

Logging Data on PX4

Overview:

- PX4 can log any ORB topic (generated from message file) with all included fields
- ULog is the file format used for logging system data
- By default, logging is started when “armed”, and stopped when “disarmed”
- A new log file is created for each arming session on the SD card
- A variety of default logging topics and rates can be set with the parameter “sdlog_profile” including general analysis, EKF replay, System ID, High rates
- Customization of topics and logging rates is accomplished with the steps below
- See PX4 documentation online for latest information

Manual Start/Stop Logging Realtime

- Logging can be controlled manually through mavlink console in QGroundControl
- To start logging at any time, type the command: logger on
- To stop logging at any time, type the command: logger off
- To check the status, type the command: logger status
- For a list of all supported commands, type: logger help

Manual Logged Topics and Rates

- The list of logged topics can be customized with a file on the SD card
- Create a file `etc/logging/logger_topics.txt` on the card with a list of topics
- `logger_topics.txt` file contains the information: `<topic_name> <interval> <instance>`
- `<interval>` is optional, and if specified, defines the minimum interval in ms between two logged messages of this topic. “0” will set to full rate. If not specified, the topic is logged at full rate.
- `<instance>` is optional, and defines the instance to log. If not specified, all instances of the topic are logged.
- The topics in this file replace all of the default logged topics
- The last page contains a useful example for System ID
- See PX4 “logging” documentation online for latest information

Tools for Log Analysis

- Details at can be found here: https://docs.px4.io/v1.9.0/en/log/flight_log_analysis.html
- Flight review
 - (<https://logs.px4.io/>) is an online tool. Upload the log file it will plot the default topics.
- Pyulog
 - a python package to parse ulog files. It can be installed from here <https://github.com/PX4/pyulog>
 - CSV files can be extracted from log file using the command `ulog2csv`

- In the terminal, navigate to the folder where the ulog file is and type the command:
ulog2csv filename.ulg
 - By default, the CSV files of all topics will be generated in the same folder
 - There is also an option to specify the desired topics you want to generate a CSV file of.
 - The directory where the CSV files should be generated can also be specified
 - Go to the github link for more details.
- Matlab
 - Introduced in Matlab 2020b, the UAV Toolbox includes ulogreader()
 - Documentation: <https://www.mathworks.com/help/uav/ref/ulogreader.html>
 - Easy use for those doing analysis in Matlab

Best Practices:

- The following topics are useful for system ID analysis at their highest rates
 - estimator_status 0 0
 - sensor_combined 0
 - vehicle_air_data 0
 - actuator_outputs 0 0
 - input_rc 0
- The estimator_status is the EKF output, delayed ~120ms. This time skew should be estimated from the raw sensor data and removed before analysis.
- The actuator_outputs_0 is the pwm signal sent to the control surfaces. The actual deflection will have a time delay which can be estimated from the raw accelerometer response for a given step input. It is typically ~30ms.
- The text on the following page can be used in a "logger_topics.txt" for system identification analysis with general additional topics

RPM Logging

- PX4 tachometers found at <https://docs.px4.io/master/en/sensor/tachometers.html>
- Tachometer used by the NSL is ThunderFly TFRPM01 Revolution Counter with documentation at https://docs.px4.io/master/en/sensor/thunderfly_tachometer.html
- Follow all documentation, including adding the driver to the firmware build
- Create a file etc/extras.txt on the card with additional drivers to initiate on startup
- For our setup the extras.txt includes the line: "pcf8583 start -X -b 1"

Topics for logger_topics.txt

```

actuator_armed 500
actuator_controls_0 20
actuator_outputs 0 0
actuator_outputs 100 1
airdata 0
airspeed_validated 1000
battery_status 300
commander_state 500
cpuload 500
distance_sensor 0
ekf2_timestamps 500

```

ekf_gps_drift 200
estimator_attitude 0
estimator_local_position 0
estimator_innovation_test_ratios 200
estimator_innovation_variances 200
estimator_innovations 200
estimator_sensor_bias 1000
estimator_states 0
estimator_status 0
home_position 20000
input_rc 0
logger_status 1000
manual_control_setpoint 200
offboard_control_mode 100
px4io_status 1000
rate_ctrl_status 200
rpm 0
safety 1000
sensor_accel 20
sensor_baro 50
sensor_combined 0
sensor_gyro 20
sensor_mag 1000
sensor_preflight 200
system_power 500
telemetry_status 1000
vehicle_air_data 0
vehicle_angular_acceleration 1000
vehicle_angular_velocity 20
vehicle_attitude 20
vehicle_attitude_setpoint 100
vehicle_control_mode 500
vehicle_global_position 200
vehicle_gps_position 200
vehicle_imu 500
vehicle_imu_status 1000
vehicle_land_detected 1000
vehicle_local_position 20
vehicle_magnetometer 200
vehicle_rates_setpoint 100
vehicle_status 500
vehicle_status_flags 500
wind_estimate 1000
yaw_estimator_status 200