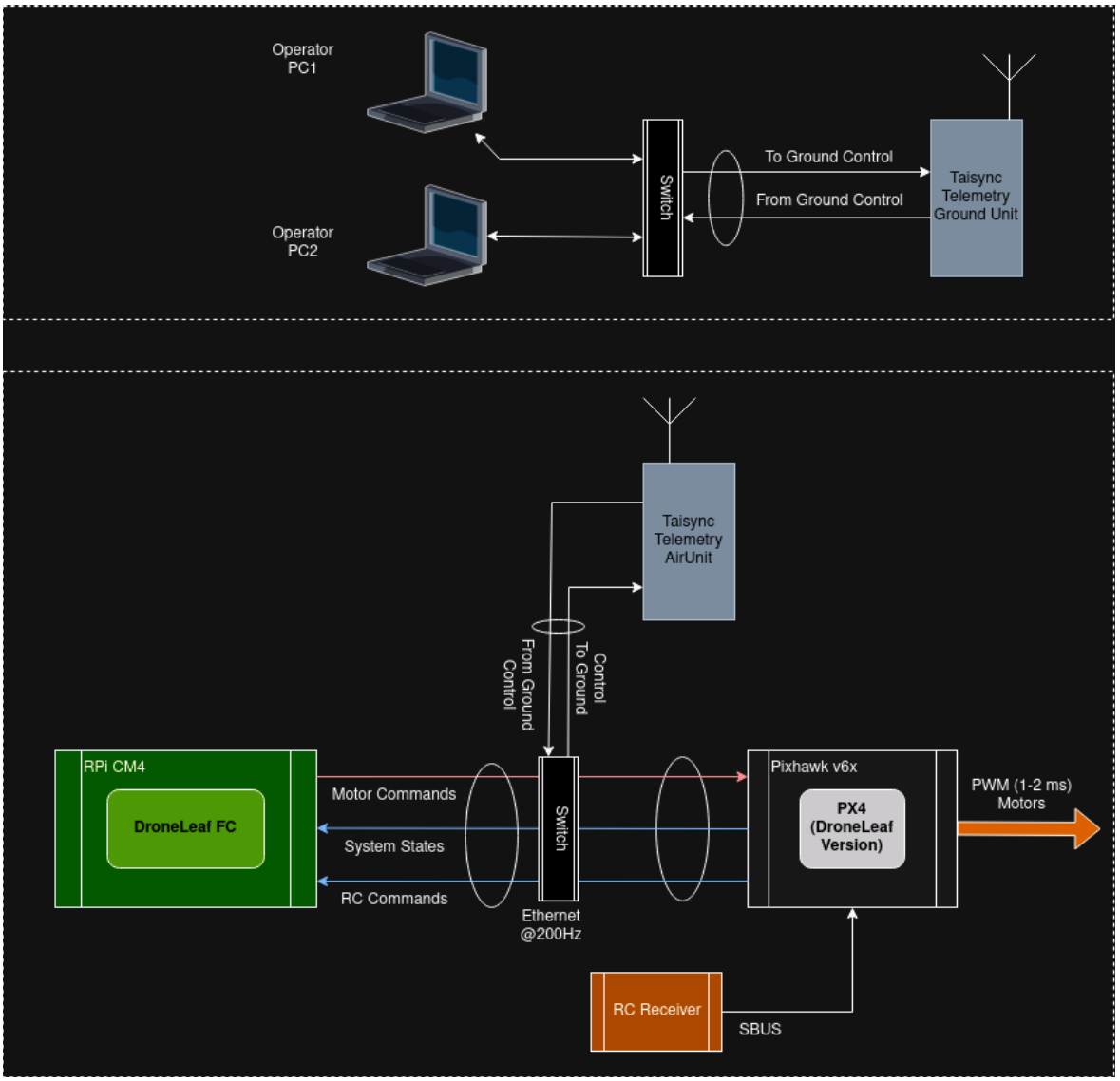
Manual Transition Flight Design Sketch

The general system archeticture is given as follows:



Taxonomy

FB: Feedback action. Output of the feedback control system from within DroneLeaf FC.

FF: Feedforward action (i.e. open-loop). Output of the feedforward system from within DroneLeaf FC.

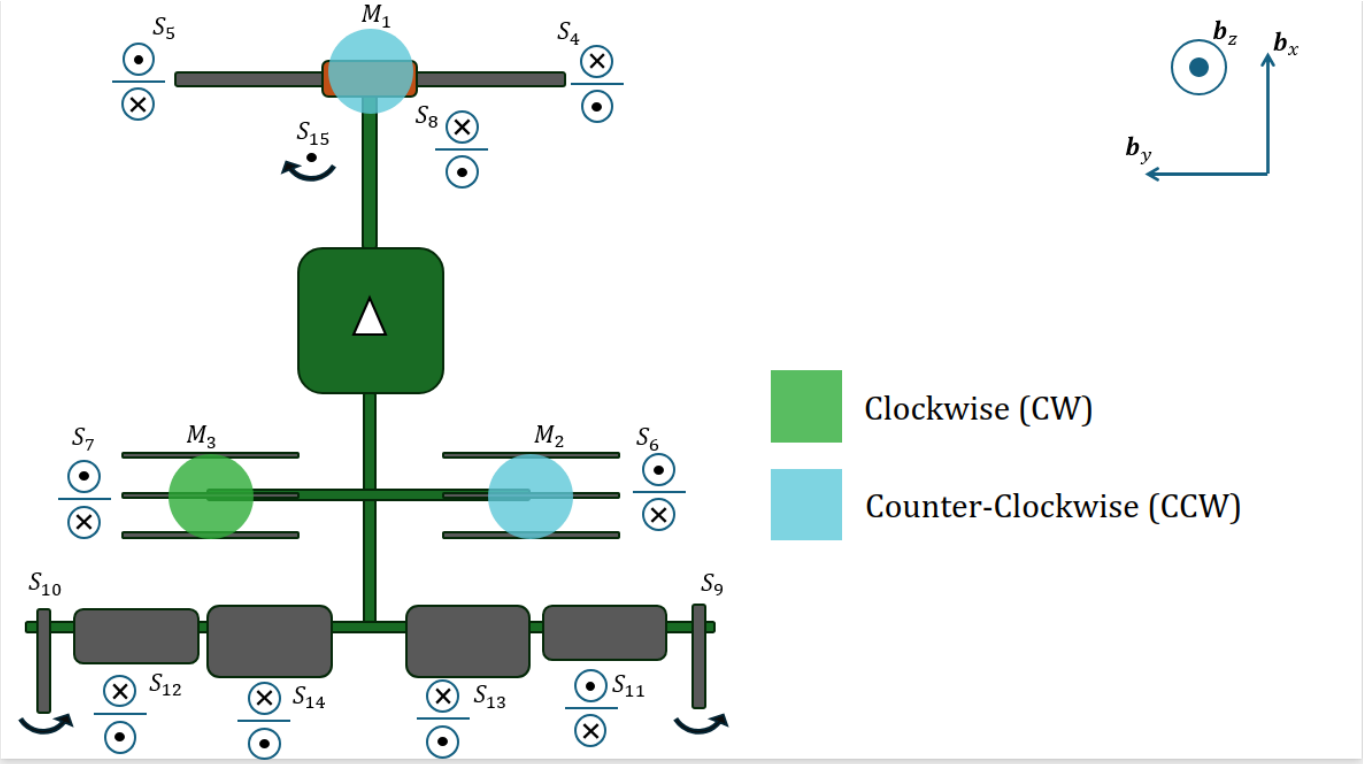
RC-D: commanded directly through RC. Configured in PX4 and NOT passed to DroneLeaf FC.

We refer to RC inputs as CH|x| with x being the channel number.
Parameters HEAR-|A||x|, HEAR-|B||x|, etc. are tunable parameters in HEAR FC with x being optional parameter index, A and B are arbitrary captions to organize parameters set.

Parameters PX4-|A||x| are tunable parameters in PX4 with x being optional parameter index, and A is arbitrary caption to organize parameters set.

Convention

This convention is what to expect when moving knobs in QGroundControl after performing all PX4 settings mentioned below.



PX4 Settings

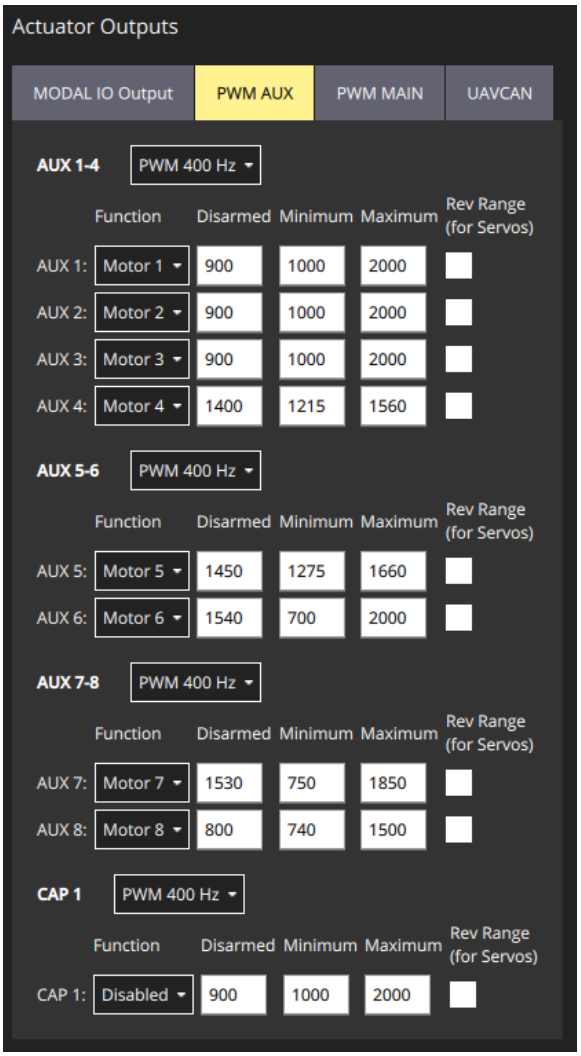
Physical Asset assignment

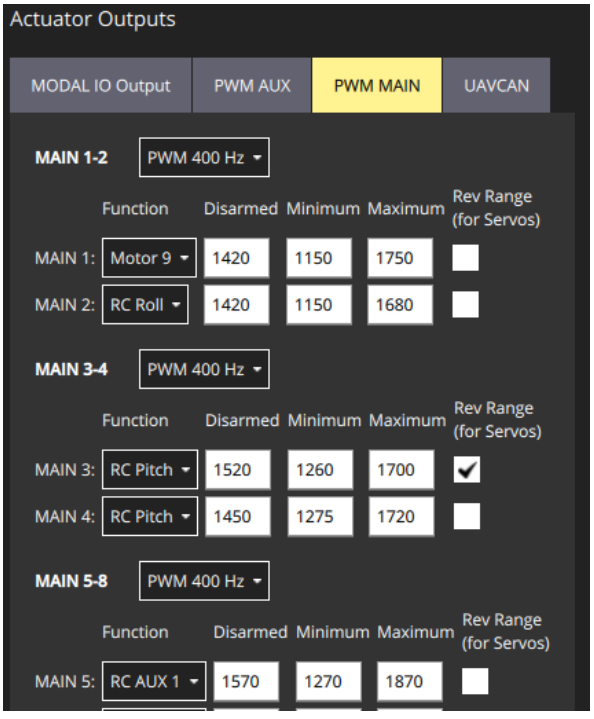
Reference	Function	Pixhawk Pin	Signal Source
M1	Front Motor	AUX 1	OFFBOARD MAVLink 1
M2	Rear Motor R	AUX 2	OFFBOARD MAVLink 2
M3	Rear Motor L	AUX 3	OFFBOARD MAVLink 3
S4	Canard R	AUX 4	OFFBOARD MAVLink 4
S5	Canard L	AUX 5	OFFBOARD MAVLink 5
S6	Vane R	AUX 6	OFFBOARD MAVLink 6
S7	Vane L	AUX 7	OFFBOARD MAVLink 7
S8	M1 Tilt Servo	AUX 8	OFFBOARD MAVLink 8
S9	Rudder R	MAIN 1	OFFBOARD MAVLink 9
S10	Rudder L	MAIN 1	OFFBOARD MAVLink 9
S11	Aileron R	MAIN 2	RC ROLL
S12	Aileron L	MAIN 3	RC ROLL
S13	Elevator R	MAIN 4	OFFBOARD MAVLink 10
S14	Elevator L	MAIN 5	OFFBOARD MAVLink 11
S15	Steering	MAIN 6	RC AUX 1
S16	Door RF	MAIN 7	RC AUX 2
S17	Door RR	MAIN 7	RC AUX 2
S18	Door LF	MAIN 7	RC AUX 2

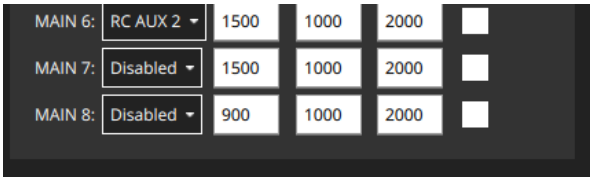
Reference	Function	Pixhawk Pin	Signal Source
S19	Door LR	MAIN 7	RC AUX 2

Actuation PX4 settings

Maximum/Minimum limits for each actuator are set in the QGC. See QGC screenshots below.







RC Settings

Used Controller is Futaba T14SG. ID: T14SG-01.

RC Channel assignment

See `Systems/RC/general.json` for updated HEAR configuration.

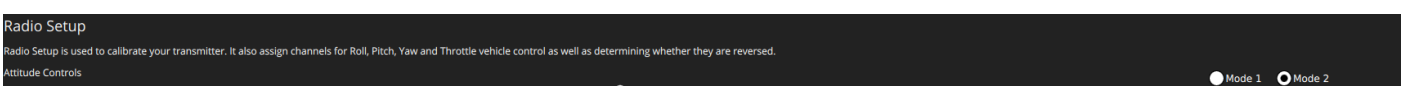
RC Channel	PX4 Assignment	Used in HEAR FC	Futaba T14SG Assignment
CH1	RC ROLL	Yes	J1
CH2	RC PITCH	Yes	J2
CH3	RC THROTTLE	Yes	J3
CH4	RC YAW	Yes	J4
CH5			
CH6		Yes (CH_number_for_forward_motion)	RS
CH7			
CH8	RC AUX 2	Yes (CH_number_for_switch_vtol_mode)	SA
CH9			
CH10	RC AUX 1		LD
CH11	Kill switch		SF
CH12			

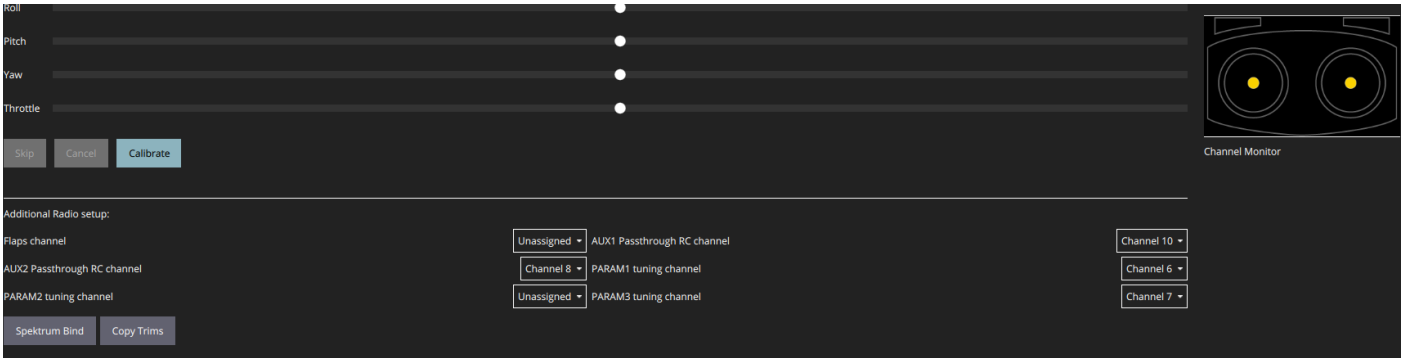
RC Switches Settings

RC Switch/Knob	Max Val	Min Val	Max Val Pos	Min Val Pos
CH1	+100	-100	West	East
CH2	+100	-100	North	South
CH3	+100	-100	North	South
CH4	+100	-100	West	East
CH6	+100	-100	South	North
CH8	+140	0	South	Middle
CH10	+100	-100	East	West
CH11	+100	-100	South	North

- Top of the RC points north

RC PX4 settings





Surfaces and Servos calibration

Calibration values

Actuator	Positive Set Angle Limit	Negative Set Angle Limit	Positive Mechanical Limit	Negative Mechanical Limit	PWM at the Positive Set Angle	PWM at the Negative Set Angle	PWM at the Positive Mechanical Limit	PWM at the Negative Mechanical Limit	Zero Angle Reference wrt datum
S6	30	30							
S7	30	30							
S8	7	33		11					
S11	22	22							
S12	22	22							
S13	18	18							
S14	18	18							

- For PWM limits corresponding to the physical angle limits, refer to the PX4 actuator settings panes above.
- All angles are in degrees.

Datum reference

Datum reference	Image	Comments
Main Chassis		
Rear Wing		

Known Limitations

#1: RC inputs and servo outputs are not in SI units.

Proposed solution: prepare a calibration and trimming procedure based on manual angle measurements. Manually obtained angle measurements + angle specifications are input into `HEAR_Configurations`. A special subsystem in `RC_OrientationThrustControlSystemVTOL` picks up angle specifications and updates all `RC_OrientationThrustControlSystemVTOL` parameters accordingly.