

# ODrive Controller Code

February 28, 2019

```
In [48]: import odrive
         from odrive.enums import *
         import time
         import matplotlib.pyplot as plt
```

## 0.0.1 Connect to Odrive:

```
In [49]: print("using lib at", odrive.__file__)
         print("Finding an odrive...")
         odrv0 = odrive.find_any()
```

```
using lib at C:\Users\Rachel Dunwoody\Anaconda3\lib\site-packages\odrive\__init__.py
Finding an odrive...
```

## 0.0.2 Print requested outputs right after start up

```
In [51]: print(odrv0)
```

```
vbus_voltage = 19.878149032592773 (float)
serial_number = 208537773548 (int)
hw_version_major = 3 (int)
hw_version_minor = 5 (int)
hw_version_variant = 24 (int)
fw_version_major = 0 (int)
fw_version_minor = 4 (int)
fw_version_revision = 7 (int)
fw_version_unreleased = 0 (int)
user_config_loaded = True (bool)
brake_resistor_armed = True (bool)
system_stats:
  uptime = 169479 (int)
  min_heap_space = 14264 (int)
  min_stack_space_axis0 = 7860 (int)
  min_stack_space_axis1 = 7860 (int)
  min_stack_space_comms = 3136 (int)
  min_stack_space_usb = 1332 (int)
  min_stack_space_uart = 3964 (int)
```

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min_stack_space_usb_irq = 1824 (int)
min_stack_space_startup = 556 (int)
usb: ...
i2c: ...
config:
    brake_resistance = 0.4699999988079071 (float)
    enable_uart = True (bool)
    enable_i2c_instead_of_can = False (bool)
    enable_ascii_protocol_on_usb = True (bool)
    dc_bus_undervoltage_trip_level = 8.0 (float)
    dc_bus_overvoltage_trip_level = 25.920001983642578 (float)
    gpio1_pwm_mapping: ...
    gpio2_pwm_mapping: ...
    gpio3_pwm_mapping: ...
    gpio4_pwm_mapping: ...
axis0:
    error = 0x0000 (int)
    step_dir_active = False (bool)
    current_state = 1 (int)
    requested_state = 0 (int)
    loop_counter = 1343075 (int)
    config: ...
    get_temp()
    motor: ...
    controller: ...
    encoder: ...
    sensorless_estimator: ...
    trap_traj: ...
axis1:
    error = 0x0000 (int)
    step_dir_active = False (bool)
    current_state = 1 (int)
    requested_state = 0 (int)
    loop_counter = 1343084 (int)
    config: ...
    get_temp()
    motor: ...
    controller: ...
    encoder: ...
    sensorless_estimator: ...
    trap_traj: ...
can:
    node_id = 0 (int)
    TxMailboxCompleteCallbackCnt = 0 (int)
    TxMailboxAbortCallbackCnt = 0 (int)
    received_msg_cnt = 0 (int)
    received_ack = 0 (int)
    unexpected_errors = 0 (int)

```

```

    unhandled_messages = 0 (int)
test_property = 0 (int)
test_function(delta: int)
get_oscilloscope_val(index: int)
get_adc_voltage(gpio: int)
save_configuration()
erase_configuration()
reboot()
enter_dfu_mode()

```

```
In [52]: print(odrv0.axis0)
```

```

error = 0x0000 (int)
step_dir_active = False (bool)
current_state = 1 (int)
requested_state = 0 (int)
loop_counter = 1400705 (int)
config:
    startup_motor_calibration = False (bool)
    startup_encoder_index_search = False (bool)
    startup_encoder_offset_calibration = False (bool)
    startup_closed_loop_control = False (bool)
    startup_sensorless_control = False (bool)
    enable_step_dir = False (bool)
    counts_per_step = 2.0 (float)
    step_gpio_pin = 1 (int)
    dir_gpio_pin = 2 (int)
    ramp_up_time = 0.4000000059604645 (float)
    ramp_up_distance = 12.566370964050293 (float)
    spin_up_current = 10.0 (float)
    spin_up_acceleration = 400.0 (float)
    spin_up_target_vel = 400.0 (float)
get_temp()
motor:
    error = 0x0000 (int)
    armed_state = 0 (int)
    is_calibrated = False (bool)
    current_meas_phB = -0.023365497589111328 (float)
    current_meas_phC = 0.010439634323120117 (float)
    DC_calib_phB = -1.2255303859710693 (float)
    DC_calib_phC = -2.5078701972961426 (float)
    phase_current_rev_gain = 0.02500000037252903 (float)
    current_control: ...
    gate_driver: ...
    timing_log: ...
    config: ...
controller:

```

```

error = 0x0000 (int)
pos_setpoint = 0.0 (float)
vel_setpoint = 0.0 (float)
vel_integrator_current = 0.0 (float)
current_setpoint = 0.0 (float)
vel_ramp_target = 0.0 (float)
vel_ramp_enable = False (bool)
config: ...
set_pos_setpoint(pos_setpoint: float, vel_feed_forward: float, current_feed_forward: float)
set_vel_setpoint(vel_setpoint: float, current_feed_forward: float)
set_current_setpoint(current_setpoint: float)
move_to_pos(goal_point: float)
start_anticogging_calibration()
encoder:
error = 0x0000 (int)
is_ready = False (bool)
index_found = False (bool)
shadow_count = -233 (int)
count_in_cpr = 3767 (int)
interpolation = 0.5 (float)
phase = 1.9006714820861816 (float)
pos_estimate = -232.765625 (float)
pos_cpr = 3767.234375 (float)
hall_state = 2 (int)
vel_estimate = 0.0 (float)
config: ...
sensorless_estimator:
error = 0x0000 (int)
phase = 0.0 (float)
pll_pos = 0.0 (float)
vel_estimate = 0.0 (float)
config: ...
trap_traj:
config: ...

```

```
In [53]: print(odrv0.axis0.encoder)
```

```

error = 0x0000 (int)
is_ready = False (bool)
index_found = False (bool)
shadow_count = -234 (int)
count_in_cpr = 3766 (int)
interpolation = 0.5 (float)
phase = 1.881819248199463 (float)
pos_estimate = -233.765625 (float)
pos_cpr = 3766.234375 (float)
hall_state = 3 (int)

```

```

vel_estimate = 0.0 (float)
config:
    mode = 0 (int)
    use_index = False (bool)
    pre_calibrated = False (bool)
    idx_search_speed = 10.0 (float)
    zero_count_on_find_idx = True (bool)
    cpr = 4000 (int)
    offset = 0 (int)
    offset_float = 0.0 (float)
    bandwidth = 1000.0 (float)
    calib_range = 0.019999999552965164 (float)

```

```

In [54]: print(odrv0.axis0.motor)

```

```

error = 0x0000 (int)
armed_state = 0 (int)
is_calibrated = False (bool)
current_meas_phB = 0.04768204689025879 (float)
current_meas_phC = 0.05201864242553711 (float)
DC_calib_phB = -1.2158033847808838 (float)
DC_calib_phC = -2.509281635284424 (float)
phase_current_rev_gain = 0.02500000037252903 (float)
current_control:
    p_gain = 0.0 (float)
    i_gain = nan (float)
    v_current_control_integral_d = 0.0 (float)
    v_current_control_integral_q = 0.0 (float)
    Ibus = 0.0 (float)
    final_v_alpha = 0.0 (float)
    final_v_beta = 0.0 (float)
    Iq_setpoint = 0.0 (float)
    Iq_measured = 0.0 (float)
    max_allowed_current = 60.75 (float)
    overcurrent_trip_level = 67.5 (float)
gate_driver:
    drv_fault = 0 (int)
timing_log:
    TIMING_LOG_GENERAL = 0 (int)
    TIMING_LOG_ADC_CB_I = 2502 (int)
    TIMING_LOG_ADC_CB_DC = 12886 (int)
    TIMING_LOG_MEAS_R = 0 (int)
    TIMING_LOG_MEAS_L = 0 (int)
    TIMING_LOG_ENC_CALIB = 0 (int)
    TIMING_LOG_IDX_SEARCH = 0 (int)
    TIMING_LOG_FOC_VOLTAGE = 0 (int)
    TIMING_LOG_FOC_CURRENT = 0 (int)

```

```

config:
    pre_calibrated = False (bool)
    pole_pairs = 12 (int)
    calibration_current = 10.0 (float)
    resistance_calib_max_voltage = 2.0 (float)
    phase_inductance = 0.0 (float)
    phase_resistance = 0.0 (float)
    direction = 1 (int)
    motor_type = 2 (int)
    current_lim = 10.0 (float)
    requested_current_range = 60.0 (float)
    current_control_bandwidth = 1000.0 (float)

```

### 0.0.3 Calibrating motor, search for index and offset calib script

```

In [57]: odrv0.axis0.error = 0
         odrv0.axis0.encoder.error = 0
         odrv0.axis0.motor.error = 0
         odrv0.axis0.motor.config.calibration_current = 10
         odrv0.axis0.motor.config.current_lim = 10

         print(odrv0.vbus_voltage)
         print(odrv0.axis0.motor.config.current_lim)
         print(odrv0.axis0.motor.config.calibration_current)
         print(odrv0.axis0.motor.config.pole_pairs)
         print(odrv0.axis0.motor.config.motor_type)
         print(odrv0.axis0.encoder.config.cpr)

         def wait_and_exit_on_error(ax, info=''):
             import time
             global cpr_hist
             while ax.current_state != AXIS_STATE_IDLE:
                 x = ax.encoder.count_in_cpr
                 cpr_hist.append(x)
                 time.sleep(0.01)

             if ax.error != 0:
                 print("Axis Error at {}: {:#x}".format(info, ax.error))
                 raise Exception('stop')

         # odrv0.axis0.config.lockin.current = 10.0
         # odrv0.axis0.config.lockin.vel = 20.0
         # odrv0.axis0.config.lockin.accel = 5.0

         print("Calibrating motor {}...")
         odrv0.axis0.requested_state = AXIS_STATE_MOTOR_CALIBRATION

```

```

wait_and_exit_on_error(odrv0.axis0)

# print("Checking motor {} direction...")
# odrv0.axis0.requested_state = AXIS_STATE_ENCODER_DIR_FIND
# wait_and_exit_on_error(odrv0.axis0)

odrv0.axis0.encoder.config.use_index = True
cpr_hist = []
print("checking for index")
odrv0.axis0.requested_state = AXIS_STATE_ENCODER_INDEX_SEARCH
wait_and_exit_on_error(odrv0.axis0)
time.sleep(0.2)
print("count in cpr", odrv0.axis0.encoder.count_in_cpr)
print("shadow count", odrv0.axis0.encoder.shadow_count)
plt.plot(cpr_hist, '-.')
plt.title('plot of index search')
plt.show()

print("checking for encoder offset")
cpr_hist = []
odrv0.axis0.motor.config.current_lim = 5
odrv0.axis0.motor.config.calibration_current = 5
odrv0.axis0.requested_state = AXIS_STATE_ENCODER_OFFSET_CALIBRATION
try:
    wait_and_exit_on_error(odrv0.axis0)
except Exception:
    print("OFFSET CALIB FAILED")
except Exception:
    print("OFFSET CALIB FAILED")

odrv0.axis0.motor.config.current_lim = 10
odrv0.axis0.motor.config.calibration_current = 10

plt.plot(cpr_hist, '-.')
plt.title('plot of encoder offset')
plt.show()

print(odrv0.axis0.config)

```

```

19.878149032592773
10.0
10.0
12
2
4000
Calibrating motor {}...

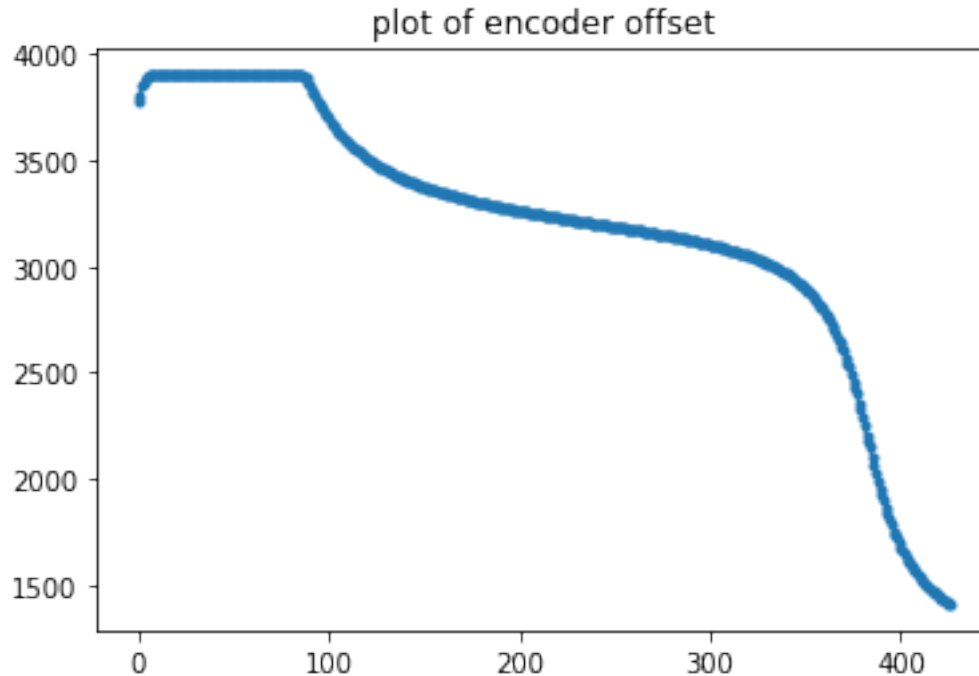
```

```
checking for index  
count in cpr 3781  
shadow count -219
```



```
checking for encoder offset  
Axis Error at : 0x100  
OFFSET CALIB FAILED
```





```

startup_motor_calibration = False (bool)
startup_encoder_index_search = False (bool)
startup_encoder_offset_calibration = False (bool)
startup_closed_loop_control = False (bool)
startup_sensorless_control = False (bool)
enable_step_dir = False (bool)
counts_per_step = 2.0 (float)
step_gpio_pin = 1 (int)
dir_gpio_pin = 2 (int)
ramp_up_time = 0.4000000059604645 (float)
ramp_up_distance = 12.566370964050293 (float)
spin_up_current = 10.0 (float)
spin_up_acceleration = 400.0 (float)
spin_up_target_vel = 400.0 (float)

```

#### 0.0.4 Printing Errors:

```

In [58]: print('Axis error:', hex(odrv0.axis0.error))
         print('Motor error:', hex(odrv0.axis0.motor.error))
         print('Encoder error:', hex(odrv0.axis0.encoder.error))
         print('Controller error:', hex(odrv0.axis0.controller.error))

```

```

Axis error: 0x100
Motor error: 0x0

```

Encoder error: 0x2  
Controller error: 0x0

### 0.0.5 Printing requested outputs after attempted offset calibration

```
In [59]: print(odrv0)
```

```
vbus_voltage = 19.8515625 (float)
serial_number = 208537773548 (int)
hw_version_major = 3 (int)
hw_version_minor = 5 (int)
hw_version_variant = 24 (int)
fw_version_major = 0 (int)
fw_version_minor = 4 (int)
fw_version_revision = 7 (int)
fw_version_unreleased = 0 (int)
user_config_loaded = True (bool)
brake_resistor_armed = True (bool)
system_stats:
  uptime = 313313 (int)
  min_heap_space = 14264 (int)
  min_stack_space_axis0 = 7772 (int)
  min_stack_space_axis1 = 7860 (int)
  min_stack_space_comms = 3136 (int)
  min_stack_space_usb = 1332 (int)
  min_stack_space_uart = 3964 (int)
  min_stack_space_usb_irq = 1824 (int)
  min_stack_space_startup = 556 (int)
  usb: ...
  i2c: ...
config:
  brake_resistance = 0.4699999988079071 (float)
  enable_uart = True (bool)
  enable_i2c_instead_of_can = False (bool)
  enable_ascii_protocol_on_usb = True (bool)
  dc_bus_undervoltage_trip_level = 8.0 (float)
  dc_bus_overvoltage_trip_level = 25.920001983642578 (float)
  gpio1_pwm_mapping: ...
  gpio2_pwm_mapping: ...
  gpio3_pwm_mapping: ...
  gpio4_pwm_mapping: ...
axis0:
  error = 0x0100 (int)
  step_dir_active = False (bool)
  current_state = 1 (int)
  requested_state = 0 (int)
  loop_counter = 2493736 (int)
```

```

    config: ...
    get_temp()
    motor: ...
    controller: ...
    encoder: ...
    sensorless_estimator: ...
    trap_traj: ...
axis1:
    error = 0x0000 (int)
    step_dir_active = False (bool)
    current_state = 1 (int)
    requested_state = 0 (int)
    loop_counter = 2493748 (int)
    config: ...
    get_temp()
    motor: ...
    controller: ...
    encoder: ...
    sensorless_estimator: ...
    trap_traj: ...
can:
    node_id = 0 (int)
    TxMailboxCompleteCallbackCnt = 0 (int)
    TxMailboxAbortCallbackCnt = 0 (int)
    received_msg_cnt = 0 (int)
    received_ack = 0 (int)
    unexpected_errors = 0 (int)
    unhandled_messages = 0 (int)
test_property = 0 (int)
test_function(delta: int)
get_oscilloscope_val(index: int)
get_adc_voltage(gpio: int)
save_configuration()
erase_configuration()
reboot()
enter_dfu_mode()

```

```
In [60]: print(odrv0.axis0)
```

```

error = 0x0100 (int)
step_dir_active = False (bool)
current_state = 1 (int)
requested_state = 0 (int)
loop_counter = 2525116 (int)
config:
    startup_motor_calibration = False (bool)
    startup_encoder_index_search = False (bool)

```

```

startup_encoder_offset_calibration = False (bool)
startup_closed_loop_control = False (bool)
startup_sensorless_control = False (bool)
enable_step_dir = False (bool)
counts_per_step = 2.0 (float)
step_gpio_pin = 1 (int)
dir_gpio_pin = 2 (int)
ramp_up_time = 0.4000000059604645 (float)
ramp_up_distance = 12.566370964050293 (float)
spin_up_current = 10.0 (float)
spin_up_acceleration = 400.0 (float)
spin_up_target_vel = 400.0 (float)
get_temp()
motor:
    error = 0x0000 (int)
    armed_state = 0 (int)
    is_calibrated = True (bool)
    current_meas_phB = 0.10364222526550293 (float)
    current_meas_phC = 0.04542136192321777 (float)
    DC_calib_phB = -1.231593370437622 (float)
    DC_calib_phC = -2.502847194671631 (float)
    phase_current_rev_gain = 0.02500000037252903 (float)
    current_control: ...
    gate_driver: ...
    timing_log: ...
    config: ...
controller:
    error = 0x0000 (int)
    pos_setpoint = 0.0 (float)
    vel_setpoint = 0.0 (float)
    vel_integrator_current = 0.0 (float)
    current_setpoint = 0.0 (float)
    vel_ramp_target = 0.0 (float)
    vel_ramp_enable = False (bool)
    config: ...
    set_pos_setpoint(pos_setpoint: float, vel_feed_forward: float, current_feed_forward: float)
    set_vel_setpoint(vel_setpoint: float, current_feed_forward: float)
    set_current_setpoint(current_setpoint: float)
    move_to_pos(goal_point: float)
    start_anticogging_calibration()
encoder:
    error = 0x0002 (int)
    is_ready = False (bool)
    index_found = True (bool)
    shadow_count = -2603 (int)
    count_in_cpr = 1397 (int)
    interpolation = 0.5 (float)
    phase = 1.2095136642456055 (float)

```

```

pos_estimate = -2602.765625 (float)
pos_cpr = 1397.234375 (float)
hall_state = 1 (int)
vel_estimate = 0.0 (float)
config: ...
sensorless_estimator:
  error = 0x0000 (int)
  phase = 0.0 (float)
  pll_pos = 0.0 (float)
  vel_estimate = 0.0 (float)
  config: ...
trap_traj:
  config: ...

```

In [61]: `print(odrv0.axis0.encoder)`

```

error = 0x0002 (int)
is_ready = False (bool)
index_found = True (bool)
shadow_count = -2603 (int)
count_in_cpr = 1397 (int)
interpolation = 0.5 (float)
phase = 1.2095136642456055 (float)
pos_estimate = -2602.765625 (float)
pos_cpr = 1397.234375 (float)
hall_state = 1 (int)
vel_estimate = 0.0 (float)
config:
  mode = 0 (int)
  use_index = True (bool)
  pre_calibrated = False (bool)
  idx_search_speed = 10.0 (float)
  zero_count_on_find_idx = True (bool)
  cpr = 4000 (int)
  offset = 0 (int)
  offset_float = 0.0 (float)
  bandwidth = 1000.0 (float)
  calib_range = 0.019999999552965164 (float)

```

In [62]: `print(odrv0.axis0.motor)`

```

error = 0x0000 (int)
armed_state = 0 (int)
is_calibrated = True (bool)
current_meas_phB = -0.054940223693847656 (float)
current_meas_phC = 0.005420684814453125 (float)
DC_calib_phB = -1.234103798866272 (float)

```

```

DC_calib_phC = -2.502919912338257 (float)
phase_current_rev_gain = 0.02500000037252903 (float)
current_control:
    p_gain = 0.0 (float)
    i_gain = nan (float)
    v_current_control_integral_d = 0.0 (float)
    v_current_control_integral_q = 0.0 (float)
    Ibus = 0.0 (float)
    final_v_alpha = 0.0 (float)
    final_v_beta = 0.0 (float)
    Iq_setpoint = 0.0 (float)
    Iq_measured = 0.0 (float)
    max_allowed_current = 60.75 (float)
    overcurrent_trip_level = 67.5 (float)
gate_driver:
    drv_fault = 0 (int)
timing_log:
    TIMING_LOG_GENERAL = 0 (int)
    TIMING_LOG_ADC_CB_I = 2902 (int)
    TIMING_LOG_ADC_CB_DC = 12890 (int)
    TIMING_LOG_MEAS_R = 0 (int)
    TIMING_LOG_MEAS_L = 0 (int)
    TIMING_LOG_ENC_CALIB = 7494 (int)
    TIMING_LOG_IDX_SEARCH = 7462 (int)
    TIMING_LOG_FOC_VOLTAGE = 7442 (int)
    TIMING_LOG_FOC_CURRENT = 0 (int)
config:
    pre_calibrated = False (bool)
    pole_pairs = 12 (int)
    calibration_current = 10.0 (float)
    resistance_calib_max_voltage = 2.0 (float)
    phase_inductance = 0.0 (float)
    phase_resistance = 0.0 (float)
    direction = -1 (int)
    motor_type = 2 (int)
    current_lim = 10.0 (float)
    requested_current_range = 60.0 (float)
    current_control_bandwidth = 1000.0 (float)

```