ER9x Manual

because you asked for it!

Nov 20, 2014

Note: This manual will be more 'often' updated than the actual software. ;-)

PRE-RELEASE. Not the real one yet :-)

Table of Contents

Disclaimer

THIS FIRMWARE IS PROVIDED ON AN "AS-IS" BASIS WITHOUT WARRANTY OF ANY KIND AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE DEVELOPER AND/OR AUTHOR BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO: PERSONAL AND/OR PROPERTY DAMAGE) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS FIRMWARE, EVEN IF THE DEVELOPER AND/OR AUTHOR. HAS BEEN ADVISED BY USER OF THE POSSIBILITY OF SUCH POTENTIAL LOSS OR DAMAGE. USER AGREES TO HOLD THE DEVELOPER AND/OR AUTHOR. HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, LOSSES, LIABILITIES AND EXPENSES.

Yeah, and no spitting either!

Introduction

The IMAX/FLYSKY/TURNIGY/EURGLE 9x is a computerized radio from china. The transmitter is outfitted with a 128x64 pixel monochrome LCD, 2-2axis gimbals, 3 variable potentiometers (pots), 6 2-position switches, 1 3-position switch and some funky red trim.

The big thing about this transmitter is the price. At the time of writing radios may cost anywhere from $180 for simple units up to $1000+ for super blinged out bazillion channel super heavyweight monsters.

This one costs $60.

Where's the catch then? (you might ask) The catch is in the software (firmware - FW). The original FW is less-than-perfect. It has bugs, funky navigation and the most annoying beeping I have ever heard. Not good.

However, some neat guy called Thus figured out that the whole radio is made from gimbals, switches, funky trim and a very generic main processing unit that does absolutely everything. He had one of those ah-ha moments where insanity overrides common-sense and decided to completely rewrite the original software and replace it with his own.

At some point I decided that while Thus' FW is great I really wanted more bling for my TX. So in the spirit of open-source Thus' source was stolen and ER9x was born. (Yeah, I was vain. ER are my initials)

You might want to check out Thus' code – it's available here: http://code.google.com/p/th9x/

While you're at it check out RadioClone's code – which also runs on the 9x. While ER9x is based on Thus' code, I have managed to pilfer some of RC's excellent code. His FW is more complex but also more powerful. Check it out here: http://radioclone.org/

Got you all worked up about this? Good. Go now to the kitchen, make yourself a nice cup of coffee. This is a long read. I'll wait here till you're ready. Promise!

Erazz

Ok this was the introduction from Erazz, the man that got all this started the way we have it today. Then Mike came along and he has been doing it since then. Mike already implemented most of the features we have currently available in er9x.

This manual wasn't up to date so I've decided to spend some hours, eerrrrrr... days updating this manual to the latest still not released test version.. Yes, some of the features aren't still available on a released version. If you want to try the latest test version please find it here.

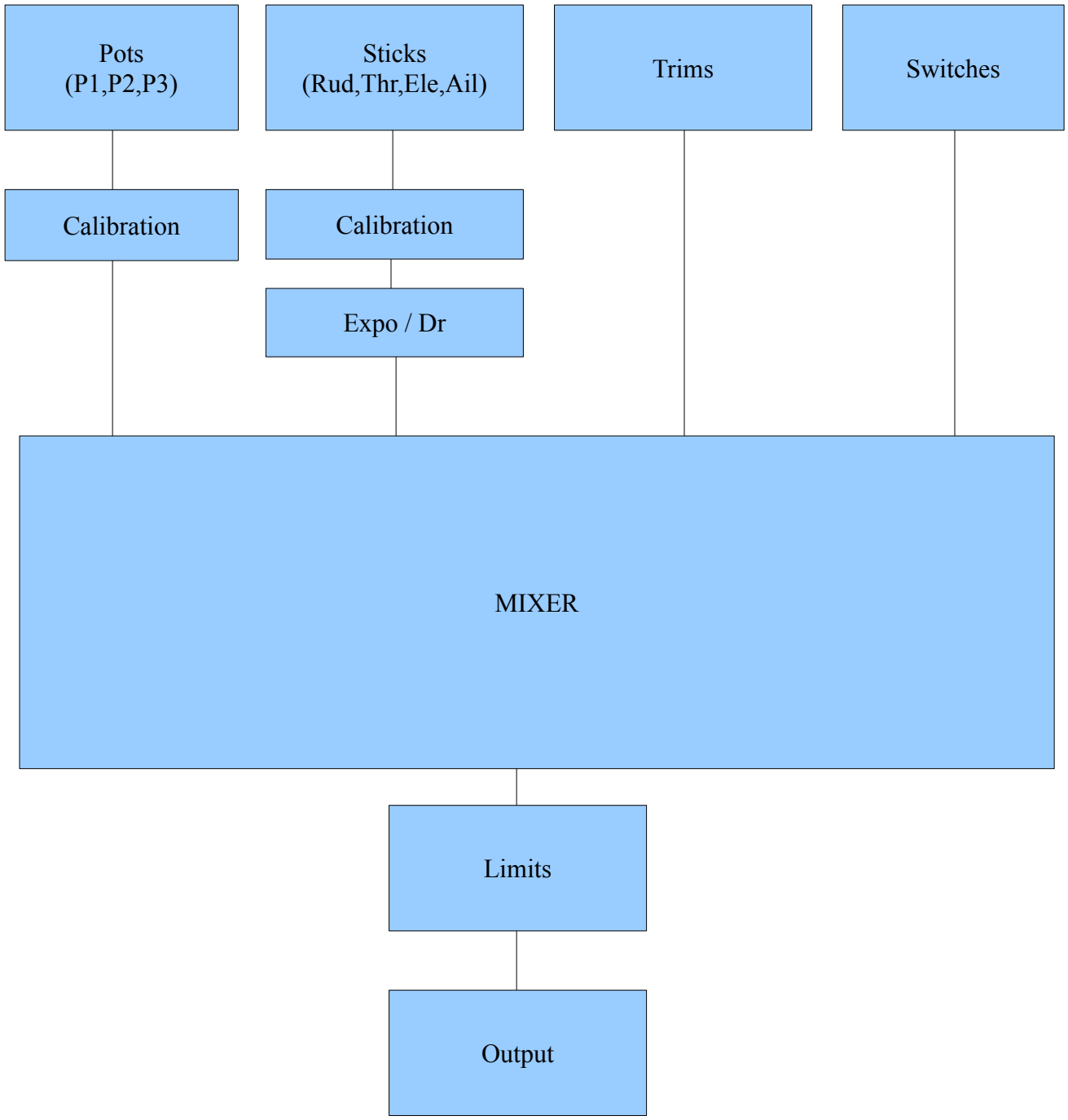
Many of us replaced the processor of the 9x radio with a better one that offers more flash and eeprom memory. The Atmega128 that has the double of flash and eeprom, and the Atmega2561 that also has the double of the RAM of the original chip.
So, some of the features described in this manual aren't available for the 9x radio with the original Atmega64 provcessor.
Also there are some features like Telemetry, voice, Haptic (vibration), rotary encoder, etc, that require modifications to the TX.

YOU NEED TO DO THE HARDWARE MODIFICATIONS BEFORE YOU CAN USE THOSE FEATURES.

João

How it works

Bear with me here - some flow charts coming up:



The system receives 4 types of inputs:

1. Main Sticks
2. Potentiometers
3. Trims
4. Switches

The analog inputs (sticks and pots) go through a calibration phase. The sticks can also go through Expo and Dr filters before going to the mixer.

The mixer does it all. It directs each input to the desired output (CH1..CH16). It controls how the inputs are added. It also controls the timing of each function.

After the inputs are processed by the mixer they are directed to the relevant output channels. The limit procedure takes over and makes sure no output goes too far.

Finally the channels are encoded and sent to the RF module to take that nice little hike through the air to your model. Here is a little list showing what happens since you move a stick, pot, etc, until your command is sent to the model.

The order of processing of an input is:

1. Obtain the source value, with expo/dual rates applied to sticks.
2. Add offset (if "late offset" is not enabled).
3. Delay and Slow.
4. Curve/differential.
5. Weight.
6. "late offset" if enabled.
After all mixes:
7. Apply Sub-trim.
8. Apply Limits.
9. Apply Safety Switches.

Nomenclature *(just so we understand each other)*

Inputs:

1. Rud – Rudder.
2. Ele – Elevator.
3. Thr – Throttle.
4. Ail – Aileron.
5. P1/P2/P3 – Pots.
6. Switches:
    1. THR – Throttle cut switch, don't confuse this with the THR stick. The THR switch is located on the back left side.
    2. RUD – Rudder Dr switch.
    3. ELE – Elevator Dr switch.
    4. ID0, ID1, ID2 – Three position switch. These 3 define the 3-position switch. ID0 is the top position, ID1 – mid position and ID2 – bottom position.
    5. AIL – Aileron Dr switch.
    6. GEA – Gear switch.
    7. TRN – Trainer switch. This switch is spring loaded.
    8. SW1..SW6 – Custom switches. More on these later.

It should be stated that every function in this FW is assignable. There are no fixed switches. You can choose the TRN switch to be throttle cut and use the triple switch to control Dr. The names are useful since they are labeled like that on the Tx.

Edit buttons

There are 6 edit buttons on the Tx. In this manual they are noted with square brackets ([MENU]). Some functions need the button to be pressed and held for a second or so. They are noted as “long” presses like so: [MENU LONG]

Also since the “+” and “-” keys are placed stupidly in the original Tx I've switched their position. So [+] is actually [-] and vice-versa. This is actually more intuitive than the original (trust me, I've tried using them as is).

Since to upload this FW you need to open up your Tx and do some modifications (which void your non-existent warranty FYI) it is highly recommended you switch between the [+] and [-] keys. It's a simple job, so don't skimp, you'll thank me later.

To avoid confusion with people who modded their keys and all the others I'll refer to the [+] and [-] keys as [LEFT] and [RIGHT] from now on. (I hope that left and right are still universal values – you can never tell today)

The “!” sign. Whenever you see the “!” sign you can read that as “not” or “inverted”. Switches can be “normal” or “inverted”. So when choosing the elevator d/r switch ELE is normal operation and !ELE denotes inverted operation.

Navigation

As a general rule the [UP]/[DOWN]/[LEFT]/[RIGHT] move the cursor appropriately The [MENU] key is used for selection and for editing. The [EXIT] key is used for exiting (surprise). Pressing [EXIT] will generally bring the cursor to the top of the screen. Another press will exit the menu to the main screen. Pressing [EXIT LONG] will exit immediately to the main screen.

Pressing [MENU] from the main screen will take you back to the last menu.

From the main screen you can press [RIGHT LONG] to enter the model setup pages. Pressing [LEFT LONG] will enter the general setup menus.

Once in the menus you can navigate between different screens using the [LEFT]/[RIGHT] keys as long as the cursor is at the top right position of the screen.

Editing and Saving

As a rule once a value is changed it is saved. You can turn off your Tx and turn it back on and the values will be saved. The values are saved internally in the MCU's eeprom. However there is a slight delay sometimes so it's probably a good idea to wait a couple of seconds before turning off.
There is no undo functionality. Once something is erased/changed it's changed for good.

Generally, when a value is highlighted and you cannot move left or right then pressing [LEFT]/[RIGHT] will change that value.
When moving left or right is possible you need to press [MENU] to edit that value. Edit-mode is displayed by the cursor blinking. To exit edit-mode press either [MENU] or [EXIT].

When editing, pressing both [LEFT] and [RIGHT] simultaneously inverts the value. Try it, it's cool!
Also , with r155 and up it is now possible to change values with the P3 pot (the one at the front of the Tx called PIT. TRIM/AUX 2).
Pot scroll ON: **P1:** page change
P2: line change.
P3: value change.

On Startup – Quick Model Select

On startup holding a certain key will load an associated model memory. This is useful for quickly changing between model memories:

1) Holding [**MENU**] Will load Model memory **#1**
2) Holding [**EXIT**] Will load Model memory **#2**
3) Holding [**DOWN**] Will load Model memory **#3**
4) Holding [**UP**] Will load Model memory **#4**
5) Holding [**RIGHT**] Will load Model memory **#5**
6) Holding [**LEFT**] Will load Model memory **#6**

Transmitter Layout

Main Screens

There are five main screens, 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 main screen shows telemetry (Frsky version of the er9x firmware only).
You can flip between these with the [UP]/[DOWN] keys.

Main Screen 1 (Stick and Pot Positions)

In the first main screen, the lower half of the screen shows a graphical representation of stick and potentiometer positions, as well as a list of the physical switches and also all the custom switches (see page --). When a switch or custom switch is on, it will be highlighted.
Press [RIGHT] or [LEFT] to cycle through 4 pages showing all the switches and custom switches.

In the upper half of the screen, the transmitter voltage is displayed in large print, along with the trim increment type, here ‘Med’ (see page --). The current value of the Timer is also shown in large print, along with the switch used to activate it, here ‘THs’ (see page --). In addition, the current Flight Mode will be displayed if it is other than the default FM0.

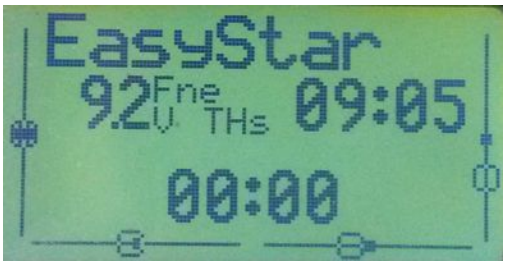
Main Screen 2 (Graphic Servo Outputs)

In the second main screen view (short press down from the previous screen), the upper part of the screen is identical to main screen 1, while the lower half of the screen shows in bar graph form the channel outputs. These bars reflect the outputs resulting from the programming for the particular model processing the inputs of the sticks, pots and switches.
Note that just above the channel output graphic is a bar showing which channels are being 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). With the necessary hardware, the transmitter is capable of controlling 16 channels.
Warning: It’s easy to give a short [RIGHT/LEFT] press inadvertently and display channels not being used on your transmitter.

Main Screen 3 (Numeric Servo Outputs)

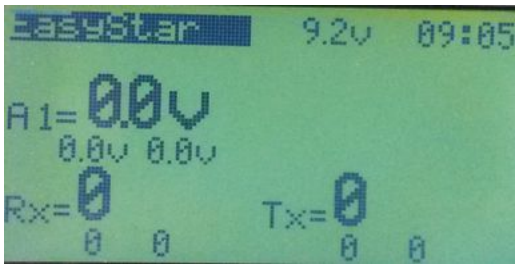
In the third main screen (short press down from the previous screen) the lower half of the screen shows the channel outputs in digital form from -100% to +100%.
Again, the bar shows which channels are being displayed (here 1-8). A short press of the [RIGHT] or [LEFT] key changes the channel view from the first set of 8 channels (1-8) to the second set (9-16).
The upper part of the screen is identical to the previous screens.

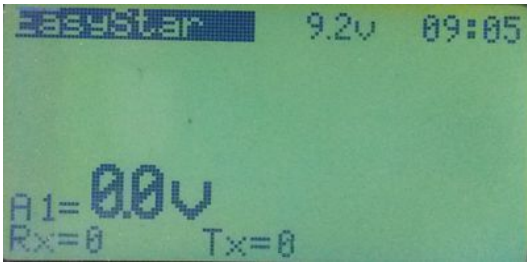
Main Screen 4 (Timer 2)



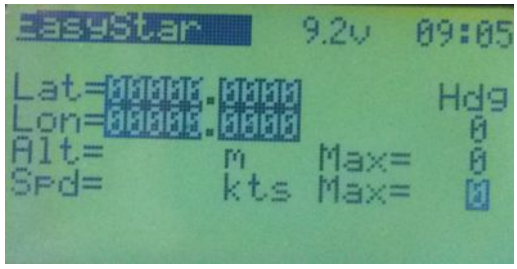
In this main screen the lower half displays just an extra timer that may be started / paused by pressing [MENU], or stopped and reset to zero by pressing [EXIT]. A long press will reset both timers and/or stop timer 2.

Main Screen 5 (Telemetry screens) *(Frsky version of the er9x firmware only)*





To get to the telemetry screens short press [DOWN] from the previous one, or press [DOWN LONG] from any other main screen. Use the [RIGHT] or [LEFT] keys to cycle through the four telemetry screens, including a custom screen which you can adapt to suit your requirements. Consequently, the information in the screens may vary from what is shown below.
The telemetry data displayed 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.



Custom Telemetry Display

In the custom telemetry display, when pressing [LONG MENU]:

If **ALT** is displayed, set to 0.

If **A1** or **A2** is displayed, and is measuring current, use the present value as an offset, thus setting the displayed value to zero.

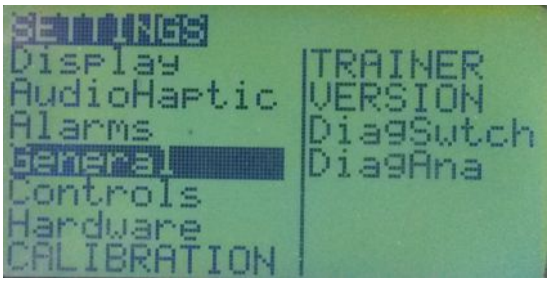
If a **SCALER** is displayed (see page 55) and its source is ALT, the ALT value is used as an offset to set the ALT value displayed to zero.

Statistics Screens

From any of the main screens pressing [UP LONG] will enter the statistics screen, then press [UP] / [DOWN] to cycle between them. Pressing [DOWN] from the STAT screen or [UP] from the STAT2 screen will bring you back to the main screens
The first (STAT) shows some available timers and traces the throttle stick as well.
The second (STAT2) shows general timing of the Tx. The value “tmain” shows how long the math takes. This will increase as you add more mixers. It can be very large sometimes depending on eeprom writes. The Stack value shows the unused space, in hexadecimal, between the end of used Ram memory and the lowest point the stack has reached. You can reset the timers by pressing [MENU].

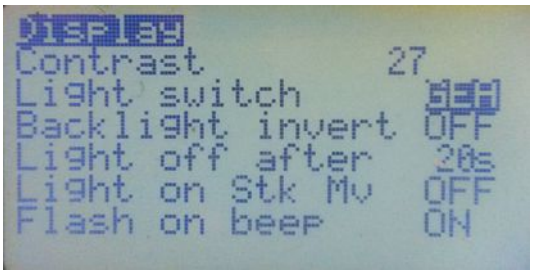
General Settings

From the main screen pressing [LEFT LONG] will enter the general settings menus. Here you can set up settings that will be the same regardless of chosen model.
Initially you see an index of the various menus like this:



Use the [UP], [DOWN], [LEFT] and [RIGHT] buttons to highlight the sub-menu required then press [MENU] to select it. [EXIT] returns to the main screen.

Display



Contrast

The LCD's contrast. The values can be 20..45. The higher the value the darker the screen.

Light switch

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

Backlight invert

Option to invert the backlight output, needed for the rev 2.2 SmartieParts board.

Light off after

When this is not OFF any keypress will turn on the backlight and turn it off after the specified number of seconds.

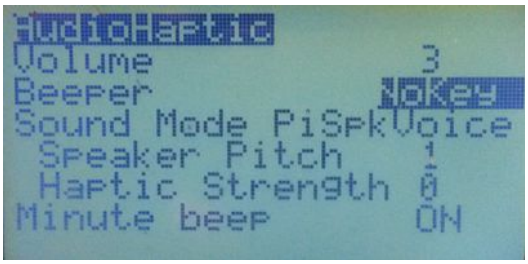
Light on Stk Mv

When this is not OFF movement of the sticks will turn on the backlight and turn it off after the specified number of seconds.

Flash on beep

Flashes the backlight on timer beeps.

AudioHaptic *(some options need a voice module installed)*



Volume
The volume setting for the add on voice module.

Beeper: Sets Beeping levels.

i. Quiet. No beeping at all. No warning – nada. If the kids are sleeping and you must setup the model in your living room this is the mode to use. Just remember that the Tx will not even warn you when the battery is low. If you're using a Lipo watch out!

ii. No keys. The beeps are normal but edit keys are silent.

iii. Normal. Normal beeping.

iv. Long beeps. For those who want to annoy other people.

v. Extra long beeps.... You gotta be joking, right??

Sound Mode
Sets use of beeper, Piezo speaker, and/or Voice module.

i. Beeper. The standard beeper.

ii. PiSpkr. Assumes you have the piezo speaker fitted, works OK with stock beeper.

iii. BeeprVoice. The standard beeper, beeper, with added voice module.

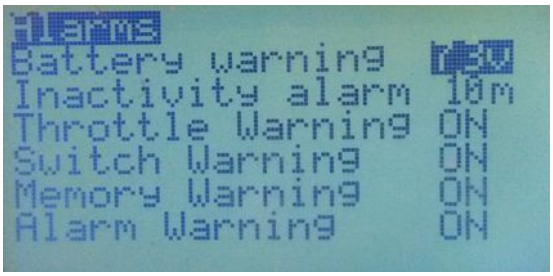
iv. PiSpkVoice. The piezo speaker, with the added voice module.

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

Haptic Strength *(Haptic mod needed)*
Values from 0 to 5 may be set. This parameter determines the strength of the vibration.

Minute beep
Beeps every full minute while the timer is running.

Alarms



Battery warning (Battery voltage warning)
When the connected battery's voltage drops below this voltage the Tx will beep. Though the Tx will continue to function normally it's really advisable to land as it is known that this FW was not able to fix the “zero voltage non-functionality” problem of the original.

Inactivity alarm
This will set up a warning that will Play an audio alarm* if the Tx is left unattended for the specified amount of time. The default value is 10 minutes. To turn off the Inactivity timer – set the value to zero. Also, when running on USB power, the alarm is inactive. Values can be from 1 to 250 minutes. To reset the timer (and stop the alarm) simply move one of the sticks.

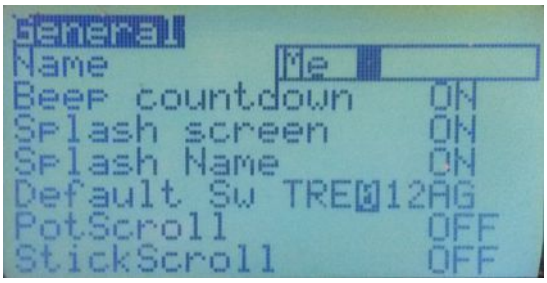
Throttle warning
If ON will show a warning when throttle is not at idle when the Tx is turned on. The Tx will not output a signal until the alert is cleared.

Switch warning
If ON will show a warning when the switches are not at the default position when the Tx is turned on. The Tx will not output a signal until the alert is cleared.

Memory warning
If ON will show a warning when the available eeprom memory is less than 200 bytes when the Tx is turned on. The Tx 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. This has been added after a programing session left
a user flying on silent. I find it really useful!

General



Name
The radio owner's name. You... Unless.... (hmmm...) This will also be displayed on the splash screen.

Beep Countdown
Beeps at 30, 20, 10, 5, 4, 3, 2 and 1 seconds before the timer ends. If a voice module is installed, the radio will speak the remaining time.

Splash screen
Show the logo on radio startup. Btw, you might not know this but the splash screen can be skipped on startup by pressing any key or moving a stick.

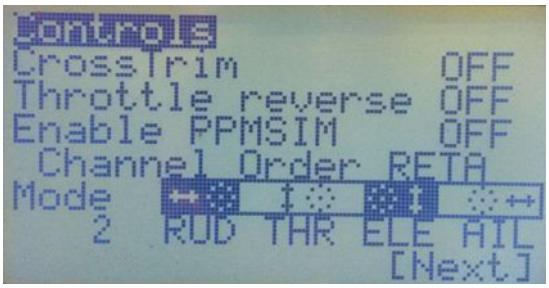
Splash Name
This may be set to ON or OFF. If ON, the name set in *Owner Name* above will be shown on the splash screen.

Default Sw
Sets the default switch positions at start-up. Set the switches in the desired positions, then press the [MENU] key. *This will set the new switch positions as default at start-up.*

PotScroll
Option to use the pots to move between, and edit, menu items.

StickScroll
Option to one of the sticks to move between, and edit, menu items.

Controls



Cross Trim

Swap the trims so the trim switches on the left apply to the stick on the right, and those on the right apply to the stick on the left. 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 28).

Throttle reverse

This is for all you wacky people who fly with the throttle backwards (i.e., with idle away from you and full throttle towards you). Though I personally don't understand how you fly like that, it's a nice feature. The throttle reverse will also reverse the throttle warning on startup and some other throttle related functions.

Enable PPMSIM

Enable the PPMSIM protocol, this reroutes the PPM output for use when using a simulator, and when in 'student' mode for buddy boxing. This avoids the need to do a hardware mod or remove the stock Tx module to use these functions.

Channel order

This setting determines the sequence of the first four channels that will be used in setting up a new model or applying a template. This is the order in which the outputs will be available from the receiver. Popular channel orders include TAER (used for DSM receivers, which typically provide throttle failsafe only on channel 1) and AETR (used by many manufacturers). Note that Ersky9x provides complete flexibility in selecting channel order.

RETA means RUD = 1, ELE = 2, THR = 3, AIL = 4.
AETR means AIL = 1, ELE = 2, THR =3, RUD = 4.(and so forth).

Stick Reverse

Rud and Ele sticks are reversed. Mode 2 is selected

When the diagrams of the sticks are highlighted by a rectangle drawn around them, pressing [LEFT] or [RIGHT] cycles through 16 different possibilities where one, or more, of the diagrams are highlighted in reverse. When so highlighted, the operation of the corresponding stick is reversed. This is useful if you have fitted alternative gimbals (like the Taranis gimbals or the Aurora 9 gimbals), and the wiring causes a stick to operate in the wrong direction. The picture above show "Rud" and "Ele" sticks reversed.

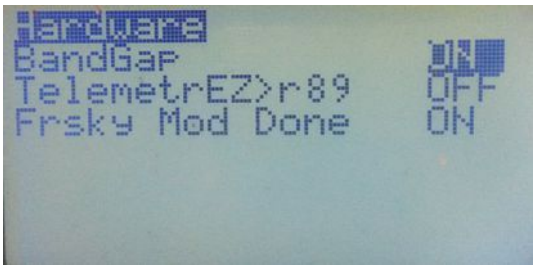
Mode (i.e., stick mode)

Choose the Mode setting (1, 2, 3 or 4) to suit your preference and/or match local practice. Mode 1 (throttle and aileron on right stick, elevator and rudder on left) and Mode 2 (elevator and aileron on right stick, throttle and rudder on left) are by far the most popular stick configurations around the world. Less common are Modes 3 and 4, which are similar to modes 1 and 2 respectively except that they have aileron control on the left and rudder on the right. *(see picture above)*

Names of the four sticks

Here you may rename the sticks from the default names of Rud, Ele, Thr and Ail. You choose in each model whether to use the default names or these alternative names. Four characters allowed.

Hardware



Bandgap

Option to enable the use of the on chip Bandgap device for battery voltage measurement.

TelemetrEZ>= r90

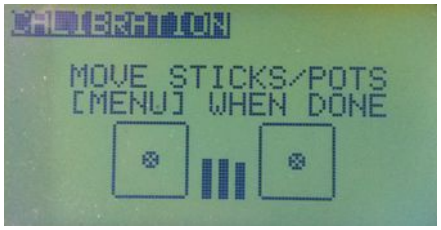
Set this option if you have installed the optional add on TelemetrEZ board, for telemetry, AND have flashed the TelemetrEZ board with r90, or later, firmware.

Frsky Mod Done

Set this to ON if you have done the Frsky telemetry mod.

Note: This option is only available on radios with the Atmega128 or Atmega2561

Calibration



This screen allows you to calibrate the analog inputs A1..A7 (all Sticks and Potentiometers).
The calibration method goes like this:

1. Press [MENU]

2. Set Sticks to center. (Including throttle and pots)

3. Press [MENU] → (SetSpan)

4. Move sticks and pots through full range.

5. Press [MENU] → (Done) – Values are saved here.
The values are calculated when you press [MENU]. They are saved when you press [MENU] to (Done).

Trainer

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 to which the model’s receiver is bound). The menu allows the PPMin (trainer) inputs coming 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.
Also, the student transmitter does not need to have the same model setup as the instructor.
The slave transmitter does not have to be a 9x. Compatible transmitters include the 9XR, 9XR-PRO, among others. Normally any transmitter that sends a valid PPM signal on it's trainer port should work. Transmitters such as Futaba and Spektrum can also be used but may require special cables or circuitry. As an example, Spektrum's PPM signal might not be strong enough to drive the 9x trainer input and a circuit with a transistor might be needed to boost the signal.

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 use a different switch, or even transfer control selectively with separate switches for some channels. When the Trainer Switch is held ON, all the mixes on the instructors Tx will be applied to the student's (Trainer) inputs. If, for example, The model being controlled has expo programmed, this will be applied to the raw trainer inputs when they are selected.
The Slave (Student) transmitter just needs a model memory with a basic four channel model programmed in it. No special settings or mixes are needed.

This menu allows the PPMin (trainer) inputs to be configured. It enables the RAW PPM inputs to be selected to Replace (or Add to) the sticks for training purposes.

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 (sometimes used for training)
:= 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 trainer operation, normally TRN.

Multiplier

Adjusts PPMin values by a factor from 0.0 to 5.0. Normally left at 1.
The multiplier does as it's name suggests. It multiplies the ppm Input by a set amount. Great for dealing with different tx's whose makers don't know how to encode PPM :-P

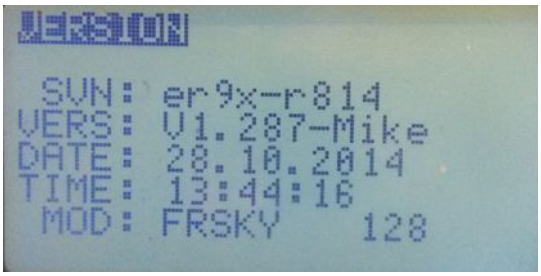
Cal (Calibrate the Trainer Input)

How to calibrate the radio to the PPMin signal coming from the slave TX. First turn the master radio on using the Power switch. Then plug the trainer cable into the slave (student) TX with the power switch in the OFF position. The tx will power on and start sending a PPM signal on it's trainer port. Plug the cable to the master Tx trainer port, and navigate to the Trainer menu. You should see the values changing when you move the sticks on the slave (student) radio.

Center the sticks and trims on the student Tx, including the throttle. Now highlight **'Cal'** in the Trainer setup menu on the instructor Tx. Press the [MENU] button on the Instructor Tx. All of the values to the right of **'Cal'** should have changed to zero. This is how you calibrate the centers from the student Tx.
In order to check that this calibration has been successful, you should move the sticks on the Student Tx to their fullest extents and make sure that each stick has a range of about **-100** to **100**.

There is an option for each model to enable or disable the trainer input function. If you do not need the trainer function you may disable it, and use the selected switch for something else (see page 30).
While a trainer setup normally uses only the first four channels, all the PPMin values are available as source in the mixer (PPM1.....PPM8).

Version



This screen shows the version information for the current FW:

SVN
The SVN name of the current revision.

DATE
Compile date for the current FW.

TIME
Compile time for current FW.

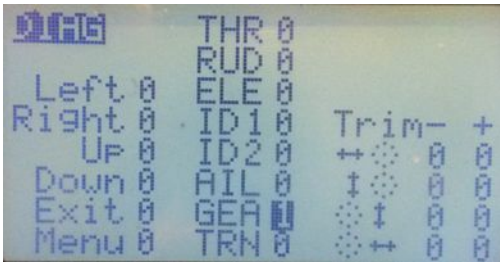
VERS
Version number.

MOD
The hardware specific version chosen (e.g. 128 for ATMEGA128 processors)
Since ER9x is OPEN SOURCE I try to help out anyone who has problems. Please feel free to open new issues for defects and/or enhancement requests at the project's code page:

http://code.google.com/p/er9x/issues/list

Your participation is what helps me makes the FW better (and your donations of course!). Please use the revision number stated in this screen when you report a problem.

DiagSwtch



This menu will help you visualize the current state of the trims, keys and physical switches.
Each Key/Switch/Trim is represented. When pressing a key or switch they are highlighted.
Very useful for troubleshooting problems with switches or trims.

DiagAna

Here you can see the analog inputs in hexadecimal format to save space and annoy you at the same time. Values range between 0..0x3FF (0..1023).

A1..A4 are the gimbals (sticks).
A5..A7 are the pots.
A8 is the radio's battery voltage. You can press [DOWN] and highlight the battery voltage. Pressing [LEFT]/[RIGHT] will increase and decrease the value and so enable you to calibrate the radio battery voltage monitor. Just measure the voltage of the TX battery with a voltmeter and insert the same value here.

The **BG** value is the Bandgap measurement. It is displayed to help detect a bad internal bandgap device. The value should be between about 230 and 280.

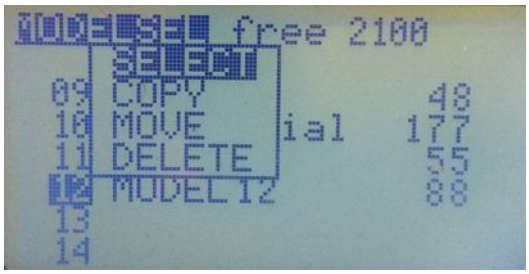
Model Setup

From the main screen pressing [LONG RIGHT] will enter the model select/settings menus. Here you can set up settings that are model specific.
The menus are as follows:

Model Select
1. Model Setup
2. Heli Setup
3. Modes
4. Expo/Dr
5. Mixer (This is the important one)
6. Limits
7. Curves
8. Custom Switches
9. Safety Switches
10. Telemetry
11. Telemetry2
12. Templates
13. Global Variables and Scalers
14. Model Settings (This one is still under development and will replace, or even better, organize all the menus above)

ModelSel (Model Select)

Press [LONG RIGHT] from the Main Screen 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. At the top of this screen you can see the amount how much space is still available in the EEPROM.



Once a model slot has been highlighted, SELECT, COPY, MOVE and DELETE options 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 / Select a Model

An asterisk next to the model number indicates that this is the currently active model. Only the active model can be edited, but cannot be deleted. 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 for the chosen model. Press short [LEFT] to enter the last of the Model Setup pages for the chosen model.
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 Er9x are associated with individual models and thus may vary from one to another. 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 based on the simple four channel template (see page 52) 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.

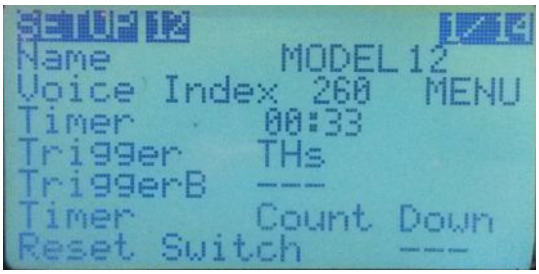
Copy, Move, Delete a Model

Note that the commands in the Model Select menu (SELECT, COPY, etc.) apply to the model whose number you have highlighted (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.

Note: You cannot delete the active model. You first need to make another model the active one.

Model Setup (1/14)

The Setup screen has many lines and presents a wide range of settings specific to the individual model that is currently active (Model Number XX). 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 General Settings menu. To edit, scroll down until the first letter or space in the name is highlighted. Press [MENU] and the highlighted character will start flashing. You can now edit it using the [LEFT] and [RIGHT] keys. 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. Once you have finished, press [DOWN] to get to the next menu item.

Voice Index *(Only radios with a voice module installed)*

Here you specify the voice file that will be announced when the model is selected. Highlighting the number and pressing [MENU] will cause the corresponding voice file to be played. To edit it just press the [LEFT] or [RIGHT] Keys to change the file number. The range of numbers for the models voice files 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).

Timer

This is a fully programmable timer that can count either up or down. By default, the timer is set to OFF and is not operational.

To set the time, Press [RIGHT]/[LEFT] to choose between minutes and seconds.
Press [MENU] and the cursor will blink. To edit use the [UP]/[DOWN]/[RIGHT]/[LEFT] beys.
Press [MENU]/[EXIT] when done.

Trigger

Choose what triggers the timer → (remember – by pressing [LEFT] you'll see the same values with the "!" sign. This means that the usage is inverted).
Options for Trigger are OFF, ABS, Rus, RU%, ELs, EL%,THs, TH%, ALs, AL%, P1, P1%, P2, P2%, P3, P3%, all the Physical switches, all the virtual switches (custom switches), momentary switches, or all the channel outputs (c1% to c16%).

OFF - Timer is off. It doesn't even show on the main screens

ABS - Timer is on. Always counting.

XXs, XX% - Select this to activate the timer based on stick position. When a XXs is selected (THs for example) The timer starts whenever the stick is not at zero. The XX% sign is the same except the timer speed is determined by stick position. When at zero, the timer is stopped. When at full the timer goes at normal speed. When midway the timer's speed reflects the sticks position.

Px, Px% - Select this to activate the timer based on Pot position. The same as for the sticks.

Switches - You can specify a physical switch or a logical switch (see page 42) so whenever that switch is activated the timer counts.

Momentary switches - A switch denoted with “m” (like TRNm) means “momentary”. That means that moving the switch once to the on position and back turns the timer on. Moving it on and off again turns the timer off. Try it with the TRNm switch. Flick the switch to toggle the timer on and off. (Difficult I know, take a sip from your coffee, relax a bit, take a break, it's not difficult once you try it out :))

TriggerB

TriggerB is best described as an "AND" switch to “**Trigger”** (Please see above).
If a TriggerB switch is defined, then it needs to be ON for the Trigger to work. That means you need two conditions for the Timer to start counting. Options are any physical switch or any custom switch.

Timer - Here you can choose whether the timer counts up or down. Press [MENU], [RIGHT] or [LEFT] to toggle between “Count Up” and “Count Down”

Timer Reset Switch

This resets the timer to it's set value. Options are any physical switch or any custom switch, plus ON and OFF. For example, imagine you set the “TRN” switch as the timer reset switch, and the Timer is set to count down from 10:00 (ten minutes) with the throttle stick as trigger (THs).
At any point if you hit the “TRN” switch, the timer will be reset to 10:00. If it is counting, when you reset it, it will continue counting from the beginning.

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.

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 the expo setting on all the other sticks.

Trim Inc (Trim increments)

This setting determines how the active trims behave.

Exp - Exponential. Trims are fine near the center and get progressively coarser further out.

ExFine - Extra fine – 1 step per click.

Fine - 2 steps per click.

Medium - 4 steps per click.

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 menu). 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, if necessary.

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

Fast Mix Delay

Fast Mix Delay changes the scale of both "**Delay"** and "**Slow"** in the mixer. If "Fast Mix Delay" is OFF, delay and slow go from 0 to 15 in steps of 1 second. If "Fast Mix Delay" is on, then they go from 0.0 to 3.0 in steps of 0.2 seconds. Press[MENU] to toggle this option On or OFF

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. It will then become highlighted.

Proto (Encoding Protocol)

PPM - Is the protocol used for many plug-in RF modules (including the OrangeRX DSM2/DSMX and the FrSky DJT). You can set the number of channels to encode (4 to 16 channels). If you set it for example to 6 channels, that is the number of channels the radio will output. This is important when using the TX with some flight simulator dongles, as they don't work well when the radio outputs more than 4 or 6 channels. You can also change the pulse spacing and the frame length. This is useful for systems which might experience jitter. On the whole it might be a good idea to leave it alone. (If you use a Spektrum DM9 module, set spacing to 350uSec for more accurate centering.)

PXX - This setting should be selected for the newer FrSky XJT module. Options for this protocol are:
RxNum - Receiver match. It gives the receiver a number (0...124). This prevents you from flying with the wrong model selected in the radio.
Bind - Puts the XJT module in Binding Mode
Range - Puts the XJT in Range Check Mode (reduced power)
Type - This selects the type of receiver. D16 for the "X" series receivers, D8 for the "D" series receivers, and LRP for the long range receivers
Country - This sets the RF module power to match the legal requirements in some countries..

Failsafe - Set failsafe from the radio.

For more information, please go to the frsky website and download the manuals..

DSM2 - This setting is used where an internal module extracted from a Spektrum transmitter is "hacked" into the 9x. Instructions for doing this can be found here.

Options for this protocol are:

RxNum - Model match. It gives the receiver a number (0...124). This prevents you from flying with the wrong model selected in the radio.

DSM Type - LP4/LP5, DSM2only, DSM2/DSMX

PPM16 - This setting sends channel 9 to 16 to the trainer port. If you connect another RF module to it, you can have a system that outputs 16 channels. Cool!!

The following applies only to the PPM setting:

PPM FrLen (Frame length)
The length of each frame within the PPM train, in milliseconds. Normally it it can be left alone.

PPM 1st Chan
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.

Shift Sel (Shift select)
POS/NEG. Select PPM signal shift. POSitive or NEGative.

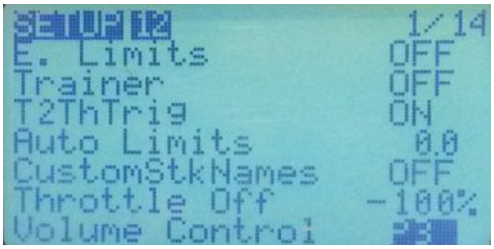
E. Limits
Extended limits. Allows control limits to go to plus or minus 125% instead of the normal 100% maximum. Note that 100% on the Er9x firmware already corresponds to 125% on most other transmitters, so extended limits should not normally be required.

Warning: *Please test to make sure this does not cause unwanted mixing between channels or exceed servo mechanical limits.*

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 21) for an explanation of the Trainer function. Selecting OFF frees up a switch, usually TRN, for other purposes.

*T2ThTrig (*Timer 2 Throttle Trigger)
Timer 2 has a "*Timer 2 throttle trigger*" available, as well as using the [MENU] button. Advancing the throttle past -95% starts the timer 2. This only work when the timer is at 00:00. To start the timer again with the throttle stick, you must reset the timer by pressing the [EXIT] key.
Use the [MENU] key to toggle this feature On or OFF

Auto Limits
This setting allows Sub Trim to override the Limits setting so that servo throw remains the same on both sides of center. The value here determines the maximum amount the limits can be exceeded (e.g., 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 control limit values are no longer absolute and could allow a servo to exceed a mechanical limit.



CustomSTKNames
This enables the custom stick names you have defined in the "*General Settings / Controls menu" (see page 19), on this model. Use the [MENU] key to toggle this feature On or OFF*

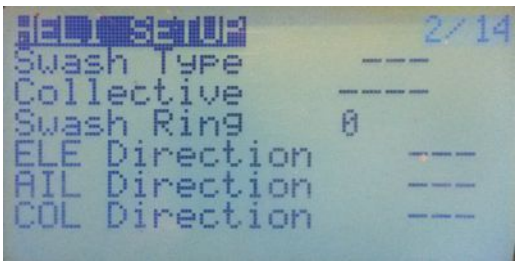
Throttle Off
This option allows us to set the throttle idle position in the centre (0%) instead of at -100%. This works for both the "Power On" throttle check, and for the "sticky" safety switch (see page 45). It is selectable on a per model basis. Very useful for land and water vehicles.

Volume Control
For use if you have a voice module installed in the radio. You may select a specific control to adjust the audio volume, typically one of the three pots.

After you've finished editing the "Model Setup" menu just press [EXIT] and the page number at the top of the menu will be highlighted. Press the [RIGHT] key to move to the next menu, or hit [EXIT] again to exit to the previous main screen.

Heli Setup (2/14)

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 cannot accept CCPM mixing. Likewise, coaxial helicopters typically 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.



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 helicopters.

Collective

This defines the source of the collective input. The idea is that you can create a mix in a virtual channel (above those sent to the receiver) incorporating all the required curves and switches, then 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

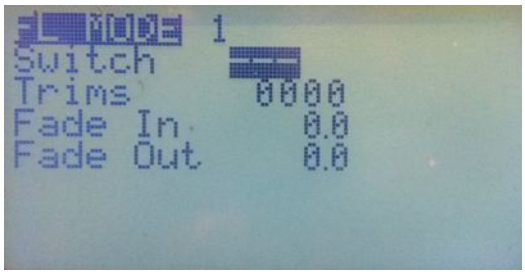
These allow the direction of the input functions to be inverted. Use them to make the controls move the correct way when setting up your heli. The outputs of this Heli Setup menu are CYC1, CYC2 and CYC3. These need to be assigned on the MIXER menu to the channels that will drive the swash servos. The settings made here have no effect unless you use CYC1, CYC2 and CYC3 as source in the mixer.

As noted above, a multirotor or flybarless helicopter which uses onboard flight controllers will NOT use the CCPM configuration.

For more information on setup please consult forums devoted to the relevant type of helicopter.

After you've finished editing this menu just press [EXIT] and the page number at the top of the menu will be highlighted. Press the [RIGHT] key to move to the next menu, or hit [EXIT] again to exit to the previous main screen..

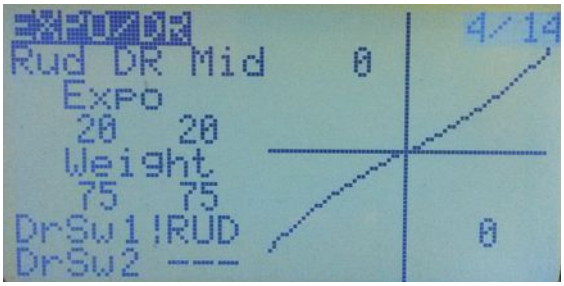
Modes (Flight Modes) (Page 3/14)

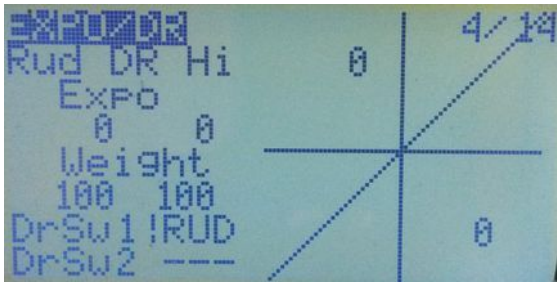


Five flight modes are available. The default mode FM0, plus FM1 to FM04. Each flight mode has a selectable activation switch (physical or logical), a trim selection array, and Fade in / out parameters for smooth transitions between modes.
One main reason for using Flight Modes, rather than just programming 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. 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. If more than one flight mode is enabled, then the lower numbered mode will be active. Flight mode 0 (FM0) is the default, and always has its own trim settings. FM0 is active if no other flight mode is active.
A box is drawn around the name of the currently active flight mode. To change a flight mode setting, press [MENU] when the values of the mode you wish to edit are highlighted. This will display the editing screen.

After you've finished editing this menu just press [EXIT] and the page number at the top of the menu will be highlighted. Press the [RIGHT] key to move to the next menu, or hit [EXIT] again to exit to the previous main screen..

Expo/Dr (4/14)



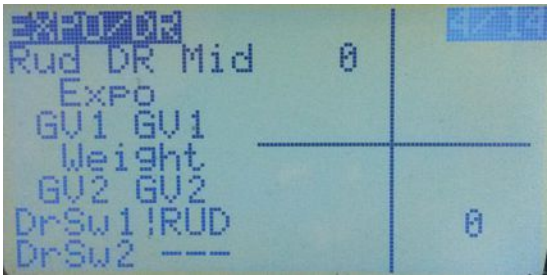


This screen allows you to enter and edit Expo and D/R (Dual Rate) values for the main controls (Rud/Ele/Thr/Ail). Actually dual rate is not quite the correct description as there are THREE different rates that may be set.

For each control you can input values for Left/Right for both Expo and D/R. The control being edited is shown as RUD, you may select this entry and use the [LEFT/RIGHT] buttons to select the other controls (ELE/THR/AIL) for editing.
The current rate setting (High, Mid or Low) is shown on the same line, and corresponds to the actual switch settings defined for DrSw1 and DrSw2.

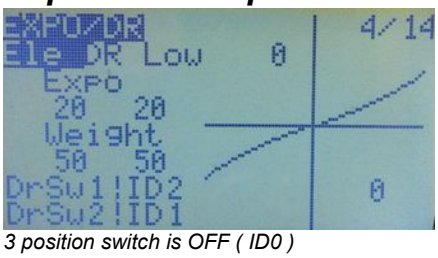
To edit expo values highlight the values under “Expo”. By default, both values will change, but if the control stick for the current control is held to one side or the other, just one of the values will be highlighted and hence change.

Similarly, you may edit either both or just one of the weight (dual rate) values. Also, when highlighting the expo and DR values, these can be replaced by GVARs by pressing [MENU LONG]. See picture below. More on GVARs later (see page 54).

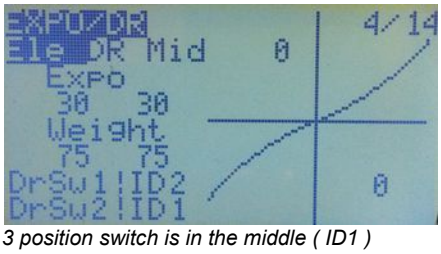


For each control you can set 2 switches. The main switch changes between high rate/high expo and mid/low rate. If the main switch is “low” (i.e. mid rate) the second switch can switch between mid and low rate. Again “High”, “Mid” and “Low” are only names, you can set any rate you like for each of them.

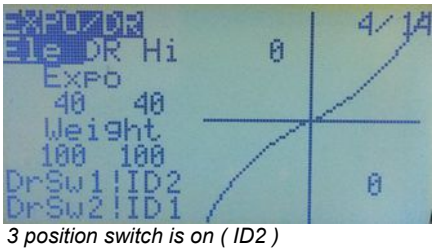
Triple Dr Example



3 position switch is OFF (ID0)



3 position switch is in the middle (ID1)



3 position switch is on (ID2)

For a triple rate arrangement you can use 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. Confusing, isn't it? It doesn't matter, it works ;-)

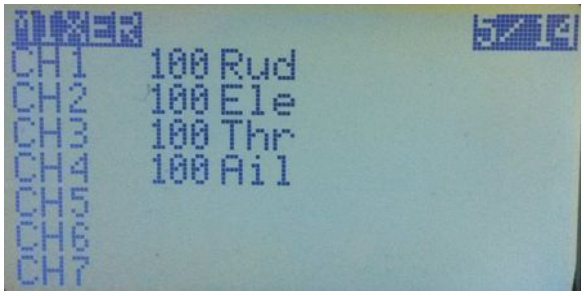
Mixer (5/14)

If you're still awake now would be a good time to sip that coffee and wake up. You want to understand ER9x? Understand the mixer and you're very nearly there.

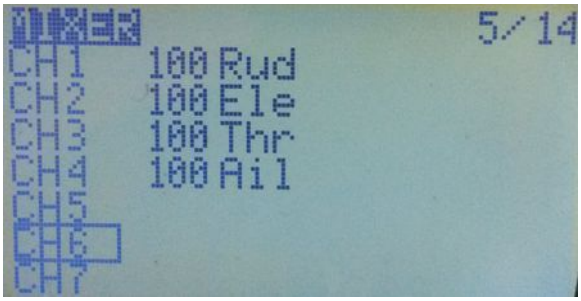
The function of the mixer is to take the inputs (Sticks, Pots, Switches (currently only 3POS), etc), perform some function on them, and route them to the output channels. Since selection is totally free you have a very flexible system which is extremely powerful and very quick to boot.

Main Screen

When you enter the mixer menu for the first time you will probably see something like the simple mix in the pictures below:



What the above is telling you is that for example the rudder stick's input (Rud) is being routed with a weight of 100% to CH1. Same for the elevator on CH2, throttle on CH3 and aileron on CH4.
As you scroll down you'll see that the weight value is being highlighted on channels with a mix already programmed. Pressing [LEFT]/[RIGHT] will edit the weight value.



If a channel has no mix programmed, a box appears around the channel number. An empty channel will simply centre any servo connected to it. The servo will not move at all as the channel has no input. Pressing [MENU] on an empty channel immediately adds a new mix and goes to edit it. Please see "*Edit Mix*" below. Pressing [MENU] on an existing mix will pop up a menu of options.

The popup menu has five entries:

EDIT - Edit the mix. Will enter the “Edit Mix” menu

INSERT - Insert a new mix after the highlighted one.

COPY - Copy the highlighted mix and place it on the same channel after the highlighted one.

MOVE - The whole mix will be highlighted and [UP] and [DOWN] move it. Press [MENU] to return to normal selection mode.

DELETE - Allows you to delete a mix, a confirmation screen will be displayed.

Edit 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 the corresponding receiver channel.

It’s important to understand that in the Er9x kind of programming, the only way anything can be controlled is through an explicit mix. In many other radios, most of the mixes are built-in but hidden; 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:

Source

This is the input 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 normally controlled by a switch

FULL - Output is either -Weight if the switch is OFF or +Weight if the switch is ON.
HALF and FULL can be a little confusing. Look in the examples section for, well, examples :).

CYC1, CYC2, CYC3 - The three outputs of the heli swash-plate mix. Once swash mixing is turned on (Heli Setup, page 31) these mix inputs become active and reflect the result of the swash mix. Generally CYC1 holds the fore/aft output and the other two do the rolling. On the 120X mode CYC1 is the odd one out.

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 menu under General Settings 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..CH16 - Outputs of all 16 mixes. Normally higher channels can be used as virtual channels and their output can be used as input to the mixer. This capability can be used to chain mixes for more complex behavior.

3POS - This uses the Three Position Switch (ID0, ID1, ID2) to give an output of -weight, 0, +weight.
End points can be configured normally in the “Limits” menu, by changing the limits values. The middle point can be configured by changing the SubTrim value. The direction can also be reversed by reversing the channel.

GV1..GV7 - The values of the Global Variables (GVARs). (see page 54)

THIS - A source that represents the combination of all mixes for the channel to this point. Well what does this means? Tricky ;-)
In er9x, if we apply *“Slow down/up”* to a single mix on a channel, it works as it should. Example:

CH5 100% FULL switch (ID1) slow (u3 : d3)

This will work without any problems. But if we do something like:

CH15 -100% HALF
R +50% FULL switch (ID1) slow (u3 : d3)
R +100% FULL switch (ID2) slow (u3 : d3)

This won't work.. When we flick the switch the channel will not slow down but jump when coming back towards -100%. This is due to how the mixer works. If we have more than one mix with “slow” on the same channel, it won't work well. Sometimes flexibility comes at a cost.

Anyway, we can solve this problem by using a higher unused channel as a virtual channel for handling the switches, and then apply it as source on CH5. Then apply the slow to CH5.

CH5 +100 CH16 slow (u3 : d3)

CH16 -100% HALF
R +50% FULL switch (ID1)
R +100% FULL switch (ID2)

This works. We removed the “slow” from the mixes with the switches, and applied it to a single mix on CH5. Well **“THIS”** will solve the problem in a different way, without having to use a virtual channel. You can keep all your mixes together and create a mix AFTER all of them with **“THIS”** as it's source. Then apply the “slow” to this last mix. It has the same effect as having all the mixes with the switches on a virtual channel. The difference is, you keep all your mixes together. Here is how to do it:

CH15 -100% HALF
R +50% FULL switch (ID1)
R +100% FULL switch (ID2)
R +100% **THIS** slow (u3 : d3)

SC1..4 – Scalers. (See page 55)

Weight

This value multiplies the value from the input. It can range from -125% to +125%.
Default is 100%. GVARs can also be used as weight. To use a GVAR press [MENU LONG].

Offset

This value is added to the value from the input. It can range from -125% to 125%.
Default is 0%. GVARs can also be used as offset. To use a GVAR press [MENU LONG].

Fix Offset

This delays adding the offset value until AFTER the weight has been applied, instead of being applied to the value from the input. The order of processing of a mix is:

1. Obtain the source value, with expo/dual rates applied to sticks.
2. Add offset (if "fix offset" is not enabled).
3. Delay and Slow.
4. Curve/differential.
5. Weight.
6. "Fix offset" if enabled.

Fix offset is ON by default. If this option is NOT enabled, then the offset value is affected by curve/differential and weight which is quite confusing. With a curve or differential applied the resulting offset value is almost unpredictable. Quite simply, any offset value you enter is scaled by the weight (and curve/diff) if you don't enable "fix offset". So, here is a little example using this feature. The mix below outputs values from 0% to 100% when moving the pot from -100% to +100”.

CH6 50% P1 Fix offset 50%

So, when P1 is at 0%, the channel is offset by 50%. when P1 moves to both ends, the result will be offset - weight, and offset + weight. That means 50 - 50 = 0% and 50 + 50 = 100%

For a weight of 20% and an offset of 60%, the channel output will be 60 - 20 = 40% and 60 + 20 = 80%
This is much easier to understand than the normal offset.

Trim

When this is ON, the trim value (if exists) will be carried on through the mix. When OFF, any trim value is ignored.

Curve

Here you may select either a Curve, apply “Diff” (Differential), or some Expo (Exponential) to the mix. The display either shows “Curve” on the left, “Diff” in the middle, or “Expo” on the right. Use the [LEFT] and [RIGHT] keys to select the one you want to apply to the mix. Pressing the [DOWN] key highlights the value under the words “Curve”, “Diff” or “Expo”. The [LEFT] and [RIGHT] keys adjust the values. The range of possible values for Expo and Diff is 0 to +/- 100.

For a curve you have:

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 the 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 (7/14)" menu (page 41). You can press [MENU] to edit the curve directly. When you are finished editing the curve, short press the [EXIT] key to return to the EDIT MIX menu.

Switch

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

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.

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. You can add a fixed value to the channel, a little bit like an offset:

CH2 +90% Ele
+10% FULL

When the Ele channel is in the middle, the output will be 0 + 10 = 10% (just like an offset)

When at full throw, the outputs are:

-90 + 10 = -80% and 10 + 90 = 100%

Now we ADD a variable value to the first mix. Two examples. The first one is the very well known Rudder-Aileron mix. Will will ADD a bit of Aileron to the Rudder

CH1 +100% Rud
+10% Ail switch (AIL)

Another example. The famous Elevon mix used on flying wings:

CH1 +50% Ele
+50% Ail
CH2 +50% Ele
-50% Ail

Multiply - Use this to multiply the previous values in the same channel. A multiply mix is recognized by a **“ * ”** before the weight value. What is a multiply mix?

A multiply mix multiplies percentages!
80% is 80/100
60% is 60/100
So if they are multiplied we get
(80*60)/(100*100) = 4800/10000 = 48/100 = 48%.

Basically it applies a percentage to the value of the mixes above it on the same channel. For example:

CH1 +100% Rud
* +20% FULL

The output of the channel here goes from -20% to +20%. 20 is 20% of 100.
Imagine that we change the weight value to 80%. The output will go from -16% to 16%

Another example of a multiply mix using a “fix offset” to change the output of a channel from 0% movement to full throw, -100% to +100% (+/- weight).

CH1 +100% Rud
* +50% P1 Fix offset 50% *(This line will gives an output from 0% to 100%.)*

So, the total output from CH1 will be scaled, depending on the position of P1, from 0% (no output, servo centered) to full throw which is the value of the weight of the mix above, which is 100%

If you have eepe installed on your computer you can just play with these values and confirm what I have been explaining here. You can also change the values and see the output of the channel change accordingly. If you still didn't install eepe, well, what are you waiting for? ;-)

Replace - It's used in conjunction with a switch. When the switch is ON, a replace mix overrides all the previous mixes on the same channel. A Replace mix is recognized by a “R” on the left hand side before the weight value. Example of a replace mix. A safety switch on the throttle channel:

CH3 +100% Thr
R -100% FULL !THR

As we know, the “!” indicates the reversed operation of the switch, that means the mix will be ON when the switch is OFF. So in this case when the switch is OFF, the channel output will be -100% because the replace mix is overriding the throttle stick.. You can move the THR stick as much as you like, your plane ain't goin' nowhere :-)

When you turn the switch ON, the mix will turn OFF, and the THR stick will control the channel again. Cool..!!!

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.

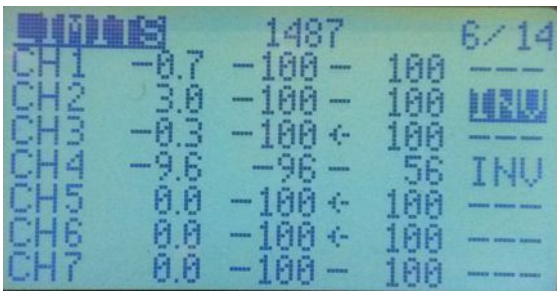
Slow Down/Up
Slow the rate of change in the channel. When not zero these will determine the maximum speed with which the value can change. The specified value is the number of seconds to go between -100% to 100%. When you select slow for a mix:

1 - It only applies to that mix, NOT any others on the same channel.

2 - Slow only applies to changes in the SOURCE, not the mix being enabled or disabled by a switch.

If you want a channel output to always move slowly, but with multiple mixes, one easy way is to use another channel for all the mixes, then use the output of that channel as the SOURCE of the real output with slow selected. Yet another possibility, if you really wish to keep all your mixes together is to use a Replace mix after all the others, with **"THIS"** as source. This mix will then handle the slow Down/Up function.

Limits (6/14)
Limits operate on the output channels. In the LIMITS menu you can set the centre point (subtrim), set 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 [EXIT] 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:

Channel Output
At the top of the screen and in the middle, when you select one of the channels, you can see a numeric value that corresponds to the channel output in milliseconds. -100% to 100% will display as 988 to 2012 milliseconds.

Columns

subT - *Subtrim (first column)*
This sets the channel's centre point.

The values of subT can be -100 to 100. Increments are 0.1, giving fine resolution when setting the centre for each channel.

You can also use the stick to set the centre point. While subT is highlighted hold the stick so the surface is centered. Press [MENU LONG] and the position will be recorded. It's the magic of ER9x again :-)

Limits - 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 can range between -100% and +100%. If the “E-Limits” (extended limits) option is ON in the Model Setup menu, then it's possible to set a range between -125% and +125%. Note that 100% on the Er9x firmware already corresponds to 125% on most other transmitters, so extended limits should not normally be required.

Warning: *Please test to make sure this does not cause unwanted mixing between channels or exceed servo mechanical limits.*

The limits act both as gains and as absolute limits. The servo will not move beyond the limits you set here.

Note: If you turn the AUTO LIMITS option On in the Model Setup menu, it will allow the Sub Trim to override the Limits setting by a maximum amount of 10, so that servo throw remains the same on both sides of center. Be careful when using this feature as the control limit values are no longer absolute and could allow a servo to exceed a mechanical limit. Such modified values are displayed with a box around them.

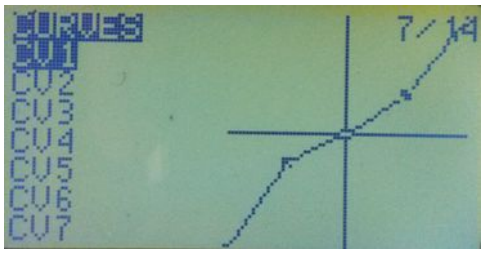
INV

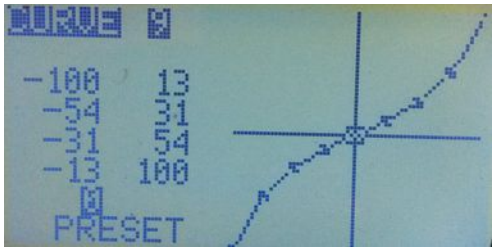
Invert. (fourth column)
This reverses the output of the channel. Choices are **‘---‘** or **‘INV’**.

COPY TRIM

At the very bottom of the LIMITS menu 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 Main Screens will all be returned to centre.
Note that InstaTrim (controlled by the switch selected as ‘Trim Switch’) offers another approach to trimming by converting stick positions to SubTrim in flight (see page 28). The two methods are complementary.

Curves (7/14)



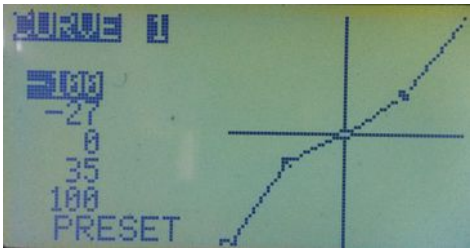


Curves tell your servo how to move in response to your stick movement. In Er9x there are eight 5-point curves and eight 9-point curves. Curves CV1 to CV8 are 5-point, while CV9 to CV16 are 9-point.

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%.

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.

Logical Switches (8/14) *(Previously called Custom Switches)*

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 18 such custom switches in Er9x.

The first column shows the "operation", listing several arithmetic, logical and differential operations. In arithmetical operations, **“v1”** and **“v2”** represent variables, **“v”** represents a variable, and **“val”** represents a value.

Variables can be any source, i.e., all those available in mixers, plus the seven global variables, Scalers 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 it was last matched to another value.

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

Setting Up a Logical Switch

First we define the condition or operation. This can be: an arithmetic function, or a logical condition, or an evaluation between two sources. It may also be a timer.

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

The source can be a Stick, Pot, PPM input, Output channel, Telemetry value, GVAR or a Scaler.

The value can be anywhere between -100 and +100. It 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, Latch, F-Flop), 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)

Another example. Try it ;-)

Say you have a glow plug driver which you want to turn on when the throttle is below 10%:

1. Highlight “L1”
2. Select the condition as “v<val”.
3. Select the source as “Thr”.
4. Select the “value” as -80 (remember -100 – 100 so 10% from idle is -80).

Now you need to use a mix to run the switch. Go to the mixer menu. Select the CH8 as the channel you want the GP driver to operate on. On that channel select source as “HALF” and Switch as “L1”.
Now whenever the throttle goes below 10%, CH8 will go to 100%. Cool, huh?

Timer

If you select a timer then you specify the time for which the switch is OFF and the time for which the switch is ON. These are in seconds, The default value is 1 when you select the timer. By pressing the [RIGHT] key you increment the value in steps of 1 second. The maximum value is 100 seconds. By pressing the [LEFT] key, you increment the value in steps of 0.1 second to the maximum value of 5.0 seconds. Example:

TimeOff 5 On 0.5 THR *(This is an AND switch, please see below)*

AND Switch

Custom switches also offer an extra **AND** condition. If a switch is selected in the last column, it must be ON for the logical switch to become active. Timers are synchronised to this switch turning ON.

Latch and Flip-Flop Functions

Two special functions available in logical switches are helpful when it is necessary to use a brief input to trigger a persistent state.

Latch

The Latch function allows a state or event to be captured and held for as long as required. For example, the maximum altitude reached by a glider can be retained until it is desired to measure a new maximum.

Two switches are used as input to the Latch function. Turning ON the first sets the logical switch output to ON. When the first switch is ON, the second switch has no effect, but when the first is OFF, turning OFF the second will reset the custom switch to OFF.
For example, the following causes “L3” to turn ON when the “TRN” switch is pulled and off if the “RUD” switch is turned ON (but only if the “TRN” switch is released to OFF).

L3 Latch TRN RUD

The LATCH is useful where you wish to 'capture' an event has happened (time reached, height reached, battery briefly goes too low), to be able to report it, but then you want to cancel the warning until it happens again.

F-Flop (Flip-Flop)

The F-Flop function “remembers” the input state and provides it as the output. Again, two switches are used for input, one as the trigger and the other to provide the “data”.
So, for example, if the momentary “TRN” switch is used as the trigger, pulling it ON sets the output of the logical switch to the current state of the second input.

The F-Flop can be used to make a counter, so you can count events, and only warn the user when the event has occurred enough times. It is also useful, in toggle mode, with the trainer switch so each time you flip the trainer switch you get an output that 'flips' ON and OFF. Please see the example below.

The following entry causes the “state” of logical switch 4 to change every time the trainer switch is pulled, as the second input is defined as opposite to the current state.

L4 F-Flop TRN !L4

Safety Switches (9/14)

This page allows you to define safety switches that will overwrite the existing value for a particular channel.

For example, you might want to set a switch on the channel your electric ESC is placed. That way you can work on your model and not worry that a programing error could start the motor at full throttle.

This does not make your radio fool proof! You must be careful at all times. Hopefully this can add another level of safety and reduce the risks associated with this hobby.

NOTE: Safety switches only affect the channel to which they are applied, they do NOT affect the channel value that is used as inputs to other mixes.

Safety switch entries that are not required for the safety function may be used to control audio, haptic (vibration (if available)), and voice output if the voice modification has been carried out.

There are four types of safety switch:

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

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

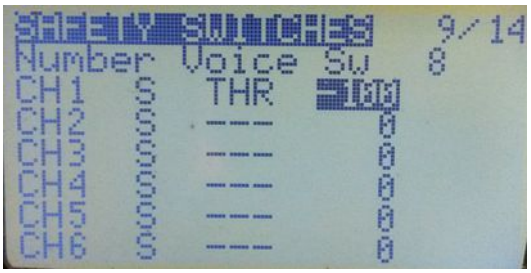
A - (Audio): Plays a sound or haptic vibration chosen from a list.

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, and full low throttle is -100, 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 output of the channel is replaced by the defined safety switch value (here -100). The value 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** safety switch works exactly like the basic safety switch, except that it is “sticky”. Before the channel can function normally again, the throttle stick must be returned to full low (below around -98%). In other words, the X-type safety switch performs the same function as the Sticky T-Cut template, and it is much easier to program. With the X-type safety switch the template doesn't make sense anymore in my opinion.

***Note:* If your radio has an Atmega128 or an Atmega2561 as Processor, and you are running the latest version of Er9x, then you can skip the next chapter about audio, haptic and voice alarms, as it is dedicated to the 9x radio with the atmega64. You have the new “Voice Alarms” menu which is much better (Please see page 56).**
The m64 processor doesn't have enough flash memory for this menu.

The **A-type** safety switch (for Audio) at 4 second intervals plays a sound or haptic vibration chosen from the following list: Warn1, 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** safety 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 full down. For full control of voice announcements, use a Voice Switch, as explained below.

Voice Switches

Following the 16 Safety Switches (CH1 to 16) are, by default, 8 Voice Switches (VS17 to 24) that trigger the playing of a particular voice file and determine the conditions and manner in which it is played. If more than eight Voice Switches are required, Safety Switches can be converted into Voice Switches. At the top of the screen the value of ‘Number Voice Sw’ can be adjusted to increase the default 8 up to a maximum of all 24 switches.
The following picture shows the lower portion of the list, where Safety Switches give way to Voice Switches. If the number of voice Switches were increased to, for example, 10, then CH15 and CH16 would become VS15 and VS16.

In this screen, the first column identifies the Voice Switch number.

The second column may contain any physical or virtual switch such as RUD, ELE, ID0, ID1.....L1, L2, L3,...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 ONCE.
'OFF' means that when the switch is deactivated, the item in the fourth column will be announced ONCE.
‘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:

VS26 GEA BOTH 76

means that when the GEA switch is activated the transmitter plays file 76 ‘Gear Up’ and when the switch is deactivated it plays file 77 ‘Gear Down’.

When “Varibl” is selected in the third column, the voice will play a telemetry, GVAR, or scaler value available on the 4th column

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 (see page 54).

The next example shows how to program a telemetry alarm using a Logical Switch, a “V” type safety switch, an audio alarm using the “A” type safety switch and a voice switch:

Set a Logical Switch to detect the voltage of a battery connected to a sensor plugged in the A1 analog port of a frsky receiver.

L1 v<val A1= 10.1V (This Logical Switch will be on if the voltage drops under 10.1V)

Then we will use this Logical Switch to trigger the alarm. I will show a few possibilities..

First option is an audio alarm. In case you don't have a voice module installed in the radio:

Choose an unused channel in Safety switch menu, normally a high number channel:

CH13 A L1 warn1

Second option is a voice alarm that plays a voice file every 4 seconds if the logical switch stays on:

Choose an unused channel in Safety switch menu, normally a high number channel:

CH13 V L1 31 (31 is the voice file number)

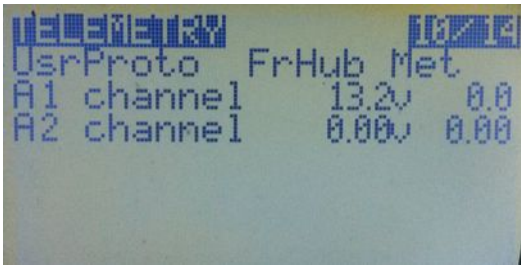
As you can see this uses a “V” type safety switch.

Third option (and my favorite) uses a “Voice Switch” to play a voice file ONCE every time the Logical Switch turns ON:

VS18 L1 ON 31

Telemetry (10/14)

Telemetry is only available if you have modified your radio for telemetry, and loaded the FrSky version of er9x, 9x with Atmega64. On the radios with Atmega128 ou Atmega2561, telemetry will be available if you modified the radio by re-routing the THR and AIL switches to another 2 pins of the processor, and set the option “Frsky Mod Done” to ON



The first item on the page is ‘UsrProto’, where you toggle between WSHhi (*Winged Shadow How Hi*) and FrHub (*FrSky Telemetry Hub*), by Pressing [MENU]. On the same line you can select either Metric or Imperial units using the same method.

A1 and A2 on this screen refer to the two analog inputs available on FrSky D-series receivers. These inputs can accept a maximum of 3.3v. To measure higher voltages, therefore, a voltage divider consisting of a pair of resistors must be used. For example, a divider with 4:1 ratio will measure voltages up to 13.2v (4 x 3.3v).

The A1 input is normally used to measure receiver voltage. All of the FrSky D-series and X-series receivers do this by connecting the A1 input by way of a built-in 4:1 divider.

The A2 port does not provide an internal voltage divider. Consequently, to measure voltages above 3.3v, an external divider must be used as a voltage sensor. For example, to measure the voltage of a 4-cell LiPo battery (maximum 16.8v fully charged), a 6:1 divider can be used; this will accept voltages up to 6 x 3.3v = 19.8v. With such a divider, 16.8v will be seen as 16.8v/6 = 2.8v as input to the receiver telemetry.

Note that the FrSky X8R receivers only have only one analog input, 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 of the X8R. The X6R receivers have an external A1 port like that on most D-series receivers.

Within the telemetry circuits of the receiver, the value of the analog input (between 0 and 3.3v) is converted to a number between 0 and 255. This is encoded digitally and sent to the transmitter, where it is converted back to a number representing the voltage (to do this the transmitter must be given the divider ratio).

In the screen shot above, the numbers immediately to the right of “A1 channel” and “A2 channel” represent the measurement **Range**, which depends on the divider ratio of the voltage sensor. For the 4:1 ratio used to measure receiver voltage, this value should be set to 13.2 (i.e., 3.3 x 4). For a 6:1 ratio sensor, the range would be 19.8.

The number in the right hand column represents the final **Telemetry** read-out. If it does not agree exactly with the actual value measured with a voltmeter, the range value can be adjusted slightly. The usual cause of inaccuracies in the reading is the tolerance of the resistors used in the voltage divider.

The lowercase ‘v’ following the Range value represents one of four **scaling factors** used in converting the telemetry number (0-255) into a suitable read-out value. The ‘v’ setting corresponds to a read-out range of 0 to 25.5 volts, while a ‘V’ setting gives 0 to 51 volts (at reduced resolution). Set to ‘A’ for current measurement, the telemetry number is converted to a range of 0 to 65 Amps. Finally, the ‘-‘ setting displays the unconverted telemetry number (0-255), which can be used for parameters other than voltage or current, such as temperature or RPM, depending on the sensor.

The A2 read-out works in the same fashion. The Range setting will depend on the sensor being used. For the FBVS-01 voltage sensor, using the default ratio of 1:6, the range setting would be 19.8v. Fuel level, GPS position, Altitude, Current and RPM may also be measured using FrSky sensors which plug into a hub. The hub produces a stream of signal outputs suitable for the serial port on some D-series receivers.

When using third party sensors, the scaling factor of the voltage divider depends on the type of sensor installed and the magnitude of the values being measured. Refer to the instructions which come with the sensor for details on how to install and calibrate it.

Voice (if available) or audio warnings can be enabled for A1 and A2 values if a custom switch is used to detect the alarm condition and a voice switch is used to play an appropriate track. (m64).
For the radios with m128 and m2561, please use the Voice Alarms menu (see page 56)

Telemetry 2 (page 11/14)

This page continues the telemetry settings

RSSI Alarms

The “TxRSSIalrm” and “RxRSSIalrm” settings are those stored on a FrSky DJT or DHT module. They are read from the module for display. If they are changed in the menu, then the module is updated with the new values. They are therefore common to all models. Yellow causes a single beep, Orange causes a double beep and Red causes a triple beep from the module.

mAh Limit

This causes an audio alarm (selectable) to sound when the used capacity of your flight battery exceeds the set value. This may be removed in a future release. It is now recommended to use a custom switch to detect the event, and then either an audio switch or a voice switch to 'play' the actual alarm. I put this in (er9x) before we had voice or telemetry in custom switches.

Num Blades

Setting for the RPM sensor.

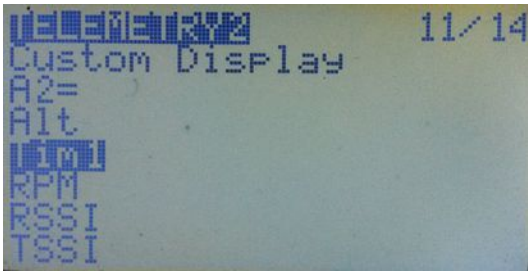
GpsAltMain

Is the Global Positioning System (GPS) determination of altitude and may be turned ON or OFF. If ON, the barometric altitude reading is replaced by GPS altitude.
You can use **"Galt"** as a telemetry entry in a logical switch.

Telemetry 2 Custom Display

Short presses of the DOWN key will take you to the custom telemetry display screen.

Up to six telemetry variables can be displayed on a single screen in the order you select. Highlight the empty field, and using the [LEFT] or [RIGHT] keys select from the options available.



Telemetry sources:

A1 - 'D' series Rx A1
A2 - 'D' series Rx A2
RSSI - RSSI
TSSI - 'D' series Rx RSSI, 'X' series Rx SWR
Tim1 - Timer 1
Tim2 - Timer 2
Alt - Barometric Altitude
Galt - GPS Altitude
Gspd - GPSspeed
T1 - Temperature 1
T2 - Temperature 2
RPM - RPM
FUEL - FUEL
Mah1 - mAh from A1 used as current sensor
Mah2 - mAh from A2 used as current sensor
Cvlt - Cell Voltage (lowest)
Batt - Tx battery
Amps - FASV current
Mah - FASV mAh
Ctot - Sum of cell voltages
FasV - FASV voltage

AccX - Acceleration X
AccY - Acceleration Y
AccZ - Acceleration Z
Vspd - Barometric Vertical speed
Gvr1..7 - Global Variables 1 to 7
Fwat - Watts from FASV (V * I)
RxV - 'X' series receiver voltage
Hdg - GPS Heading
A3 - SPort A3
A4 - SPort A4
SC1..4 - Scaler 1 to 4

FAS Offset

Some FAS sensors show a small reading when no current is really flowing. The FAS Offset field may be used to 'zero' out this value.

Vario

The 'new' (Sport enabled) FrSky variometer sensor vario mode is also configured here.

Source: The Source may be either 'vspd', the value passed directly over telemetry, or the A2 port if using the analog value.

Switch: Vario tones may be enabled by means of a switch, the specific switch is selected by the Switch entry. The value includes 'ON' to allow the vario tones to be permanently enabled. The vario tones are short bleeps that sound more frequently the higher the climb or sink rate.

Sensitivity: The sensitivity for sounding the tones may also be set. The higher the value, the less the sensitivity. Typical values are 2 for vspd and 40 for A2.

Sink Tones: Option to turn the sink tones OFF. Some might find the sink tones annoying. I do :-)

Current Source: Here we indicate where a Current Sensor (if available) is connected.
Possible Current Sources are A1/A2, FasV, and Scalers 1 to 4

Templates (page 12/14)

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. Pressing [MENU LONG] when this option is highlighted will clear all the mixes leaving you with an empty mixer.

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 **General Settings/Controls**. Note that applying this template overwrites anything already set for all channels in the mixer.

02 T-Cut

Inserts a mix line for the throttle channel that replaces throttle stick input by -100% when the T-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 T-CUT switch is ON. When the switch is moved to OFF, the throttle stick remains inactive until moved to the throttle closed position.

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. You can also use CH16 on another mix.

Note: The built-in templates cannot be edited or replaced. As a starting point for new models, you may wish to create generic models and store them either on the computer (using Eepe), or in unused model memories of the transmitter. You can then simply copy, rename and adapt a suitable model as required.

Global Variables (page 13/14)

(Also includes Scalers for Mega128 and Mega2561 based transmitters)

Global variables are values that can replace 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. To use a GVAR on any of the fields mentioned above just highlight the field's value and LONG press the [MENU] key. The value will be replaced by “GV1”. Then press [RIGHT] or [LEFT] to select the desired GVAR number.

There are 7 **G**lobal **VAR**iable**S** (GVARS) available. They may be configured on the GVAR menu.
Each GVAR may be a constant, input as ---, or be controlled.

Possible control inputs are:

Rtm - Rudder TriM
Etm - Elevator TriM
Ttm - Throttle TriM
Atm - Aileron TriM
REN - Rotary Encoder
Rud - RUDder stick
Ele - ELEvator stick
Thr - THRottle stick
Ail - AILeronstick
P1 - Pot P1
P2 - Pot P2
P3 - Pot P3
C1..C16 - The channel outputs

Each GVAR has a value between -125 and +125, and is constrained to this range. In certain cases the use is restricted to -100 to +100. GVARS may be used in a number of places. Only GVARS 1-5 are available in all places.

The source of a mix.

GVARS 1-7: The value of the mix (-125 to +125) is scaled to provide a -100 to +100 input to a mix. One use of this is to obtain a trim control as the source of a mix. On many electric models and gliders the throttle trim in particular is not used. It may be disabled from being included in the mix of the stick, and is then available for use as the input to a GVAR, and then that GVAR may be used as the source of a mix.

Weight and offset of a mix.

GVARS 1-5: The weight and offset values for a mix may be set to use a GVAR. This allows the values of these to be adjusted in flight.

EXPO and Dual Rate.

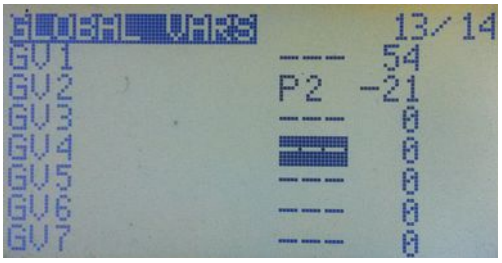
GVARS 1-5: The expo and dual rate values may be set to use a GVAR. This allows the values of these to be adjusted in flight.

Voice source.

GVARS 1-7: GVARS are in the list of items that may be used by voice messages.

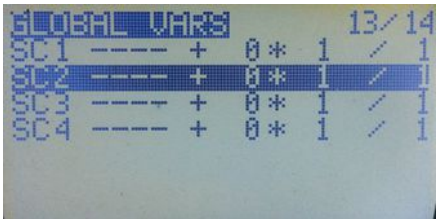
A couple examples:

1. 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 the GVARs menu (*see picture below*) is all it takes for all four differentials to be updated simultaneously.



2. How to use a global variable in the EXPO/DR menu. Highlight the Expo or D/R value and then long press the [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 as well as the shape of the Expo Curve.

Scalers



A scaler is a function that takes an input value and applies an offset and scaling (multiplication or division by a fixed ratio). The result may be used for: display on the custom telemetry screen, voice output, as the source for a mix, or as a comparison value for a custom switch.

For telemetry display purposes each scaler may be given a four character name. For both telemetry display and voice usage, the units may be selected, together with the number of implicit decimal places. The parameters for a scaler are:

Source: Stick/pot value, trainer input, channel output or telemetry value.

Offset: -125 to +125.

Multiplier: 1 to 256.

Divisor: 1 to 256.

Unit: Select from Feet, Volts, Deg_C, Deg_F, mAh, Amps, Metre, Watts.

Negate: Change the sign of the result

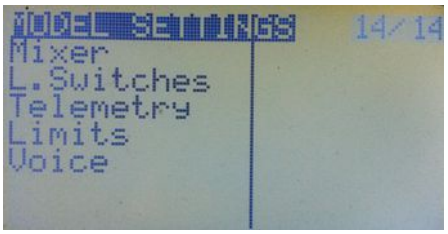
Precision: Number of decimal places 0, 1 or 2.

Offset At: Define whether the offset is applied First, or after the multiplier and divisor.

Name: Four-character, user-edited name.

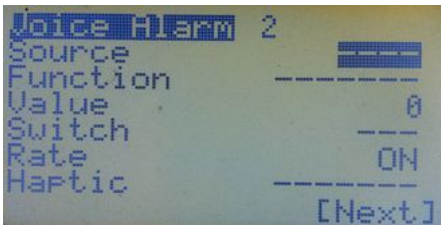
Model Settings (14/14)

This the new Model Settings menu and it is still under development. It will be similar to the “General Settings” menu. You can have a play with it though as there are already a few menus in it. Actually, the Voice Alarms menu can only be found there.



Voice Alarms *(Only available for the 9x / 9XR with the Atmega128 or Atmega2561)*

Here you program all your audio, voice and haptic (vibration) as long as you have the hardware installed, of course. Before you would have to program a Logical Switch (former Custom Switch) to detect for example a telemetry event like a battery pack voltage, set a condition to trigger the switch, and then use it in the Safety Switches menu to create an audio, voice and/or haptic alarm. A bit confusing in my opinion, but it did work well. Now we have the Voice Alarms menu that do all the others did, and much more. And all in one place. Eight Voice Alarms are available in Er9x. VA1 to VA8.



So, take a look at the picture above. This is how a voice alarm looks when you start a new one.
As you can see, on the left there are a few fields available. This makes it very flexible. Before, and as I mentioned above, we had to use Logical Switches, Safety Switches, and Voice Switches, which we created from the safety switches, to achieve what we wanted when programming some voice, audio or haptic. Now, we have it all in one single menu. And there are more options available too.

Source

Here you select all the sources, that is, Sticks, Potentiometers, Channels, PPM inputs (Trainer Port), Scalers, Telemetry, GVARs, etc. These, combined with a function, can be used to generate alarms, or just let the nice lady that lives inside your radio tell you the source values. I will show some examples later.
If a source is selected, it's current value will be displayed to the right of the word “Source”. In the picture above (0.0v), as no telemetry was being received..

Function

Here we set a logical condition based on the source value and another value in order to verify if the condition is true or not. It works in the same way as a logical switch. For example:
Imagine we have the analog port 1 (A1=) as source, and we want to play an alarm if the voltage drops under a certain level. Then we select the function “v<val”, and that means that IF the voltage on A1 (v) is smaller (<) than the value we set (val), let's assume it is 10.6V, then the condition will be met and this “switch” will turn on, and something else like playing a voice/audio file or vibrating, can be done.

Value

This together with a function (as explained above) is used to detect a logical condition by comparing a value we set to the value of the source. If the logical condition is verified, the function will act like a switch and will turn on. This will then trigger some audio/voice or vibration events.

Switch

It's used for playing events like telemetry, or play voice files when turning switches ON or OFF. It´s normally not used in alarms.
Example: Flaps up, Flaps down, Gear up, Gear down, ect. We can also play a source, like a telemetry event, a GVAR, a stick position, etc, when you flick a switch. You can select all the physical and logical switches plus ON and OFF.

Rate

This field allow us to set how the Voice/Audio/Haptic will be played.

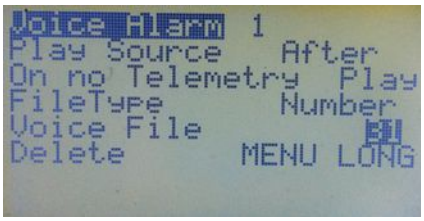
On **-** The event/file will be played when the physical switch is ON, or the “function switch” is ON (logical condition is TRUE).

Off **-** The event/file will be played when the physical switch is OFF, or the “function switch” is OFF (logical condition is FALSE).

Both **-** This plays a file when the switch is ON, and the consecutive file when the switch is OFF.
For example, imagine you have two files. “Flaps1 and Flaps2”. You only select the first file “Flaps 1”. When you turn the switch ON, this file (Flaps 1) will be played, and the other file (Flaps 2), which must be the consecutive file number on the SD Card, will be played when you turn the switch OFF.

1,2 ,3 ,4... **-** This repeats a file or event every “n” seconds, from 1 to 30 seconds.

Haptic
Or vibration. If you want your tx to vibrate along with alarms or events, just select one of the 3 presets. It will be active when a voice or audio event is played.



Play Source
As the name says it will play the source value, in our case the A1 voltage, BEFORE or AFTER the selected voice file/audio that you can select below. Before we had the Voice Alarms menu, we needed 2 voice switches to say for example:

“Flight Pack Voltage”, and then the telemetry value “10.6V”.

Now with the play source option, we can combine them in only one menu.
If you select BEFORE, the source value will be played before the file.
If you select AFTER, the source value will be played after the selected voice file.
If you want only vibration, set it to NO and don't select any voice file, or audio.

On no Telemetry
When this option is active, the radio will play the phrase “No Telemetry” when you trigger a telemetry event but the tx is not receiving any. Some people find this annoying so you have two options. PLAY or MUTE. You decide :-)

File Type
Here you select the type of alarm by pressing the [LEFT/RIGHT] keys.. “Number” for voice, or “Audio”

Voice File
If the File Type is set to number, here you select the voice file number. By pressing [MENU LONG] when the file number is highlighted, the radio will play the voice file corresponding to the selected number. Press [LEFT/RIGHT] to select a different file.

As mentioned before you need a voice module with SD Card installed in your radio.

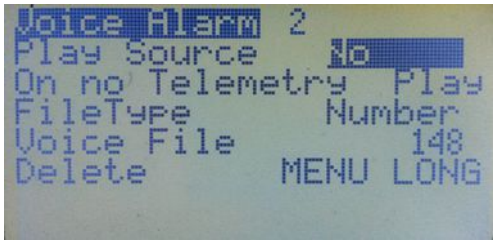
If the File Type is set to audio you can select some pre-programmed sounds. These are generated internally by the Er9x firmware. The options are:

Warn1, Warn2, Cheap, Ring, SciFi, Robot, Chirp, Tada, Crickt, Siren, AlmClk, Ratata and Tick.

Delete
Press [MENU LONG] to delete the voice alarm. All fields will reset to their default values.

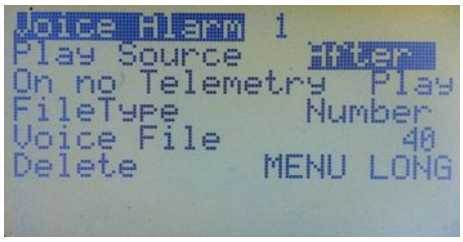
Examples
Below there are 3 Voice Alarms examples:

Example 1 - Normal voice switch.



This shows how to program a normal voice switch using a 2 position switch “THR” to play 2 files. One when the switch is turned ON, and the other when it is turned OFF. For this, we will use the BOTH option. That means that the first file will be played when we turn the switch ON, and the consecutive file number on the SD Card plays when we turn the switch OFF.
The first file is the one we select when using the BOTH option. In this case File number 0148 (Throttle enabled). This will play when we turn the switch ON. The next one 0149 (Throttle disabled) will be played when we turn the switch OFF.

Example 2 - Play a Source Value (Telemetry) after a Voice File.

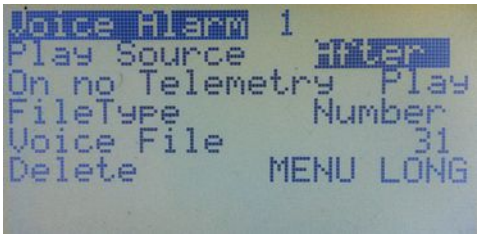


Here, when the switch “TRN” is turned ON, the source value “A1=” will be played once (ON), AFTER the Voice file number 0040 (Pack Voltage). If the voltage on A1= is for example 11.5V, the tx will say:

“Pack Voltage, Eleven Point Five Volts” Cool, isn't it?? ;-)

Play with different settings and values to get to understand what every option does..

Example 3 - Voice alarm with Haptic (Vibration). To have haptic you must do the corresponding modification, as the 9x radio and 9XR don't ship with this feature.



Here we have a voltage alarm. We want the TX to warn us if the voltage drops under 10.6V, by playing a voice alarm followed by a voltage report (Play the Source Value).

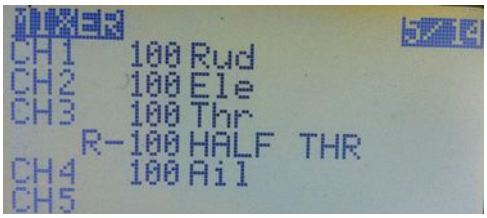
So, the voice file number 0031 (flight battery low) will play once (ON), if the source (A1=) drops below 10.6V (v<val = A1<10.6V), followed (AFTER) by the voltage report (Play Source). The radio will vibrate at the same time (Haptic1). So the complete phrase will be:

“Flight Battery Low, Ten Point Six Volts”. Try it.

Er9x general Programming examples

Simple Throttle cut

Though you can use a template for this it's instructional to do it via the mixer.
1. Go to the mixer menu.
2. Start off with the default 4 mixes.
3. Scroll down to your throttle channel.Let's say CH3
4. Press [MENU] to display the popup window with more options, and then select “INSERT”. A new mix will be inserted on CH3 and the “Edit Mix” menu will come up.
5. Change source to “HALF” and Weight to “-100”
6. Scroll down and set The switch to “THR”
7. Next keep on scrolling down until you reach Multpx. Change the value to “Replace”
8. Press [EXIT]. You should now see something like in the picture below:



What it tells you is that on CH3 you have 2 mixes defined.
The first takes the value of the throttle stick. The second depends on the THR switch. When the switch is off the mix is ignored so the only value will be the value of the throttle stick. When the switch is on that value will be replaced with -100% And the channel will be locked to that value. The throttle stick won't control the channel anymore..

A few more examples by a few users of the openRCforums. Thanks to Reinhard (ReSt) for collecting them and sharing it with us.

What are the different Mix options

==========

Quick lesson on the three types, **ADD**, **MULTIPLY** and **REPLACE**

An Add mix is added to the result of all mixer lines above it.

A Multiply mix works on the result of all mixer lines above it.

If several replace mixes are active, the last active mix replaces everything above

Generally you use ADD,
Example

CH4 100% RUD
+ 10% AIL Switch(RUD)

would move the rudder servo on ch4 with the rudder stick and mix in 10% from the Aileron stick when the Rudder switch is on.

Change it to

CH4 100% RUD
R 100% AIL Switch(RUD)
This would control the rudder with the rudder stick only with the rudder switch off. With the switch on the rudder stick would do nothing, but the aileron stick would move the rudder.

Change it to

CH4 100% AIL
* 5% P1 Offset 100
+ 100% RUD

And ch4 would move with the rudder stick, and by adjusting the pot you would have variable control of the amount of the aileron to rudder mixing.

Pat MacKenzie

Shift a curve up and down by a pot (possible through gvar)

Set up another curve (e.g. C2) 0, 100, 100, 100, 0.
On an unused channel e.g. 16

CH16: +100% THR Curve(c2) (or whichever curve you just set up)
CH16: * 50% P1 Offset(100%) (MULTIPLY multiplex NOT ADD)

now on you original throttle channel add:
CH3: +10% CH16

This will add 0 to 10% to your throttle output controlled by P1, in the middle range, but the addition will be steadily reduced as you go towards the ends of the throttle setting.

Mike.

Steering wheel servo thrust depending on throttle position

I have a Cessna 180 200mm with a independent Nose Wheel stering servo. So now i want to do a mix in combination with throttle. (Same like cars have for Steering and Speed).

So, as more throttle i have, as slower (weight) i want to have reaction to my Nose Wheel steering servo.

For Example:

Throttle	Steering Wheel Servo
0%	100%
10%	90%
20%	80%
30%	70%

and so on...
Add a mix line to your steering servo output like (note a MULTIPLY multiplex mix):

* -50% THR Offset(-100%)

Mike.

Scaling a channel with a pot

For a scaling operation you need to use an offset of +100 and and weight of 50%. THe offset changes -100 to + 100 into 0 to +200, then the weight scales it back to 0 to 100.

Using the same +100% mix on one channel is the same as having a single mix with a 5 point curve set to -100, -100, 0, 100, 100.

An intersting way of increasing the rate of response is:
+100% AIL
* +50% P1 offset 100 (multiply mix)
+100% AIL

Now, if the pot P1 is fully one way you get the normal movement, and if the pot is fully the other way you the same as having the +100% AIL in twice. But you can now choose, while flying, the amount of increased movement by turning P1.

Mike.

Adjust throttle idle with a pot

Help with pot for idle adjust and logic definitions

OK, the T-TRIM effect may be obtained, but using a pot for the trim, like this:
CH03: -50% THR Offset (-100)
CH03: * +20%P1 Offset(100%) -- MULTIPLY multiplex
CH03: +100% THR

This allows P1 to adjust the throttle at the low end, but does not affect to top end.

Mike.

Inverse proportional channels

Is is possible to have an inversely proportional mix between throttle and ailerons? ie idle throttle having 90-100% aileron movement 100% throttle having 10-20% aileron movement.

Aileron channel:
CH01: +100% Ail
* -40% THR Offset(60%) Late Offset (MULTIPLY multiplex)

Mike.

Build and Program Instructions

You might want to play with the code and modify it for your own needs. It's really easy if you know a little C.

First, to program the MCU, download the full programing instructions:
Flashing the 9x by Jon Lowe.

Building from Source

First checkout using svn: **svn checkout http://er9x.googlecode.com/svn/trunk/ er9x**
Enter the src/ directory.
To make the standard version type: **make**
To make the JETI DUPLEX enabled version type: **make EXT=JETI**

Flashing

(you may have to run as admin to access the USB port in Linux)
To write the FW: **make wflash AVRDUDE_PROGRAMMER=usbasp**
To write the EEPROM: **make weeprom AVRDUDE_PROGRAMMER=usbasp**
To read FW: **make rflash AVRDUDE_PROGRAMMER=usbasp TARGET=backupflash**
To read the EEPROM: **make reeprom AVRDUDE_PROGRAMMER=usbasp TARGET=backupeeprom**
Make sure you replace "usbasp" with the name of your programmer.
To list available programmers type: avrdude -c ?

make targets

- make all (default): build the source
- make clean: Remove compiled files and directories.
- make wflash: Write flash (program) memory.
- make rflash: Read flash memory.
- make weeprom: Write eeprom.
- make reeprom: Read eeprom.
- make coff: Convert ELF to AVR COFF.
- make extcoff: Convert ELF to AVR Extended COFF.
- make debug: Start either simulavr or avarice as specified for debugging, with avr-gdb or avr-insight as the front end for debugging. (for debug info look into the makefile)
- make filename.s: Just compile filename.c into the assembler code only.

make options

- T=JETI: maEXke jeti vesion.
- AVRDUDE_PROGRAMMER: Set avr programmer name - *default: usbasp*
  (to list all available: avrdude -c ?)
- TARGET: Set target name - *default: er9x*
- OPT: Set optimization level - *default: s*
- FORMAT: Set format (can be srec, ihex, binary) - *default: ihex*
- MCU: Set MCU - default: *atmega64*

MORE

I sincerely hope you enjoy both the ER9x FW and this manual.
I also sincerely hope you're still awake. If you are I applaud you :)

This is an Open Source project. It means that I request no money for it. You are free to look up, download, modify and release the code under the GNU v2 software license.

If you have any questions, requests and/or gaudy compliments I'll be happy to hear them either on the FW's code page:
http://code.google.com/p/er9x/

Or on the following threads in RCG or RCModelReviews:
http://www.rcgroups.com/forums/showthread.php?t=1266162
http://www.rcmodelreviews.com/forum/viewtopic.php?f=47&t=292

Also bug reports and enhancement requests can be reported here:
http://code.google.com/p/er9x/issues/list

eePe and er9x are free to use under the GNU v2.0 License. Feel free to use, copy and modify it as you wish! I have spent a lot of time (and will continue to) to make this software as good as possible. If you feel that this software has been beneficial to you please show your support by donating 5$USD. This will be greatly appreciated and you'll be added to the "contributors" list in the code (optional of-course).

If you feel you'd like to contribute time, software code, documentation, tutorials, examples and/or money (I like money :) Please feel free to email me at: erez.raviv@gmail.com

Please tell your friends about this cheapie $60 Chinese Tx. I bet They'll roll their eyes up and tell you to go buy a *real* system. That's o.k. You'll have more money for *real* models!