representation

■ the trimmer values in a grafical representation.

| key | function |
|---|---|
| LONG | Open menu-set *'Global Setup'* |
| LONG | Open menu-set *'Model-specific Setup'* |
| LONG | Move to menu *'Timing statistic'* |
| | Change output view mode from *grafical view to numeric view* |

| | |
|---|---|
| Trim keys | *Change the Trim Values.*<br>*Attention!! the values are evaluated in a non linear manner.* |
|  | *move cursor left* |
|  | *move cursor right* |
|  LONG | *Open menu-set* **'Global Setup'**<br>*or Open menu-set* **'Model-specific Setup'** |
|  LONG | *reset timer* |
|  | *stop timer alarm.* |

## 3.3 Model-specific Setup

This set of menus does handle any settings which are related to one unique model. All menus are consecutively numbered and they are cycled by pressing the left or right key. The menü 1/7 is used to select one of 16 memory slots which holds any setup-data related to one model.

| key | function |
|---|---|
|  | *cycle through the model menus* |

### 3.3.1 Model selection 1/7



Select one of 16 memory-slots by cursor movement up or down. Then activate this slot by pressing exit or by cycling to the next model-menu.

Please notice the memory free value in the title line. If this value gets lower than about 200 bytes then you should remove some model slots. Properly storage operation is only guaranteed if enough memory is available.

| key | function |
|---|---|
|  | *Select memory slot by cursor movement.* |
|  | *cycle to next menu* |
|  | *back to main screen* |
|  | *select current line for edit commands.(model name is blinking)* |
|  | *move current line up ur down.* |
|  | *duplicate the selected model into next free memory-slot.* |

## 3.3.2 Model basic setup 2/7
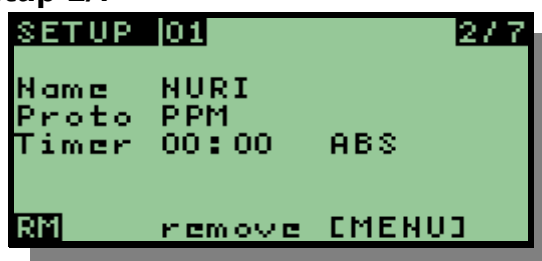


- In edit field 'Name' you can change the model name. For this reason move the cursor right to a character position and then change the value.

- In field 'Proto' you can select one of several transmitter protocols. Normaly you select PPM here.

- In field Timer you can preset a count down start value and a count down mode. This value is then decremented according to the selected modeOFF / ABS / THR / THR%.

    - OFF: no decrementing.
    - ABS: always count down.
    - THR: only count down when the Throttle Stick is not in its neutral position.
    - THR%: like before, but count down more or less fast dependent to the THR-position.

- When the cursor is positioned to RM then the whole model memory can be removed by pressing menu

| key | function |
|---|---|

| | | |
|---|---|---|
| 1. | | *move cursor up and down* |
| 2. | | *move cursor left rigth* |
| 3. | oder | *change vlaues* |
| 4. | | *reset cursor to the upper right edge* |
| 5a | | *leave this menu* |
| 5b | | *cycle to the next menu* |
| | LONG | *Remove this model memory. Only valid if Cursor is positioned at RM.* |

### 3.3.3 Expo function 3/7



```
EXPO/DR              3/7
        Exp   DrSw  DrExp
RUD      0
THR      0
ELE     70    ELE    14
AIL     66
```
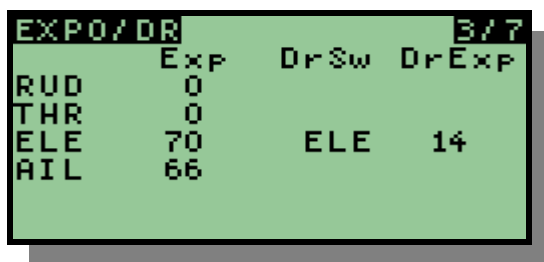
In this menu you can set up an exponential behaviour for each of the four sticks. Select a value between -100 up to +100.

You can open a submenu '**Expo function Details**' to see even more settings like a dual-Rate-switch and a dual rate expo function.

| | key | function |
|---|---|---|
| 1. | | *move cursor up and down* |
| 2. | | *change vlaues* |
| 3a | | *open menü **Expo function Details*** |
| 3b | | *reset cursor to the upper right edge* |
| 4a | | *leave this menu* |
| 4b | | *cycle to the next menu* |

### 3.3.4 Expo function Details
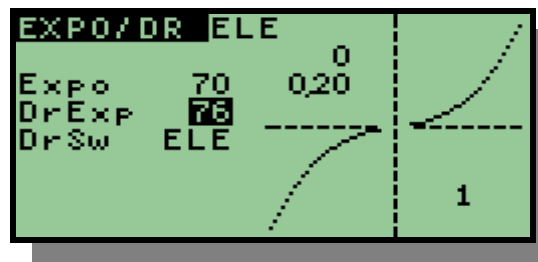


You can change the two expo values an the expo switch in this menu. In the diagram you see the shape of the expo function.

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### 3.3.5 setup trim values 4/7
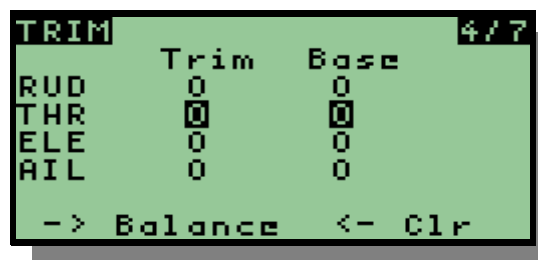


Here you can swap the trim values to a base value. After this operation, the trim values in the main screen are repositioned to zero.

| | key | function |
|---|---|---|
| 1. | | move cursor up and down |
| 2a. | | add the trim value to the base value and reset the trim value to zero |
| 2b. | | reset the base value, |
| 3. | | reset cursor to the upper right edge |
| 4a | | leave this menu |
| 4b | | cycle to the next menu |

12

### 3.3.6 Mixer 5/7

```
MIXER                    5/7
CH1  -80% ELE
      100% AIL
       20% AIL   ID1  |x|
CH2   80% ELE
      100% AIL
      -20% AIL   ID1  |x|
CH3  100% THR
```
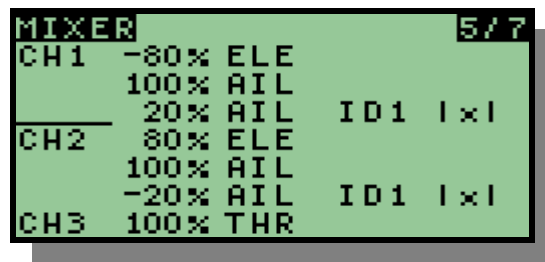
This menu is the most important menu of the whole arrangement. You can combine here several Inputs like stick values, poti-values or constants into each one of the output channels. Additionaly there are four Helper channels which are used as temporary values X1-X4. These values are calculated first, and can then be used as inputs.

Each mixer line can contain a weight, an input channel, an optional switch, a curve and some delay values. Switches are available in a normal or in an inverted style.

Curves:

There are 8 kinds of curves:  -- , >0  , <0 ,  |x| , cv1, cv2, cv3 und cv4

- -   : no curve, bzw. y=x

- >0 :  y=x | x>0, else y=0

- <0 :  y=x | x<0  else y=0

- |x|    y=|x|

- Cv1..Cv4 Use one of four user defined curves.
  Cv1 and Cv2 have 5 nodes at x=-100, -50, 0, 50, 100;
  Cv3 and Cv4 have 9 nodes at x=-100, -75, -50, -25, 0, 25, 50, 75, 100

|    | key | function |
|----|-----|----------|
| 1. |     | *move cursor at or between two lines* |
| 2a. |    | *change weight value.* |
| 2b. |    | *Open menu 'Edit-Mixer'. if the cursor was positioned between two lines, then a new line is generated, else the curent line is edited.* |
| 3. |     | *reset cursor to the upper right edge* |
| 4a |     | *leave this menu* |
| 4b |     | *cycle to the next menu* |

### 3.3.7 Edit Mixer

```
EDIT MIX CH1
    AIL SRC
    20 PRC
  |x| CURVE
  ID1 SWTCH
< 0 > 0 SPEED

  RM remove [Menu]
```

In this menu you can adjust all the details of one single mixer line.

- *SRC: select the input channel* **RUD, THR, ELE, AIL, P1, P2, P3, X1, X2, X3, X4, MAX FUL***.*
  with **MAX** you can emit a constan value 0 or +100%

  with *FUL you can emit a constan value -100% or +100%*

- PRC: weight from -125% to +125%

- CURVE: one of eight curve types.

- SWTCH: a switch. Dependent from the SRC-Value the switch acts in two different manners.

  When SRC=MAX or FUL then the switch selects one of two fixed values as input values and the line is calculated with the whoe set of parameters.
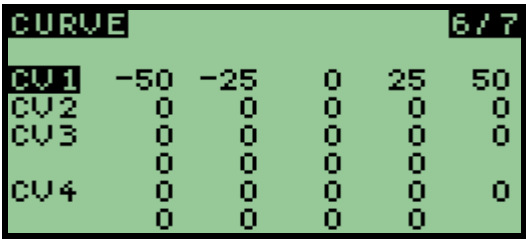
  When SRC!=MAX or FUL then the switch can switch on the whole line or it can switch off the whole line. In the last case no one of the remaining parameter has any effect.

- SPEED: These two values determine the speed in which rising or falling input values are propagated to the output channel

- RM: This field is used to remove the whole mixer-line.

|  | key | function |
|---|---|---|
| 1. | | *move cursor up and down* |
| 2a. | | *change vlaues* |
| 2b | | *remove whole line,. Tis is only valid  when cursor is at **RM**.* |
| 2c | | *edit curve. This is only valid when cursor is at **CV1**-**CV4*** |
| 3. | | *leave menu* |

### 3.3.8 Curve 6/7
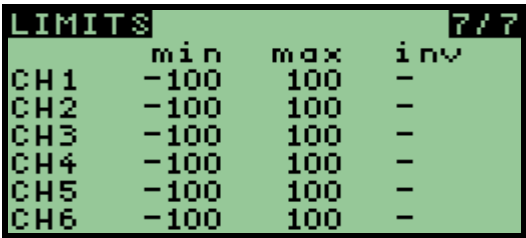
```
CURVE                  6/7
CV1   -50  -25    0   25   50
CV2     0    0    0    0    0
CV3     0    0    0    0    0
        0    0    0    0
CV4     0    0    0    0    0
        0    0    0    0
```

### 3.3.9 Edit Curve

```
CURVE 1
-50
-25
  0
 25
 50
PRESET
```
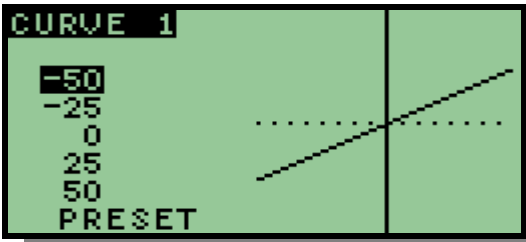
| | key | function |
|---|---|---|
| 1. | | *move cursor up / down* |
| 3. | | *change value.* |
| | | *select predefined curve. Tjhis is only valid if cursor is at PRESET* |
| 4 | | *leave menu* |

### 3.3.10 Limits 7/7

```
LIMITS                 7/7
        min   max   inv
CH1    -100   100    -
CH2    -100   100    -
CH3    -100   100    -
CH4    -100   100    -
CH5    -100   100    -
CH6    -100   100    -
```

In this menu you can revert output channels and you set up the output value limits.

| | key | function |
|---|---|---|
| 1. | | *move cursor up / down* |
| 2. | | *move cursor to a column.* |
| 3. | | *change value.* |
| 4 | | *reset cursor to the upper right edge* |
| 5a | | *leave menu* |
| 5b | | *cycle to the next menu* |

## 3.4 Global setup, diagnosis and calibrating

In this group of menus is combined any setups that are not model specific. The menus are numbered as well and can be cycled with the left and right keys as the group above.

| key | function |
|---|---|
| | *Cycle through the menus. This is only valid if the cursor is positioned at the upper right edge.* |

### 3.4.1 Global Setup I

```
SETUP BASIC        1/7

30   CONTRAST
5.0V BAT WARNING
 -   LIGHT

Mode  ↔⊙  ↕⊙  ⊙↕  ⊙↔
 2   RUD THR ELE AIL
```

In this menu you can change some global values.

Screeen contents:
- The contrast value.
- The warning level for the battery voltage alarm.

16

- A switch which is used to control the lcd-backlight.
  Attention! This feature requires a hardware extension..

- The mode selection is used to assign a specific function to any input stick. At the end it changes the labels which are shown in all other menus where input values are selected.

| | key | function |
|---|---|---|
| 1. | | move cursor up / down |
| 2. | | change values |
| 3. | | reset cursor to the upper right edge |
| 4a. | | leave this menu |
| 4b | | cycle to the next menu |

### 3.4.2 Global Setup II (Options)

```
SETUP OPTS          2/7

    OFF THR Warn
    OH  SW  Warn
    OH  Mem Warn
    OH  Key Beep
```
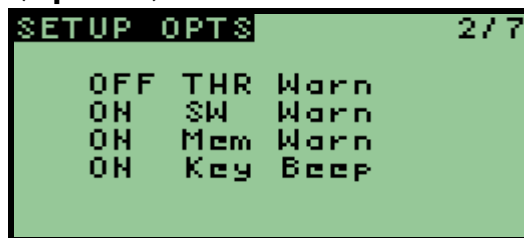
In this menu you can select several options like warnings or the key-beep.

### 3.4.3 Trainer Mode

```
TRAINER             3/7

RUD off    0 ch1    -
THR off    0 ch1    -
ELE off    0 ch1    -
AIL off    0 ch1    -

Cal    0,0   0,0   0,0   0,0
```
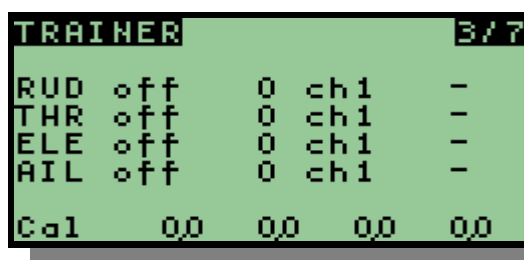
Here you can decide how each Input stick is handled in trainer mode.

Each line shows:
- RUD    the input channel in the trainer radio
- off     no student activity

- ◢ +=      trainer and student values are both added and then used as input signal
- ◢ :=      only the student controls this channel
- ◢ 98      the students values are weighted by this value
- ◢ ch1     this is the channel number which is received from the students radio. In the students radio this channel has to be connected to one single stick.
- ◢ RUD     Here you can define a switch which controls this trainer line
- ◢ Cal:    This line shows the input values which are received from the students radio. If you press Menu, then the current values are defined as reference values for the student inputs.

### 3.4.4 Software Version

```
VERSION              4/7

VERS: V1.1233-thus
DATE: 10.05.2010
TIME: 22:37:39
```

Shows the current software version

|      | key | function |
|------|-----|----------|
| 1a. |     | *leave this menu* |
| 1b  |     | *cycle to the next menu* |

### 3.4.5 key diagnosis

```
DIAG      THR 0        5/7
          RUD 0
 Left 0   ELE 0
Right 0   ID1 0   Trim- +
   Up 0   ID2 0   ↔⬡  0  0
 Down 0   AIL 0   ↕⬡  0  0
 Exit 0   GEA 0   ⬡↕  0  0
 Menu 0   TRN 0   ⬡↔  0  0
```

Show the current levels of any key,switch or trim-switch

|  | key | function |
|---|---|---|
| 1a. |  | leave this menu |
| 1b |  | cycle to the next menu |

## 3.4.6 Diagnosis of Analogue inputs and calibrating of battery voltage measurement



Shows the values of all analogue inputs with 10 bit resolution. The stick-values are also shown in %.

Value number eight shows the battery voltage. Here you can also calibrate the shown voltage level.

|  | key | function |
|---|---|---|
| 1. |  | move cursor up and down |
| 2. |  | change shown battery voltage. |
| 3. |  | reset cursor to the upper right edge |
| 4a. |  | leave this menu |
| 4b |  | cycle to the next menu |

## 3.4.7 Calibrating the sticks

With the help of this menu you can calibrate the values of all four sticks in a four step procedure.

The procedure requires moving the sticks, then hold them and then press cursor down while holding the sticks..

| | key | function |
|---|---|---|
| *1.* | | �*move cursor to* **SetMid** <br> �*move all sticks into the center position.and hold them* |
| *2.* | | �*move cursor to* **SetLow** <br> �*move all sticks to the lower left edge and hold them.* |
| *3.* | | �*move cursor to* **SetHigh** <br> ➬*move all sticks to the upper right edge and hold them.* |
| *4.* | | ➬*move cursor to* **Ready** <br> ➬*now its finished* |
| *5* | | *change to previous menu and check the shown persentage values.* |

20

# **4** **Function**

## 4.1 Power on sequence

During power on sequence some important tests are executed.

First the EEPROM data is loaded and verified. In case of fault a warning is given and the whole EEPROM is formatted.

After this it is checked if free memory is enough.to store at least one additional model memory. In case of fault a warning is given.

After this it is checked that the throttle stick is located at its initial position. In case of fault a warning is given.

Then any switches are checked. If at least one switch is not in its off-position then we are led to the switches dialog which shows us any swith value.

Each warning screen can be left with te exit key.

## 4.2 Data flow

How we mentioned earlier, this radio works with a  very simple calculation model. Any stick value and any switch value is considered to calculate the value of the outputs. Special attention is taken to handle any input with the same priority and without any special function dependent meaning.
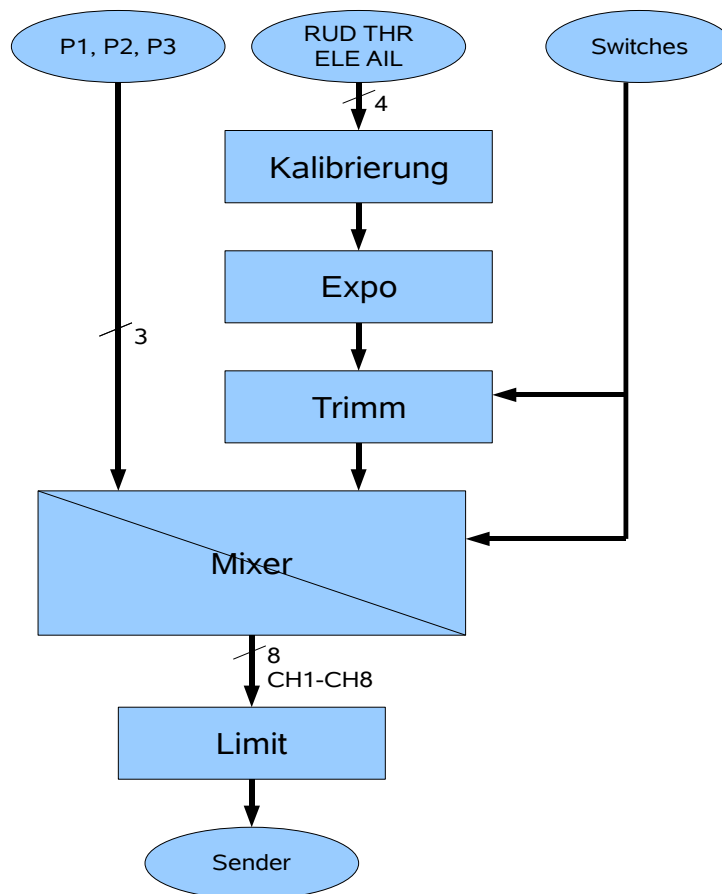
Daten-Fluss-Diagramm:

## 4.2.1 Calibrating

This first block changes the 10bit AD-value into a symmetrical value from -512 up to +511. It is guaranteed that the center position of the sticks leads to the value 0. Poti-values are handled according to this.

## 4.2.2 Expo

The expo function transfers the linear input values into some output values with non linear behaviour. This means that the sensibility of a stick is dependent from the working position of this stick.

As an approximation to the expo-function the following polynom is used.

$y = f(x) = x^3 * k + x * (k-1)$   with $0 < k < 1$

y = f(x) = x^k  mit 1<=k<=3
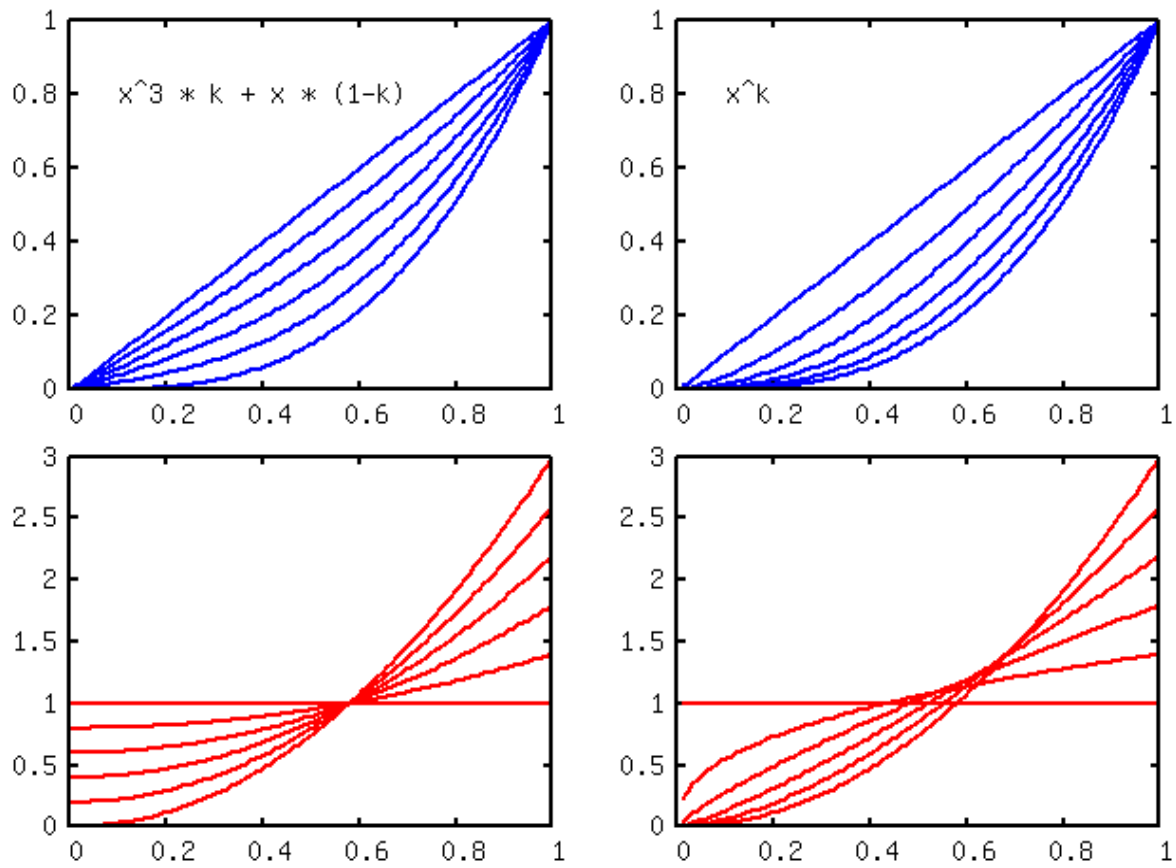


This diagram shows both curves, the polynom and the original expo-function in a blue colored line. The lines in red show the derivation of the blue line. Therefore you can recognize the sensitivity of the stick at several working positions..

The polynom was used in the implementation because we can evaluate it without usage of any floating point arithmetics.

```
#define RESX   512ul
#define RESK   100ul
uint16_t expou(uint16_t x, uint16_t k)
{
  // k*x*x*x + (1-k)*x
  return ( (unsigned long)x * x * x / 0x10000 * k /
             (RESX*RESX/0x10000)
         + (RESK-k) * x + RESK / 2 ) / RESK;
}
```

This implementation needs only one real 32-bit Integer-Division.

### 4.2.3 Trim

This block adds the current trim-value to the associated input value..

   This trim value is generated by pressing the trim-keys.The range of this trim -value is -31 to +31. This value is directly shown in the grafical representation in the main screen. To extend this value range at up to +/. 512 we use a quadratic polynom..
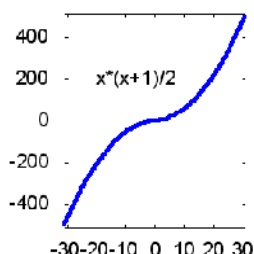
This polynom allow a resolution of 1 in the mid range and it reduces the resolution in outer ranges. At the same time we can reach the whole value range in 31 stepts.

### 4.2.4 Mixer

The mixer block combines several input channels to the output channels. The inputs are weighted by some persentage-value an they are assigned to the outputs. Additional to this weight we can assign a user defined curve to this value and we can assign some delay-values to one mixer line.

### 4.2.5 Curves
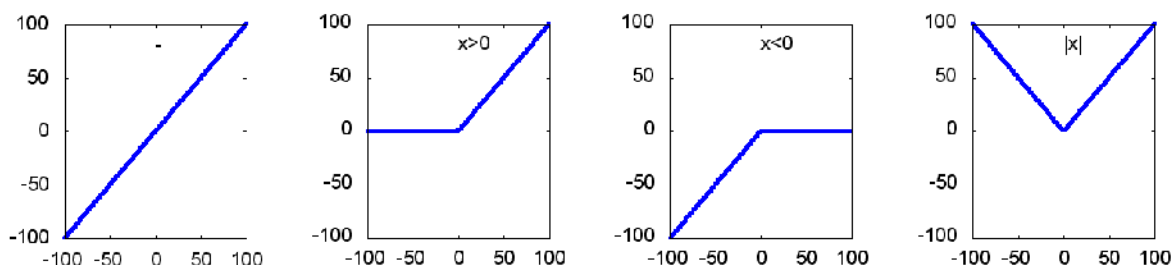
- : no curve,. y=x

>0 : y=x | x>0, else y=0

<0 : y=x | x<0 else y=0

|x|    y=|x|

Cv1..Cv4 use one of four user defined curves.
   Cv1 and Cv2 use 5 nodes at x=-100, -50, 0, 50, 100;
   Cv3 and Cv4 use 9 nodes at x=-100, -75, -50, -25, 0, 25, 50, 75, 100

24

### 4.2.6 Limits

Before this output values are sent to the receiver, they are checked against the maximum limitations given by the limits menu. Additionaly each channel can become revertet.

## 4.3 Trainer mode

To use trainer mode, we need two separate radios..One radio works as a students radio and the other works as a trainer radio Please note tha the students radio must have the powerbutton switched off..

🔲 Power-Off  is students radio, no sender module necessary.

🔲 Power-On  is trainer radio.

Both radios become connected with a stereo cable. After connecting the radios, the students radio gets powerd.

Now change to the trainer menu and look for the students stick values..

Any further computations are done in the trainer dvice.  Student and trainer values can be exclusive or added to each other.

## 4.4 Flash programming

### 4.4.1 Programmierstecker anschließen
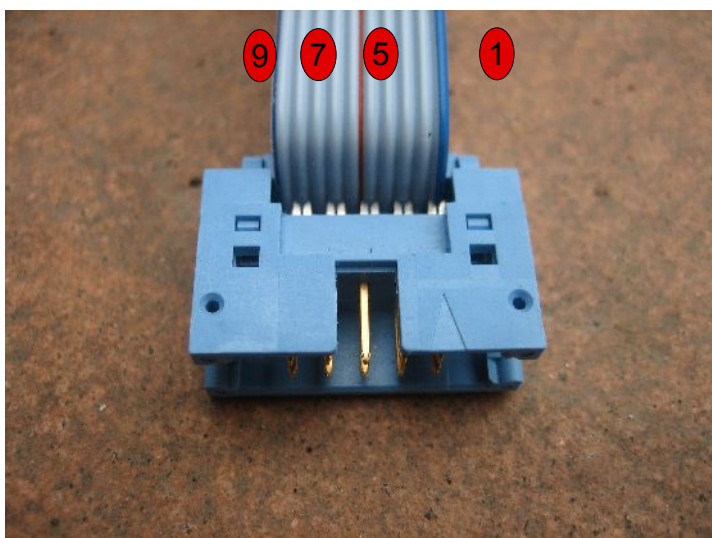


1. MOSI
2. -
3. -
4. -
5. RESET
6. -
7. SCK
8. -
9. MISO
10. GND
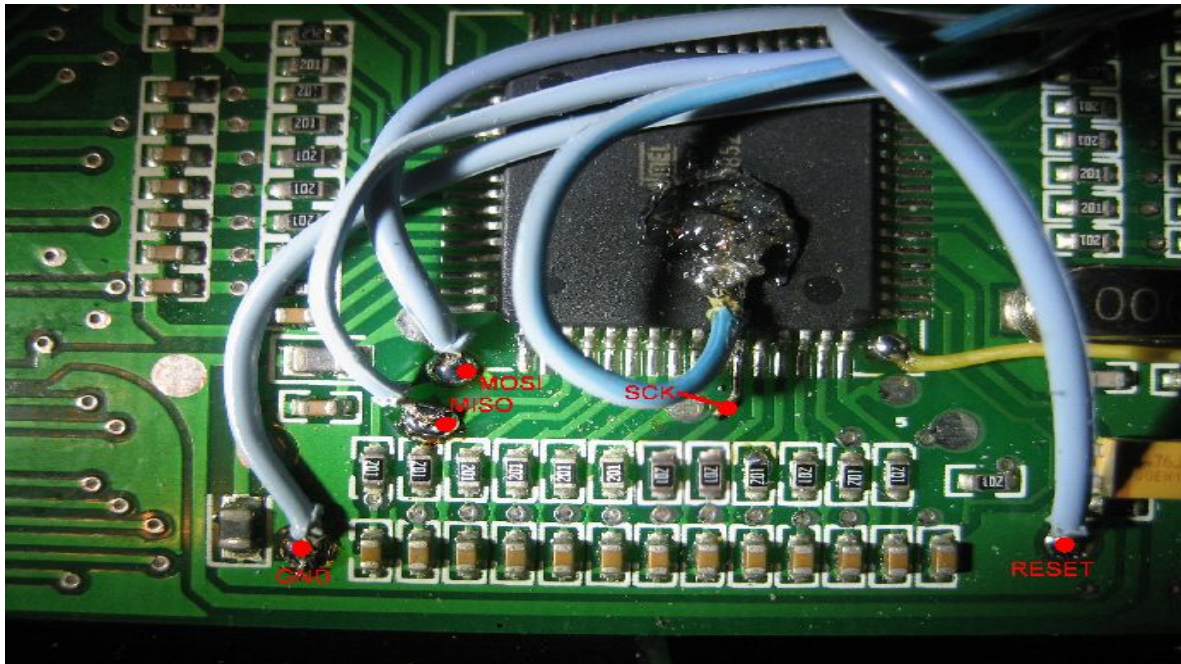
## 4.4.2 Fuse Bits

Beim neu laden des Flashes ist es nicht notwendig die Fuses in irgend einer Weise zu ändern. Falls dies doch einmal passiert habe ich hier meine Originalwerte aufgelistet:

```
sig=1e,96,02,ff  Atmel AVR ATmega64
Lock Bits:          0xff 0b11111111
Fuses low:          0x0e 0b00001110
Fuses high:         0x89 0b10001001
Fuses ext:          0xff 0b11111111
```

# 5 Programming examples

Grundsätzliches:

**Im Gegensatz zu anderen Sendern gibt es keine vorgefertigten Mischprogramme (Fläche, Heli). Dies soll zwar die Programmierung vereinfachen, schränkt aber die Programmiermöglichkeiten unser Meinung nach ein. Die hier gezeigt Lösung ist sehr flexibel. Allerdings muss sich der Modellbauer über die gewünschten functionen unter Umständen etwas mehr Gedanken machen. Hat man das System aber begriffen ist es sehr leicht anzuwenden.**

Es können alle 8 Ausgänge für beliebige functionen (Servos) verwendet werden. Es gibt also keine spezielle Zuordnung, wie dies bei anderen Computersendern zum Teil der Fall ist. Sinnvoll ist es aber trotzdem, die Ausgänge zu Beginn der Programmierung festzulegen und so zu belassen.

Bei den Eingängen (Steuerknüppel, Schalter, Poti) gibt es **eine** einzige Zuordnung. Diese betrifft den Timer. Wird diese function genutzt muss zwingend der richtige Mode gewählt werden. Außerdem sind dann die Bezeichnungen im Mischer für die Eingänge entsprechend korrekt. Ansonsten ist es vollkommen egal, welcher Mode verwendet wird.

## 5.1 Motorsegler bzw. Motormodell mit Seitenruder, Höhenruder und Querruder

Belegung der Känale

| Kanal 1: | Seitenruder |
|----------|-------------|
| Kanal 2: | Höhenruder |
| Kanal 3: | Querruder links |
| Kanal 4: | Querruder rechts |
| Kanal 5: | Motor |

### 5.1.1 Besondere Steuerfunctionen:

Jedes Querruder mit einem separaten Servo angesteuert, so dass diese mit P1 als Bremsklappen verwendet werden können.

```
MIXER                5/7
CH1   100% RUD
CH2   100% ELE
CH3  -100% AIL
      100%  P1        x>0
CH4   100% AIL
      100%  P1        x>0
CH5   100% THR
```

### 5.1.2 Erläuterung:

Die Steuerfunctionen RUDer, ELEvator und THRottle werden 1:1 an die Ausgänge 1, 2 und 5 übertragen.

P1 (Bremsklappen) wird sowohl auf Ausgang (Kanal) 3 wie auch 4 gemischt. Dabei werden aber nur positive Werte berücksichtigt, da ansonsten auch in die entgegengesetzte Richtung gemischt wird.

Die Querruder (Aileron) werden für eine Ruderfläche positiv, für die andere negativ gemischt, so dass sich ein entgegengesetzter Ausschlag ergibt.

**Sind allerdings die Servos spiegelverkehrt angeschlossen (was wohl der Normalfall Ist) müssen die Querruder gleichsinnig und die Bremsklappen gegensinnig gemischt werden. Alternativ können auch die Ausgänge (Servokanäle) invertiert werden.**

| | | |
|---|---|---|
| Kanal 1: | Seitenruder | 1:1 Stick Seitenruder |
| Kanal 2: | Höhenruder | 1:1 Stick Höhenruder |
| Kanal 3: | Querruder links | -100% Stick Querruder<br>1:1 Landeklappen P1 |
| Kanal 4: | Querruder rechts | 1:1 Stick Querruder<br>1:1 Landeklappen P1 |
| Kanal 5: | Motor | 1:1 Stick Gas (THROTTLE) |

## 5.2 Segler mit 4 Klappen Flügel

Belegung der Kanäle:

| | |
|---|---|
| Kanal 1: | Seitenruder |
| Kanal 2: | Höhenruder |
| Kanal 3: | Querruder links außen |

| | |
|---|---|
| *Kanal 4:* | *Klappen links innen* |
| *Kanal 5:* | *Querruder rechts außen* |
| *Kanal 6:* | *Klappen rechts innen* |

## 5.2.1 Besondere Steuerfunctionen:

- die inneren Klappen sollen als Landeklappen und für Querruderunterstützung verwendet werden.

- Die äußeren und inneren Klappen sollen über einen Flugphasenschalter auf verschiedene Mittelpositionen gestellt werden (Schnellflug, Thermikflug ...).

- Beim Setzen der Landeklappen soll das Höhenruder verzögert korrigiert werden

- Beim Landen soll die Butterfly- Stellung verwendet werden, bei der die Querruder nach oben und die inneren Klappen nach unten ausschlagen.
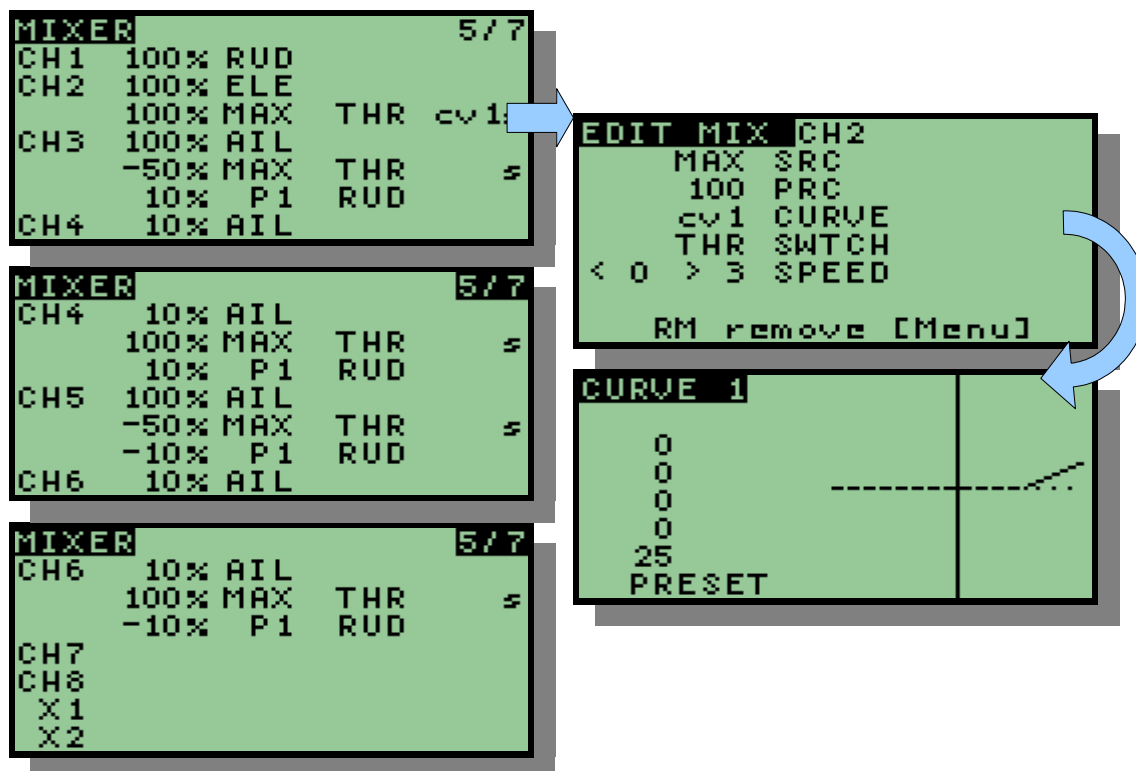


## 5.2.2 Erläuterung

Butterfly- Stellung wird über den Schalter THR aktiviert

Die Flugphasen werden mit Schalter RUD aktiviert und mit P1 eingestellt. Falls eine Höhenruderkompensation erforderlich ist, muss diese noch programmiert wer-

den. Im Beispiel ist sie nicht vorhanden. Die Servos der Tragfläche sind spiegelverkehrt angeschlossen.

| | | |
|---|---|---|
| *Kanal 1:* | *Seitenruder* | *1:1 Stick Seitenruder* |
| *Kanal 2:* | *Höhenruder* | *1:1 Stick Höhenruder*<br>*25% bei ausgefahrenen Landeklappen; die Mischung erfolgt verzögert über Curve 1* |
| *Kanal 3:* | *Querruder links außen* | *1:1 Stick Querruder*<br>*-50% Butterfly invertiert*<br>*10% P1 für Flugphasen aktiviert über RUD* |
| *Kanal 4:* | *Klappen links innen* | *Bei Betätigung des Schalters THR werden die Klappen LONGsam ausgefahren*<br>*10% Querruder werden dazugemischt*<br>*10% P1 für Flugphasen aktiviert über RUD* |
| *Kanal 5:* | *Querruder rechts außen* | *1:1 Stick Querruder*<br>*-50% Butterfly invertiert*<br>*-10% P1 für Flugphasen aktiviert über RUD* |
| *Kanal 6:* | *Klappen rechts innen* | *Bei Betätigung des Schalters THR werden die Klappen LONGsam ausgefahren*<br>*10% Querruder werden dazugemischt*<br>*-10% P1 für Flugphasen aktiviert über RUD* |

## 5.3 Motormodell mit Einziehfahrwerk und Fahrwerksklappen

tbd

## 5.4 Hubschrauber mit Pitch

tbd

## 5.5 Hubschrauber mit 120° Anlenkung

tbd

## 5.6 Flugphasenschalter

Wie im Beispiel 5.2.2 erläutert kann über einen Schalter, in Verbindung mit einem Poti oder einem festen Wert, ein Offset auf jeden Kanal gerechnet werden. Über die SPEED- function kann dies LONGsam und die CURVE- function verzögert realisiert werden.