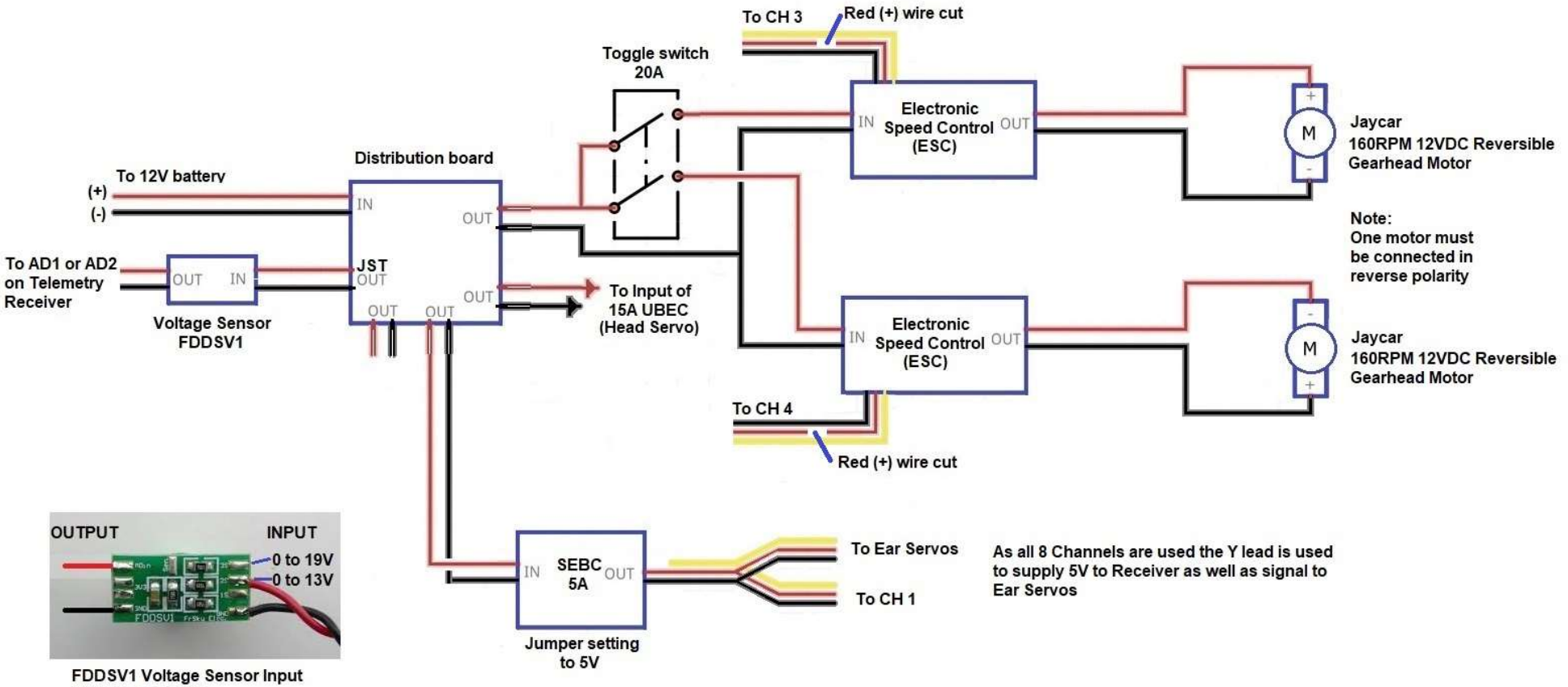
12v relay	Scanners drive	2	FRM3-4BC 12V	https://uk.rs-online.com/web/p/non-latching-relays/3949065/
relay base	Scanners drive	2	PYF14A-N	https://uk.rs-online.com/web/p/relay-sockets/1966147/
universal power antenna	Scanner drive	1		Try and buy 2 wire type – if using 3 wire type them need to dismantle and solder red/ black directly to motor, green wire not required
Head servo	Head	1	TGY S8166M	https://hobbyking.com/en_us/turnigytm-s8166m-high-torque-servo-33kg-0-21sec-154g.html
Head servo UBEC	Head	1	TR-UBEC15	https://hobbyking.com/en_us/turnigy-8-15a-ubec-for-lipoly.html
Power Dist Board	Power		9171000033	https://hobbyking.com/en_us/hobby-king-quadcopter-power-distribution-board.html
5A SEBC	Power		SBEC-26V	https://hobbyking.com/en_us/turnigy-5a-8-26v-sbec-for-lipo.html
FrSky Battery Voltage Sensor	Power	1	FBVS01	https://hobbyking.com/en_us/frsky-battery-voltage-sensor-frsky-telemetry-system.html
20A motor isolator switch	Drive	1	ST0579	https://www.jaycar.com.au/spst-20a-12vdc-toggle-on-off-switch/p/ST0579
Jaycar motors	Drive	2	YG2738	https://www.jaycar.com.au/160rpm-12vdc-reversible-gearhead-motor/p/YG2738
Red 5mm Cree LED 23500mcd Round Clear	Eyes + Laser	3	ZD0293	https://www.jaycar.com.au/red-5mm-cree-led-23500mcd-round-clear/p/ZD0293
100 ohm1W resistor	Eyes + Laser	3	RR2550	https://www.jaycar.com.au/100-ohm-1-watt-carbon-film-resistors-pack-of-2/p/RR2550
Micro Switch lever arm	Laser	1	SM1036	https://www.jaycar.com.au/spdt-125v-3a-sub-miniature-micro-switch-with-lever/p/SM1036
Turnigy TX Controlled Relay Switch	Audio	1	9171000272-0	https://hobbyking.com/en_us/turnigy-tx-controlled-relay-switch.html
Reciever controlled switch	Scanners drive	2	9107000266-0	https://hobbyking.com/en_us/turnigy-receiver-controlled-switch-1.html
Servo reverser	SD and ears	2	9171000295-0	https://hobbyking.com/en_us/turnigytm-servo-signal-reverser.html
Voltage regulator	Arduino+ Pi	1	AA0372	https://www.jaycar.com.au/adptr-module-multi-voltage-reg-1-5a/p/AA0372
Twin USB Panel or Surface Mount Outlet 5V 3.1A	Arduino+ Pi	1		https://www.jaycar.com.au/twin-usb-panel-or-surface-mount-outlet-5v-3-1a/p/MP3616
Mp3 player panel	Audio	1		https://www.amazon.co.uk/Digital-Player-Decoder-Support-Display/dp/B07G7ZCM3R
Servo Y leads	wiring	5	AM-3003-15	https://hobbyking.com/en_us/jr-y-servo-lead-15cm-length-5pcs-bag.html
Servo lead various lengths	wiring	10	AM1043-60CM	https://hobbyking.com/en_us/60cm-servo-lead-extention-jr-26awg-10pcs-bag.html
18awg silicon wire Black	wiring	2 metres		https://hobbyking.com/en_us/turnigy-18awg-siliconewire-black-2m.html
18awg silicon wire red	wiring	2 metres		https://hobbyking.com/en_us/turnigy-high-quality-18awg-silicone-wire-2m-red.html
3.5mm connector plugs	power	20		https://hobbyking.com/en_us/polymax-3-5mm-gold-connectors-10-pairs-20pc.html
Assorted Heatshrink	wiring	1		https://hobbyking.com/en_us/heat-shrink-tubing-tube-kit-580pcs.html
Ear servos	Ears	2	9468000001-0	https://hobbyking.com/en_us/turnigytm-tgy-50090m-analog-servo-mg-1-6kg-0-08sec-9g.html
Nose servo	nose	1	TGY-9018MG	https://hobbyking.com/en_us/turnigytm-tgy-9018mg-mg-servo-2-5kg-0-10sec-13g.html
Tail servo	Tail	1	9225000014	https://hobbyking.com/en_us/hobbykingtm-high-torque-servo-mg-bb-w-proof-12-8kg-0-22sec-58g.html
Taranis Mode 1 transmitter	Control Control	1	236000063-0	https://hobbyking.com/en_us/frsky-2-4ghz-accst-taranis-x9d-x8r-plus-telemetry-radio-system-mode-1-eu-version.html
Turnigy 9XRpro	Control	1	171000413-0	https://hobbyking.com/en_us/turnigy-9xr-pro-radio-transmitter-mode-1-without-module.html
Module to suit 9XRpro	Control	1	DJT	https://hobbyking.com/en_us/frsky-df-2-4ghz-combo-pack-for-jr-w-module-rx.html
Battery to suit 9XRpro	Control	1	9171000183	https://hobbyking.com/en_us/turnigy-9xr-safety-protected-11-1v-3s-2200mah-1-5c-transmitter-pack.html
Arduino Uno	Panel lights	1		Any Uno or Uno clone
Raspberry Pi	Display driver	1		Any type of Raspberry Pi will drive display including the new Zero. May require HDMI adaptor with Zero.



FDDSV1 Voltage Sensor Input
Voltage Selection

1S = 0 to 6.6V
2S = 0 to 13.2V
3S = 0 to 19.8V

Important Note:

Servo leads to Receiver from both ESC's must have the RED wire CUT.

The ESC's have onboard Battery Eliminator Circuits (BEC) which must be removed from the circuit as the SEBC 5A supplies 5V to the receiver.

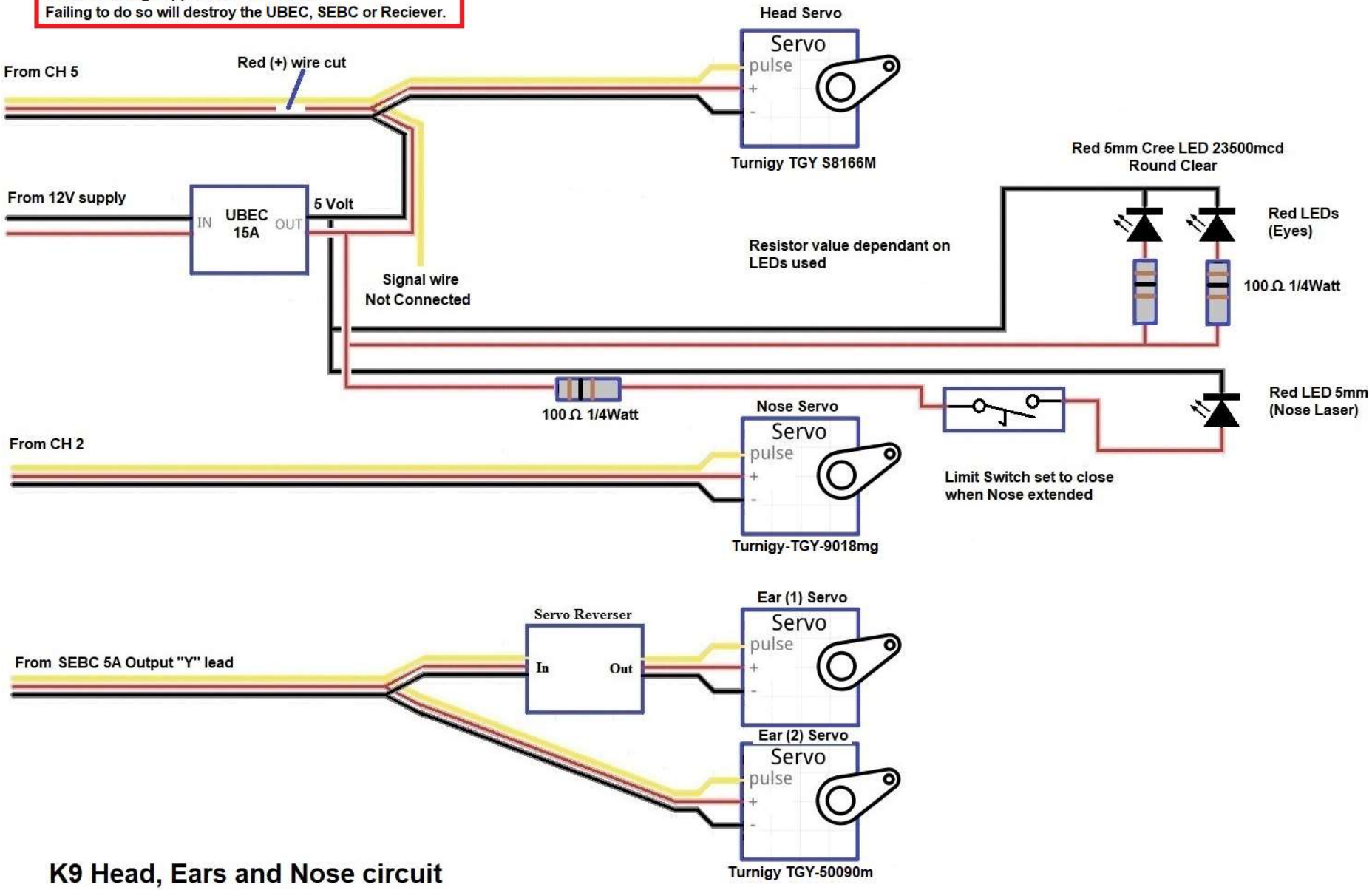
Failing to do so will destroy the ESC or Reciever.

K9 Power Distribution and motor drive circuit

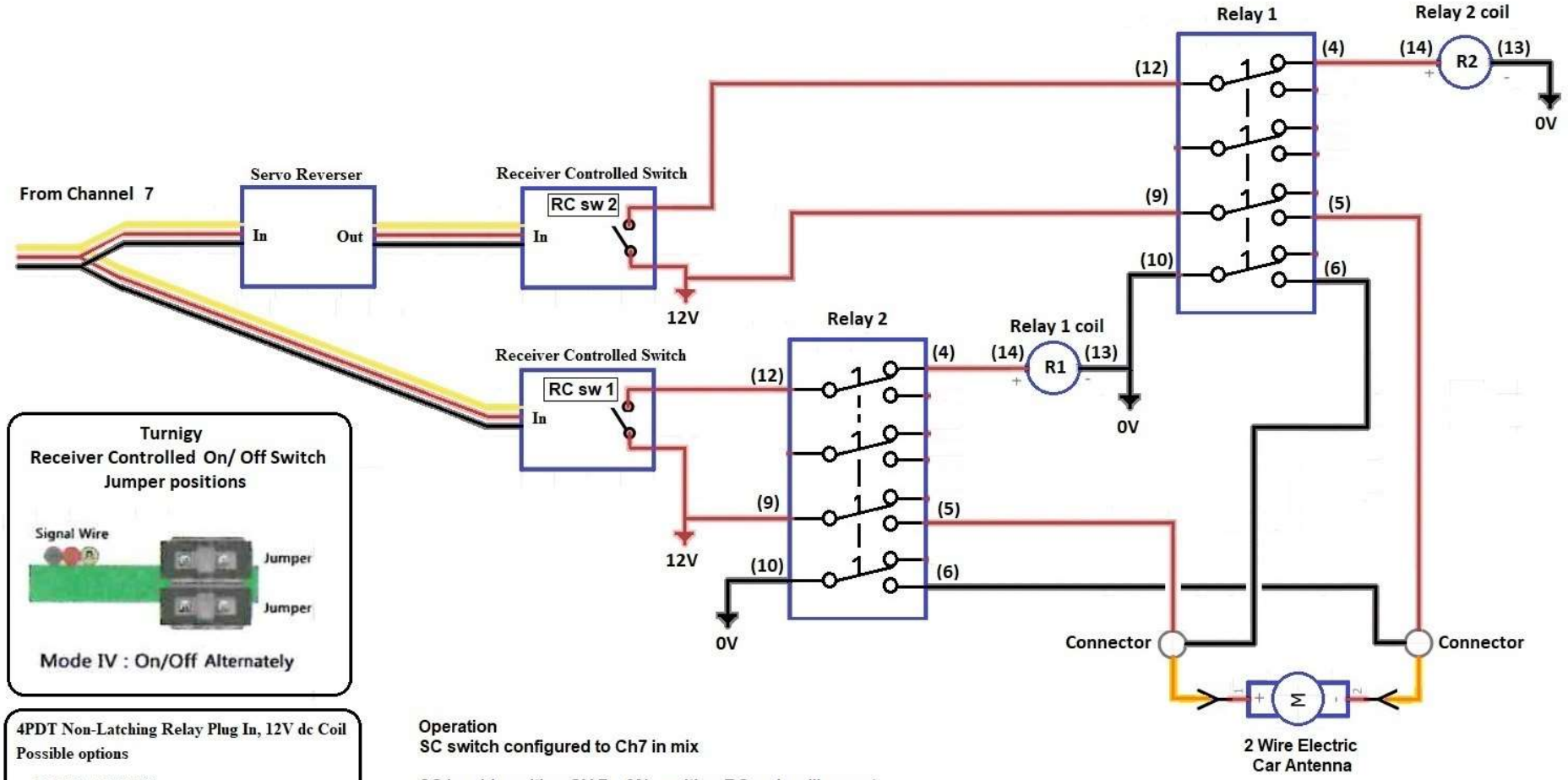
Important Note:

CH 5 Servo lead to Receiver must have the RED wire CUT.

Receiver being supplied from SEBC 5V
Failing to do so will destroy the UBEC, SEBC or Reciever.



K9 Head, Ears and Nose circuit



Turnigy
Receiver Controlled On/ Off Switch
Jumper positions

Mode IV : On/Off Alternately

4PDT Non-Latching Relay Plug In, 12V dc Coil
Possible options

FRM3-4BC 12V
RS Components 394-9065
Omron MY4 12DC(S)

Operation
SC switch configured to Ch7 in mix

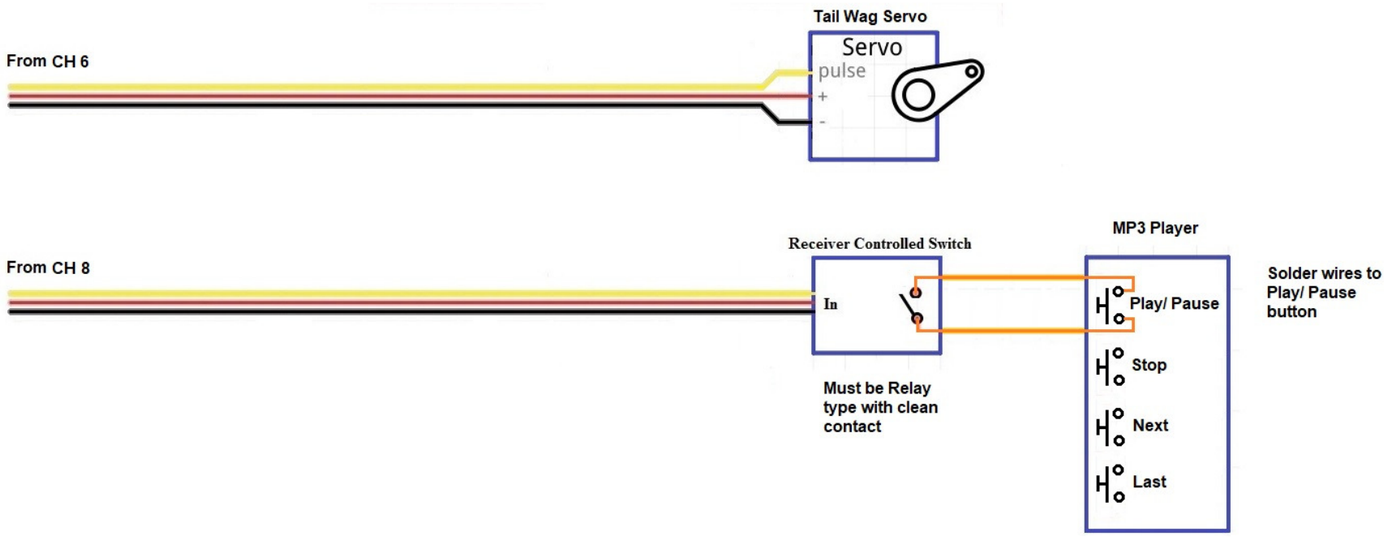
SC in mid position CH 7 = 0%. neither RC sw's will operate

SC in Up position CH 7 = 100%. RC sw 1 will operate. contact (12) (4) Relay 2 is closed so R1 will energise.
R1 contacts (9) (5) will close and apply 12V to motor
R1 contacts (10) (6) will close and apply 0V to other side of motor. Motor will extend antenna

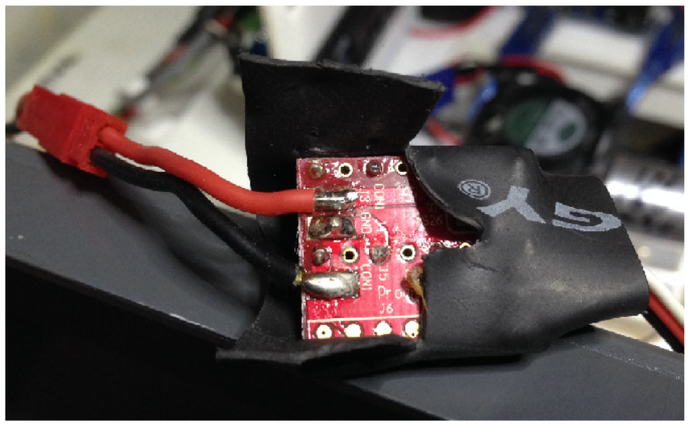
SC in Down position CH 7 = -100%. Signal reveresed to 100%. RC sw 2 will operate. contact (12) (4) Relay 1 is closed so R2 will energise.
R2 contacts (9) (5) will close and apply 12V to motor.
R2 contacts (10) (6) will close and apply 0V to other side of motor. Motor will retract antenna.

R1 and R2 contacts (12) (4) are to prevent both relays being energise at the same time. As this would short out the supply.

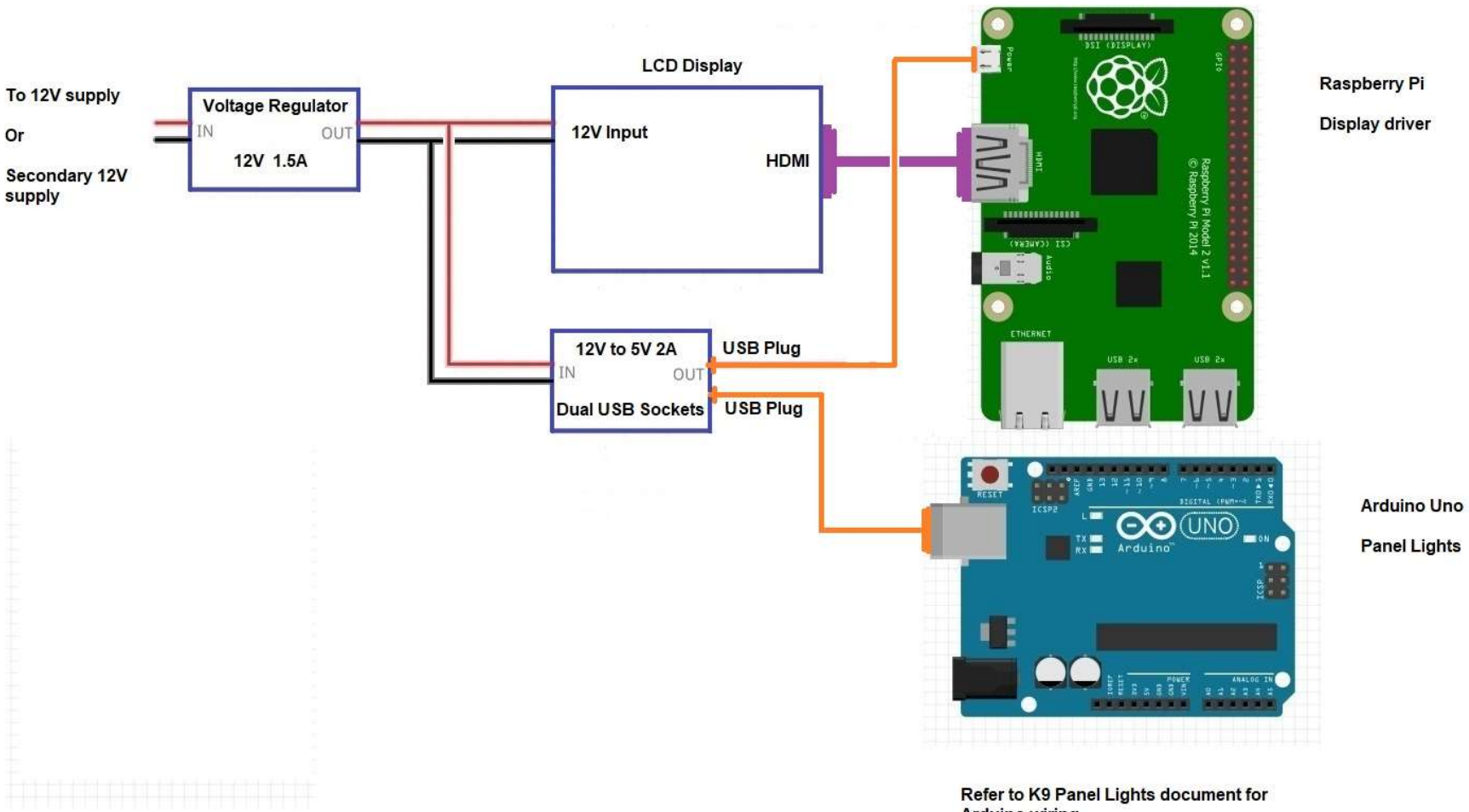
K9 Scanner/ Senor extend and retract circuit



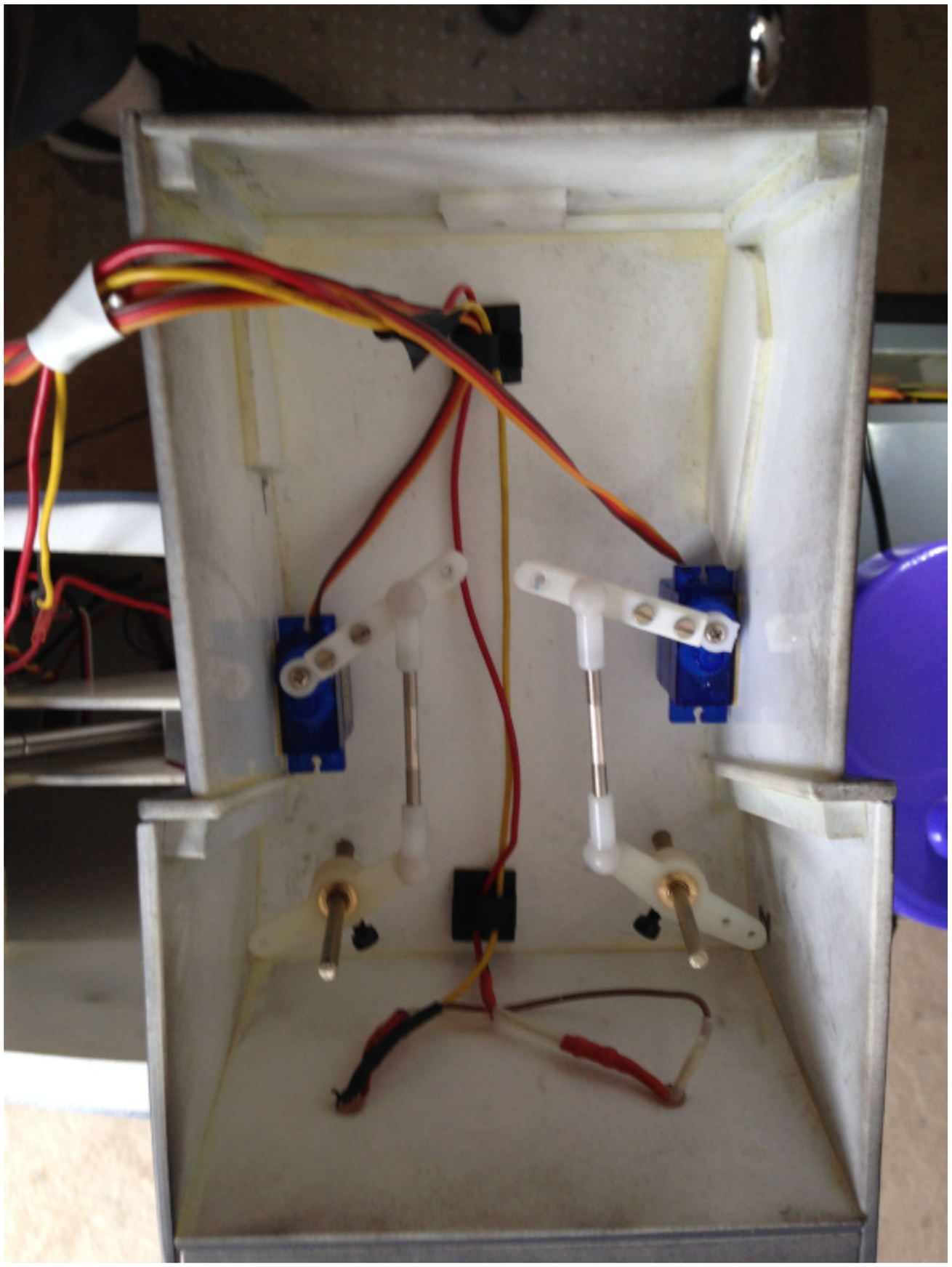
Receiver Controlled Switch output modified to Normally Open Contact



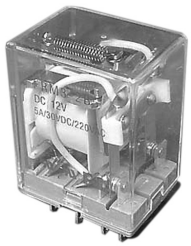
K9 Tail and Audio



K9 Arduino and Raspberry Pi circuit



FRM3



FRM3/FRM3N

- Small size and light weight
- High reliability, long service life
- Cover load from 3A up to 10A on 2, 3 and 4 poles
- Test bottom is available (FRM3N)
- Strong construction for vibration and shock

Recognized File No.: E 141516 - for FRM3 only
Recognized File No.: R2024411 - for FRM3 only

Technical data

Characteristics

- Contact Arrangement: DPDT (2 Form C), 3PDT (3 Form C) (for FRM3 only), 4PDT (4 Form C)
- Contact Material: Silver Alloy
- Contact Resistance: 50mΩ Max. (Measured at 1A 30VDC)
- Contact Rating (Resistive Load): see figure 1 and 2
- Switching Voltage: 125V DC/250V AC Max.
- Operate Time (Initial): 25 ms Max.
- Release Time (Initial): 25 ms Max.
- Insulation Resistance: 1000MΩ Min. (500V DC)
- Dielectric Strength:
  - 1000V AC (50 Hz/min.) between open contacts
  - 1500V AC (50 Hz/min.) between coil and contact (Special: 2000VAC)
- Shock Resistance: Functional 100 m/s^2, Destructive 1000 m/s^2
- Vibration Resistance: 1.5mm, Double Amplitude 10-50Hz
- Ambient Temperature: -55 °C to +70 °C
- Humidity: 35 - 95% RH
- Operation Life:
  - Mechanical: FRM3 $2x10^7$, FRM3N $1x10^7$
  - Electrical:
    FRM3: DPDT or 3PDT 7A $1x10^5$ 5A $2x10^5$
    4PDT 5A $1x10^5$ 3A $2x10^5$
    FRM3N: DPDT 10A or 4PDT 5A $1x10^5$
- Weight:
  - FRM3: 35g Approx.
  - FRM3N: 37g Approx.

Coil rating

Rated Voltage (V)		Coil rResistance Ω +/- 10%	Rated Current (mA)		Must operate voltage	Must dropout voltage	Maximum voltage	Power consumption
			50Hz	60Hz	% of rated voltage (at +20 °C)			
AC	6	11.5	234	200	80 Max.	30 Min.	110 Max.	1.2 VA
	12	46	117	100				
	24	184	58.5	50				
	36	370	39	33.4				
	48	735	28	24				
	120	4550	14.1	13.6				
	220/240	14400	11.4	10				
DC	6	40	150		80 Max.	10 Min.	110 Max.	0.9W
	12	160	75					
	24	650	36.9					
	36	1500	24.5					
	48	2600	18.5					
	110	11000	10					

Figure 1: FRM3

Load / Item	2-3 Poles		4 Poles	
	5A	7A	3A	5A
Rating Load	30V DC/220V AC		30V DC/220V AC	
Switching Current	5A	7A	5A	5A
Switching Capacity	100VA/150W	1540VA/210W	660VA/90W	1100VA/150W

Figure 2: FRM3N

Load / Item	2 Poles	4 Poles
	10A	5A
Rating Load	250V AC	250V AC
Switching Current	10A	5A
Switching Capacity	2500VA/300W	1250VA/150W

Ordering information

FRM3 - H 2 A 5 - L - DC 12V

- DC 12V — Rated voltage
- L — L: With Led
- 5 — Contact capacity: 3 - 3A; 5 - 5A; 7 - 7A (see Note); 10 - 10A
- A — A: PCB mounting; B: Soldering type
- 2 — Contact Arrangement: 2: 2PDT; 3: 3PDT (see Note); 4: 4PDT
- H — Cover: Nil: Standard type; H: Mount Frange type
- FRM3 — Relay model: FRM3; FRM3N (Test Button type)

Note:

FRM3
2PDT - available with 3A, 5A or 7A
3PDT - available with 3A, 5A or 7A
4PDT - available with 3A or 5A

FRM3N (Test Bottom type)
2 PDT - available with 10A
3PDT - not available for FRM3N model
4PDT - available with 5A

DIMENSIONS (mm)

2 Poles

FRM3N-2A X X DC XV
PCB Terminals

FRM3N-2B X X DC XV
Q.C. Terminals

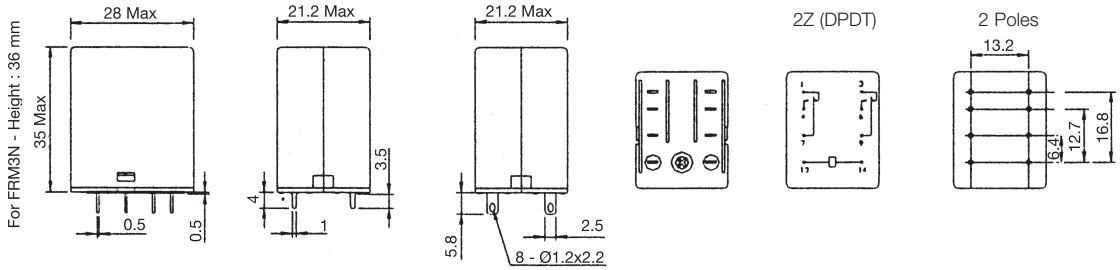
Bottom view

Wiring Diagram
Bottom view

2Z (DPDT)

PC Board Layout
Bottom view

2 Poles



3 Poles

3 Poles
PCB Terminals

3 Poles
Q.C. Terminals

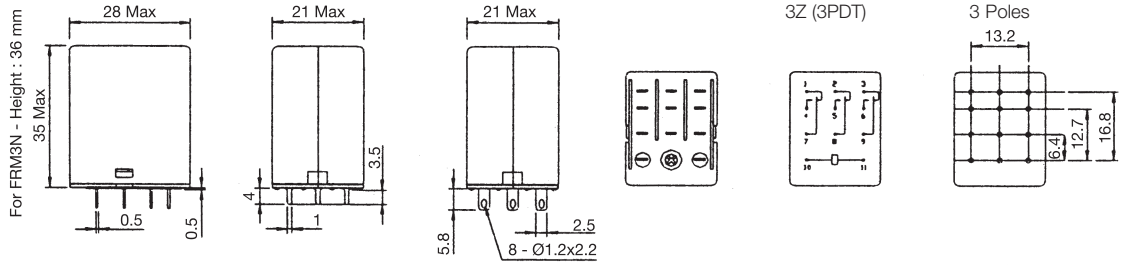
Bottom view

Wiring Diagram
Bottom view

3Z (3PDT)

PC Board Layout
Bottom view

3 Poles



4 Poles

FRM3N-4A X X DC XV
PCB Terminals

FRM3N-4B X X DC XV
Q.C. Terminals

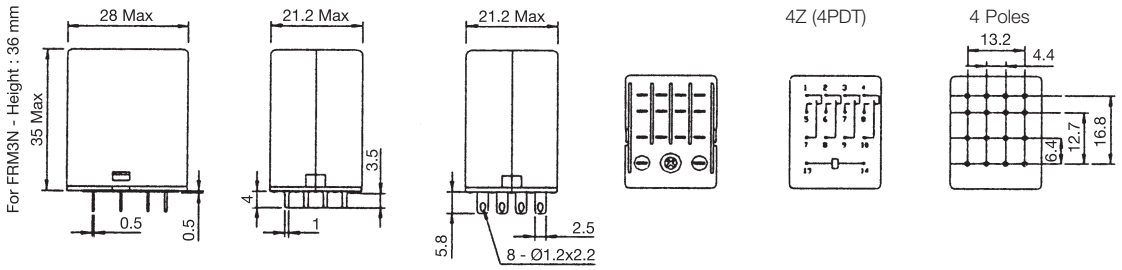
Bottom view

Wiring Diagram
Bottom view

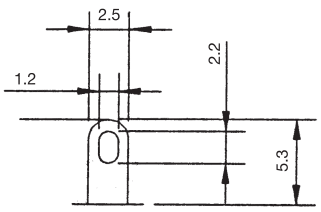
4Z (4PDT)

PC Board Layout
Bottom view

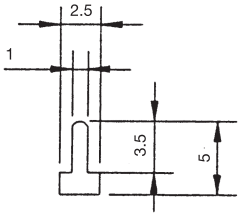
4 Poles



Socket Type Terminal



PC Type Terminal



Alexander “Datos”
«http://forum.modelka.com.ua»

Using FrSky FLD-02 + battery level sensor FrSky FBVS01 + FrSky D8R-II receiver. Short manual.

1.1 Specifications of FrSky FLD-02:
Model: FLD-02
Compatibility: FrSky DFT, DJT and DHT
Dimensions: 55*40*12mm
Screen resolution: 128*64
Backlight: yes, light-cyan
Power: from TX

1.2 Features:
1) Shows data from any compatible sensors connected to RX
2) Programmable alarms
3) Upgradable firmware

2 Quick start:
Connect FrSky FLD-02 to FRSky TX module using the cable supplied with FLD-02. Maintain polarity: black wire means - ground. Make sure that both switches of FRSky TX module are at “OFF” position.

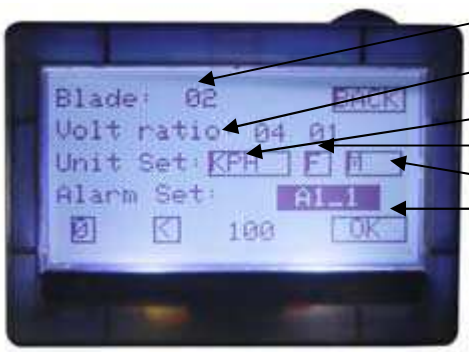
3 Screen structure:

3.1 Main screen:

FrSky logo
Firmware version
«DATA» button
«MENU» (settings) button
FrSky website

***note:** you can scroll through buttons|values|digits by rotating upper button to either direction. Short button press would choose|confirm value. Turning and keeping button for more than 1 second at either end would set the cursor to the next location in more-than-one digit cell.

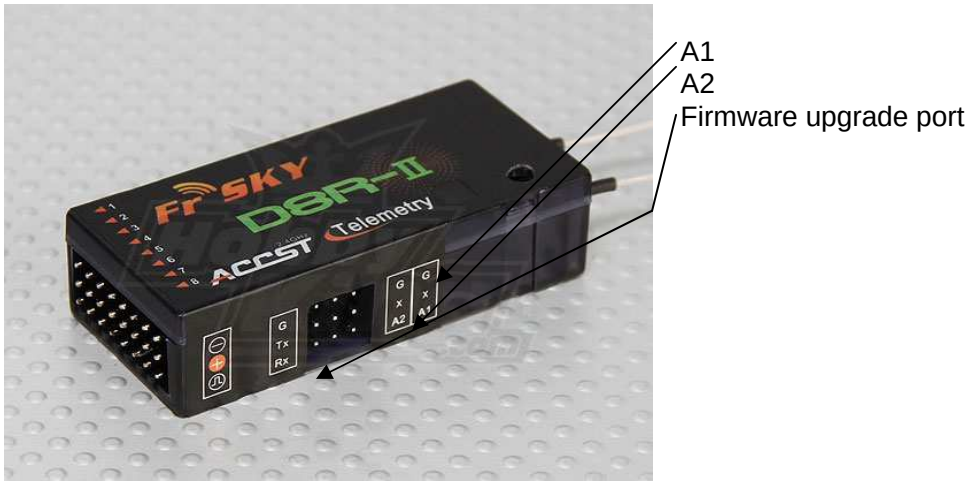
3.2 «MENU» Screen



Blade: # of blades
Volt ratio: voltage divider on A1 (left cell) & A2 (right cell) ports
Unit Set: Speed (KPH | MPH)
Temperature: (C | F)
Altitude: (meter | feet)
Alarm Set: alarm setup for A1_1/2, A2_1/2, RSSI_1/2

3.2.1 D8R-II receiver (additional information)

D8R-II receiver has 2 telemetry ports A1 and A2 (you can simultaneously connect either only 2 of any telemetry sensors or more than 2 sensors by using special sensor-hub) + 1 firmware upgrade port.



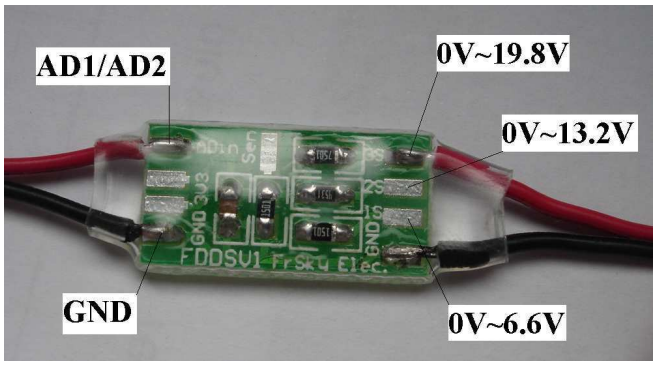
Port A1 has a default bridge installed from the factory between X and A1 pins. Pin X supplies power to a sensor. A1 pin receiver data from a sensor. G stands for Ground.

Therefore, if there is a bridge between X and A1 pins – telemetry screen FLD-02 would show the inner RX voltage in the left cell “A1 & A2 Voltage” (look at section 3.3.1 of this manual) The readings of this cell A1 (left) on “DATA Screen 1” would be true (4.2V) only in case if voltage divider for A1 is set correctly. Don’t forget that this is stabilized voltage inside the RX circuit that is supplied either by ESC (in case of using only 1 battery in RC-model) or separate battery used to power-up electronics. Consequently, this reading could not be used as a reference to overall main battery charge level.

In order to setup an appropriate voltage divider you should turn to “MENU” Screen (look at section 3.2 of this manual) “Volt Ratio” value (left value stands for A1 port)). This value should be equal to the number of cells of the battery, that supplies voltage to the receiver (3 for 3-cells LiPO). If this value is set correctly – it would read 4.2V

Furthermore, apart from A1 inner RX voltage readings, you can connect **FBVS01** battery voltage sensor to A2 RX telemetry port.

3.2.2 FBVS01 external battery level telemetry sensor



This sensor has 3 voltage dividers - soldering pins: 1S (1-2 cell LiPO max. Divider for FLD-02 = 2), 2S (1-4 cell LiPO max. Divider = 4), 3S (1-6 cell LiPO max. Divider = 6).

Initially, red wire that goes to the battery is soldered to 3S pin on board, i.e. – any LiPO battery from 1 to 6 cells. In case of using, for example, up to 4 cells – you should re-solder it to 2S pin in order to get more accurate voltage metering by the sensor.

*from now on – we would use 3-cell LiPO (11.1V) as an example….

After re-soldering red wire to 2S pin, connecting this wire to the battery, and connecting FBVS01 sensor to RX A2 telemetry port – you would have to setup the appropriate voltage divider for our specific soldering type in order to have the appropriate readings in A2 cell (right) of “A1 & A2 Voltage” section (look at section 3.3.1 of this manual) of “DATA Screen 1”. To do this – go to “MENU” Screen (section 3.2 of this manual) and set the appropriate divider value for A2 in “Volt Ratio” section (as it is stated above, near the picture with soldering pins layout), i.e. 4 (for our soldering type 2S and 3-cell LiPO battery).

***note:** if you are using only 1 battery in you RC-model (without separate battery for electronics) – you should NOT use|connect black (Ground) wire of voltage sensor. Just do NOT connect it. Throw it away or cut it, or just forget it. The only cable that should be connected to RX and battery – red (+). In case of 1 battery, Ground is already supplied to the RX from ESC. If you would supply another one Ground through sensor to RX telemetry port – you would have Ground-loop because electrons would follow the lowest-resistance route omitting long RX-electronic circuit. It would eventually result into electronics (gyro, servo, etc) short-time or permanent failure.

In case if you use 2 separate batteries – 1 for electronics and another one to power-up the motor and you are connecting sensor to motor-battery – you can use + and – without any ground-loop.

How to setup an alarm for sensor readings (look at section 3.3.2 of this manual)

3.3 DATA Screen:

3.3.1. Screen-1

GMT (h/m/s)
Fuel level
A1 & A2 Voltage (readings from A1 and A2 RX ports)
Temperature 1 & 2
Rx RSSI (level of RX signal) & Tx RSSI (level of TX signal)

***note:** RX and TX signal level is shown without any sensors attached to RX. This is default built-in function. This function also allows alarms to be set (look at section 3.3.3 of this manual)

3.3.2 How to setup an alarm for battery sensor readings (3-cell LiPO, connected to A2 telemetry RX port)

In order to program low-battery alarm at a certain battery level, you should go to “MENU” Screen (section 3.2 of this manual) and than in “Alarm Set” section choose A2_1 and enter the following values underneath:

1 < 218

Where:

1 – is a level (volume/frequency/number) of beeps (0 – no beep, 1 – low beep, 2 – meduim, 3 – high)

< - means lower than

218 – a value at which alarm starts working

WHY 218???? 218, in this case means = 11.25V. i.e., 3.75V/cell for 3-cell LiPO. How to calculate this value or setup your own:

(desired Voltage (V) / voltage divider (4 – as it is defined by our soldering type) / 3.3V) x 256 (number of values that A/D converter can have, from 0 to 255)

Example: we want alarm to sound when 3-cell LiPO would reach 11.25V (3.75V/cell) discharge level:

(11.25V / 4 (divider for 2S soldering type) / 3.3) x 256 = 218

Now, using this formula – you can calculate the appropriate value for any battery discharge level.

Moreover, you can setup 2 alarms for the same sensor|port. For example, alarm could sound low at 12V level and sound high at 11.23V level. To do this, go to “MENU” Screen (section 3.2) and set all values for A2_1 and than A2_2 alarms in “Alarm Set” section. Last digits here stand for 1-st and 2-nd alarm.

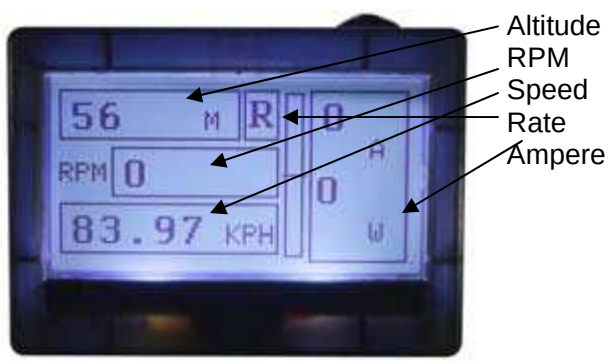
3.3.3 How to setup RX-TX signal level alarm

In order to setup an alarm for RX-TX signal fall-down/loss – you should go to “MENU” Screen (section 3.2) and in “Alarm Set” section choose RSSI and set the following values underneath (as recommended in the manual):

RSSI_1
1 < 45

RSSI_2
2 < 42

3.3.4 Screen-2



3.3.5 Экран-3

Total Voltage
Voltage for each cell

***note**: this screen would only be shown if **FLVS-01** sensor is connected. Otherwise, Screen-4 would follow Screen-2 directly.

3.3.6 Screen-4

Acceleration X/Y/Z
Longitude & Latitude (GPS-data)

SWITCHING BATTERY EMULATION CIRCUIT (SWITCHING BEC)

SPECIFICATION

Input Protection:	Reverse Polarity Protection
Input Voltage:	
Model SBEC26:	8-26V
Model SBEC40:	8-40V
Model SBEC60:	8-60V
Output Voltage:	5V or 6V (selectable)
Output Current:	5A maximum

SETUP AND CONNECTION

1. Connect the battery. Make sure the polarities are correct. (Red + , Black -)
2. Make sure the polarities are correct when inserting output connector to the receiver.

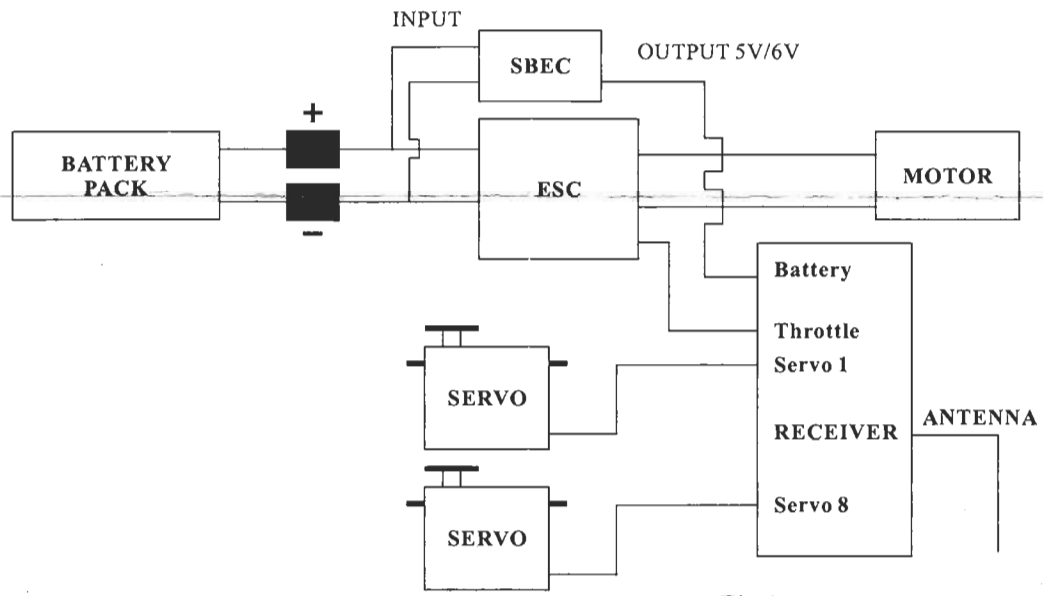


Fig 1

CAUTIONS

- Incorrect polarities at the output connection can damage the receiver, servo, ESC and battery.
- For ESC that already come with a BEC : remove the 5V output pin (red color wire) from the middle of the throttle connector before using the SBEC.

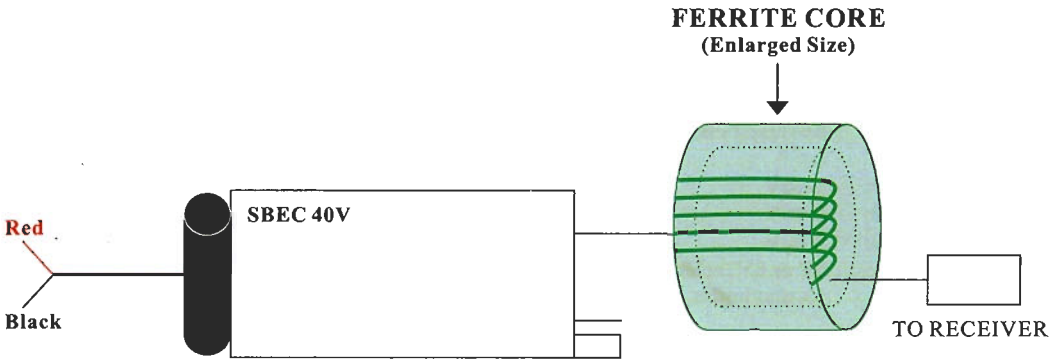


Fig 2

Put the wire through the hole of the ferrite core and make five turns per Fig 2.

Jumper setting for selection of 5V / 6V.

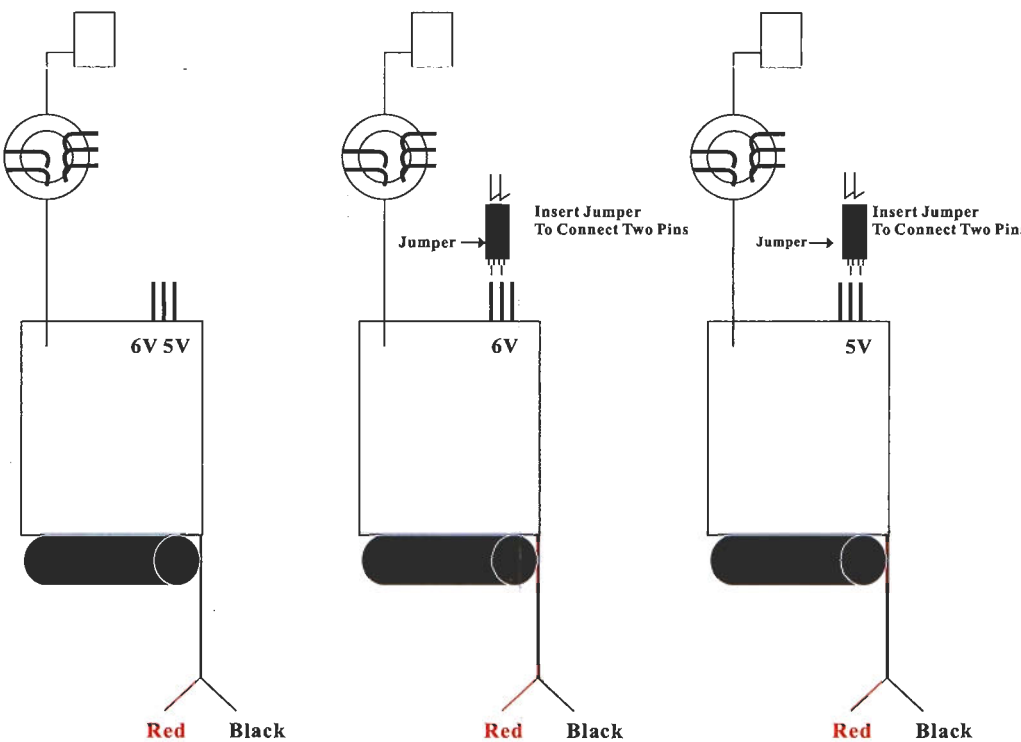


Fig 3

R/C Electronic Swtich Manual

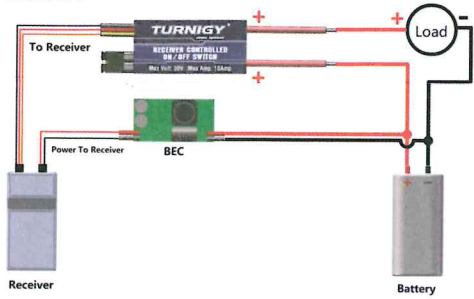
Overview

Radio Control Electronic Switch allow you to plug directly into an open channel on your receiver and control electronic equipment by your transmitter.The high current capacity, small size and flexible allow for variety of use.

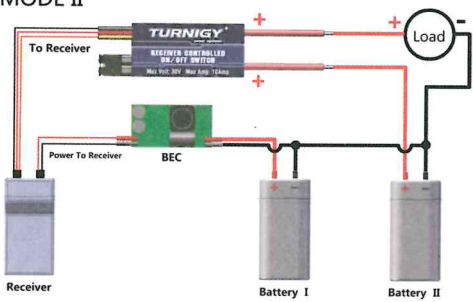
Features:

- Works with any radio system
- Heavy Duty Ability (10amp at 30V max)
- Compact size,light weight (7g)
- Flexible fail safe setting (keep on, keep off, last situation and on/off alternately)

MODE I

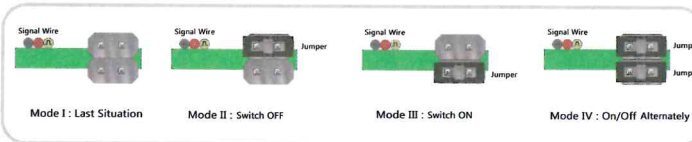


MODE II



Note: this picture show when you have two or more than two battery (Power supplier), you need make **THEIR GROUND CONNECTED** (common ground).Other wise, the Electronic Switch not working.

Fail safe mode



User Manual of 8A UBEC

8 Amps Switch-Mode UBEC

1. Why do you need UBEC?

The 8A-UBEC is a switch-mode DC-DC regulator supplied with a 2-3 cells lithium battery pack and outputs a consistent safe voltage for your receiver, gyro and servos. It is very suitable for nitro powered RC helicopter (above 30 class) and big fixed-wing aircraft.

Compared with the linear mode UBEC, the overall efficiency of the switch-mode BEC is much higher, so it can extend the working time of the receiver battery pack, and because a switch mode UBEC can significantly reduce the heat emission, it can avoid the loss of control caused by the over-heat problem which is frequently happened with the linear mode UBEC.

2. Specification:

2.1. **Output:** 5V/8A or 6V/8A (Changeable with an output-voltage select switch)

2.2. **Input:** 6V-12.6V (2-3 cells lithium battery pack)

2.3. **Size:** 42mm*39mm*9mm (length*width*height)

2.4. **Weight:** 38g

2.5. **Quiescent current:** 60mA

3. Features:

3.1. Designed with an advanced switch mode DC-DC regulator IC.

3.2. The output current is very large, the continuous output current is up to 8A, and the burst output current is 15A.

3.3. With the output short-circuit protection function.

3.4. A metal shield covers almost all the electronic components, and a specially made filter (ferrite ring) is attached with the output wires to significantly reduce the electromagnetic interference.

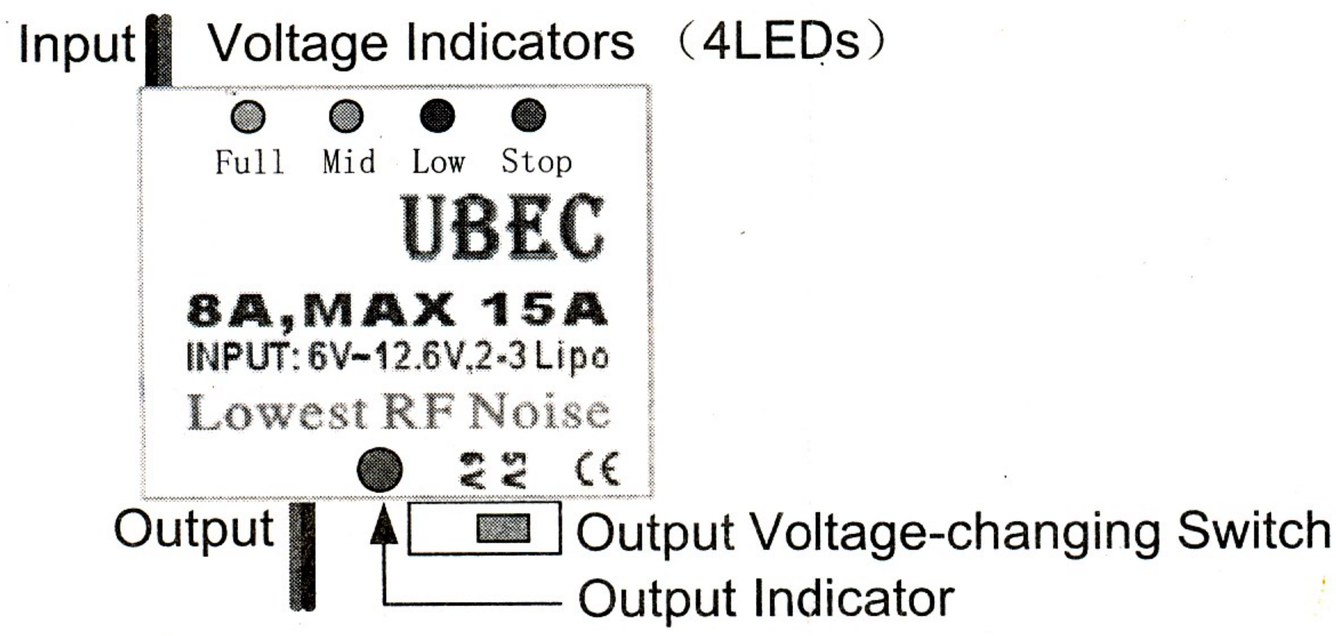
3.5. Automatically detects the number of the lithium battery pack (2 cells or 3 cells), and shows the battery capacity with 4 indicators (LEDs).

3.6. Shows the working status with an indicator (LED), lights when the output is in normal range.

3.7. 2 output leads to reduce the resistance when connecting the UEBC to the receiver.

3.8. Accessory: A step-down voltage regulator with 0.7V down (from 6.0V to 5.3V).

4. Wiring Method



5. Special Explanation

5.1. Although we have tried our best to reduce the electromagnetic interference caused by switch model UBEC, it still may cause some interference to the receiver. So please install the filter far away from the UBEC's main board, and DON'T stack the filter on the main board. Please put the whole UBEC as far as possible away from the receiver.

5.2. This UBEC is only designed for using lithium batter pack; we don't recommend the use of NiMh / NiCd battery pack.

5.3. The input polarity must be correct; otherwise the UBEC will be damaged. Please check the polarity carefully before connecting the battery pack.

6. How to Use the UBEC?

6.1. Change the output voltage

The voltage is chosen by an output-voltage select switch.

6.2. Working status indicator (LED)

The LED shows whether the output is normal or not. It lights when the UBEC has the normal output. If it doesn't light, please check the battery connections.

6.3. Battery capacity indicators (4 LEDs)

LED Status				The voltage of the lithium battery pack	
Full	Mid	Low	Stop	2S battery pack	3S battery pack
○	○	○	○	7.8－8.4V	11.7－12.6V
●	○	○	○	7.2－7.8V	10.8－11.7V
●	●	○	○	6.6－7.2V	9.9－10.8V
●	●	●	○	5.4－6.6V	<9.9V
4 LEDs flash at the same time				1)The voltage <5.4V 2)The voltage >13.5V	1)The voltage >13.5V
One LED flashes for a short time				The voltage of the battery pack is just at the critical edge of each range.	

○ means the LED lights, ● means the LED does not light

When you are using a 3 cells lithium battery pack, if there is only one LED ("STOP") lights, that means the voltage is less than 9.9v, please change the battery pack as soon as possible, otherwise it will be damaged because of over-discharging. For such a fully-discharged 3S battery pack, if the voltage is less than 9V, please don't use it again before it is recharged, otherwise the UBEC may mistakenly consider this battery as 2 cells, so the power capacity indication function will be confused.

6.4. Turn on or turn off the output

Set the main switch to the "ON" position to turn on the output; Set the main switch to the "OFF" position to turn off the output.

6.5. About the 0.7V step-down voltage regulator

Allowing use of Futaba servo models 9241, 9251, 9253, 9254, 9255, 9256 and other digital servos not capable of handling 6V. This small device can change the voltage from 6V to 5.3V. When the UBEC output is set to 6V, the step-down voltage regulator is useful.

Method: Just connect the regulator inline between the Gyro and the rudder servo (Or between the receiver and the servo), that's OK.

If you are using a servo that can accept 6V input, the regulator is not required.

Single stick tank style controls for K9

Taranis / Taranis plus Radio Control Equipment.

Features of Mix

- Throttle Channel redefined so that full travel of stick is 0 to 100% forward speed. SH switch initiates reverse, 0 to 100% stick travel = 0 to 25% reverse speed.

- Steering command mixed with Throttle command so drive motors also do the steer to give tank style steering on a single stick.

- Wheel spin slip is limited by a ramp on the throttle position “Slow(u3:d0)” this can be increase or decrease as needed but you will need to do it to both motors eg CH3 and CH4.

- Reverse is activated by the SH switch (spring return switch) when switch SH is held against the spring. Motors will drive in reverse at the current throttle position to prevent rapid change in direction the speed signal to the motors is delayed and ramped “Delay(u0.5:d0) and Slow(u3:d0)” ideally the throttle should first be put to zero speed before activating SH.
  Steering input mixed with reverse speed command to give steering in reverse mode.

- Reverse speed is limit to 25% speed by CH16 but can be changed if higher reverse speed required, transmitter will Beep when in reverse.

- Forward speed control will be returned when switch SH released and again to prevent rapid change in direction the speed signal is ramped by the acceleration ramp.

- To prevent K9 running off unexpectedly SE switch is used to disable the throttle and steering stick this is done in the mix CH14, CH15 and CH16

- K9 sound via MP3 player, a soft switch is connected to CH8 and connected across the MP3 player “Pause” button. When Switch L1 operated a 0.6 second pulse is sent to soft switch which will either Pause or Play the MP3 player.

- Tail wag and radar ears have an automatic oscillation feature, these can be independently turned on or off.

- Nose Laser slow extend and retract

- Slow head up and down movement to protect head servo mechanism.

- Probe/ scanner insert and retraction feature utilising electric car antenna.

OpenTx configuration to suit Taranis and Taranis Plus.
Configuration would also work on the Turnigy 9xrpro with some syntax changes.

**Mix written and tested on a Mode 1 transmitter with RETA (Rudder, Elevator, Throttle, Aileron) outputs if Mode 2 or none RETA output selected you will need to confirm your output channels.

Input configuration

Inputs	**Outputs**
Throttle Stick = speed control	CH1 = Radar Ears
Aileron Stick = Left/ right steering (Rubber stick for Mode 2 transmitter)	Ch2 = Nose Laser
Elevator Stick= Head movement	Ch3 = Left motor ECS
Switch SH (down)= To activate Reverse function	CH4= Right motor ECS
Switch SA (down)= Nose Laser operate	CH5 = Head movement
Switch SG (down) = Radar Ears operate	CH6 = Tail wag servo
Switch SF (down) = Tail wag operate	CH7= Probe scanner
Switch SD (down) = Activate/ De- Activate sound	CH8= Sound activation
Switch SC (toggle) = Probe scanner insert/ retract	
Switch SE (up) = Drive Failsafe	

Inputs menu

Input		**Comments**
[I1] Rud	Weight (+100%) Source (Rud)	Rubber stick
[I2] Ele	Weight (+100%) Source (Ele)	Elevator stick
[I3] Thr	Weight (+100%) Source (Thr)	Throttle stick
[I4] Ail	Weight (+100%) Source (Ail)	Aileron stick

Logical Switches menu

		Comments
L1	(Timer (0.6 154.0)) AND SD(on) (0.6s)	Send a Pulse of (+100) for 0.6 seconds. To activate sound. When Switch SD on
L2	(CH20<CH21) AND SG (on)	Ear oscillation When Switch SG on
L3	(CH20> 100) AND SG (on)	Ear oscillation When Switch SG on
L4	(CH20< -100) AND SG (on)	Ear oscillation When Switch SG on
L6	(CH22<CH23) AND SF (on)	Tail oscillation When Switch SF on
L7	(CH22> 96) AND SF (on)	Tail oscillation When Switch SF on
L8	(CH22< -96) AND SF (on)	Tail oscillation When Switch SF on

Special Function Menu

		Comments
SF1	Switch SG (on) Play Track wheredoc	Play Track on transmitter when Ears on
SF2	Switch SA (on) Play Sound Siren	Play sound on transmitter when nose laser extends
SF3	Switch SE (on) Play Track online	Play Track on transmitter when failsafe turned off
SF4	Switch SH (down) play Value (A1)	Say on transmitter K9 battery voltage

Special Function menu is a means of assigning a function to certain switch operations in this case SF1 to SF3 play a sound or WAV file when assigned switch is operated.
SF4 speaks K9 main battery voltage when reverse is selected, an alarm can be configured in the transmitter telemetry section to warn when battery voltage falls below a predefined voltage.

Note: “wheredoc” and “online” are WAV files download from the internet, these can be left blank if sounds not required or substituted with any WAV file.

MIXES menu

	Statement	Comments
CH1	Ch20 Weight (+100%) Switch (SG-) Slow(u1:d1)	Ear servo
CH2	MAX Weight (+110%) Switch (SA-) Slow(u5:d5)	Nose laser servo
CH3	CH15, Weight (+100%) Switch (SH)(up) Slow(u3:d0)	**Left** motor forward speed, has slow to prevent fast acceleration
	CH16, Weight (+85%) Switch (SH)(down) Delay(u0.5:d0) Slow(u0:d2)	**Left** motor reverse speed, has delay and slow to prevent fast direction change
	Source CH14, Weight (+20%)	**Left** motor steering input
CH4	CH15, Weight (+100%) Switch (SH)(up) Slow(u3:d0)	**Right** motor forward speed, has slow to prevent fast acceleration
	CH16, Weight (+85) Switch (SH)(down) Delay(u0.5:d0) Slow(u0:d2)	**Right** motor reverse speed, has delay and slow to prevent fast direction change
	CH14, Weight (-20%)	**Right** motor steering input
CH5	[I2]Ele Weight (+100%) Slow(u2:d2)	Head servo has slow to slow down head movement if Elevator stick moved too fast.
CH6	CH22 Weight (+83%) Switch (SF)(down) Slow(u0.1:d0.1)	Tail servo
CH7	SC Weight (-100%)	Probe scanner extend and retract via electric car antenna motor
CH8	MAX Weight (+100%) Switch (L1)	Sound activation
CH14	[I4]Ail Weight (+100%)	Steering input -100% = Left, 0% = centre, +100% =Right
	R MAX Weight (0%) Switch SE (up)	Fail safe switch. Ignore Steering input to prevent motors running.
CH15	[I3]Thr, Weight (+50%), Offset (50%)	Offset Throttle channel for forward so stick at bottom = 0% and at Top = 100%
	R MAX Weight (-100%) Offset (-100%) Switch SH(down) Warn(3)	Force Forward Throttle to 0% when Reverse Switch SH on and Play Warn sound when in Reverse
	R MAX Weight (0%) Switch(SE)(up)	Fail safe switch to ignore throttle input to prevent Left/ right motors running.
CH16	[I3]Thr Weight (-25%) Offset (-25)	Offset Throttle channel for reverse so stick at bottom = 0% and at Top = -25%. Increase (-%) for more reverse speed.
	R MAX Weight (-100%) Offset (-100%) Switch(SH)(up)	Force Reverse Throttle to 0% when Reverse Switch SH off
	R MAX Weight (0%) Switch SE(up)	Fail safe switch to ignore input to prevent Reverse driving motors.
CH20	CH21 Weight (+100%) Slow(u2:d0.8)	Second Intermediate stage for Ear movement to add slow movement
CH21	L2 Weight (+110%)	First Intermediate stage for Ear movement to add oscillation generated by L3 and L4
	R MAX Weight (-100%) Switch(L3)	
	R MAX Weight (+100%) Switch(L4)	
CH22	CH23 Weight (+100%) Slow(u0.4:d0.4)	Second Intermediate stage of Tail movement to add slow movement
Ch23	L6 Weight (+110%)	First Intermediate stage for Tail movement to add oscillation generated by L7 and L8
	R MAX Weight (-100%) Switch(L7)	
	R MAX Weight (+100%) Switch(L8)	

Explanation of Mix

CH** is the output corresponding to the receiver Channel where the servo is plugged in. When a CH number is greater than the available receiver channel eg CH16 in a 8 channel then consider that channel as an internal variable with no function on the receivers.

	Statement	**Comments**
CH1	Ch20 Weight (+100%) Switch (SG-) Slow(u1:d1)	Ear servo

Receiver Channel 1 will be driven by this statement.
Input (Source) is CH20 which has a full travel input signal of -100 to +100.
A weight of +100% will be applied to that input signal so no change in level will be applied to CH1 output signal.
CH1 output signal will follow CH20 only if Switch SG is ON.
Slow(u1:d1) statement slows the rate of change of the raw input in this case full input change would take 2 seconds. U= upward signal change D= downward signal change.

This is now the Ear oscillation is generated

CH20	CH21 Weight (+100%) Slow(u2:d0.8)	Second Intermediate stage for Ear movement to add slow movement
CH21	L2 Weight (+110%)	First Intermediate stage for Ear movement to add oscillation generated by L3 and L4
	R MAX Weight (-100%) Switch(L3)	
	R MAX Weight (+100%) Switch(L4)	

(refer Logical Switches menu)
Depending on current value of CH20 either (Logical Switch) L3 or L4 will be ON when 100 or -100 reached L3 or L4 will switch and change direction of travel of CH21. This cycle keeps repeating causing CH21 to ramp up and down continually
Slow(u2:d0.8) limits rate of change to CH20, ears will rotate outwards slower than ears rotate inwards by factor 2 to 0.8. Changing to same number will make ears rotate symmetrically.
L2 Weight (+110%) and L2 (CH20<CH21) AND SG (on) are a kick starter logic to get things moving

	Statement	**Comments**
CH2	MAX Weight (+110%) Switch (SA-) Slow(u5:d5)	Nose laser servo

Receiver Channel 2 will be driven by this statement.
Input (Source) is MAX which is an internal variable of (+100%)
A weight of +110% will be applied to CH2 output signal when Switch SA is ON. When SG OFF (-110%)
Slow(u5:d5) will slow rate of change of input signal so nose will extend in 5 seconds and retract in 5 seconds.

	Statement	Comments
CH3	CH15, Weight (+100%) Switch (SH)(up) Slow(u3:d0)	**Left** motor forward speed, has slow to prevent fast acceleration
	CH16, Weight (+85%) Switch (SH)(down) Delay(u0.5:d0) Slow(u0:d2)	**Left** motor reverse speed, has delay and slow to prevent fast direction change
	Source CH14, Weight (+20%)	**Left** motor steering input

Receiver Channel 3 will be driven by this statement.

First line is normal forward speed.
The source is from CH15 and weight of +100 so weight will not alter the signal value from CH15,
If Switch SH(up) CH15 will goto CH3
Slow(u3:d0) limits the rate of change of increasing signal value so forward acceleration will be limited to prevent wheel spin, de-acceleration has no rate so will slow down in response to throttle stick.

Second line is reverse speed.
The source is form CH16 and weight of +85 so only 85% reverse speed available.
If Switch SH(down) CH16 will goto CH3, a delay of 0.5 seconds to allow some of the forward speed to be reduced if Switch SH operated when driving forward.
Slow(u0:d2) to limit reverse acceleration.

Third line which is the steering.
The source is from CH14 and weight of +20, 20% of the steering valve will be added to the first line signal (CH15) if in forward or to reverse signal (CH16) to provide a steering offset on the Left drive motor. If more steering required change this to 30%

	Statement	Comments
CH4	CH15, Weight (+100%) Switch (SH)(up) Slow(u3:d0)	**Right** motor forward speed, has slow to prevent fast acceleration
	CH16, Weight (+85) Switch (SH)(down) Delay(u0.5:d0) Slow(u0:d2)	**Right** motor reverse speed, has delay and slow to prevent fast direction change
	CH14, Weight (-20%)	**Right** motor steering input

Same as CH3 statement except third line steering Weight of -20 so will be subtracted from forward or reverse signal to provide a steering offset on the right motor.

	Statement	Comments
CH5	[I2]Ele Weight (+100%) Slow(u2:d2)	Head servo has slow to slow down head movement is stick moved too fast.

Receiver CH5 will be driven by this statement.
Input (Source) is from Elevator stick which has a full travel raw input signal of -100 to +100.
Weight of +100%. will be applied to that raw input signal., So raw input signal will be applied to CH5.
Slow(u2:d2) will limit rate of change of the input signal so Head will not move up and down too fast to prevent damage to servo.

	Statement	Comments
CH6	CH22 Weight (+83%) Switch (SF)(down) Slow(u0.1:d0.1)	Tail servo

Receiver CH6 will be driven by this statement.
Input (Source) is from CH22 and weight of +83% applied. So tail will only wag between -83% and +83% of servo travel.
If more wag required increase weight to +100%
Slow(u0.1:d0.1) does very little rate limit but could be used to modify the wag in one direction.

The oscillation is generated in the same manner as the ears except generated in CH22 and CH23 by (Logical switch) L6, L7, L8

	Statement	Comments
CH7	SC Weight (-100%)	Probe scanner in and out via electric car antenna motor

Receiver CH7 will be driven by this statement.
Switch SC is a three position switch with raw value of +100%, 0% and -100% a weight of -100% will be applied to the raw signal so:
Switch SC up position +100% x -100% = -100%
Switch SC mid position 0% x -100% = 0%
Switch SC bottom position -100% x -100% =+100%

CH7 drives two relay which control the electric car antenna when -100% antenna retracts, at 100% antenna extends and at 0% no relays are activated.and antenna will not move.

	Statement	Comments
CH8	MAX Weight (+100%) Switch (L1)	Sound activation

Receiver CH8 will be driven by this statement.
Input (Source) is MAX which is an internal variable of (+100%) and Weight +100 is applied so no change in signal level
(refer Logical Switches menu)
(Timer (0.6 154.0)) AND SD(on) (0.6s)
Switch SD ON (Logical switch) L1 will send a 0.6 second pulse of +100% to Ch8

This drives a relay that basically switches the MP3 player Pause/Play button. So consecutive operation of SD will Play or Pause the MP3 player.

CH14, 15 and 16 are used to modify the raw Throttle and Aileron stick to drive the forward/ reverse and steering signals used in CH3 and CH4

	Statement	Comments
CH14	[I4]Ail Weight (+100%)	Steering input -100% = Left, 0% = centre, +100% =Right
	R MAX Weight (0%) Switch SE (up)	Fail safe switch to ignore input to prevent motors running.

CH14 is an internal variable for the steering command.

First line sets up Aileron stick input
Input (Source) is from Ail (Aileron stick) and weight +100 is applied so no change in signal level.

Second line is fail safe function
(Source) is MAX which is an internal variable of (100%) and 0% weight is applied so signal will be 0%
If Switch SE(up) 0% will Replace whatever the value in CH14 with 0%.
This effectively stops any motor drive that might be caused by the steering stick position.

	Statement	Comments
CH15	[I3]Thr, Weight (+50%), Offset (50%)	Offset Thr channel so stick at bottom = 0% and at Top = 100%
	R MAX Weight (-100%) Offset (-100%) Switch SH(down) Warn(3)	Force Forward Throttle to 0% when Reverse Switch SH on and Play Warn sound when in Reverse
	R MAX Weight(0%) Switch(SE)(up)	Fail safe switch to ignore throttle input to prevent **Left/ right** motors running.

CH15 is an internal variable for the Forward drive command

First line re-ranges the Throttle stick input (see graphic below)
Input (Source) Thr (Throttle stick) and Weight +50% and Offset 50.
Note: Normal range of throttle stick is -100% to +100% typically on a reversing speed control -100% equals full reverse, 0% equals stop and +100% equals full speed. This statement converts throttle stick to 0% and fully up to 100%.

Second line forces forward throttle to 0 speed when reverse selected.
(Source) is MAX and weight of (-100%) and offset (-100%) so applied signal will be 0%,
If Switch SH (down) will Replace whatever value on Ch 15 with 0%

Third line similar to previous line except forces CH15 to 0% when Fail Safe switch SE is in the up position.

	Statement	Comments
CH16	[I3]Thr Weight (-25%) Offset (-25)	Offset Throttle channel for reverse so stick at bottom = 0% and at Top = -25%. Increase (-%) for more reverse speed.
	R MAX Weight (-100%) Offset (-100%) Switch(SH)(up)	Force Reverse Throttle to 0% when Reverse Switch SH off
	R MAX Weight (0%) Switch SE(up)	Fail safe switch to ignore input to prevent **Reverse** driving motors.

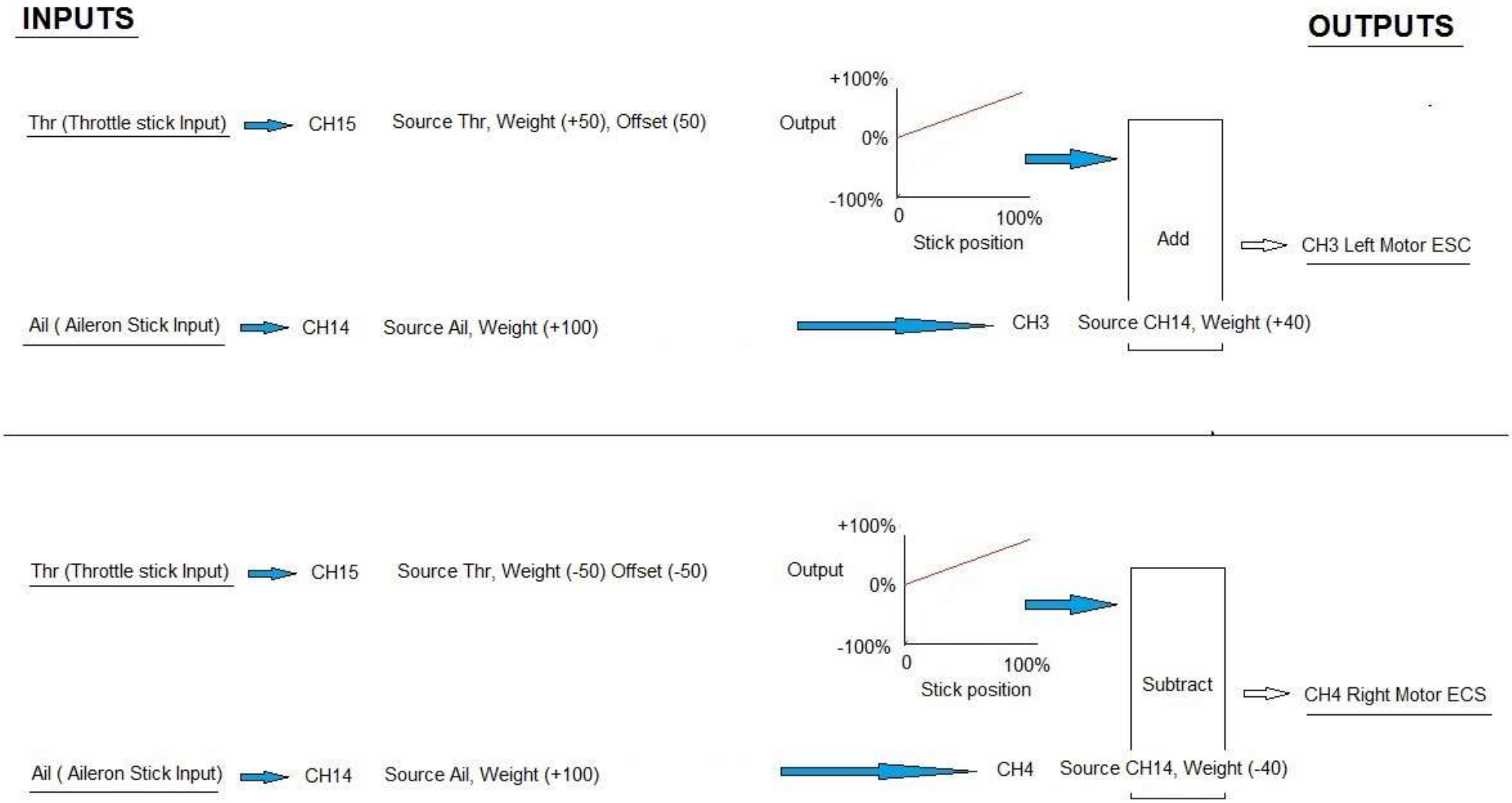
CH16 is an internal variable for the Reverse drive command

First line re-ranges the Throttle stick input (see graphic below)
Input (Source) Thr (Throttle stick) and Weight -25% and Offset -25.
Note: Normal range of throttle stick is -100% to +100% typically on a reversing speed control -100% equals full reverse, 0% equals stop and +100% equals full speed. This statement converts throttle stick to 0% and fully up to -25%.

Second line forces reverse throttle to 0 speed when forward selected.
(Source) is MAX and weight of (-100%) and offset (-100%) so applied signal will be 0%,
If Switch SH (up) will Replace whatever value on Ch 16 with 0%

Third line similar to previous line except forces CH16 to 0% when Fail Safe switch SE is in the up position.

Drive program flow chart.
The addition or subtraction of the Steering command to the Throttle command to derive final drive command to the drive motor speed controllers, same process happens when reverse is selected.



Revision

Revision	Comment	Date	By
1	Original Document for K-9 Builder's Group	23rd Jan 2019	Mat Prentis