V2.2.1 Connection plan

27.02.2024

V2.2.1 summary:
- single board
- 1x sabertooth 2x60A driver
- modified board 'motorctl' from V2.1
- control chair adjustment via 4 relays

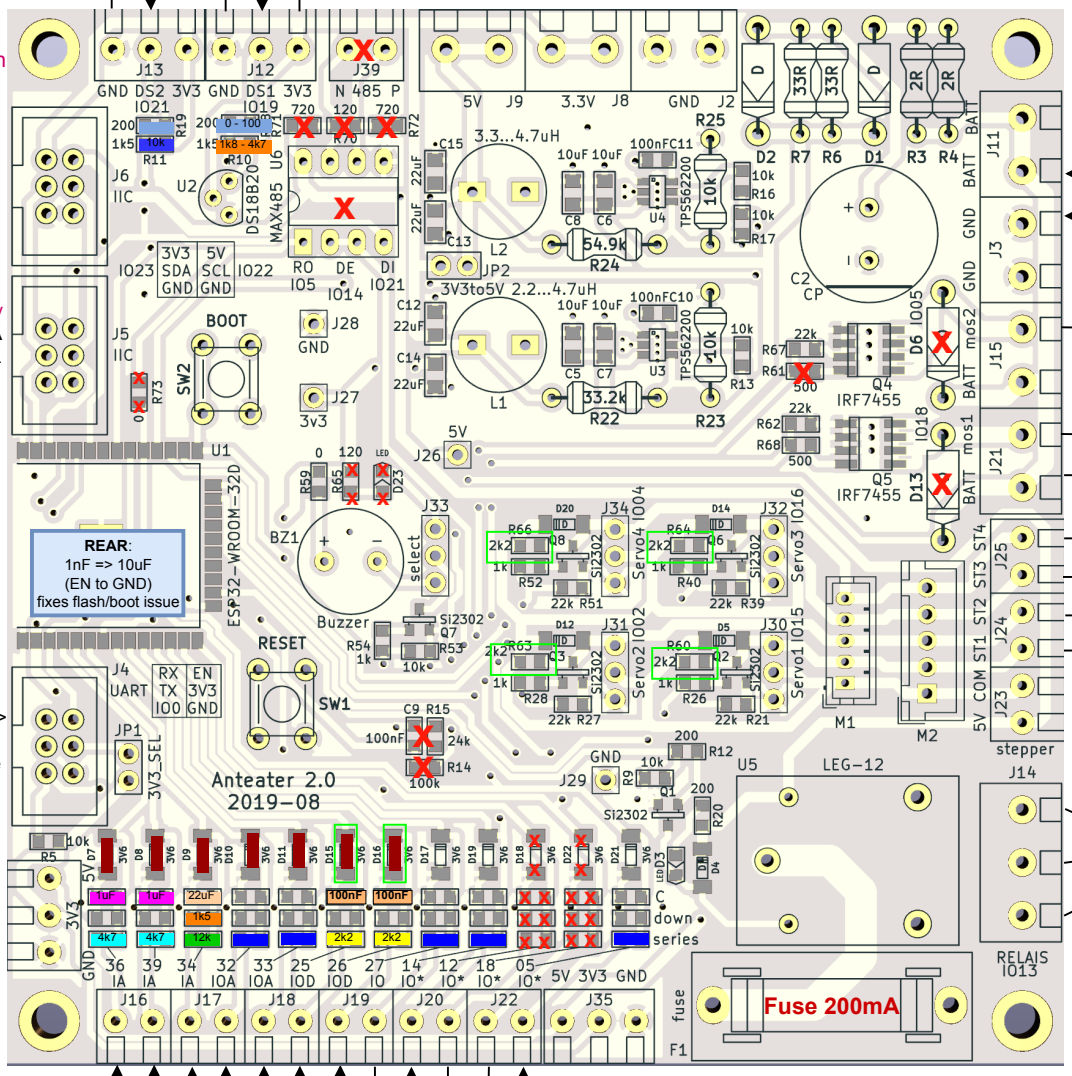
Button in housing for standalone operation

gpio19: 3x ds18b20 OWB bus temp sensors (driver, motors)

gpio21: UI: Button

UI: Display
IO23: SDA
IO22: SCL
3V3
GND

UART<=> USB for firmware upload



12V from stepdown/fuse
GND from stepdown
[disabled]
FREE
12V to Relay COM
gpio 04: relay back-rest down
gpio 16: relay back-rest up
gpio 02: relay leg-rest up
gpio 15: relay leg-rest down

gpio13: Relay
NC
COM 12V (stepdown)
NO driver: 12V fan

gpio 36: ADC UI: Joystick Y
gpio 39: ADC UI: Joystick X
gpio 34: ADC Battery voltage [29.4 -> 3.27V]
gpio 32: ADC driver: Current sensor motor-left
gpio 33: ADC driver: Current sensor motor-right
gpio 25: UI: Encoder B
gpio 26: UI: Encoder A
gpio 27: driver: RS232 RX 2x60A Sabertooth driver
gpio 14: [RS485] optical encoder right axle
gpio 12: [LED/BUZZER]
gpio 18: [MOS1] **FREE**
gpio 05: [MOS2] optical encoder left axle

cable configuration

control-box => driver-box

Oelflex 12x0.5mm²
gn: GND (driver)
01. 5V (reserve)
02: 3V3
03: RX/S1 Sabertooth driver
04: S2 Sabertooth driver (reserve)
05: current-sensor left
06: current-sensor right
07: fan 12v from relay
08: ds18b20 owb
09: GND (current-, ds18b29-sensors)
10: GND (reserve)
11: GND (reserve)

optical-sensor axle => control-box

2 cables (one for each axle):
Oelflex 5x0.5mm²
gn: GND
01: 3V3 [unused]
02: 5V
03: Sensor out (drain) / pulses
04: [unused]
05: [unused]

driver configuration

DIP switches:
"simplified serial, 9600 Baud"
101011 (1=up)

control-box => UI-arm

D-Sub 9 pin
green: GND
red: 3V3
brown: Joystick X
purple: Joystick Y
yellow: encoder A
blue: encoder B
black: encoder switch
gray: display SDA
orange: display SCL

Joystick pinout

JST connector 5 pin || 4 pin
(5 pin stick: order left to right)
VCC (3V3): red || red
GND: orange || black
X (analog 0-3V): brown || white
n.c. white || ---
Y (analog 0-3V): black || gray

control-box => relay-box chair

Mini-DIN 6 connector (PS/2 6 pin cable)
green: GND
red: 12V
yellow: relay leg-support UP
orange: relay leg-support DOWN
pink: relay back-support DOWN
brown: relay back-support UP

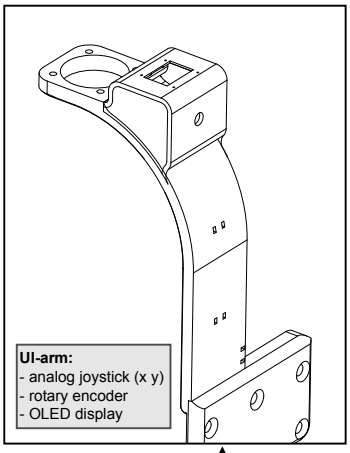
Legend pcb

- 0 Ohm Resistor
- 3v3 Z-Diode
- 0 Ohm Optional
- [xxx] Conflicting Component
- xx nopop
- critical / important

V2.2.1 Wiring-plan

27.02.2024

Armchair



UI-arm:
- analog joystick (x y)
- rotary encoder
- OLED display

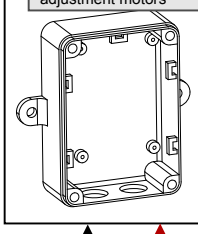
Motor back-rest

Motor leg-rest

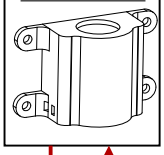
red, green

black, brown

relay-box:
- 4x relay module
- controlling 2 chair adjustment motors



24V power outlet



Li-ion Battery
Samsung INR18650-35E 3500mAh 3,7V
7S 15P
150A BMS

120A connector

Main power switch

charging port
(50A connector)

Fuse box

9 pin SUB-D connector

6 pin Mini-DIN connector

50A Anderson connector

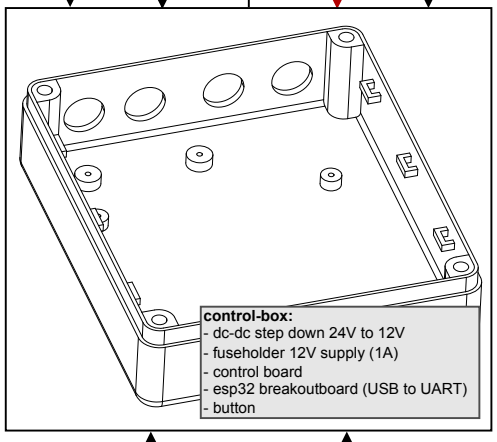
USB Cable
(firmware upload)

2x2.5mm^2
24V (2A fuse)

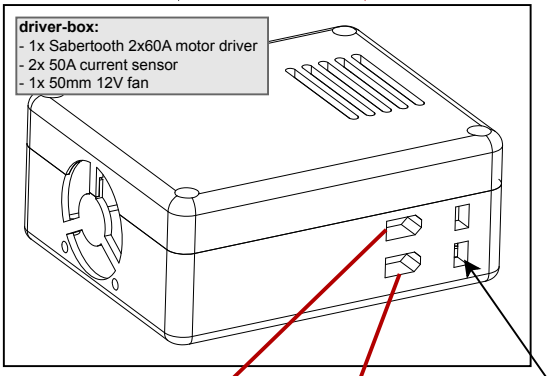
1x10mm^2 GND
1x10mm^2 24V (2x40A fuse)

12x0.5mm^2

Control driver
via RS232
(1 pin)



control-box:
- dc-dc step down 24V to 12V
- fuseholder 12V supply (1A)
- control board
- esp32 breakoutboard (USB to UART)
- button



driver-box:
- 1x Sabertooth 2x60A motor driver
- 2x 50A current sensor
- 1x 50mm 12V fan

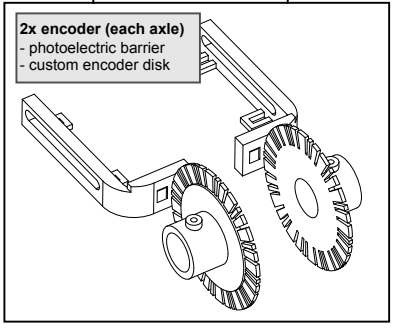
5x0.5mm^2

5x0.5mm^2

Motor right

Motor left

2x temperature sensor motor
red: 3V3
black: GND
yellow: owb

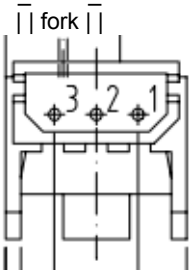


2x encoder (each axle)
- photoelectric barrier
- custom encoder disk

Note: inverted direction of right motor
already accounted in the driver box
=> motors with connectors are interchangeable

measure rotational speed + direction

Transmissive Optical Sensor
TCYS5201

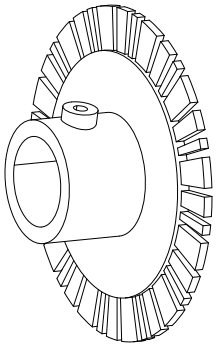


1: GND
2: out
- low when not interrupted
- floating when interrupted
=> pullup needed
3: (2.9V) - 5.5V

optical-sensor axle => control-box

2 cables (one for each axle):
Oelflex 5x0.5

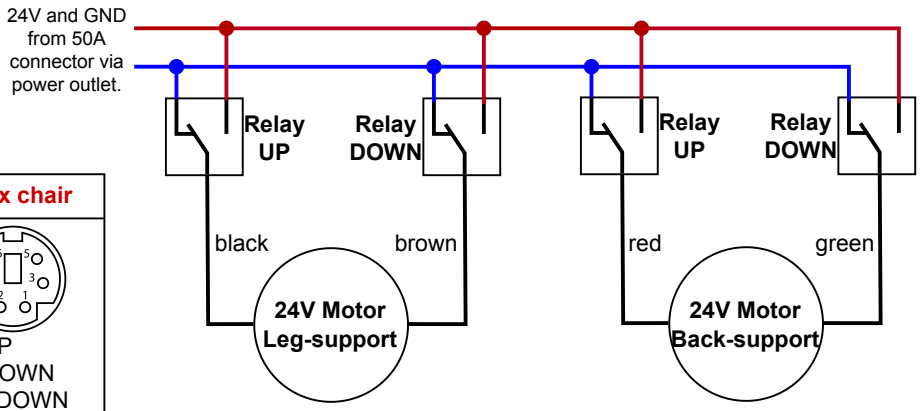
gn: GND
01: 3V3 [unused]
02: 5V
03: Sensor out (drain)
04: [unused]
05: [unused]



Custom Encoder disk
mounted on each Axle

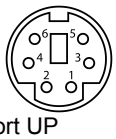
To be able to detect the direction of rotation the disk has 12 groups of segments with 3 different lengths (ratio 1:2:3) with a constant gap between each segment

relay-box for chair-adjust



control-box => relay-box chair

Mini-DIN 6 connector (PS/2 6 pin cable)



green: GND
red: 12V
yellow: relay leg-support UP
orange: relay leg-support DOWN
pink: relay back-support DOWN
brown: relay back-support UP

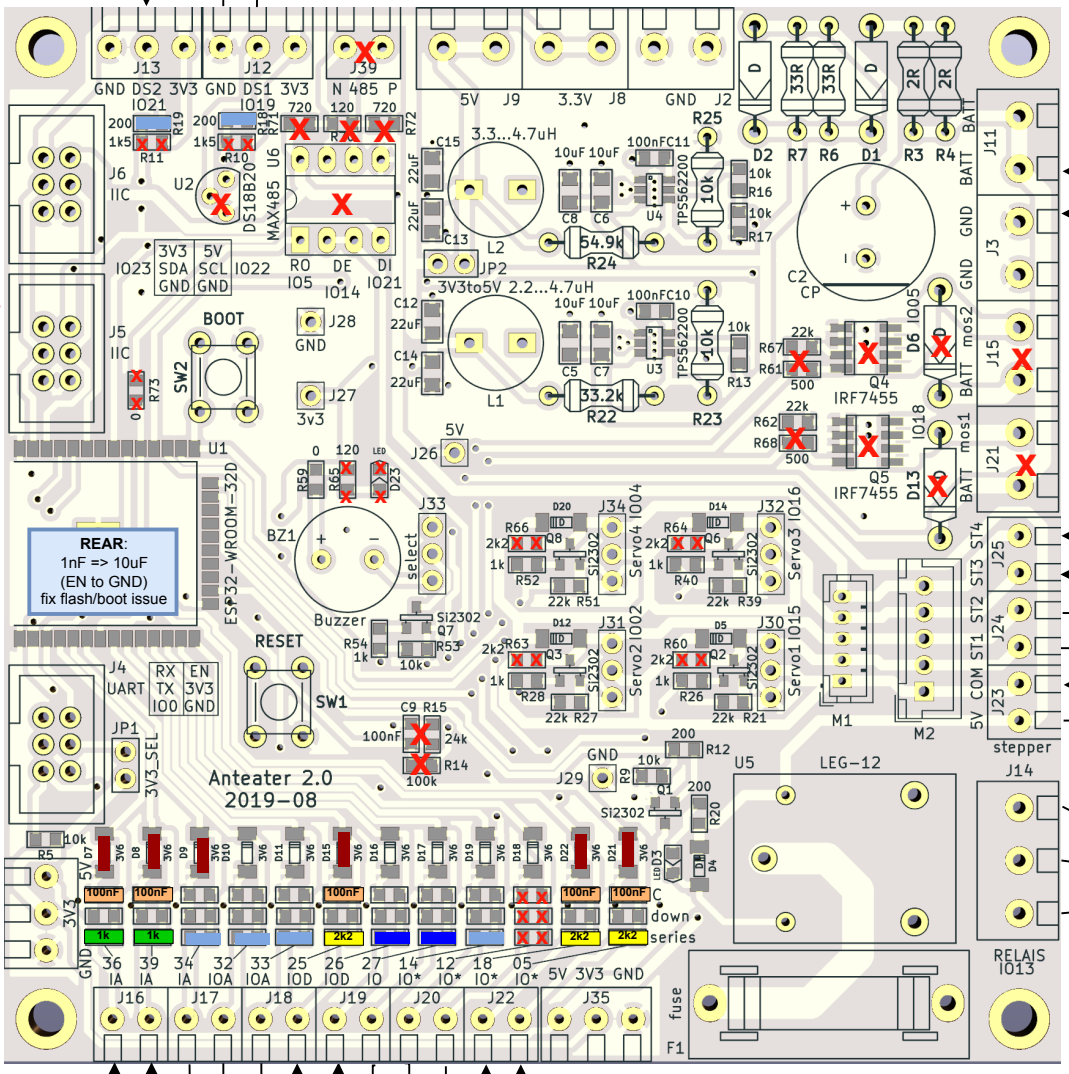
V2.1 Board 1: control

07.09.2023 [dropped]

UART => motorctl pcb
IO21:RX - IO19:TX - GND

V2.1 summary:
- two boards
- 2x HC240A driver
- brake resistors
- UART communication

=> dropped due to driver change



UI: Display
IO23: SDA
IO22: SCL
3V3
GND

UART<=>
USB for
firmware
upload

UI: Display
3V3
GND

12V from pcb motorctl
GND from pcb motorctl

gpio 04: **FREE**
gpio 16: **FREE**
gpio 02: **FREE**
gpio 15: **FREE**
5V (signal pullup)

gpio13 Relay
NC:
COM: **FREE**
NO:

note: esp32 internal pullup = 10k - 100k

gpio 36: ADC UI: Joystick Y
gpio 39: ADC UI: Joystick X
gpio 34: ADC **FREE**
gpio 32: ADC **FREE**
gpio 33: ADC **FREE GPS?**
gpio 25: UI: encoder switch
gpio 26: UI: Display SCL
gpio 27: UI: Display SDA
gpio 14: [RS485] **FREE**
gpio 12: [LED/BUZZER]
gpio 18: [MOS1] UI: encoder B
gpio 05: [MOS2] UI: encoder A

Legend pcb

- 0 Ohm Resistor
- 3v3 Z-Diode
- 0 Ohm Optional

[xxx] Conflicting Component
xx nopop

cable configuration

control-box => UI-arm

D-Sub 9 pin

green: GND
red: 3V3

brown: Joystick X
purple: Joystick Y

yellow: encoder A
blue: encoder B
black: encoder switch

gray: display SDA
orange: display SDC

Joystick pinout

JST connector 5 pin
(pins stick order left to right)

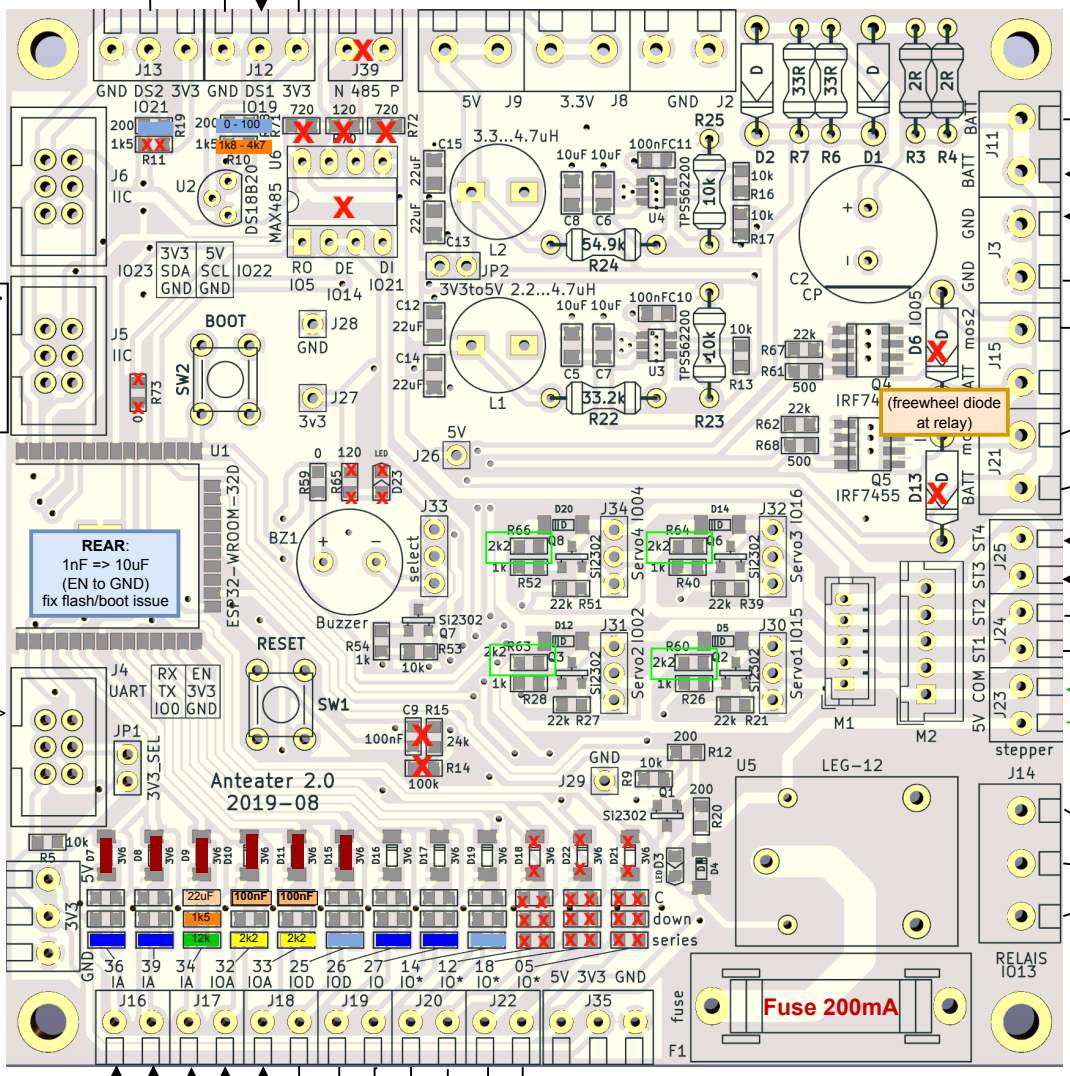
red: VCC (3V3)
orange: GND
brown: X (analog 0-3V)
white: n.c.
black: Y (analog 0-3V)

V2.1 Board 2: motorcontrol

07.09.2023 [dropped]

gpio19: 6x ds18b20
OWB bus temp sensors
(drivers, motors, brakes)

gpio21: **FREE**



UART => Control pcb
IO23 RX
IO22 TX
GND

UART<=> USB for firmware upload

12V to pcb control
12V from stepdown
GND from stepdown
GND to pcb control
brake relay left (24V)
brake relay right (24V)
12V to Relay COM

gpio 04: driver: motor-left A
gpio 16: driver: motor-left B
gpio 02: driver: motor-right A
gpio 15: driver: motor-right B
5V (signal pullup)
2k2 pullup required for driver

gpio13 Relay
NC:
COM: 12V ("Batt" / stepdown)
NO: driver: 2x fan

gpio 36: ADC driver: Current sensor motor-left
gpio 39: ADC driver: Current sensor motor-right
gpio 34: ADC Battery voltage (stepdown) [29.4 -> 3.27V]
gpio 32: ADC encoder left axle
gpio 33: ADC encoder right axle
gpio 25: FREE
gpio 26: driver: motor-left PWM
gpio 27: driver: motor-right PWM
gpio 14: [RS485]
gpio 12: [LED/BUZZER]
gpio 18: [MOS1] [brake relay right]
gpio 05: [MOS2] [brake relay left]

Legend pcb

- 0 Ohm Resistor
- 3v3 Z-Diode
- 0 Ohm Optional

[xxx] Conflicting Component
xx nopop

cable configuration

control-box => driver-box

Oelflex 12x0.5

gn: GND
~~01: 5V~~
01: 3V3

02: bridge-left A
03: bridge-left B
04: bridge-left PWM

05: bridge-right A
06: bridge-right B
07: bridge-right PWM

08: current-sensor left
09: current-sensor right

10: fan 12v from relay
11: ds18b20 owb

optical-sensor axle => control-box

2 cables (one for each axle):
Oelflex 5x0.5

gn: GND
01: 3V3 [unused]
02: 5V
03: Sensor out (drain) / pulses
04: [unused]
05: [unused]

control-box => Brake Relays

Oelflex 9x0.5

gn: GND
01: 3V3 (temp sensors)
02: 24V (BATT -> relays)
03: Brake Relay left (MOS / GND)
04: Brake Relay right (MOS / GND)
05: ds18b20 OWB resistors

V2.1 Wiring-plan (2 boards)

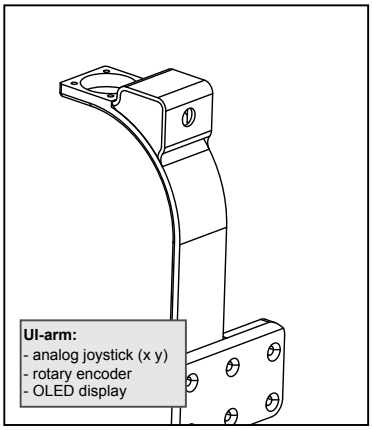
07.09.2023 [dropped]

Li-ion Battery
Samsung INR18650-35E 3500mAh 3,7V
7S 15P
150A BMS

120A connector

Main power switch

charging port
(50A connector)



UI-arm:
- analog joystick (x y)
- rotary encoder
- OLED display

Fuse box

50A connector

armchair:
control box for electric-adjustment

2x 2.5mm2
24V (2A fuse)

4x 2.5mm2
- 2x gnd
- 1x 24V (40A fuse)
- 1x 24V (40A fuse)

USB Cable
(fw upload)

12x 0.5mm2

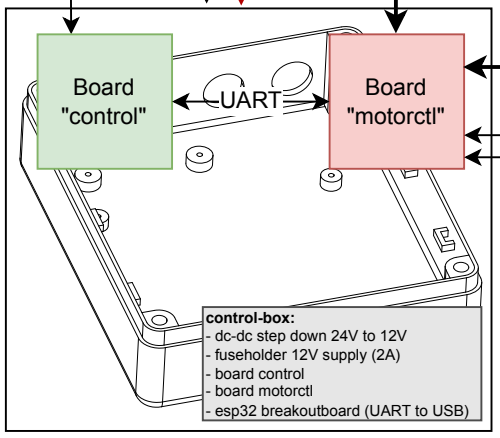
Control each driver
via 3 GPIO Pins
10khz PWM, A, B

9 pin sub-d connector

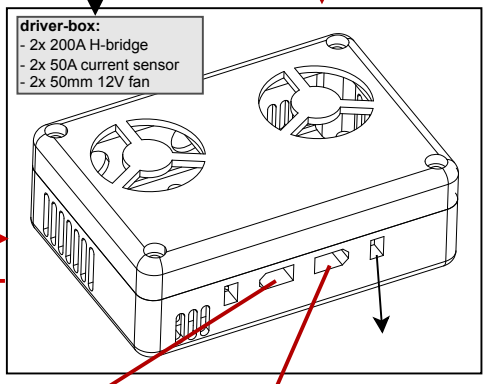
Board "control"

UART

Board "motorctl"



control-box:
- dc-dc step down 24V to 12V
- fuseholder 12V supply (2A)
- board control
- board motorctl
- esp32 breakoutboard (UART to USB)



driver-box:
- 2x 200A H-bridge
- 2x 50A current sensor
- 2x 50mm 12V fan

2x 2.5mm2
driver -> relay

2x 2.5mm2
relay -> connector

Motor left
straight: negative
angular: positive

Motor right

Note: inverted direction of right motor
already accounted in the driver box
-> motors with connectors are interchangeable

ds18b20 sensor motor
red: 3V3
black: GND
yellow: owb

optical sensor left axle

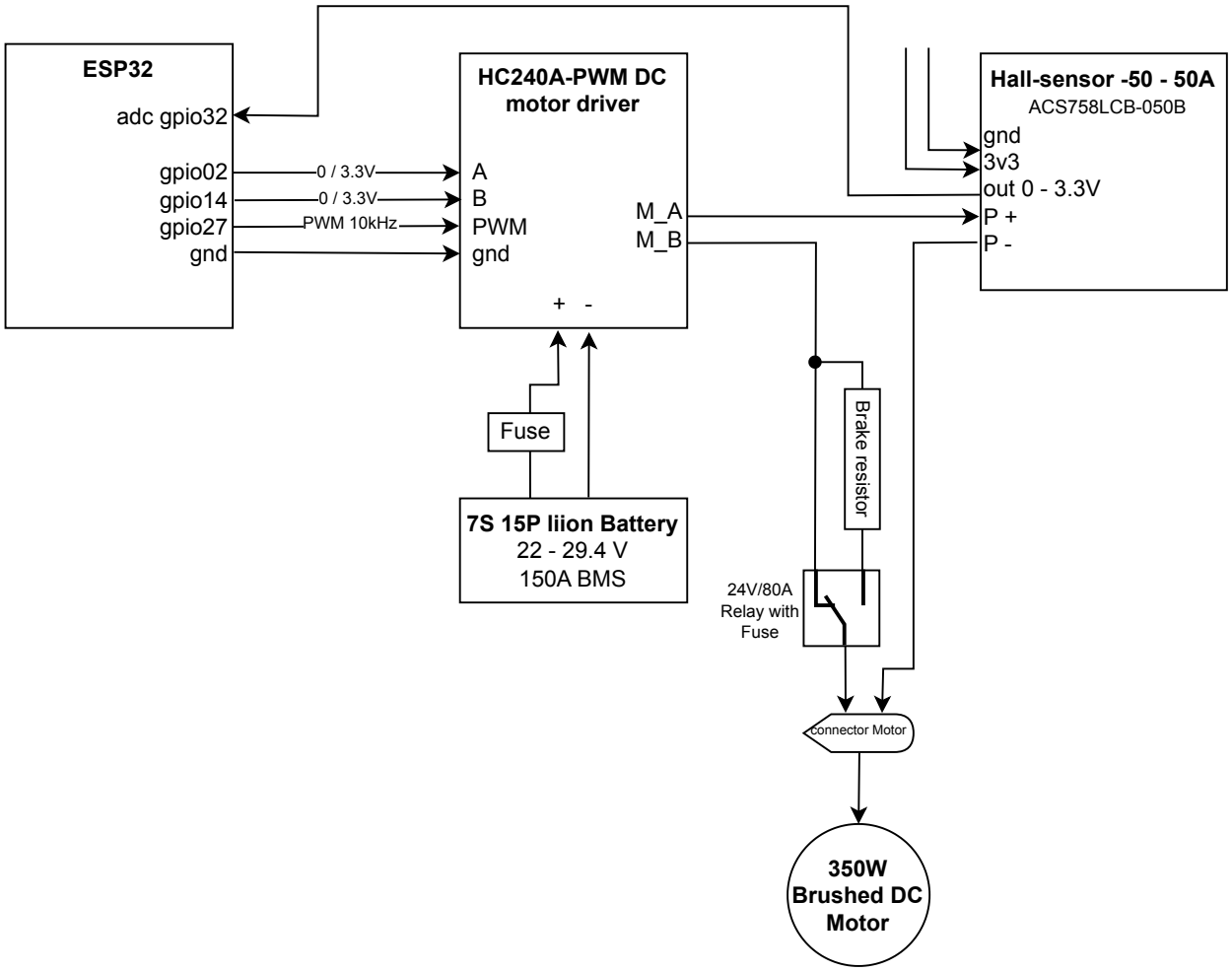
optical sensor right axle

9x 0.5mm2

Brake-Plate
- 2x 1Ohm 100W Brake resistor
- 2x 80A 24V 5-pin relay
- 2x ds18b20 sensor

V2.1 Driver box overview

07.09.2023 [dropped]



V2.0 Connection plan (single board)

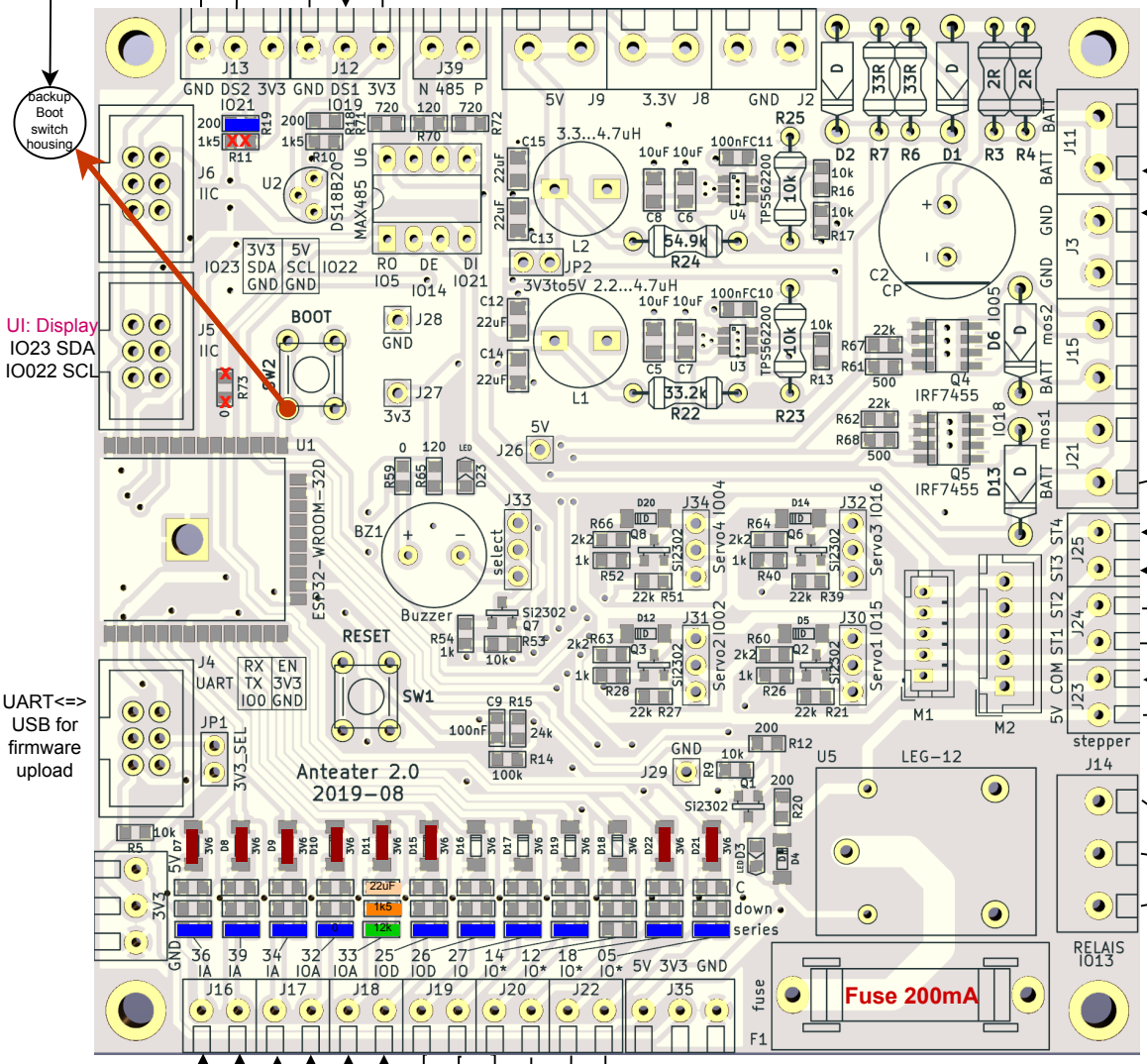
22.08.2023 [dropped]

gpio19: 4x ds18b20
OWB bus temp sensors
(drivers, motors)

gpio21: **FREE**

V2.0 summary:
- amost the same as V1.0 with a few additions
- 2x HC240A driver

=> dropped due to pin limitation



12V from stepdown
GND from stepdown

12V to Relay COM

gpio 04: driver: motor-left A
gpio 16: driver: motor-left B
gpio 02: driver: motor-right A
gpio 15: **FREE**
5V (signal pullup)

gpio13 Relay
NC:
COM: 12V ("Batt" / stepdown)
NO: driver: 2x fan

gpio 36: ADC UI: Joystick Y
gpio 39: ADC UI: Joystick X
gpio 34: ADC driver: Current sensor motor-left
gpio 32: ADC driver: Current sensor motor-right
gpio 33: ADC Battery voltage (stepdown) [29.4 -> 3.27V]
gpio 25: UI: encoder switch
gpio 26: driver: motor-left PWM
gpio 27: driver: motor-right PWM
gpio 14: [RS485] driver: motor-right B
gpio 12: [LED/BUZZER]
gpio 18: [MOS1] UI: encoder B
gpio 05: [MOS2] UI: encoder A

cable configuration

control-box => driver-box

Oelflex 12x0.5

gn: GND
~~01: 5V~~
01: 3V3

02: bridge-left A
03: bridge-left B
04: bridge-left PWM

05: bridge-right A
06: bridge-right B
07: bridge-right PWM

08: current-sensor left
09: current-sensor right

10: fan 12v from relay
11: ds18b20 owb

control-box => UI-arm

D-Sub 9 pin

green: GND
red: 3V3

brown: Joystick X
purple: Joystick Y

yellow: encoder A
blue: encoder B
black: encoder switch

gray: display SDA
orange: display SDC

Joystick pinout

JST connector 5 pin
(pins stick order left to right)

red: VCC (3V3)
orange: GND
brown: X (analog 0-3V)
white: n.c.
black: Y (analog 0-3V)

Legend pcb

- 0 Ohm Resistor
- 1.5k Ohm Resistor
- 3v3 Z-Diode
- 12k Ohm Resistor
- 1k5 Ohm Resistor

[xxx] Conflicting Component
xx nopop

V2.0 Wiring-plan (single board)

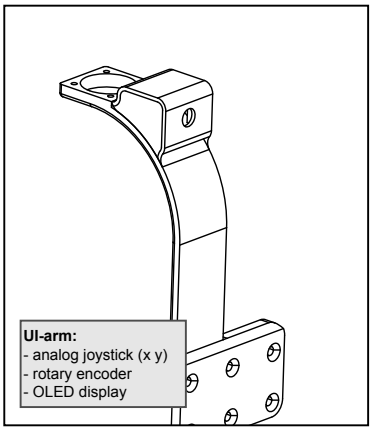
22.08.2023 [dropped]

Li-ion Battery
Samsung INR18650-35E 3500mAh 3,7V
7S 15P
150A BMS

120A connector

Main power switch

charging port
(50A connector)



UI-arm:
- analog joystick (x y)
- rotary encoder
- OLED display

Fuse box

50A connector

armchair:
control box for electric-adjustment

2x 2.5mm2
24V (2A fuse)

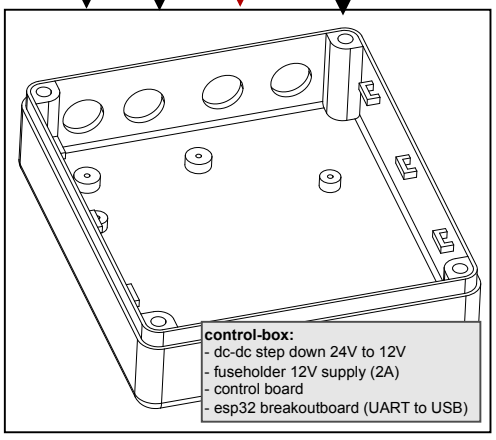
4x 2.5mm2
- 2x gnd
- 1x 24V (40A fuse)
- 1x 24V (40A fuse)

USB Cable
(firmware upload)

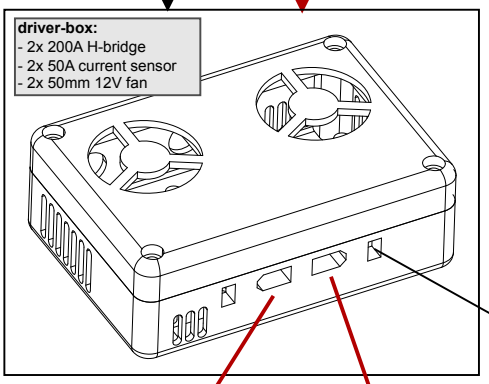
9 pin sub-d connector

12x 0.5mm2

Control each driver
via 3 GPIO Pins
10khz PWM, A, B



control-box:
- dc-dc step down 24V to 12V
- fuseholder 12V supply (2A)
- control board
- esp32 breakoutboard (UART to USB)



driver-box:
- 2x 200A H-bridge
- 2x 50A current sensor
- 2x 50mm 12V fan

ds18b20 sensor motor
red: 3V3
black: GND
yellow: owb

Motor left
Motor right
straight: negative
angular: positive

Note: inverted direction of right motor
already accounted in the driver box
-> motors with connectors are interchangeable