Open Source Firmware

ErSky9x Explained

for the Turnigy 9XR Pro

ErSky9x Explained

Contents

Introduction

This manual provides a detailed overview of the *ErSky9x* open source firmware used in the *Turnigy 9XR Pro* transmitter. The great flexibility of this programming system means that there is a lot that needs to be described. You might see this as intimidating, but you don't need to learn everything before you can enjoy flying with this transmitter. That's why we have provided a separate and simpler guide: *First Steps with ErSky9x*. We recommend you read that first to get the overall picture and to learn enough to get you flying. Also be sure to read *Introduction to the Hardware* (see "Further Information" at the end of this manual).

We also recommend that you make use of the available RC forums and especially *OpenRCForums.com*, which is dedicated to the various open source RC firmwares. There you will find enthusiasts, including the program and hardware developers, ready to help you get the most from this amazingly advanced and still evolving RC software. While there, you might consider making a donation for their efforts.

The features of the *9XR Pro* transmitter running *ErSky9x* firmware include: 32 model memories plus more on your computer; up to 24 channel operation; potential for telemetry communication and display on the screen; spoken announcement of alarms, switch settings and telemetry values; completely free mixes allowing almost unlimited programming of controls and switches; 5 point and 9 point custom curves; assignment of any channel to any function; and support for an SD card for the storage of audio and other files. *ErSky9x* supports Bluetooth communication if the required hardware is added to the circuit board. It also provides USB access to the computer-based *Eepskye* program, which allows updating the firmware, model memory and SD card. *Eepskye* also simulates the sticks, sliders and switches on the radio, both for programming and for developing model settings.

The combination of extremely flexible programming and powerful new main board designed by Sky North results in an inexpensive transmitter among the most capable available today.

Navigating in ErSky9x

Button Navigation

The transmitter has six input keys: a cruciform set of RIGHT/LEFT/UP/DOWN keys, plus contextual MENU and EXIT keys.

The RIGHT/LEFT/UP/DOWN keys to the left of the screen move the cursor or pages in the appropriate directions. Short presses and long presses are used to go to different pages in the same direction.

For example, when you turn your transmitter on it will start at one of five 'Home' pages. Short presses of the UP and DOWN keys will take you to different home pages. Each press of the key brings a new screen, eventually taking you back to where you started. Whichever screen you last used will be the home screen that appears when you next switch the transmitter on.

If you press the UP key for about half a second (i.e., long UP) you will be shown a screen which has information about the Battery and related matters (see page 6).

Don't worry, all this gets quite easy once you have handled the transmitter for a short while.

Navigating Between Pages.

The home pages form a central core from which you can go right, left, up or down to access sets of pages which have similar functions (see diagram below).

A long LEFT press takes you to the Radio Setup section where short presses RIGHT or LEFT allow you to cycle through the 11 pages. A long RIGHT press takes you to the 14 pages of the Model Setup section. A long UP press takes you to three Statistics pages as you have seen above in the example. And a long DOWN press takes you directly to the Telemetry pages.

The Telemetry pages can also be accessed from the Home pages by short presses of DOWN or UP a number of times until the first telemetry page shows. This page is
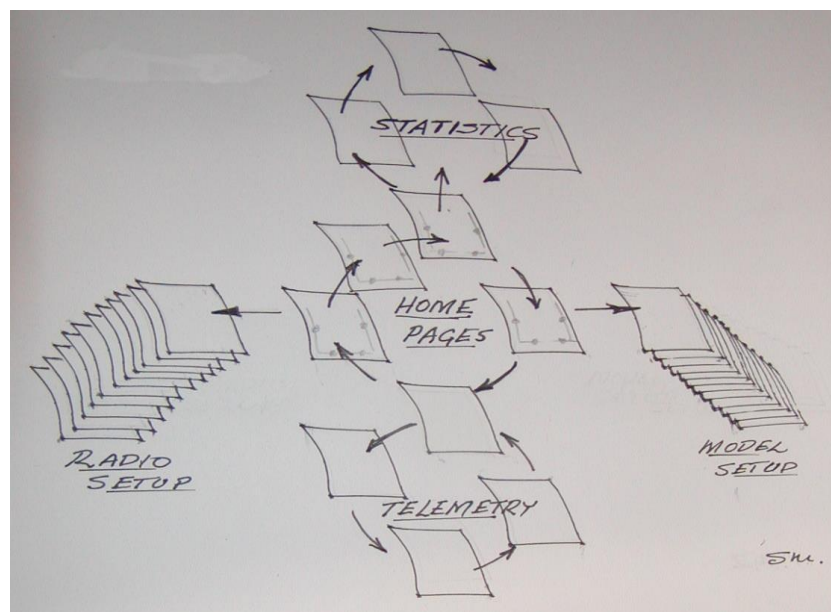
recognizable because it does not have the trim position graphics along the bottom and edges of the screen.

Navigation in a Menu

Navigation in a menu is straight forward: The UP/DOWN/RIGHT/LEFT keys will navigate between editable fields, or lines of fields depending on the screen.

Pressing MENU will enter the edit mode. In this mode, RIGHT/LEFT change the value, while MENU or EXIT validate the input and return to navigation. If there is only one value on a line to be edited, the LEFT and RIGHT keys change it directly without pressing MENU.

A short press on EXIT goes back to the previous navigation level, but a long press goes back to the home page where you started. To return to the previous page, long press the MENU button.

In edit mode, we have two shortcuts available:

- Press LEFT and MENU or RIGHT and MENU together to set a value to zero.
- Press LEFT and RIGHT together and the sign of a value will change from positive to negative or vice versa. This is somewhat difficult to do using the cruciform shaped key but it is possible. The RIGHT and LEFT keys register at slightly different times but close enough so that the radio recognizes the shortcut.

Home Pages

There are five Home pages, four of which show the same basic information in the top part of the screen: model name, transmitter battery voltage, timer value, timer switch identity, and trim increment setting. Trim position graphics are shown on the sides and bottom of the screen. The fifth Home page shows telemetry.

Home Page 1 (Stick and Pot Positions)

In the first Home page view the lower half of the screen shows a graphical representation of stick and potentiometer positions. A list of the switches shows those in the 'down' position in white letters on a dark background (i.e., reversed). The Timer 1 reading is displayed.

Home Page 2 (Graphic Servo Outputs)

In the second Home page view (short press down from the previous screen) the lower half of the screen shows the channel outputs corresponding to the current positions of the sticks, pots and switches resulting from given the current model programming. 'Med' in the picture refers to the Trim Increment setting (see page 18), while 'THs' shows that Timer 1 is started by moving the throttle stick from zero (see page 18).

Just above the channel output graphic is a bar showing which channels are currently displayed. A short press of the RIGHT or LEFT key changes the channel view from the first

set of 8 channels (1-8) to the second set (9-16) and then to the third set (17-24). With the necessary hardware, the transmitter is capable of controlling 24 channels.

Warning: It's easy to give a short right press inadvertently and change to displaying channels not being used on your transmitter. This can be very confusing.

Home Page 3 (Numeric Servo Outputs)

In the third Home page view (short press down from the previous screen) the lower half of the screen shows the channel outputs in digital form from -100% to +100%. Again, the bar shows which channels are being displayed (here 1-8).
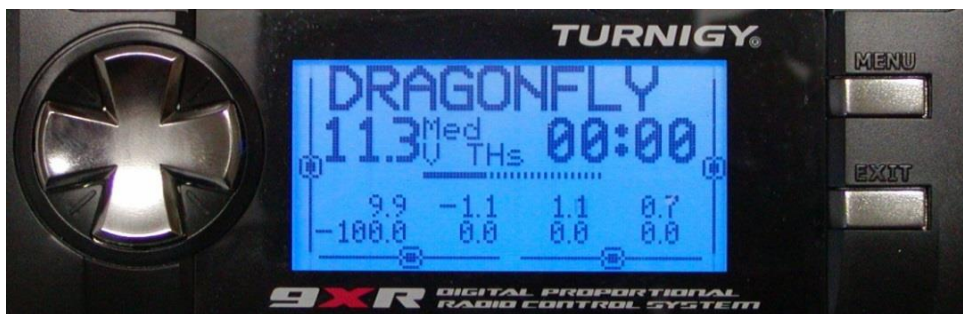
Home Page 4 (Timers)

In this Home page the lower half displays just the Timer 2 reading in bold type for easy visual reference.

Home Page 5 (Telemetry Series)

In the fifth Home page (short press down from the previous one) the screen shows various sets of telemetry data. These may include Global Positioning System (GPS) data, voltage, temperature, rate of climb, battery capacity used or other information, depending on what sensors you have installed in your model.

In the picture above, along the top is the model name, battery voltage and timer value. The other values come from sensors in the aircraft and give the GPS latitude, longitude, altitude above the starting point, current speed, maximum altitude and maximum speed since the radio has been turned on. A long press of the MENU button will reset the maximum altitude and maximum speed readings to zero. For further information on telemetry see page 33.

A short press of the RIGHT or LEFT key will cycle among the five Telemetry screens, which you can adapt to suit your requirements. Consequently, the information in the screens may vary from what is shown below.

The next page (not shown) is a page with the upper half as described before and the lower half a customizable value, which may be a timer or a telemetry value or other variable.

The last Telemetry screen provides for information specific to the DSM protocol and is intended for use with a future transmitter module. It only appears when DSM2 or DSMX operating mode is selected in the Model Setup Screen 1/13.

A short press of the UP or DOWN key will take you back to the Home screens and allow you to cycle through them.

There are various operations using the EXIT button. If the timer is beeping, a quick press of the EXIT key stops the timer and the beeping. If you are on a telemetry screen, a quick press of the EXIT key resets the telemetry.

LONG EXIT resets TIMER 1 and telemetry.

Statistics Screens

1. Battery Screen

From the Home pages, a long press of the UP key brings up a screen where the battery details, time and 'CPU temperature' are shown. (In fact, the temperature shown is typically as much as 10ºC too low, as shown).

The mAh reading shows the battery capacity used since the last reset, normally after charging the battery. To reset the number to zero, long press the MENU key. To adjust date or time, go to page 6/11 of the Radio Setup screens.

2. STAT Screen

A short press UP from the Battery screen brings a statistics screen whose main feature is a graph of throttle position versus time. It also shows the periods for which the timers have been active and total time the transmitter has been on.

3. STAT2 Screen

Another short press brings a screen which shows the 'tmain' in milliseconds (the maximum time taken to run the main menu loop in the firmware – this is mainly for the developers).

The screen also shows information relating to the BIND reply if a DSM module is used and 'BT reply' (Bluetooth), if the necessary hardware is installed. Another short press of the UP key brings you back to the home page from whence you started.

That's it for navigation among the various Home, Telemetry and Statistics screens that are all about displaying data. Now we explore the pages of Radio Setup that allow us to set the basic parameters for how the transmitter operates.

Radio General Settings

From the Home pages, a LONG press of the LEFT key yields the radio setup menu.

Navigation among the pages here is as follows. The UP and DOWN keys move the cursor up and down highlighting values which may be edited. A short press of the MENU key will cause the cursor to flash and allow the RIGHT and LEFT keys to change the values or options in that field. A short press of the EXIT key will stop the cursor from flashing (i.e., will exit Edit mode) and allow navigation up or down.

We are going to start with page 1/11, as this contains many of the most important settings and is the first we come to by pressing LEFT. After that we will continue to press LEFT, which takes us through the remaining pages in reverse order. (We could just as well press RIGHT and view them in nominal order.)

Radio Setup (page 1/11)

Owner Name

> This is the only field in Radio Setup where the entry method is different to the above description. Choose a space where a letter is required and press MENU to highlight it. When the UP or DOWN key is pressed the following are shown in sequence: a blank space, upper case letters, lower case letters, numerals, '_' and '- 'and '.'. When you have the correct letter or numeral in place, press MENU or EXIT to regain the ability to move left and right. Highlight the next space, press ENTER and select the character. And so on. The name you enter will show on the opening screen at startup if 'Splash Name' is ON (see below).

Beeper

> There are six options available for the duration of the beeper sound: extra-long, long, normal, short, extra short, no-key and quiet. As each option is selected the beeper makes the corresponding sound. The NoKey selection eliminates the beeps when editing but allows alarms to sound. Quiet means no sounds or alarms at all.

Contrast: Screen contrast setting

> The higher the value the darker the screen.

Battery Warning

> Sets the voltage at which a warning message will be announced, alerting you to "low battery". The voltage you choose depends on the minimum safe level for the battery size and type you have installed in the transmitter. The transmitter will work down to 6 volts, but you need time to land and your battery may have a much higher minimum safe

voltage (e.g., about 9.3v for LiFe chemistry and up to 11v for LiPo). See the manual *Introduction to the Hardware* for advice on batteries and settings.

Inactivity Alarm:

This reminds you to turn off the transmitter. If the transmitter is left turned on with no movement of the sticks for the period of inactivity set here, this alarm will sound. Values can be from 1 to 250 minutes. To reset the timer simply move one of the sticks. To turn off the alarm, set the value to zero.

Filter ADC: Analog to Digital Conversion

SING: Single conversion. This is the fastest conversion but base resolution is limited to 1024.

OSMP: Oversampling. This uses extra samples to increase resolution to 2048. Just slightly slower than SING.

FILT: Filtered. This is to be used in case you have excessive noise from the conversion (servo jitters). This will filter the input and prevent that noise. It will, however, increase latency by about 30 msec.

Throttle Reverse

Only if you fly with the throttle "backwards" (i.e., with idle away from you and full throttle towards you) should you set this to ON. It will also reverse the throttle warning on startup.

Minute Beep

Set this ON if you want a beep to sound or an announcement every minute during timer operation.

Beep Countdown

Set this to ON if you want the timer to beep or sound an announcement during the last minute of countdown.

Flash on Beep

Set this ON if you want the screen to flash every time the transmitter beeps.

Light Switch

This can be set to turn ON via any of the transmitter physical switches (i.e., RUD, ID0, ELE etc.) or any of the virtual switches (SW1, SW2, etc.).

Light Off After

This may be set to OFF or in 5 second intervals up to 600 seconds.

Light on Stick Movement

This may be set as OFF or in 5 second intervals up to 600 seconds.

Splash Screen

This may be set to ON or OFF. The splash screen is displayed at start up with an announced welcome message. An alternative is to have the model name announced or some music played. The splash screen and the announcements on start-up can be customized using voice commands as explained in a different part of this manual.

Splash Name

This may be set to ON or OFF. If ON, the name set in *Owner Name* above will be shown on the splash screen.

Throttle Warning

If ON will show a warning when throttle is not at idle when the transmitter is turned on. The transmitter will not output a signal until the alert is cleared.

Alarm warning

This will give you a "heads up" if your beeper is silent. If ON and the beeper is set to '0' (Quiet) you will receive a warning on startup.

Scrolling

The choice here is POT, STICK, BOTH or NONE. Pot Scroll means that pots can be used for control of the cursor when a menu is onscreen. The right pot scrolls the cursor up and down to choose the item, while the left pot adjusts the value. Likewise, Stick Scroll enables the elevator/rudder stick (mode 1) or elevator/aileron stick (mode 2) to move the cursor in a similar way.

Note that Stick scrolling doesn't work in menus where the sticks themselves are involved, such as the ANA page, the Calibration page and the Expo/DR page. Likewise, Pot scrolling may not always work; for example, you can't use it to choose an action on the Model Select page. In these situations, you should use the navigation keys, which always work. Normally, stick/pot scrolling will work again after the a few uses of the navigation keys. If not, you may have to turn scrolling off and back on again.

Internal FrSky Alarm

FrSky telemetry modules, when used with D-series receivers, produce distinct alarm sounds when the Received Signal Strength (RSSI) is below (a) 45 dBi and (b) 42 dBi. This setting allows the alarm to be turned ON or OFF. This feature is provided for use where alarms (either voice or beeper) are set in the transmitter itself. Generally you don't want to have the module beeping as well!

Individual sounds may be set for the three levels of alarm relating to the RSSI values the FrSky receiver telemetry is sending back to the transmitter.

> Alert (Yell) – about 45 dBi.

> Alert (Org) – about 40 dBi.

> Alert (Red) – about 35 dBi. (You are about to lose radio contact with the model!)

Cross Trim

> This allows you to swap the trim buttons for each stick swapped to the opposite side of the transmitter, i.e., Elevator trim is next to the throttle stick. This can make trim adjustment in flight easier, particularly for Mode 2 fliers, for whom it allows aileron and elevator trim to be adjusted with the left hand (for another way to assist in the trimming of a new model, see *Trim Switch* under Model Setup, page 19).

Mode (i.e., stick mode)

> Choose Mode 1, 2, 3 or 4 setting to suit your preferences and match local practice. Modes 1 (throttle and aileron right) and Mode 2 (elevator and aileron right) are by far the most popular around the world.

> Note that the stick mechanisms must match the chosen mode. The physical arrangement can be changed by removing the back of the transmitter, dismantling the sticks and then reassembling them with centering spring and friction strip interchanged on the vertical axes. Videos showing the process can be found on line.

> Press MENU to enter the edit mode. This prevents inadvertent mode changes that could assign throttle to a stick spring centred to the mid position.

That's the end of the Radio Setup screen, the longest one of all. Fortunately, it isn't necessary to change these settings very often. Now to other pages that set parameters or display information about the radio, starting at the last.

Boot Reason (page 11/11)

With the cursor on the top line of the previous screen, a short LEFT press moves to a screen which shows how the transmitter was last started (normally 'Power On'). If you have an unexplained start-up or shut-down, this information may help in troubleshooting.

SD Card Stat (page 10/11)

Another short press of the LEFT key brings up this screen showing information about usage of the memory on the Micro-SD card.

Calibration (page 9/11)

LEFT again brings up the screen that allows the firmware to recognize the limits and centering of the sticks, as well as the limits of the three pots (potentiometers).

Just follow the instructions on-screen, pressing MENU to start, then centering the sticks and pressing MENU again. Finally, move the sticks to their full extent in all directions (don't press hard against the stops) and twist the pots through their full range. Press MENU again and you're done.

NOTE: It is **essential** to calibrate the transmitter initially and whenever there are any changes that could affect the stick or pot outputs (e.g., replacement of a stick assembly). With the 9XR Pro (unlike the 9XR) the calibration data are stored in General Settings, separate from model memories.

ANA (Analogue Inputs) (page 8/11)

Another short press of the LEFT key brings up a screen that shows the analog inputs (sticks, pots and battery voltage) in hexadecimal format to save space.

A1..A4 are the gimbals (sticks). A5..A7 are the pots. A8 is battery voltage. Values range from 0 to 0x3FF (0 to 1023 decimal).

If you highlight the battery voltage, pressing LEFT/ RIGHT will adjust the value, enabling you to calibrate the reading to equal what you measure with a voltmeter at the battery itself.

This screen also shows the current being used by the transmitter in milliamps (mA).
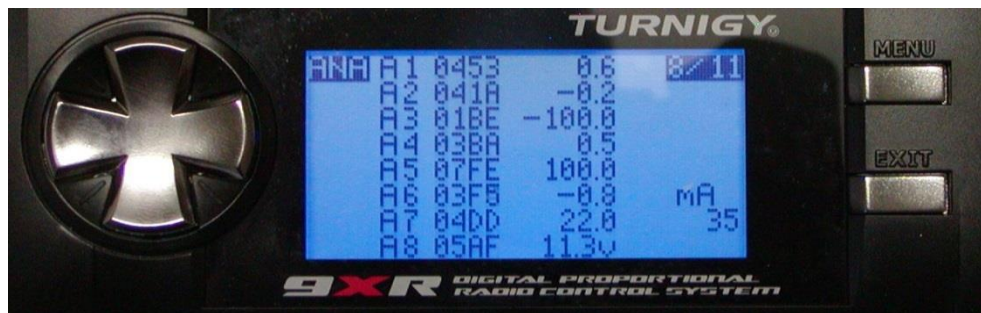
DIAG (Diagnostics) (page 7/11)

Short pressing the LEFT key brings up a screen that shows the position of every physical switch as seen by the transmitter. If a switch is OFF (up or back), a zero is shown. Note that if, for example, a switch has become loose, this page will tell you if it is mounted the right way up. The action of the trim switches is also shown (not the trim settings themselves).
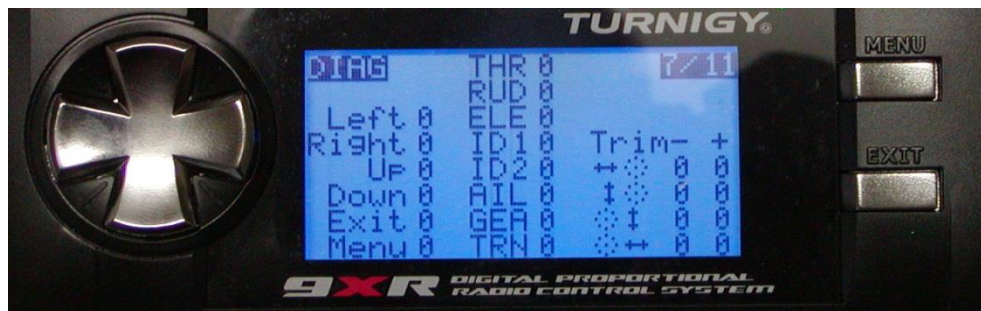
Date-Time (page 6/11)

This is the screen where the transmitter's real-time clock is adjusted to show the current date and time. Use the UP/DOWN keys to navigate and the RIGHT/LEFT keys to adjust the values. Note that the transmitter uses the 24-hour clock.

The calibration (Cal) value may be changed to correct inaccuracies in the clock.

Version (page 5/11)

This screen shows the version information for the current firmware:

SVN: The name of the current revision in the Subversion management system.

VERS: Version number used by the developer.

DATE: Compile date for the current firmware.

TIME: Compile time for current firmware.

MOD: Main circuit board model

Since ErSky9xr is open source, anyone who has problems is welcome to log on to the internet forums and seek help. Please use the revision number stated in this screen (e.g., r189) when you seek a solution.

Your participation is what helps make the firmware better.

Trainer (page 4/11)

This menu is used when the transmitter is functioning as the Master in a "buddy box" arrangement (the Master is the transmitter held by the instructor and is the one the model's receiver is bound to). The menu allows the PPMin (trainer) inputs coming (by cable or wirelessly) from the student (Slave) transmitter to be matched to the channel setup of the Master transmitter. The channel order of the Slave transmitter and the Master do not need to be the same, provided this screen is used to match them up correctly. The slave transmitter does not have to be a 9XR Pro: compatible transmitters include the 9XR, 9X, and most JR and Spektrum units. Transmitters such as Futaba can also be used but may require special cables.

Transfer of control to the student transmitter for a given channel is done by activating the switch shown in the last column. Normally this would be TRN (the momentary toggle switch) for all channels, though sometimes instructors prefer to transfer control selectively. When the Trainer Switch is held, PPMin from the Slave transmitter is substituted for input generated by the Master transmitter itself and the student takes control of the model. All the mixes on the Master Tx are applied to the student inputs. This includes, for example, expo or delta wing (elevon).
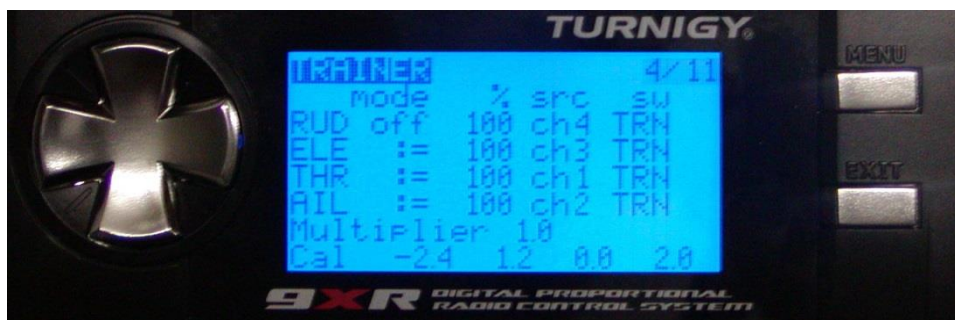
The **'mode'** column selects how PPMin is used when the Trainer Switch is activated:

off   **Channel unused**. No input from student stick

+=   **Add** student stick value to instructor stick value

:=   **Replace** instructor stick value with student stick value (normal training setup)

The **'%'** entry applies a weighting to the PPMin value from -100 to +100. Use -100 to reverse the input. Values closer to 0 reduce the student`s control sensitivity.

The '**src'** entry selects the PPMin channel for the function. In this example, the buddy box uses the Spektrum/JR channel order of TAER, while the master uses RETA.

The '**sw'** entry selects the switch used to activate the trainer operation, normally TRN.

Multiplier: Adjusts PPMin values by a factor from 1.0 to 5.0. Normally left at 1.

This is used to raise the incoming signal level if it is too low for the 9XR Pro.

**Cal**: Center calibration for first 4 PPMin values.

Allows you to calibrate the mid-point for channels 1 to 4. Highlighting 'Cal' and pressing MENU will adjust the inputs from the slave to match the master.

NOTE: There is an option under Model Setup to enable or disable the trainer function for that model. If you do not need a model to support trainer mode you may disable the function and use the trainer switch for something else (see page 19).

While a trainer setup normally uses only the first four channels, all PPMin values are available to the mixer if required.

Memory Stat (page 3/11)

This page gives the hexadecimal address for the start and end of each model in memory.
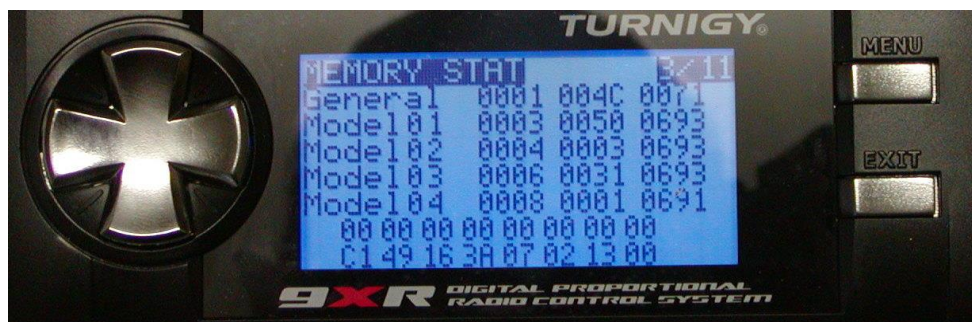
Radio Setup 2 (page 2/11)

This page deals with a number of additional settings.

Volume

This value may be set from 0 to 23. The volume of the beeps as you change the setting shows the new value. Note that within Model Setup, further control of volume can also be assigned to one of the three pots (P1, P2, P3) or a Global value (GV1 to GV7).

Speaker Pitch

Values from 1 to 100 may be set. The pitch varies one tone up for every five value increments.

Haptic Strength

Values from 0 to 5 may be set. This parameter determines the strength of the vibration.

Brightness

This refers to the screen brightness when the backlight is switched on. Values from 0 (fully dark) to 100 (very bright) may be set.

Capacity Alarm

When the battery capacity used since last reset reaches this value an alert message will be announced. Battery capacity used may be viewed and reset on the Battery screen (one long press UP from any of the Home screens).

Bt Baudrate

Speed setting for Bluetooth communications (Bluetooth requires additional hardware).

Rotary Divisor

The amplification of a rotary encoder may be set here. The range of values is 1,2, and 4. This value depends on the make of the encoder. A rotary encoder is not included in the 9XR Pro but can be added as a DIY project.

Stick Gain

This is only needed if another type of stick gimbal, such as Aurora 9, is fitted to the transmitter. 'LV' means Left Vertical, etc. If necessary, individual sticks can be reversed in the Mode section of the Radio Setup menu.

Model Setup Menus

Going long right from the Home screens gets us into the Model Setup portion of programming. In the first screen all the 32 memory slots models are listed and any models that have already been created are shown. Once a model is selected, a series of screens defining its characteristics can be accessed.

ModelSel (Model Select)

Press LONG RIGHT from the Home pages to reach the Model Select screen. On this screen, models stored in the transmitter's EEPROM memory are listed and can be selected, copied, moved, or deleted. In addition, individual models can be backed up to the Micro-SD card and subsequently restored to the transmitter (as of Ersky9x version r202).

Once a model slot has been highlighted, SELECT, COPY, MOVE, DELETE and BACKUP commands become available, as shown below. Move the cursor using the UP or DOWN key and pick the option by pressing the MENU key.

Active Model

An asterisk next to the model number indicates that this is the currently <u>active</u> model. Only the active model can be edited.

To SELECT a model or memory slot, highlight it, press MENU, choose SELECT and press MENU again to make it the active model.

Press short RIGHT to enter the first of the Model Setup pages.

Don't be surprised if you see an ALERT screen telling you that switches need to be moved to safe positions. The default switch settings in Ersky9x are now associated with individual models and thus may vary. They are checked every time you change models, not just when the transmitter is turned on. This is an important safety feature but can be turned off if desired. The throttle position is also checked when the active model is changed.

If a blank memory slot is made the active model, a basic fixed wing model is created by defining standard mixes for channels 1 through 4. The new model is initially named MODEL XX, where XX is the slot number.

Other Commands

Note that the commands in the Model Select menu (SELECT, COPY, etc.) apply to the model whose number you have <u>highlighted</u> (which may not be the active model).

To COPY a model, highlight it and press MENU. Choose COPY and press MENU again to confirm that you want to proceed with the duplication. The copy will be created in the first available blank slot.

To MOVE a model, highlight it and press MENU. Choose MOVE, press MENU again. Use the UP/DOWN keys to move it to a different memory slot and press MENU to drop the model there. Moving a model will not overwrite other models.

To DELETE a model, highlight it and press MENU. Choose DELETE and press MENU. You will be asked to confirm. Deleting a model moves up the models below it in the list. Note that you cannot delete the active model; you first need to make another model the active one.

To BACKUP a model to the Micro-SD card, highlight it, press MENU and choose BACKUP. Press MENU to complete the action. You will see "MESSAGE: MODEL SAVED" on the transmitter screen.

To RESTORE a model from a backup file, highlight a <u>blank</u> memory slot, press MENU and choose RESTORE. Highlight the model you want to restore and press MENU. You will see "MESSAGE: MODEL RESTORED" on the transmitter screen. Note that you can`t use Restore to replace an existing model without first deleting that model.

Backup files are saved on the SD card with a ".eepm" extension in a folder called MODELS. They can be copied to the computer via USB (see *Communicating with a Computer*).

In addition, .eepm files can be imported from the SD card into the Eepskye program. There they can be edited and saved to the SD card, the computer or the transmitter's EEPROM file. See the manual *Using Eepskye*.

Setup XX (page 1/13)

The Setup screen has many lines and presents a wide range of settings specific to the individual model that is currently active. Select items in the menu using the UP and DOWN keys. Here are the first items:

Name (model name)

This item works like Owner Name in the Radio Setup page. Choose a space where a letter is required and press MENU to highlight it. When the UP or DOWN key is pressed the following are shown in sequence: a blank space, upper case letters, lower case letters, numerals, '_' and '- 'and '.'. When you have the correct letter or numeral in place, press MENU or EXIT to regain the ability to move left and right. Use DOWN to get to the next item.

Voice Index

Here you specify the voice file that will be announced when the model is selected. Highlighting the number and pressing MENU will cause the voice file to be played. The range of numbers is 260 to 309 –.if you don't want a name to be announced, just assign a number that doesn't have a voice file associated with it (probably a high number). For more on this see *ErSky9x Voice Explained*.

Timer 1, Timer 2

There are two fully programmable timers, that can count either up or down. Enter the value for the timer using the LEFT or RIGHT keys. By default, the timers not operational.

Trigger A, Trigger B

Trigger A options are OFF, ABS, THs, TH%, c1% to c24%.

ABS counts up all the time, THs runs whenever the throttle stick isn't at idle, TH% counts up at a speed proportional to the throttle stick position, i.e., at 50 % throttle the timer runs at 50% of full speed. The option of c1% through to c24% means the proportional output of any channel from 1 to 24.

Trigger B options are any physical switch and any virtual switch (more on those later)

You can also enable voice announcements of time. 'Minute call' will say the time every full minute, while 'Beep countdown' will give announcements several more times during the last minute. These can be activated on page 1/11 of the Radio Setup menu.

T-Trim (Throttle Trim)

This is a useful feature for fuel-powered models. When activated (1) the centre detent for the throttle trim is removed and (2) throttle trim affects only the "low" side of the throttle range. That means you can use the trim for setting idle while full throttle remains unchanged. When not activated, throttle trim has no effect.

6. T-Expo

Another throttle-related function, this one makes the throttle stick expo setting go from zero to full instead of having a centre point like expo on all the others.

Trim Inc (Trim increments)

This setting determines how the active trims behave.

1. Exp – Exponential – trims are fine near the centre and get coarser further out.

2. ExFine – Extra fine – 1 trim step per click.

3. Fine – 2 steps per click.

4. Medium – 4 steps per click.

5. Coarse – 8 steps per click.

Trim Switch ("InstaTrim")

When this switch is activated, the current position of the sticks is copied to the subtrim settings (Limits page). Choose a switch that is easily reached but unlikely to be flipped accidentally (e.g., RUD). The function is triggered by moving the switch from its default position; to trigger it again, the switch must first be moved back to its default position.

This function is very useful for first flights, as it avoids the need to take your hands off the stick to press the trim buttons. Simply hold the plane level with the sticks and flick the selected Trim Switch. Immediately centre the sticks and the plane is trimmed. Fine trimming can still be done with the trim buttons.

NOTE: It is advisable to disable this function once initial trimming is completed as it can have seriously negative results if triggered accidentally!

E. Limits

Extended limits. Allows limits to go to plus or minus 125%. Please test to make sure this does not cause unwanted mixing between channels or exceed servo limits. Note that 100% on the Ersky9x firmware already corresponds to 125% on most other transmitters.

Trainer

Trainer ON or OFF. This allows you to select whether for this particular model the trainer inputs are available from a connected student transmitter. This is for use when the transmitter is serving as Master in a buddy box arrangement. See page 13 for an explanation of the Trainer function. Selecting OFF frees up a switch, usually TRN, for other purposes.

Auto Limits

This setting allows Subtrim to override the Limits setting so that servo throw remains the same on both sides of center. The value determines the maximum amount the limits can be exceeded (a setting of 10.0 allows a limit set at 100% to go as high as 110%). Be careful when using this feature as the limit values are no longer absolute and could allow a servo to exceed a mechanical limit.

Switch Warning

If ON will show a warning when the switches are not at their default positions when the transmitter is turned on with this model selected or when the selected model is changed to this one. The transmitter will not output a signal until the alert is cleared.

Default Switch

Sets the default switch positions at start-up. Set the switches in the desired positions, then press the Menu key. The switches in the 'on' position (up/back) will show as black on white, while those that are 'off' (down/forward) will show as white on black.

Volume Control

This can be set to use one of the three potentiometers (P1, P2, P3) or a Global Variable (GV1 to GV7). The volume control only works after you exit the menus.

Beep Cnt (Beep Centre)

Here you can set inputs to beep when centered. RETA123 corresponds to: RUD, ELE, THR, AIL, P1, P2, P3 inputs. This is useful for locating the centre of the pots without looking (e.g., while flying!). Press MENU to turn on centre beeping for an input.

Proto (encoding protocol)

PPM is the protocol used for most plug-in RF modules (including the OrangeRX DSM2/DSMX and the FrSky DJT). You can set the number of channels to encode and change the pulse spacing, but in most cases, the settings should not be changed. (If you use a Spektrum DM9 module, set spacing to 350uSec for accurate centering.)

The PXX setting can be selected for the newer FrSky X8R module.

The DSM2 setting is used ONLY where an internal module extracted from a Spektrum transmitter is "hacked" into the 9XR Pro. Instructions for doing this can be found at: http://openrcforums.com/wiki/index.php/How_to_modify_your_9x_to_the_DSM_protocol

Start Channel

This is the channel which is first in the PPM stream and is usually left at 1. Other start numbers may be needed when using a flight controller which accepts the raw PPM.

PPM FrLen (Frame length):

The length of each frame within the PPM train. Normally need not be changed.

Shift Sel (Shift select)

POS/NEG. Select signal shift. POSitive or NEGative. Leave at POS if in doubt.

PPM2 Start Channel

Where two receivers are used for extra channels, PPM 1 is set to match the capability of the first receiver, while PPM 2 is set for the second receiver. If first receiver is an 8-channel unit, then the second receiver will normally start at channel 9. The options are: 'Follow' or a specific channel from 1 through 17.

PPM2 Channels

The options are 4 through to 16 channels in 2-channel increments. This depends on the number of channels your second receiver or flight controller can handle and how many channels you need to send.

Heli Setup (page 2/13)

A short press of the RIGHT key will bring up the helicopter CCPM head mixer screen. This page allows setting swash plate type, and limiting the control authority through the Swash Ring setting.

Note that many modern rotary wing models, whether flybarless helicopters or multirotor machines, use an on-board flight controller that does not use CCPM mixing. Likewise, coaxial helicopters require only simple fixed wing type inputs for the rotors (aileron, elevator, rudder) and throttle to control climb and descent. For such models, you can ignore this page.

The inputs to the CCPM mixer are the AIL and ELE sticks, plus the input or virtual channel selected in "Collective" (which has entries on the MIXER page for one or more pitch curves). Here are the details:

Swash

This defines the type of swash plate used by the heli:

120: "Standard" 120 degree swash plate. The "pitch" servo is towards the front/back.

120X: Same 120 degree swash plate but turned 90° so the pitch servo is on one side.

140: Less common 140 degree swash plate – the "pitch" servo is towards the front/back.

90: Basically a simple 90 degree setup where a single servo operates the collective pitch directly and aileron and elevator servos tilt the swash. May be used for fixed pitch helis.

Collective

This defines the source of the collective input. The idea is that you can create a mix in a virtual channel (above those transmitted to the receiver) with all the required curves and switches and simply use it as the input here to mix with the other inputs.

Swash Ring

As the name implies, this feature limits stick movement just like a physical swash ring. Notice that this feature only works on AIL and ELE, regardless of radio mode selected.

ELE/AIL/COL Direction

These allow the direction of the input functions to be inverted. Use them to make the controls move the correct way when setting up your heli.

The outputs of the CCPM mixer are CYC1, CYC2 and CYC3. These need to be assigned on the MIXER page to the channels that will drive the swash servos. The settings made here have no effect unless you use the CYC1, CYC2 and CYC3 outputs.

As noted above, a multirotor or flybarless helicopter which uses onboard computers/mixers will NOT use the CCPM mixer or these outputs.

Modes (Flight Modes) (Page 3/13)

A short press of the RIGHT key will bring up the flight modes screen.

Seven flight modes are available: the default mode FM0, plus FM1 to FM06. Each can be named and has a selectable activation switch (physical or logical), a trim selection array, and slow up/down parameters for smooth transitions between modes.

One main reason for using FM, rather than just programming the required features directly, is to allow separate trims for different modes. When shown, R, E, T and/or A mean that a mode has its own trim setting for that control (see below); each can be changed to a number corresponding to another FM and thus use the same trim values as that mode.

The other main use of FM is to determine which mixes are turned on for each mode.

The priority of the flight modes is such that the first FM that has its switch ON is the active one. When none has its switch ON, the default FM0 is active.
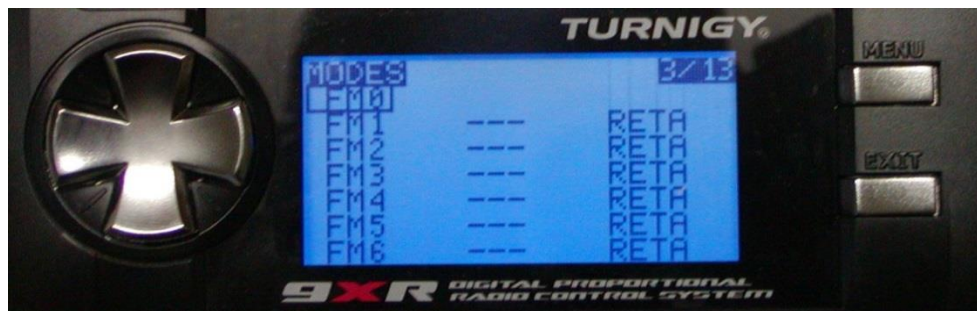

Expo/DR (page 4/13)

This is the first step of the control chain – where you define the response curve of each stick and the amount of control authority it has. This page is where you define how the transmitter sticks provide inputs to control your craft (the next page is where you define how those inputs are combined and transformed in the mixing process). If it's something the about the stick inputs, then this page is where you do it.

The Expo/DR page allows you to make the stick input non-linear. Instead of a straight line that represents equal response at any point in stick travel, expo causes servo movements around centre to be smaller for a given stick movement near the extremes of stick travel. The line becomes a gentle S-curve and the model can be flown more smoothly. This is called normal expo and for transmitters using open source firmware, it is designated by a positive number (Spektrum and JR follow this convention, but Futaba and Hitec use negative numbers for the same result – yes, it's confusing!)

Dual rate (DR or D/R) allows you to select the sensitivity of the control setup in terms of servo travel for a given stick movement. Changing the rate tilts the whole control curve, from the default 45° to a lower slope for more gentle and precise control. On the 9XR Pro either dual or triple rates can be used.

On the second line of Expo/DR screen you can select to which stick (RUD, ELE, THR, or AIL) the settings below apply. The graph changes as you enter values so you can see if you are adjusting the line in the correct way and get a sense of proportion.
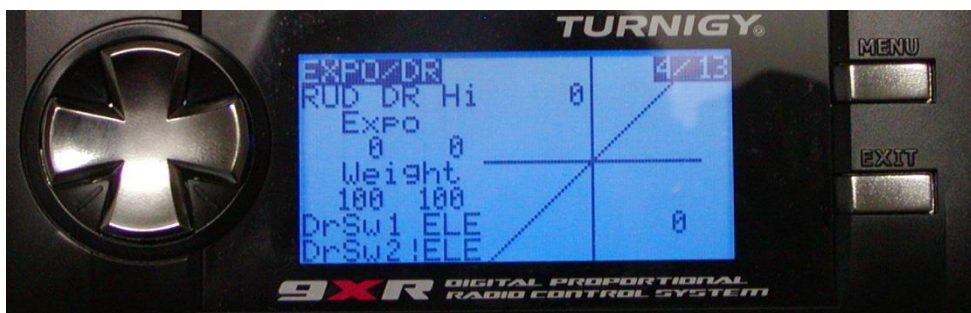
For each control you can input values for both expo and D/R by highlighting the field and using the navigation buttons to change the value. For example, to edit an expo value, press the DOWN key until the cursor blinks on the expo value. Then use the LEFT/RIGHT keys to change the value. If the stick is in its centre position, both expo values will blink and any entry will adjust the expo equally both sides of centre. However, if, for example, you hold the stick left of centre, only the left value of expo will blink, and the keys will change only the left side of the graph and left side of stick travel. In this way you can have a different expo curve on one side compared to the other.
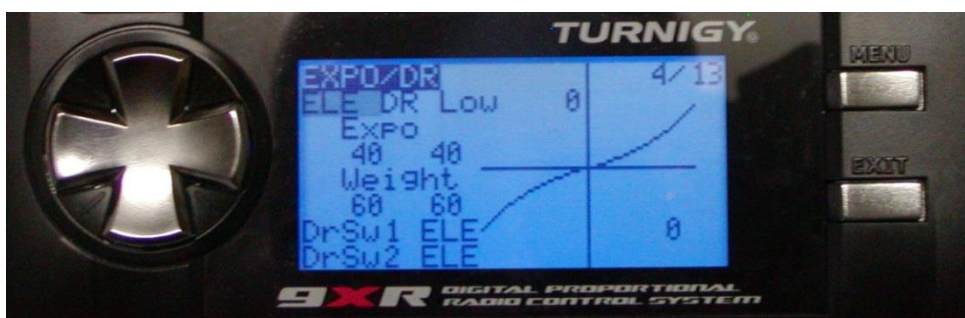
For each control you can set two switches. For a dual rate arrangement, simply chose the appropriate switch (say ELE) for DrSw1 and leave DrSw2 blank. To have the switch work in the reverse direction, choose the "not" form (!ELE).

For a triple rate arrangement you can us two switches. The main switch changes between high and mid-rate. If the main switch is "low" (i.e., mid-rate) the second switch can then switch between mid and low rate.

The three position switch (ID0, ID1, ID2) switch can also be used for triple rates. For DrSw1 enter "!ID2" (remember the exclamation mark means "not") and for the DrSw2 enter "!ID1". The logic is that Sw1 is not ID2 so it must be either ID0 or ID1. Likewise if Sw2 is not ID1 it must be ID2.

Mixer (page 5/13)

This is where you manage the relationship between the inputs (e.g., sticks, pots and switches) and outputs (servos, speed control). In Ersky9x the only predetermined mixes are the basic four channel setup that is automatically created for every new model, plus templates for some additional mixes, notably V-tail and Elevon/Delta. Beyond that, you have the freedom to create mixes to define exactly what you want the servos to do.

Here's what a simple mixer page might look like. This one has two channels for aileron (CH1 and CH2) to allow the two servos to be controlled separately. Both get their input from the aileron stick.
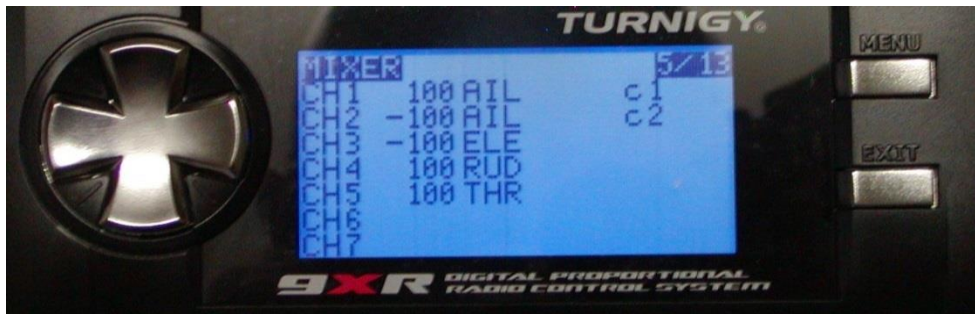
The various channels numbered on the left of the screen are outputs from the mixer to the servo. For example CH1 is servo slot number 1 on your receiver. CH2 is servo slot number 2, and so on.

What this screen is telling you is, for example, that the rudder stick input is being routed by the mixer, with a 'weight' of 100%, to the servo plugged into CH4 on the receiver. Similarly for the elevator, throttle and aileron channels.

In this case, the switch column is empty, meaning that the mixes are turned on all the time (the usual situation for the stick inputs in a simple model). The curve column shows that c1 and c2 are being applied to CH1 and CH2, the two aileron channels in this setup. They are providing aileron differential (meaning that the 'up' aileron moves more than the 'down' aileron.

A channel without a mixer command line (such as CH6 here) will simply centre any servo connected to it. The servo will not move at all as it has no variable input.

Edit Mix

Let's assume you have highlighted a channel in the screen shown above and given a long press of the MENU key. You see this screen:

Then you select Edit and get this:

Editing the Mix

We need to take a pause here and look closely at the choices available to us in setting up a mix. Here is where you can determine how the source (input) will be transformed into output that drives the servo(s) plugged into that receiver channel.

It's important to understand that in the Ersky9x kind of programming, the <u>only</u> way anything can be controlled is through an explicit mix. In many other radios, most of the mixes are hidden, but here they are fully visible and editable, giving the radio enormous flexibility and power, but requiring that you create the mixes.

Here are the available options for each mix. :

1. **Source**: This is the <u>input</u> for the mix. It can be any of the following:

> **Stick or potentiometer** (RUD, ELE, THR, AIL, P1, P2, P3).

> **HALF**: Output is either 0 or Weight. It is controlled by the designated switch (see 6).

> **FULL**: Output is either -Weight if the switch is OFF or +Weight if the switch is ON.

> **3POS**: The Three Position Switch ID0, ID1, ID2. This source gives three values: weight, 0, -weight. Centre position is 0 unless an offset has been defined.

> **CYC1, CYC2, CYC3**: The three outputs of the heli swash-plate mix. Once swash mixing is turned on (Heli Setup, page 3/10) these mix inputs become active and reflect the result of the swash mix.

> **PPM1..PPM8:** These are fed by the PPM input or "trainer port". They can be used to configure a buddy system or to simply extend the radio with more functions (like head tracking for you FPV guys). Note that the Trainer page under Radio Setup deals only with CH1 – 4. PPM input offers a more flexible means to share control of up to eight channels with a slave transmitter.

> **CH1..CH24**: Outputs of the mixes on virtual channels (channels not sent to the receiver). This capability can be used to chain mixes for more complex behavior.

> **GV1..GV7**: The values of the Global Variables

> **THIS**: A source that represents the combination of all mixes for the channel to this point.

2. **Weight**: This value <u>multiplies</u> the value from the input. It can range from -125% to +125%. Default is 100%.

3. **Offset**: This value is <u>added</u> to the value from the input. It can range from -125% to 125%. Default is 0%.

4. **Trim**: When this is ON, the trim value (if it exists) will be carried through the mix. When OFF any trim value is ignored.

5. **Curve**: This applies a <u>function or curve</u> to modify the application of the source value.

> **x>0**: The value of the source is carried through only if it is positive (greater than zero). If the source value is less than zero, a zero value is applied.

x<0: Same but for negative values.

|x|: The value is passed as an absolute value (-50 and +50 are both treated as 50).

f>0: If source is positive then the output value is "+weight" otherwise it is 0.

f<0: If source is negative then the output value is "-weight" otherwise it is 0.

|f|: Output is either "+weight" or "-weight" depending on the sign of the source.

c1..c16: Custom Curves. These are defined in the "CURVES (6/8)" screen. You can press MENU to edit the curve directly. When you are finished making the curve, short press the EXIT key to return to the EDIT MIX menu. See the *Glossary of Terms* for an explanation of the mathematical relationships used above.

6. **Switch**: Here you select the switch that controls the mix. If a switch is not selected then the mix is ON by default.

7. **Warning**: Here you can select an audible warning that will sound whenever a mix is turned on (only works when a switch is defined). You have an option of 1, 2 or 3 beeps. The warnings will sound in succession so you can hear them individually.

8. **Multpx** (multiplex): This value defines how the mix will affect the channel.

   Add: This is the default value. With this value the mix is added to the previous values in the same channel.

   Multiply: Use this to multiply the previous values in the same channel.

   Replace: This value is used in conjunction with a switch. When the switch is off the value is ignored. When the switch is on the value discards the previous values and places its own value in the channel.

9. **Delay Down/Up**: Use this to delay application of the mix. Usually used with a switch. When the switch is turned ON or OFF the mixer will wait the specified number of seconds before changing the value.

10. **Slow Down/Up**: Slow the rate of change in the channel. When not zero these will determine the maximum speed with which the value can change. The specified value is the number of seconds to go between –100% and 100%.

Mix Example

An electric powered glider usually flies a lot faster when climbing than when gliding. The extra speed generates more lift from the wings, so the model wants to do a large loop. A little down elevator is required to keep the nose from lifting. We need a mix.

Assume the throttle is operated by a switch and therefore full power is applied instantly. The Gear switch (GEA) is being used to control the motor and is on CH5, as shown below:
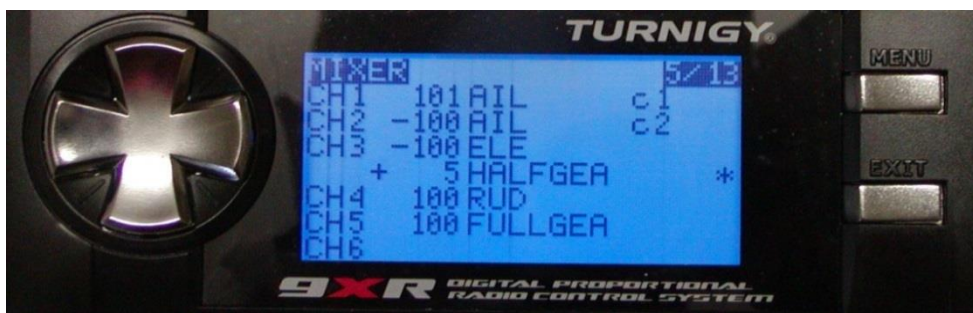
When the GEA switch is flipped to ON, the signal to the ESC via CH 5 goes from -100% to +100% because that's how the FULL input works: the value is either –weight or +weight.

In order to have this power-up command affect not only the motor via the ESC but also the elevator servo, we need the GEA switch to control a mix in the Elevator servo channel (CH3). But we only want a small effect, say 5% weight.

To create this mix navigate down the MIXER page to highlight the Elevator channel and press MENU.

In the resulting pop-up menu select INSERT. This creates a new mix line.

Press MENU. This takes you into the edit menu for the new line.

In this menu, the first field asks for the source of the mix. Because we are using a switch and not a stick we want the source to be FULL or HALF. A switch has no intrinsic value unless a source is assigned to it. Two possibilities are available for our purpose:

- FULL operates from --100 to + 100.
- HALF operates from 0 to +100.

For the elevator we choose HALF because we only want zero or negative movement (down).

The next field is the weight. If we entered 100 the elevator output would move from 0 with the switch OFF to + 100 with it ON. This is clearly too much movement. As we need only a fine adjustment let's try a weight of 5%. After the test flight this can be increased or decreased.

On the ground with motor disconnected, check that the elevator compensates in the correct direction (down). If not, invert the weight to minus 5. (i.e., just highlight the number and press both the RIGHT and LEFT keys simultaneously).

Leave offset at the default zero. We don't want to shift the point where the mix operates.

Next to edit is the switch field, where we select GEA to serve as the throttle switch.

The 'multpx' field determines how mixes interact. By default it is set to 'add', which in our case is what we want to do, i.e., add this small elevator servo movement to whatever inputs come from the elevator stick.

Those are the standard mix elements. Now for something a little more sophisticated.

Consider the behaviour of the model when you apply throttle. Even with the motor switched to full throttle, the model will take time to accelerate and make the wings generate much extra lift. So we need to delay the application of lift compensation (down elevator), let's say by one second. So we enter 1 into the 'delay up' field. 'Up' refers to the increasing input to the motor, not to elevator movement. But the model will not achieve full speed until sometime later, say 3.5 seconds. To apply the elevator correction gradually, therefore, we enter 3.5 in the 'slow up' field. The result is that when the throttle switch is activated, the motor starts immediately, but the down elevator lift compensation does not start for 1 second, and then takes 3.5 seconds for full deployment.

Now consider what happens at the top of the climb. The throttle switch instantly cuts the power. The model will be going fast so down elevator is still required to prevent the model from pitching upwards. We need to delay elevator movement by let's say 2 seconds to allow the model to slow down. Enter 2 seconds in the 'delay down' field. To avoid an abrupt change in the aircraft's attitude we can also slow the elevator movement so it takes say 1 second to return to neutral for the glide. Insert 1 in the 'slow down' field.

Here's what the mix screen looks like with these changes:

We now have a mix line in the elevator channel, using the throttle switch as the source, which gives 5% down to compensate for the extra lift generated under power. We have a 1 second delay before the elevator compensation starts and a 3.5 second period over which it is fully deployed. At throttle off, we have a delay of 2 seconds while the model slows and then a 1 second period during which the elevator resumes the neutral position for the glide.

Now we test the model by flying it to see if the settings are correct and change them as necessary to give a straight climb trajectory and smooth transition to the glide.

Limits (page 6/13)

Limits operate on the output channels. In the LIMITS menu you can set the centre point (subtrim) and the limits (both left and right) and reverse the output of the channel (INV for invert). Use the MENU key to activate a field and then use the RIGHT or LEFT keys to increase or decrease the value. Use the EXIT key to finish editing.
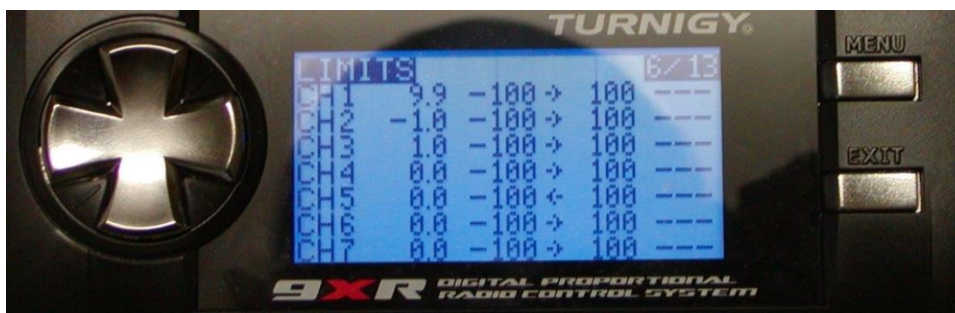
Each channel here corresponds to a channel in the receiver. The limits you set on a line apply to that channel only. Here's what you see in this screen:

Columns:

subT: Subtrim (first column)

This sets the channel's centre point.

The values of subT can be -100 to 100 with increments of 0.1. This gives fine resolution when setting the centre for each channel. You can use your stick to set the centre point as well. While subT is highlighted hold the stick so that the surface is centred. Press [MENU LONG] and the position will be recorded.

Min/Max: Limits (second and third columns)

These set the endpoints of the channel. An arrow indicates which side is active; it changes as you move the stick or other input.

Each limit point can range between -100% and +100%. The settings not only impose absolute limits on servo throw but adjust the gain and thereby maintain proportional control throughout the servo movement.

INV: Invert. (fourth column)

This reverses the output of the channel. Choices are '---' or 'INV'.
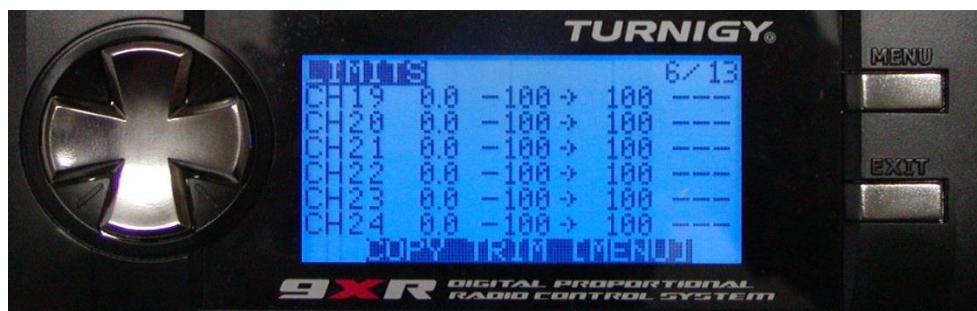
At the very bottom of the LIMITS screen is the option: COPY TRIM [MENU].

When you have landed after trimming your model to fly straight and level by using the trim buttons, you can select this command line and press the MENU button. The radio will beep, the trims will be converted into subtrim values, and the trim positions shown on the 'Home' pages will all be returned to centre.

Note that InstaTrim (controlled by the Trim Switch) offers another approach to trimming by converting stick positions to subtrim in flight (see page 19). The two methods are complementary.

Curves (page 7/13)

Curves tell your servo how to move in response to your stick movement. In ErSky9x there are eight 5-point curves and eight 9-point curves.

- A 5pt curve is a curve you can edit at positions: -100%, -50%, 0%, 50%, 100%.

- A 9pt curve is a curve you can edit at positions: -100%, -75%, -50%, -25%, 0%, 25%, 50%, 75%, 100%.

Curves CV1 to CV8 are 5-point, while CV 9-16 are 9-point. Here is an example of a 5-point curve:
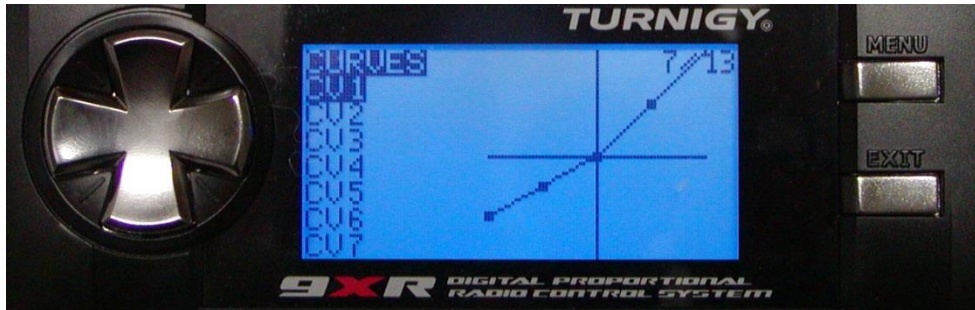
Scroll down to the curve you wish to modify and press MENU or RIGHT. This will bring up the screen for editing the curve:
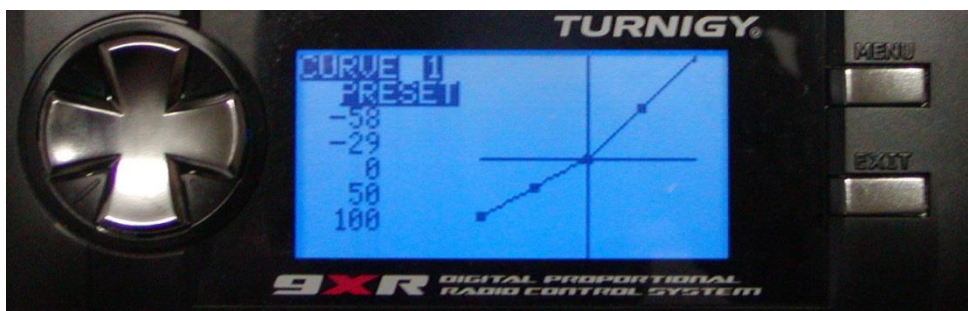
You will see 5 or 9 editable points with the values initially set a zero. Scroll through the points with UP/DOWN. Change the value with LEFT/RIGHT.

If you select the "PRESET" entry, pressing LEFT or RIGHT will populate the values with a linear curve (i.e., straight line) that is a good starting point. LEFT gives lines sloping up from left to right. RIGHT gives lines sloping the other way. Pressing the key repeatedly changes the slope. The individual points can be edited by highlighting, pressing MENU and then using the RIGHT/LEFT keys to adjust the value. Press EXIT to navigate to the next point.

The graph will show the shape of the curve as you edit the points.

Custom Switches (page 8/13)

These are logic switches that are used to compare values and combine various conditions. More precisely, they are a set of logical functions that can be used as switches. There are 25 of them in ErSky9x.

The first "operation" column lists several arithmetic, logical and differential operations. In arithmetical operations, a and b represent variables and x represents a constant. Variables can be any source, i.e., all the available in mixers, plus the five global variables and all telemetry values. In logical operations the available sources are all the physical switches and the other custom switches. Differential functions compare the changes in a variable since last match to another value.

Once the defined condition is met, the value of the switch will be "ON".

Setting Up a Custom Switch

First we define the condition. This can be:, or it can be a logical condition:, or it can be an evaluation between two sources.

1. If you've selected a **regular condition** (v>offset, v<offset, |v|>offset and |v|<offset), you need to specify a source for the value and an offset:

   ▪ The source can be a stick, a pot, a PPM input or an output channel.

   ▪ The offset can be anywhere between -100 and +100. This will be the test point for the condition.

   ▪ For example: switch "ON" only if throttle is above 50% (THR > 50)

2. If you've selected a **logical condition** (AND, OR, XOR), the conditions of the two selected switches are evaluated.

   ▪ For example: switch "ON" if either ID1 or ID2 is on (OR ID1 ID2).

3. If you've selected an **evaluation** ("==", ">", "<" etc...), you need to select the two sources to be compared.

   ▪ For example: Switch "ON" only if CH1 is less than RUD (V1<V2 CH1 RUD)

Custom switches offer three more parameters:

- Extra **AND** condition (if selected, must be on for the custom switch to become active);

- **Duration** parameter (the minimum time a custom switch will be active even if its conditions instantly become false); and,

- **Delay** parameter (that affects both activation and deactivation).

The title bar header shows the function of the field the cursor is on.

For example to turn on the timer with the THR switch and have the time announced every 30 seconds:

> SW1   TimeOff   25   ON   5   THR

The last field (THR) is the AND condition.

To finish the job, a voice switch needs to be set. More on that in the next page.

Safety Switches [and Voice Switches] (page 9/13)

This page allows you to define safety switches that will overwrite the existing value for a particular channel. It also includes provision for audio warning switches and voice switches to announce events.

Safety Switches

There are four types of safety switch:

S (Safety): Replaces the existing value for the channel when a switch is .

X (Sticky Safety): Overwrites the existing value for a particular channel.

A (Audio): Plays a sound or haptic vibration chosen from a list

V (Voice): Plays a voice file

To use the basic **S-type** safety switch, suppose you want to set a simple safety switch to lock the Electronic Speed Control (ESC) of an electric model at zero throttle. If Channel 1 is throttle, then what you need is:

CH1 S THR -100

This means that when the THR switch is 'ON' the safety switch ensures that value of Channel 1 is always -100, regardless of the position of the throttle control. When the THR switch is 'OFF' the channel works normally (typically controlled by the throttle stick). In the screen below, the first column is the channel to which the safety switch applies, 'S' identifies this as a safety switch and THR identifies the physical switch.
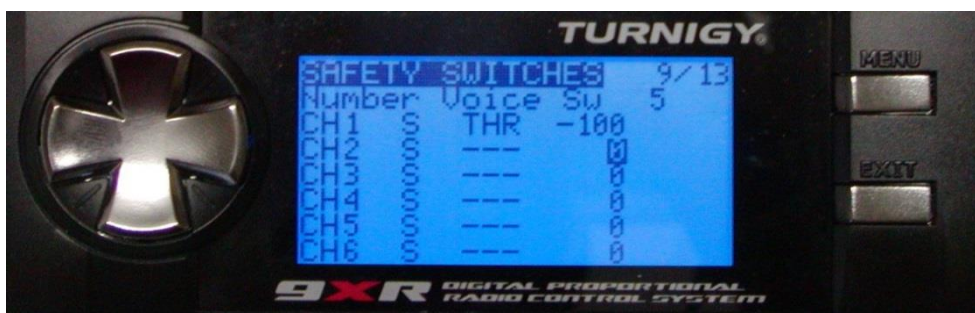
Warning! When a safety switch is active, the <u>output</u> of the channel is replaced by the defined safety switch value (here -100). The <u>value</u> of the channel, however, continues to be determined by the throttle stick position (and any other mixes that feed into it). If you were to have a mix to feed in down elevator in proportion to the throttle setting, cutting off the motor at full throttle with the safety switch would leave the elevator still in its down position.

The **X-type** switch works exactly like the basic safety switch, except that it is "sticky". Before the channel functions normally again, the throttle stick must be returned to full low (-100). In other words, the X-type safety switch performs the same function as the Sticky T-Cut template (though the latter works in a different way.

The **A-type** switch plays a sound or haptic vibration repeatedly at 4 second intervals, chosen from the following list: Warn 1, Warn2, Cheep, Ring, SciFi, Robot, Chirp, Tada, Siren, AlmClk, Ratata, Tick, Haptc1, Haptc2, Haptc3. Here's an example:

CH2 A AIL Ring

This will cause a double ring sound every four seconds whenever the Aileron switch is ON.

The **V-type** switch will play a voice file every 4 seconds when the switch is ON. For example:

CH6 V ID2 137

This will say "Flaps second position" when the 3-position switch is .

Voice Switches

Safety Switches can be converted into Voice Switches that trigger the playing of a particular voice file. Just below 'SAFETY SWITCHES' is a line that says 'Number Voice Sw'; the value determines the number Voice Switches.

In the example above, the value is set to 5. As a result, Safety Switches CH20 to 24 become VS 21-24, as shown below:
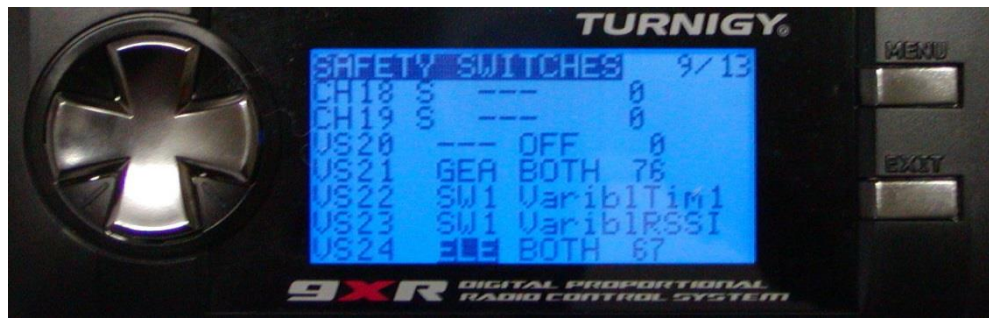
The first column identifies the Voice Switch number.

The second column may contain any physical or virtual switch such as RUD, ELE, ID0, ID1.....SW1, SW2, SW3,...etc.

The third column may contain ON,OFF, BOTH, 15 sec, 30 sec, 60 sec, and Varibl. ON means that when the switch is activated, the item in the fourth column will be announced. 'BOTH' is a means of activating both ON and OFF voice switches from the one command line provided the two voice files are consecutively numbered and are consecutively ON and OFF files.

For example, the command:

        VS21   GEA   BOTH   76

means that when the GEA switch is activated it plays file 76 'Gear up' and when the switch is deactivated it plays file 77 'Gear Down'.

The fourth column may contain a voice file number, a telemetry value, Timer 1 or Timer 2 value, or the value of a Global Variable value (see page 37).

Telemetry (page 10/13)

This page is the first of three which cover all the basic telemetry-related settings. This page applies to either the *Winged Shadow How Hi* unit or the FrSky hub inputs to the A1 and A2 ports.
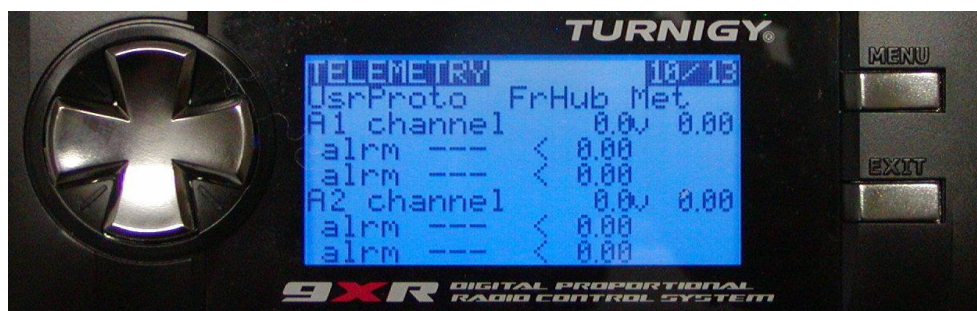
'UsrProto' is where you select between WSHhi (*Winged Shadow How Hi*) or FrHub (*FrSky Telemetry Hub*) and between Metric and Imperial units.

A1 and A2 are the two analog ports available on FrSky D-series receivers. The FrSky X8R receivers only have A1, which is connected internally to measure the voltage of the receiver power supply. A converter is available to enable analog inputs (A2) to the digital S.Port.

'Range' sets the maximum measurable voltage for the input. This is 3.3V x (divider ratio of the sensor). For example, the receivers' internal sensor has a ratio of 1:4, so the range setting is 3.3V x 4 = 13.2V.

For the FBVS-01 sensor with the default ratio of 1:6, the range setting needs to be 19.8V. The number next to A1 or A2 channel will show the currently measured value, and can be used to confirm or fine tune the Range setting by comparing the reading with that given by an external voltmeter.

If 3rd-party analog sensors are used, the Offset value and custom units (A, m/s, m, °, %...) can be used to help scale and display the input accordingly.

"Low" and "Critical" alarms for A1, A2 will trigger audio warnings when the measured value goes below the defined levels. When a microSD card with voice files is present in the slot, those alarms will be announced by voice (e.g., "A1 Low", "A2 Critical"). If no card is present each will trigger a different beep pattern.

Telemetry 2 (page 11/13)

This page continues the telemetry settings:

Alarms: "Low" and "Critical" alarms for RSSI and the mAh Alarm will trigger audio warnings when the measured value goes below the defined levels. When a Micro-SD card with voice files is present in the slot, those alarms will be announced by voice (e.g. "RF signal Low"). If no card is present each will trigger a different beep pattern.

Blades: Number of blades for the RPM sensor.

AltAlarm is the altitude alarm. Altitude is measured by a barometric device in the *Winged Shadow How Hi* unit. A frequently used setting is 122 metres (400 feet if 'Imperial' was selected on the previous telemetry page).

Voltage Thresh (Threshold): Allows the alarm threshold to be chosen.

GpsAltMain is the Global Positioning System (GPS) determination of altitude and may be turned ON or OFF.

Telemetry 2 Custom Display

Short DOWN keys will take you to a screen where you can make a custom telemetry display.

Up to six telemetry variables can be displayed on a single screen in the order you select. Highlight the blank line and using the LEFT or RIGHT keys select from the options available. You must have the corresponding telemetry sensors and hub installed in your model. BT (Bluetooth) . Telemetry may be OFF or ON.

FrSky Port refers to the port used to connect the FrSky telemetry hub to the receiver. It may be either port 1 or port 2

Each field in the custom display can be one of the various available parameters as follows:

> *Tmr1,2*: Both timers in the transmitter
>
> *RSSI*: Lowest of the RSSI values from the radio and receiver in D8 mode.
>
> *A1, A2*: Analog ports on D receivers Alt: Barometric altitude sensor
>
> *Rpm*: Engine speed, number of blades is adjusted in the settings above
>
> *Fuel*: Fuel level
>
> *T1, T2*: Temperature sensors 1 and 2
>
> *Spd, Dist, GAlt*: GPS speed, distance from starting point and GPS altitude
>
> *Cell*: Lowest cell on FLVS-01
>
> *Cels*: Sum of all cells on FLVS-01
>
> *Vfas*: FAS-40/100 voltage measurement
>
> *Curr*: Current, source configured in the settings above (FAS or analog)
>
> *Cnsp*: mAh used totaliser (needs current source configured correctly)
>
> *Powr*: Power, voltage and current sources configured above
>
> *AccX, Y, Z:* Acceleration values from TAS-01
>
> *Hdg:* GPS heading
>
> *Vspd:* Vertical speed (either calculated by the radio or reported by the sensor, depending on the sensor type chosen above)
>
> *xxx+/xxx-:* Min and max values of the available parameters

Templates (page 12/13)

The templates are "starting points" for model setups. When selected with MENU LONG they will either add to or replace the current model's mixes and settings with standard ones for a particular usage scenario. They are best applied to a newly created model. They can be

tweaked to achieve the desired result, or simply used to get an idea of what's required for the particular model type.

At the bottom of the list (most quickly reached by pressing UP from the first item in the list) we find the option to clear all mixes in the Mixer screen.

01 Simple 4-CH

Creates a basic four channel fixed wing model with 100% weighting on each of the channels. Channel order is determined by the setting in Radio Setup page 1/11. Note that applying this template over-writes channels 1 to 4.

02 T-Cut

Inserts a mix line for the throttle channel that replaces throttle stick input by -100% when the THR.CUT switch is ON. When the switch is OFF, the throttle stick is immediately active.

03 Sticky T-Cut

Replaces throttle stick input by -100% when the THR.CUT switch is ON. When the switch is moved to OFF, the throttle stick remains inactive until moved to the throttle closed position. (The "sticky" mechanism is located on CH14, which is not sent to the receiver.)

04 V-Tail

Inserts mixes for both rudder and elevator input into the two channels used for the tail servos. When the elevator stick is moved up, both surfaces move up. When the rudder stick is moved right, the left surface goes up/right and the right surface goes down/right. Note that this mix may overwrite existing mixes.

05 Elevon/Delta

Similar to V-Tail but inserts mixes for aileron and elevator into the channels that control the elevon servos. When the elevator stick is moved up, both surfaces move up. When the aileron stick is moved right, the left surface goes down and the right surface goes up. Note that this mix may overwrite existing mixes.

06 Heli Setup

Sets up basic CCPM mixes for a collective pitch flybar-type helicopter with the common 120° swash arrangement. The three swash servo output channels are CYC1, CYC2, CYC3. Flight Modes are controlled by the 3-position switch. Curves c1, c2, c3 are used for throttle on

CH5, while c4, c5, c6 are used for pitch on CH 11 (in this case a "virtual" channel not sent to the receiver). Note that this mix may overwrite existing mixes.

07 Gyro Setup

Creates adjustable outputs on CH6 controlled by potentiometer P2 and the Gear switch to set the gyro gain for a helicopter.

08 Servo Test

Uses mixes on channel 16 to generate an output on channel 15 that slowly varies from -100 to +100 and back again. To apply this output to another channel, set up a mix with CH15 as the source.

09 Range Test

Generates a varying output on channel 24 that can be used to drive servos on other channels and thus allow range testing with the transmitter in a fixed location and the model carried to a distance. Maximum range is indicated by servos ceasing to cycle smoothly.

Global Variables (page 13/13)

Global variables are values that can be substituted for the usual number on any Weight, Offset, Differential or Expo setting. Their main use is to group the adjustment of several parameters that should have the same value. For example, aileron differential on a glider with four surfaces responding to the aileron function. When trying to find the sweet spot for the differential value, instead of having to separately edit the differential value in the mixers, all four can be set to use a global variable (i.e., GV1 can be selected by a LONG press of the MENU key on the Differential field). Then adjusting GV1 on this page is all it takes for all four differentials to be updated simultaneously.

Global variables are also flight mode specific, so instead of having to create separate mixer lines with different values depending on the flight mode one, can simply use a global variable with different values for each flight mode. This can significantly help to simplify the mixer screen by avoiding many duplicate entries.

The Global Variables screen allows a name to be set for each of the five available variables for convenience, and seeing/setting the value each of them will have in each of the nine available flight modes.

For example, to use a global variable in the EXPO/DR menu, highlight the Expo or D/R value and then long press MENU key. You will then have the ability to select GV1 through to GV5. Then in the GLOBAL VARS screen (above) define the GVx, which you chose to be any of the potentiometers, P1, P2 or P3. Go back to the EXPO/DR screen. As you adjust the potentiometer, the value of the Expo changes and the shape of the graph changes.

Conclusion

There's a lot to learn about Ersky9x if you want to get the most out of your 9XR Pro. It may all look quite intimidating, but most of it you don't need initially (or perhaps ever) and can learn as you go along. Programming a simple model is not very difficult and can leave the more complex capabilities of the firmware until you really need them. But do visit the documentation from time to time to remind yourself of the amazing capabilities of this programming system. You will find something new and useful every time.

Initially, people who have worked with other transmitters may find this one very different. But most people find that once they "get" the Ersky9x approach, programming models is often quicker and easier than with the approach used by traditional transmitters. And certainly when they get to more complex models, the power and openness of the Ersky9x approach makes things easy that are hard or impossible on many traditional transmitters.

We hope this manual will help you understand Ersky9x and that it will become a major part of your enjoyment of our hobby.

One last thought. Do explore **Eepskye** on your computer. Not only does this program offer an easy way to create new models and fine tune existing ones, but it will help you update the firmware and backup your models to the computer.

Further Information

For additional information to help you understand and make best use of your Turnigy 9XR Pro, see the other manuals in this series and/or go to one of the forums dedicated to this transmitter and the open source firmware it uses.

9XR Pro Manuals

The following manuals are designed to help you get the most out of your Turnigy 9XR Pro. They are available at: http://openrcforums.com/forum/viewforum.php?f=7

1. 9XR Pro: Introduction to the Hardware

2. 9XR Pro: First Steps with Ersky9x

3. 9XR Pro: Ersky9x Explained

4. 9XR Pro: Communicating with a Computer

5. 9XR Pro: Using Voice with Ersky9x

6. 9XR Pro: Using the Eepskye Program

7. 9XR Pro: Glossary of Terms

Internet Forums

Help is always just a few clicks away on the internet forums where experienced Ersky9x users volunteer their knowledge and experience. Many of these people have been developing the firmware for years without remuneration; all they ask is donations to fund further development.

Open RC Forums: http://openrcforums.com/forum/index.php

Ersky9x index page: http://openrcforums.com/forum/

9XR index page: http://openrcforums.com/forum/viewforum.php?f=70

NOTICE

Ersky9x and Eepskye are free open source software, independently developed. This manual is provided to help you understand and use them specifically for the Turnigy 9XR Pro transmitter, though much of the information also applies to the Sky replacement boards produced as an upgrade for the 9x transmitter.

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For more information go to: http://openrcforums.com/forum/viewforum.php?f=7

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