Command Line Interface (CLI)

Cleanflight has a command line interface (CLI) that can be used to change settings and configure the FC.

Accessing the CLI.

The CLI can be accessed via the GUI tool or via a terminal emulator connected to the CLI serial port.

1. Connect your terminal emulator to the CLI serial port (which, by default, is the same as the MSP serial port)
2. Use the baudrate specified by msp_baudrate (115200 by default).
3. Send a # character.

To save your settings type in 'save', saving will reboot the flight controller.

To exit the CLI without saving power off the flight controller or type in 'exit'.

To see a list of other commands type in 'help' and press return.

To dump your configuration (including the current profile), use the 'dump' command.

See the other documentation sections for details of the cli commands and settings that are available.

Backup via CLI

Disconnect main power, connect to cli via USB/FTDI.

dump using cli

```
rateprofile 0
profile 0
dump
```

dump profiles using cli if you use them

```
profile 1
dump profile
profile 2
dump profile
```

dump rate profiles using cli if you use them

```
rateprofile 1
dump rates
rateprofile 2
dump rates
```

copy screen output to a file and save it.

Restore via CLI.

Use the cli `defaults` command first.

When restoring from a backup it is a good idea to do a dump of the latest defaults so you know what has changed - if you do this each time a firmware release is created youwill be able to see the cli changes between firmware versions. For instance, in December 2014 the default GPS navigation PIDs changed. If you blindly restore your backup you would not benefit from these new defaults.

Use the CLI and send all the output from the saved backup commands.

Do not send the file too fast, if you do the FC might not be able to keep up when using USART adapters (including built in ones) since there is no hardware serial flow control.

You may find you have to copy/paste a few lines at a time.

Repeat the backup process again!

Compare the two backups to make sure you are happy with your restored settings.

Re-apply any new defaults as desired.

CLI Command Reference

Click on a command to jump to the relevant documentation page.

Command	Description
`1wire <esc>`	passthrough 1wire to the specified esc
`adjrange` (Inflight%20Adjustments.md)	show/set adjustment ranges settings
`aux` (Modes.md)	show/set aux settings
`mmix` (Mixer.md)	design custom motor mixer
`smix` (Mixer.md)	design custom servo mixer
`color` (LedStrip.md)	configure colors
`defaults`	reset to defaults and reboot
`dump`	print configurable settings in a pastable form
`exit`	
`feature`	list or -val or val
`get`	get variable value
`gpspassthrough` (Gps.md)	passthrough gps to serial
`help`	
`led` (LedStrip.md)	configure leds
`map` (Rx.md)	mapping of rc channel order
`mixer` (Mixer.md)	mixer name or list
`mode_color` (LedStrip.md)	configure mode colors
`motor`	get/set motor output value
`play_sound` (Buzzer.md)	index, or none for next
`profile` (Profiles.md)	index (0 to 2)
`rateprofile` (Profiles.md)	index (0 to 2)
`rxrange` (Rx.md)	configure rx channel ranges (end-points)

rxfail (Rx.md)	show/set rx failsafe settings
save	save and reboot
serialpassthrough	serial passthrough mode, reset board to exit
set	name=value or blank or * for list
status	show system status
version	show version
serial (Serial.md)	configure serial ports
servo (Mixer.md)	configure servos
sd_info	sdcard info
tasks	show task stats

CLI Variable Reference

Click on a variable to jump to the relevant documentation page.

Variable	Description/Units	Min	Max	Defau
looptime	This is the main loop time (in us). Changing this affects PID effect with some PID controllers (see PID section for details). Default of 3500us/285Hz should work for everyone. Setting it to zero does not limit loop time, so it will go as fast as possible.	0	9000	3500
emf_avoidance	Default value is OFF for 72MHz processor speed. Setting this to ON increases the processor speed, to move the 6th harmonic away from 432MHz.	OFF	ON	OFF
i2c_highspeed	Enabling this feature speeds up IMU speed significantly and faster looptimes are possible.	OFF	ON	ON
gyro_sync (Pid%20tuning.md)	This option enables gyro_sync feature. In this case the loop will be synced to gyro refresh rate. Loop will always wait for the newest gyro measurement. Use gyro_lpf and gyro_sync_denom determine the gyro refresh rate. Note that different targets have different limits. Setting too high refresh rate can mean that FC cannot keep up with the gyro and higher gyro_sync_denom is needed.	OFF	ON	ON
	This is an important number to set in order to avoid trimming receiver/transmitter. Most standard receivers will have this			

mid_rc (Rx.md)	at 1500, however Futaba transmitters will need this set to 1520. A way to find out if this needs to be changed, is to clear all trim/subtrim on transmitter, and connect to GUI. Note the value most channels idle at - this should be the number to choose. Once midrc is set, use subtrim on transmitter to make sure all channels (except throttle of course) are centered at midrc value.	1200	1700	1500
min_check (Controls.md)	These are min/max values (in us) which, when a channel is smaller (min) or larger (max) than the value will activate various RC commands, such as arming, or stick configuration. Normally, every RC channel should be set so that min = 1000us, max = 2000us. On most transmitters this usually means 125% endpoints. Default check values are 100us above/below this value.	0	2000	1100
max_check (Controls.md)	These are min/max values (in us) which, when a channel is smaller (min) or larger (max) than the value will activate various RC commands, such as arming, or stick configuration. Normally, every RC channel should be set so that min = 1000us, max = 2000us. On most transmitters this usually means 125% endpoints. Default check values are 100us above/below this value.	0	2000	1900
rssi_channel (Rssi.md)	RX channel containing the RSSI signal	0	18	0
rssi_scale (Rssi.md)	When using ADC RSSI, the raw ADC value will be divided by rssi_scale in order to get the RSSI percentage. RSSI scale is therefore the ADC raw value for 100% RSSI.	1	255	30
rssi_invert (Rssi.md)	When using PWM RSSI or ADC RSSI, determines if the signal is inverted (Futaba, FrSKY)	OFF	ON	ON

rc_smoothing	Interpolation of Rc data during looptimes when there are no new updates. This gives smoother RC input to PID controller and cleaner PIDsum	OFF	ON	ON
rx_min_usec (Rx.md)	Defines the shortest pulse width value used when ensuring the channel value is valid. If the receiver gives a pulse value lower than this value then the channel will be marked as bad and will default to the value of mid_rc.	750	2250	885
rx_max_usec (Rx.md)	Defines the longest pulse width value used when ensuring the channel value is valid. If the receiver gives a pulse value higher than this value then the channel will be marked as bad and will default to the value of mid_rc.	750	2250	2115
serialrx_provider (Rx.md)	When feature SERIALRX is enabled, this allows connection to several receivers which output data via digital interface resembling serial. Possible values: SPEK1024, SPEK2048, SBUS, SUMD, XB-B, XB-B-RJ01, IBUS			SPEK1024
sbus_inversion (Rx.md)	Standard SBUS (Futaba, FrSKY) uses an inverted signal. Some OpenLRS receivers produce a non-inverted SBUS signal. This setting is to support this type of receivers (including modified FrSKY). This only works on supported hardware (mainly F3 based flight controllers).	OFF	ON	ON
spektrum_sat_bind (Spektrum%20bind.md)	0 = disabled. Used to bind the spektrum satellite to RX	0	10	0
input_filtering_mode (Rx.md)	Filter out noise from OpenLRS Telemetry RX	OFF	ON	ON
min_throttle (Controls.md)	These are min/max values (in us) that are sent to esc when armed. Defaults of 1150/1850 are OK for everyone, for use with AfroESC, they could be set to 1064/1864.	0	2000	1150
	These are min/max values (in us) that are sent to esc when			

max_throttle (Controls.md)	armed. Defaults of 1150/1850 are OK for everyone, for use with AfroESC, they could be set to 1064/1864. If you have brushed motors, the value should be set to 2000.	0	2000	1850
min_command (Controls.md)	This is the PWM value sent to ESCs when they are not armed. If ESCs beep slowly when powered up, try decreasing this value. It can also be used for calibrating all ESCs at once.	0	2000	1000
servo_center_pulse	Servo midpoint	0	2000	1500
motor_pwm_rate	Output frequency (in Hz) for motor pins. Defaults are 400Hz for motor. If setting above 500Hz, will switch to brushed (direct drive) motors mode. For example, setting to 8000 will use brushed mode at 8kHz switching frequency. Up to 32kHz is supported. Default is 16000 for boards with brushed motors. Note, that in brushed mode, minthrottle is offset to zero. For brushed mode, set max_throttle to 2000.	50	32000	400
servo_pwm_rate	Output frequency (in Hz) servo pins. Default is 50Hz. When using tricopters or gimbal with digital servo, this rate can be increased. Max of 498Hz (for 500Hz pwm period), and min of 50Hz. Most digital servos will support for example 330Hz.	50	498	50
3d_deadband_low	Low value of throttle deadband for 3D mode (when stick is in the 3d_deadband_throttle range, the fixed values of 3d_deadband_low / _high are used instead)	0	2000	1406
3d_deadband_high	High value of throttle deadband for 3D mode (when stick is in the deadband range, the value in 3d_neutral is used instead)	0	2000	1514
3d_neutral	Neutral (stop) throttle value for 3D mode	0	2000	1460
	Disabled by default, enabling (setting to 1) allows disarming by throttle low + roll. This could			

retarded_arm	be useful for mode-1 users and non-acro tricopters, where default arming by yaw could move tail servo too much.	OFF	ON	OFF
disarm_kill_switch	Enabled by default. Disarms the motors independently of throttle value. Setting to 0 reverts to the old behaviour of disarming only when the throttle is low. Only applies when arming and disarming with an AUX channel.	OFF	ON	ON
auto_disarm_delay	Delay before automatic disarming	0	60	5
max_arm_angle	Maximum horizontal angle before arming is disabled	0	180	25
small_angle	If the copter tilt angle exceed this value the copter will refuse to arm. default is 25°.	0	180	25
fixedwing_althold_dir	Used for fixed-wing aircrafts. Determines of the correction value applied to throttle in alititude hold mode should be inverted.	-1	1	1
reboot_character	Special character used to trigger reboot	48	126	82
gps_provider (Gps.md)	GPS standard. Possible values: NMEA, UBLOX			NMEA
gps_sbas_mode (Gps.md)	Ground assistance type. Possible values: AUTO, EGNOS, WAAS, MSAS, GAGAN			AUTO
gps_auto_config (Gps.md)	Enable automatic configuration of UBlox GPS receivers.	OFF	ON	ON
gps_auto_baud	Enable automatic detection of GPS baudrate.	OFF	ON	OFF
gps_pos_p	GPS Position hold: P parameter	0	200	15
gps_pos_i	GPS Position hold: I parameter	0	200	0
gps_pos_d	GPS Position hold: D parameter	0	200	0
gps_posr_p	GPS Position hold rate: P parameter	0	200	34
gps_posr_i	GPS Position hold rate: I parameter	0	200	14
gps_posr_d	GPS Position hold rate: D parameter	0	200	53
gps_nav_p	GPS Navigation: P parameter	0	200	25
gps_nav_i	GPS Navigation: I parameter	0	200	33
gps_nav_d	GPS Navigation: D parameter	0	200	83

gps_wp_radius	GPS Navigation: waypoint radius	0	2000	200
nav_controls_heading	GPS Navigation: should the craft's heading follow the flying direction.	OFF	ON	ON
nav_speed_min	GPS Navigation: minimum moving speed	10	2000	100
nav_speed_max	GPS Navigation: maximum moving speed	10	2000	300
nav_slew_rate	GPS Navigation: maximum angle correction value. Lower slew rate stops the craft from rotating too quickly.	0	100	30
telemetry_switch	When an AUX channel is used to change serial output & baud rate (MSP / Telemetry). OFF: Telemetry is activated when armed. ON: Telemetry is activated by the AUX channel.	OFF	ON	OFF
ibus_report_cell_voltage (Telemetry.md)	Determines if the voltage reported is Vbatt or calculated average cell voltage (Flysky ibus telemtery)	OFF	ON	OFF
telemetry_inversion (Telemetry.md)	Determines if the telemetry signal is inverted (Futaba, FrSKY)	OFF	ON	OFF
telemetry_send_cells	Emulates FrSky FLVSS individual cell voltages telemetry	OFF	ON	OFF
frsky_default_lattitude	OpenTX needs a valid set of coordinates to show compass value. A fake value defined in this setting is sent while no fix is acquired.	-90	90	0
frsky_default_longitude	OpenTX needs a valid set of coordinates to show compass value. A fake value defined in this setting is sent while no fix is acquired.	-180	180	0
frsky_coordinates_format	FRSKY_FORMAT_DMS (default), FRSKY_FORMAT_NMEA			FRSKY_FORM
frsky_unit	IMPERIAL (default), METRIC			IMPERIAL
frsky_vfas_precision (Telemetry.md)	Set to 1 to send raw VBat value in 0.1V resolution for receivers that can handle it, or 0 (default) to use the standard method	0	1	0
hott_alarm_sound_interval	Battery alarm delay in seconds for Hott telemetry	0	120	5
	Battery capacity in mAH. This value is used in conjunction			

battery_capacity (Battery.md)	with the current meter to determine remaining battery capacity.	0	20000	0
vbat_scale (Battery.md)	Result is Vbatt in 0.1V steps. 3.3V = ADC Vref, 4095 = 12bit adc, 110 = 11:1 voltage divider (10k:1k) x 10 for 0.1V. Adjust this slightly if reported pack voltage is different from multimeter reading. You can get current voltage by typing "status" in cli.	0	255	110
vbat_max_cell_voltage (Battery.md)	Maximum voltage per cell, used for auto-detecting battery voltage in 0.1V units, default is 43 (4.3V)	10	50	43
vbat_min_cell_voltage (Battery.md)	Minimum voltage per cell, this triggers battery-critical alarms, in 0.1V units, default is 33 (3.3V)	10	50	33
vbat_warning_cell_voltage (Battery.md)	Warning voltage per cell, this triggers battery-warning alarms, in 0.1V units, default is 35 (3.5V)	10	50	35
vbat_hysteresis (Battery.md)	Sets the hysteresis value for low-battery alarms, in 0.1V units, default is 1 (0.1V)	10	250	1
current_meter_scale (Battery.md)	This sets the output voltage to current scaling for the current sensor in 0.1 mV/A steps. 400 is 40mV/A such as the ACS756 sensor outputs. 183 is the setting for the uberdistro with a 0.25mOhm shunt.	-10000	10000	400
current_meter_offset (Battery.md)	This sets the output offset voltage of the current sensor in millivolts.	0	3300	0
multiwii_current_meter_output (Battery.md)	Default current output via MSP is in 0.01A steps. Setting this to 1 causes output in default multiwii scaling (1mA steps).	OFF	ON	OFF
current_meter_type (Battery.md)	ADC (default), VIRTUAL, NONE. The virtual current sensor, once calibrated, estimates the current value from throttle position. When running on non-default hardware or adding support for new sensors/sensor boards, these values are used for			ADC

align_gyro	sensor orientation. When carefully understood, these values can also be used to rotate (in 90deg steps) or flip the board. Possible values are: DEFAULT, CW0, CW90, CW180, CW270, CW0FLIP, CW90FLIP, CW180FLIP, CW270FLIP.			DEFAULT
align_acc	When running on non-default hardware or adding support for new sensors/sensor boards, these values are used for sensor orientation. When carefully understood, these values can also be used to rotate (in 90deg steps) or flip the board. Possible values are: DEFAULT, CW0, CW90, CW180, CW270, CW0FLIP, CW90FLIP, CW180FLIP, CW270FLIP.			DEFAULT
align_mag	When running on non-default hardware or adding support for new sensors/sensor boards, these values are used for sensor orientation. When carefully understood, these values can also be used to rotate (in 90deg steps) or flip the board. Possible values are: DEFAULT, CW0, CW90, CW180, CW270, CW0FLIP, CW90FLIP, CW180FLIP, CW270FLIP.			DEFAULT
align_board_roll	Arbitrary board rotation in degrees, to allow mounting it sideways / upside down / rotated etc	-180	360	0
align_board_pitch	Arbitrary board rotation in degrees, to allow mounting it sideways / upside down / rotated etc	-180	360	0
align_board_yaw	Arbitrary board rotation in degrees, to allow mounting it sideways / upside down / rotated etc	-180	360	0
max_angle_inclination	This setting controls max inclination (tilt) allowed in angle (level) mode. default 500 (50 degrees).	100	900	500
	Hardware lowpass filter cutoff frequency for gyro. Allowed			

gyro_lpf (PID%20tuning.md)	values depend on the driver - For example MPU6050 allows 10HZ,20HZ,42HZ,98HZ,188HZ. If you have to set gyro lpf below 42Hz generally means the frame is vibrating too much, and that should be fixed first.	10HZ	188HZ	42HZ
gyro_soft_lpf	Software lowpass filter cutoff frequency for gyro. Default is 60Hz. Set to 0 to disable.	0	500	60
moron_threshold	When powering up, gyro bias is calculated. If the model is shaking/moving during this initial calibration, offsets are calculated incorrectly, and could lead to poor flying performance. This threshold (default of 32) means how much average gyro reading could differ before re-calibration is triggered.	0	128	32
imu_dcm_kp	Inertial Measurement Unit KP Gain	0	20000	2500
imu_dcm_ki	Inertial Measurement Unit KI Gain	0	20000	0
alt_hold_deadband	Altitude will be held when throttle is centered with an error margin defined in this parameter.	1	250	40
alt_hold_fast_change	Authorise fast altitude changes. Should be disabled when slow changes are prefered, for example for aerial photography.	OFF	ON	ON
deadband (Controls.md)	These are values (in us) by how much RC input can be different before it's considered valid for roll and pitch axis. For transmitters with jitter on outputs, this value can be increased. Defaults are zero, but can be increased up to 10 or so if rc inputs twitch while idle. This value is applied either side of the centrepoint.	0	32	0
yaw_deadband (Controls.md)	These are values (in us) by how much RC input can be different before it's considered valid for the yaw axis. For transmitters with jitter on outputs, this value can be increased. Defaults are zero, but can be increased up to	0	100	0

	10 or so if rc inputs twitch while idle. This value is applied either side of the centrepoint.			
yaw_control_direction	Use if you need to inverse yaw control direction.	-1	1	1
3d_deadband_throttle	Throttle signal will be held to a fixed value when throttle is centered with an error margin defined in this parameter.	0	2000	50
throttle_correction_value	The throttle_correction_value will be added to the throttle input. It will be maximal at the throttle_correction_angle and over, null when the copter is leveled and proportional in bewteen. The angle is set with 0.1 deg steps from 1 to 900, ie : 300 = 30.0 deg, 225 = 22.5 deg.	0	150	0
throttle_correction_angle	The throttle_correction_value will be added to the throttle input. It will be maximal at the throttle_correction_angle and over, null when the copter is leveled and proportional in bewteen. The angle is set with 0.1 deg steps from 1 to 900, ie : 300 = 30.0 deg, 225 = 22.5 deg.	1	900	800
pid_at_min_throttle	If enabled, the copter will process the pid algorithm at minimum throttle. Cannot be used when retarded_arm is enabled.	OFF	ON	ON
yaw_motor_direction	Use if you need to inverse yaw motor direction.	-1	1	1
yaw_jump_prevention_limit	Prevent yaw jumps during yaw stops and rapid YAW input. To disable set to 500. Adjust this if your aircraft 'skids out'. Higher values increases YAW authority but can cause roll/pitch instability in case of underpowered UAVs. Lower values makes yaw adjustments more gentle but can cause UAV unable to keep heading	80	500	200
tri_unarmed_servo (Controls.md)	On tricopter mix only, if this is set to 1, servo will always be correcting regardless of armed	OFF	ON	ON

	state. to disable this, set it to 0.			
servo_lowpass_freq (Mixer.md)	Selects the servo PWM output cutoff frequency. Valid values range from 10 to 400. This is a fraction of the loop frequency in 1/1000ths. For example, 40 means 0.040. The cutoff frequency can be determined by the following formula: Frequency = 1000 * servo_lowpass_freq / looptime	10	400	400
servo_lowpass_enable (Mixer.md)	Disabled by default.	OFF	ON	OFF
default_rate_profile (Profiles.md)	Default = profile number	0	2	0
rc_rate (Profiles.md)	Rate value for all RC directions	0	250	90
rc_expo (Profiles.md)	Exposition value for all RC directions	0	100	65
rc_yaw_expo	Yaw exposition value	0	100	0
thr_mid (Profiles.md)	Throttle value when the stick is set to mid-position. Used in the throttle curve calculation.	0	100	50
thr_expo (Profiles.md)	Throttle exposition value	0	100	0
roll_rate	Roll rate value		100	40
pitch_rate (Profiles.md)	Pitch rate value		100	40
yaw_rate (Profiles.md)	Yaw rate value	0	255	0
tpa_rate (Profiles.md)	Throttle PID attenuation reduces influence of P on ROLL and PITCH as throttle increases. For every 1% throttle after the TPA breakpoint, P is reduced by the TPA rate.	0	100	0
tpa_breakpoint (Profiles.md)	See tpa_rate.	1000	2000	1500
failsafe_delay (Failsafe.md)	Time in deciseconds to wait before activating failsafe when signal is lost. See Failsafe documentation (Failsafe.md#failsafe_delay).	0	200	10
failsafe_off_delay (Failsafe.md)	Time in deciseconds to wait before turning off motors when failsafe is activated. See Failsafe	0	200	200

	documentation (Failsafe.md#failsafe_off_delay).			
failsafe_throttle (Failsafe.md)	Throttle level used for landing when failsafe is enabled. See Failsafe documentation (Failsafe.md#failsafe_throttle).	1000	2000	1000
failsafe_kill_switch (Failsafe.md)	Set to ON to use an AUX channel as a faisafe kill switch.	OFF	ON	OFF
failsafe_throttle_low_delay (Failsafe.md)	Activate failsafe when throttle is low and no RX data has been received since this value, in 10th of seconds	0	300	100
failsafe_procedure (Failsafe.md)	0 = Autolanding (default). 1 = Drop.	0	1	0
gimbal_mode	When feature SERVO_TILT is enabled, this can be either NORMAL or MIXTILT			NORMAL
acc_hardware	This is used to suggest which accelerometer driver should load, or to force no accelerometer in case gyro-only flight is needed. Default (0) will attempt to auto-detect among enabled drivers. Otherwise, to force a particular device, set it to 2 for ADXL345, 3 for MPU6050 integrated accelerometer, 4 for MMA8452, 5 for BMA280, 6 for LSM303DLHC, 7 for MPU6000, 8 for MPU6500 or 1 to disable accelerometer alltogether - resulting in gyro-only operation.	0	9	0
acc_cut_hz	Set the Low Pass Filter factor for ACC. Reducing this value would reduce ACC noise (visible in GUI), but would increase ACC lag time. Zero = no filter	0	200	15
accxy_deadband	Deadband applied to accelerometrer measurements to reduce integration drift and vibration influence	0	100	40
accz_deadband	Deadband applied to accelerometrer measurements to reduce integration drift and vibration influence	0	100	40
accz_lpf_cutoff	Cutoff frequency used in the low-pass filtering of accelerometer measurements.	1	20	5
	Determines the method used to			

acc_unarmedcal	calculate gravitational compensation on the Z axis in the Inertial Measurement Unit's acceleration calculation. The method used when set to ON takes account of the armed status.	OFF	ON	ON
acc_trim_pitch	Accelerometer trim (Pitch)	-300	300	0
acc_trim_roll	Accelerometer trim (Roll)	-300	300	0
baro_tab_size	Pressure sensor sample count.	0	48	21
baro_noise_lpf	barometer low-pass filter cut-off frequency in Hz. Ranges from 0 to 1 ; default 0.6	0	1	0.6
baro_cf_vel	Velocity sensor mix in altitude hold. Determines the influence accelerometer and barometer sensors have in the velocity estimation. Values from 0 to 1; 1 for pure accelerometer altitude, 0 for pure barometer altitude.	0	1	0.985
baro_cf_alt	Altitude sensor mix in altitude hold. Determines the influence accelerometer and barometer sensors have in the altitude estimation. Values from 0 to 1; 1 for pure accelerometer altitude, 0 for pure barometer altitude.	0	1	0.965
baro_hardware	0 = Default, use whatever mag hardware is defined for your board type ; 1 = None, 2 = BMP085, 3 = MS5611, 4 = BMP280	0	4	0
mag_hardware	0 = Default, use whatever mag hardware is defined for your board type ; 1 = None, disable mag ; 2 = HMC5883 ; 3 = AK8975 ; 4 = AK8963 (for versions <= 1.7.1: 1 = HMC5883 ; 2 = AK8975 ; 3 = None, disable mag)	0	4	0
mag_declination	Current location magnetic declination in dddmm format. For example, -6deg 37min = -637 for Japan. Leading zeros not required. Get your local magnetic declination here: http://magnetic-declination.com/	-18000	18000	0

p_pitch (PID%20tuning.md)	Pitch P parameter	0	200	40
i_pitch (PID%20tuning.md)	Pitch I parameter	0	200	30
d_pitch (PID%20tuning.md)	Pitch D parameter	0	200	23
p_roll (PID%20tuning.md)	Roll P parameter	0	200	40
i_roll (PID%20tuning.md)	Roll I parameter	0	200	30
d_roll (PID%20tuning.md)	Roll D parameter	0	200	23
p_yaw (PID%20tuning.md)	Yaw P parameter	0	200	85
i_yaw (PID%20tuning.md)	Yaw I parameter	0	200	45
d_yaw (PID%20tuning.md)	Yaw D parameter	0	200	0
p_alt (PID%20tuning.md)	Altitude P parameter (Baro / Sonar altitude hold)	0	200	50
i_alt (PID%20tuning.md)	Altitude I parameter (Baro / Sonar altitude hold)	0	200	0
d_alt (PID%20tuning.md)	Altitude D parameter (Baro / Sonar altitude hold)	0	200	0
p_level (PID%20tuning.md)	Level P parameter (Angle / horizon modes)	0	200	20
i_level (PID%20tuning.md)	Level I parameter (Angle / horizon modes)	0	200	10
d_level (PID%20tuning.md)	Level D parameter (Angle / horizon modes)	0	200	100
p_vel (PID%20tuning.md)	Velocity P parameter (Baro / Sonar altitude hold)	0	200	120
i_vel (PID%20tuning.md)	Velocity I parameter (Baro / Sonar altitude hold)	0	200	45
d_vel (PID%20tuning.md)	Velocity D parameter (Baro / Sonar altitude hold)	0	200	1
yaw_p_limit	Limiter for yaw P term. This parameter is only affecting PID controller MW23. To disable set to 500 (actual default).	100	500	500
dterm_cut_hz (PID%20tuning.md)	Lowpass cutoff filter for Dterm for all PID controllers	0	500	0
gtune_loP_rll (Gtune.md)	GTune: Low Roll P limit	10	200	10
gtune_loP_ptch (Gtune.md)	GTune: Low Pitch P limit	10	200	10
gtune_loP_yw (Gtune.md)	GTune: Low Yaw P limit	10	200	10
gtune_hiP_rll (Gtune.md)	GTune: High Roll P limit	0	200	100
gtune_hiP_ptch (Gtune.md)	GTune: High Pitch P limit	0	200	100
gtune_hiP_yw (Gtune.md)	GTune: High Yaw P limit	0	200	100
gtune_pwr (Gtune.md)	Strength of each Gtune adjustment	0	10	0
gtune_settle_time (Gtune.md)	GTune settling time in milliseconds	200		450
gtune_average_cycles (Gtune.md)	Looptime cycles for gyro average calculation. Default = 16.	8	128	16
	Blackbox logging rate			

blackbox_rate_num (Blackbox.md)	numerator. Use num/denom settings to decide if a frame should be logged, allowing control of the portion of logged loop iterations	1	32	1
blackbox_rate_denom (Blackbox.md)	Blackbox logging rate denominator. See blackbox_rate_num.	1	32	1
blackbox_device (Blackbox.md)	SERIAL, SPIFLASH, SDCARD (default)			SDCARD
magzero_x	Magnetometer calibration X offset	-32768	32767	0
magzero_y	Magnetometer calibration Y offset	-32768	32767	0
magzero_z	Magnetometer calibration Z offset	-32768	32767	0