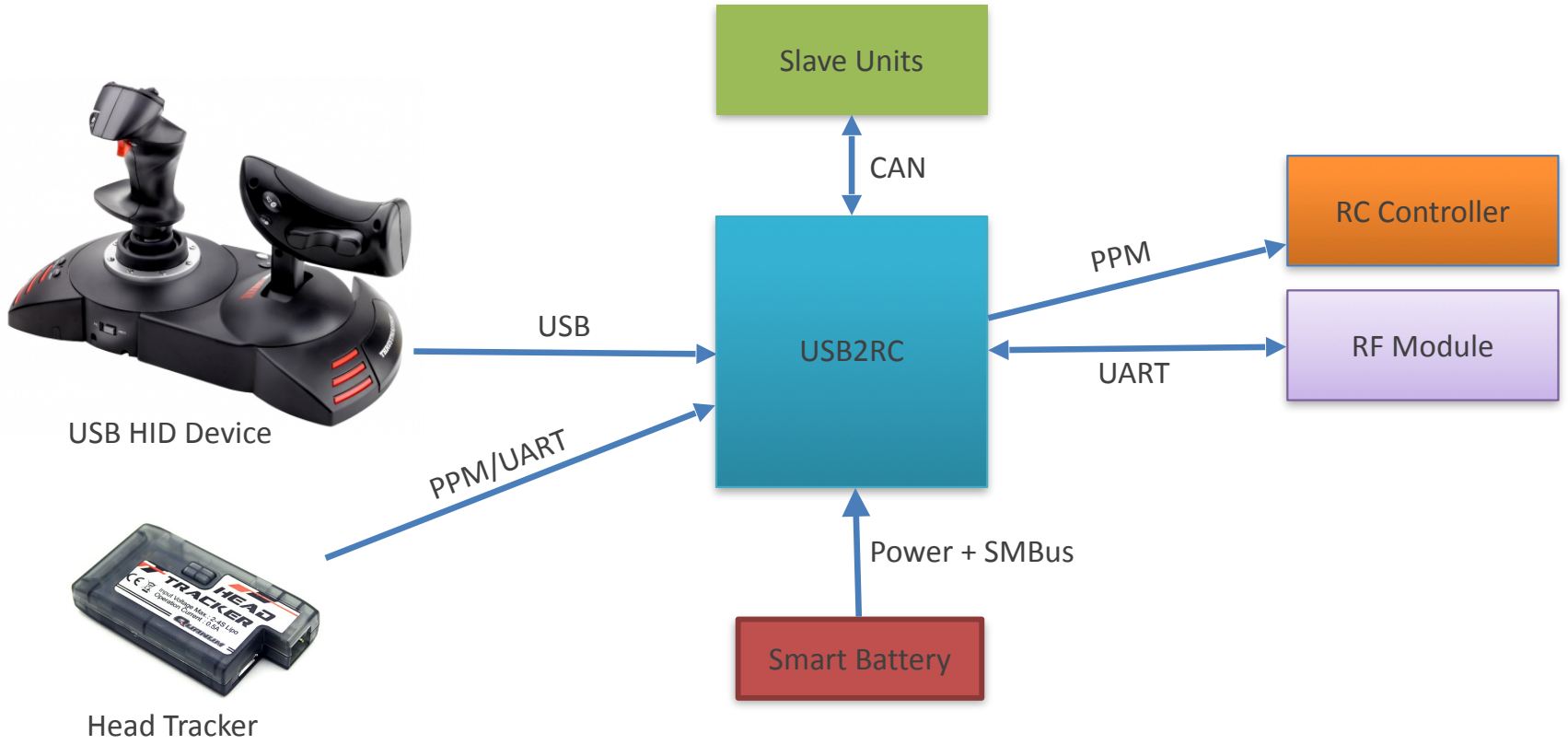
USB2RC
Module

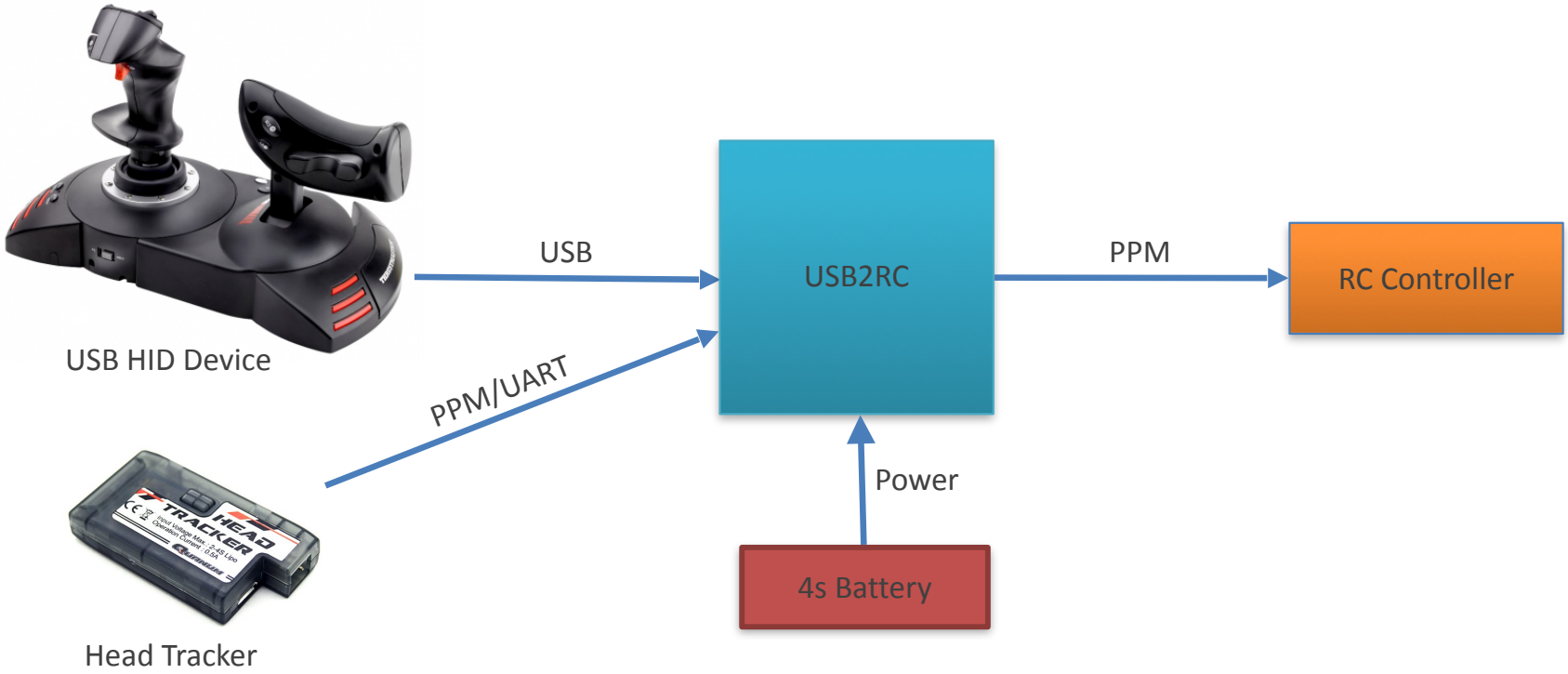
Minimum Viable Product - PRO

Block Diagram Master Unit



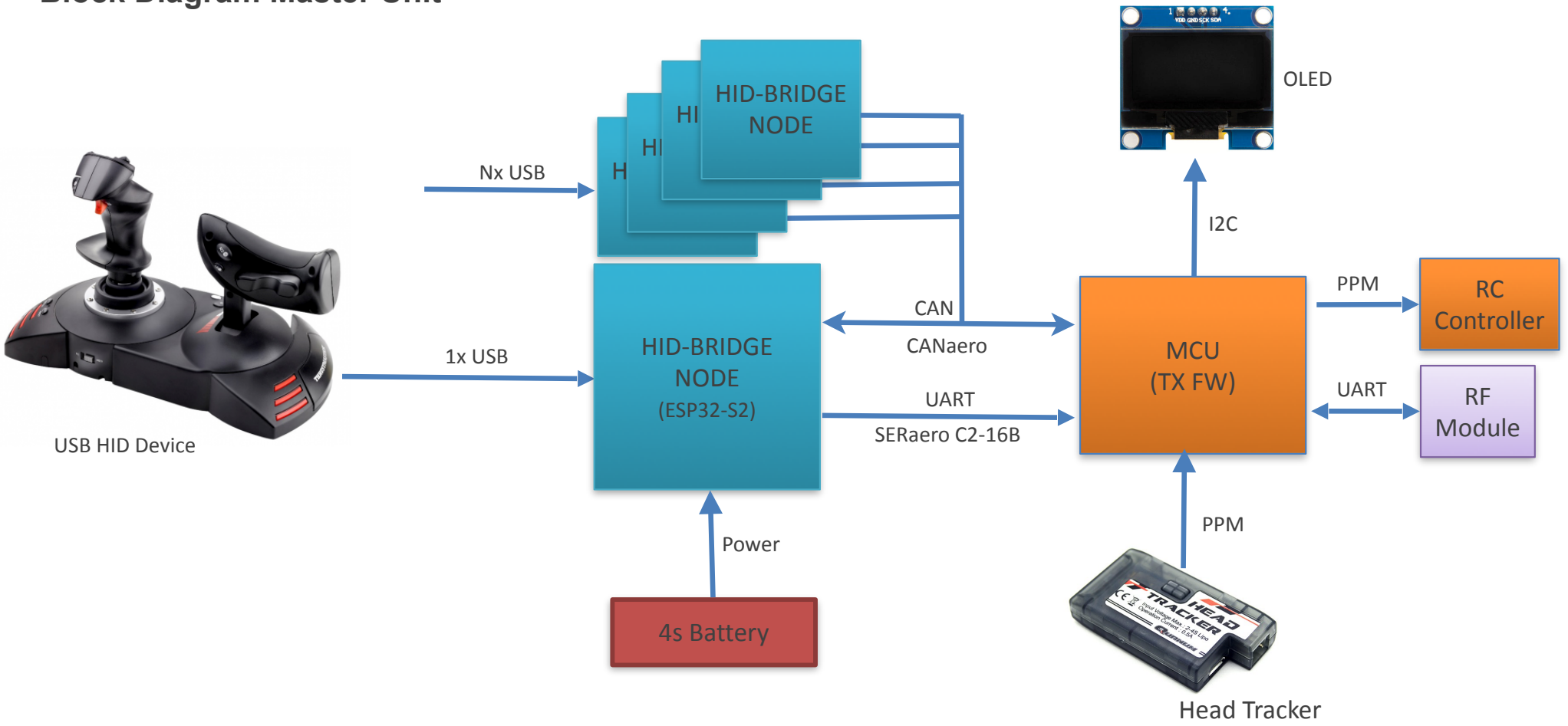
DIY Version - Minimum Viable Product

Block Diagram Master Unit



ESP32-S2 USB Host Version

Block Diagram Master Unit



Version DIY - Hardware

Hardware

- DIY PCB (MCU and USB Shield Sockets, 4s Power Input, Pin Headers for CAN, UART, I2C)
- PCB Size: 90 x 80,5mm
- ESP32 Dev Kit C v4 Board (https://www.az-delivery.de/en/products/esp-32-dev-kit-c-v4)
- CH559 Shield (Self Developed)
- OLED Display SSD1306 (https://www.az-delivery.de/products/0-96zolldisplay)
- I2C Pullups enable/disable jumpers for I2C0 and I2C1
- Analog input for battery measurement (max 18V)
- Buzzer for Warning & Alerts
- Enclosure Kit (TEKO TEKAL-21.30)
- 3D Printed Front and Back Panel for TEKO

Version DIY - Connectors

User Connectors

- PCB 4-pole 3.5mm Audio Jack Socket for HT (+5V, PPM/SoftSerial RX, RST, GND); (BKL Electronic 1109300)
- PCB 3-pole 3.5mm Mono Jack Socket for PPM-OUT (Signal, GND); (BKL Electronic 072357)
- 2x USB from Host Shield
- USB from ESP32 Shield
- Phoenix Terminal for Power (2s to 4s input)

PCB Connectors (pinouts TBD)

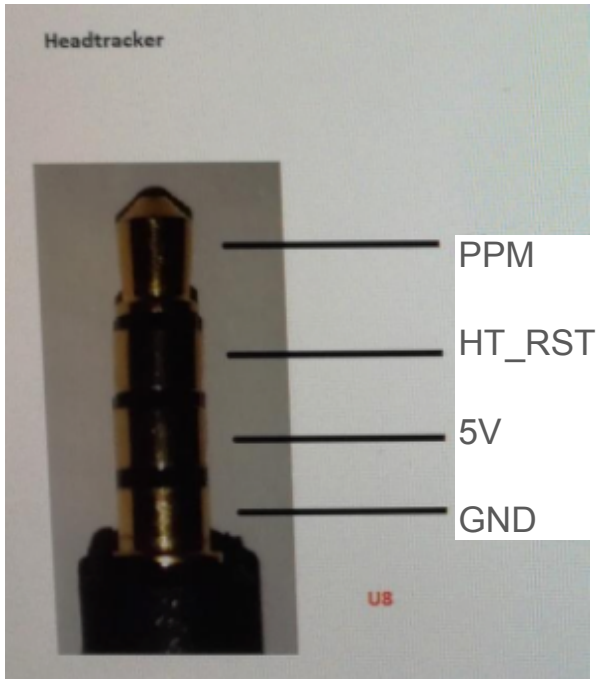
- 4-pin 2.54mm Header for OLED (SDA_0, SCL_0, +5V, GND) -> Pin compatible with OLED Module
- 4-pin 2.54mm Header for CAN Shield (GND, +3.3V/5V, CAN-RX, CAN-TX)
- 4-pin 2.54mm Header for SMBus (GND, +5V, SCL_1, SDA_1)
- 4-pin 2.54mm Header for UART1 (GND, +6V, RX, TX): NOTE 6V for JR Module!
- 4-pin 2.54mm Header for UART2 (GND, +5V, RX, TX): To USB Shield
- 4-pin 2.54mm Header for Signals (GND, Signal 1,2,3) (e.g. frequency out for sound module)
- 2x 19-pin 2.54mm Header for ESP32
- 2x 18-pin 2.54mm Header for USB Host Shield

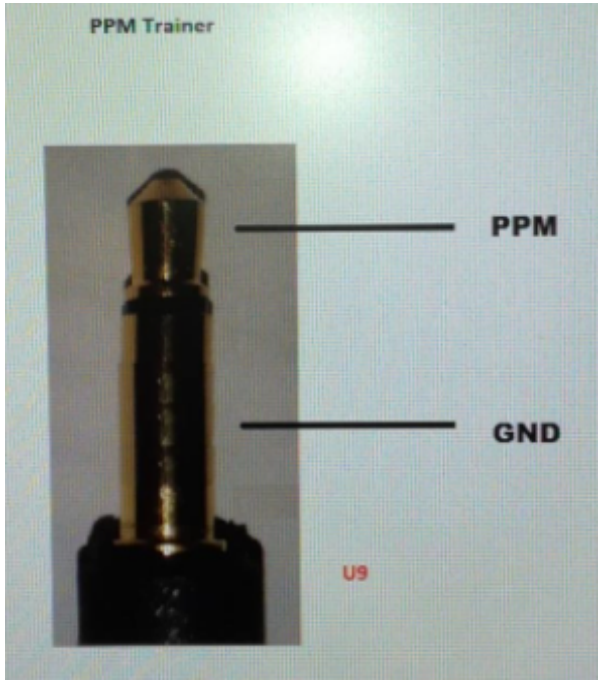
USB2RC - Pin Definitions

ESP32 Pin Mapping

- UART1: 18, 19
- UART2: 16, 17
- PPM Out: 32
- PPM In / SoftSerial Rx: 25
- I2C_OLED: 21, 22
- I2C_SMBus: 26, 27
- CAN: 4, 5
- GPIOs: 13 (buzzer), 14, 23, 33

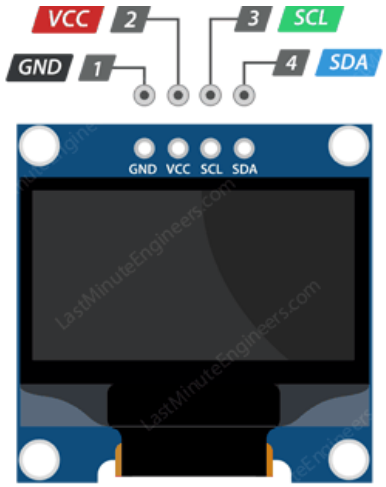
USB2RC - Audio Jack Pin Definitions





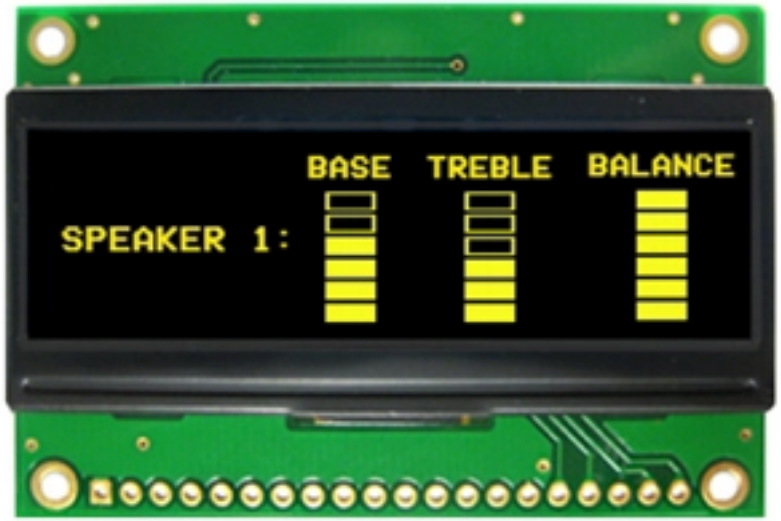
USB2RC - OLED Displays

Arduino 0.96“ Display
SSD1306



Arduino 1.3“ Display
SSH1106

NHD-2.23-12832UCY3 2.23“ Display
SSD1305



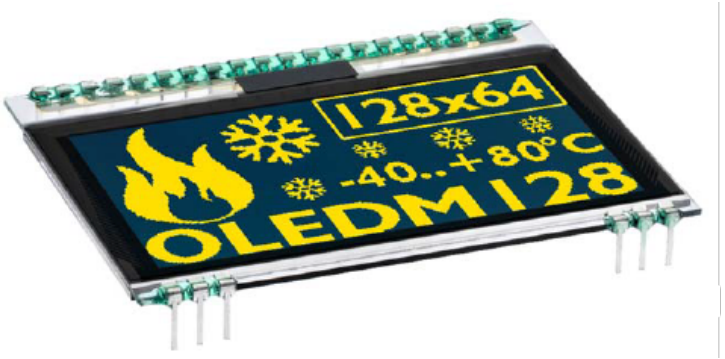
1 20

I2C Interface:

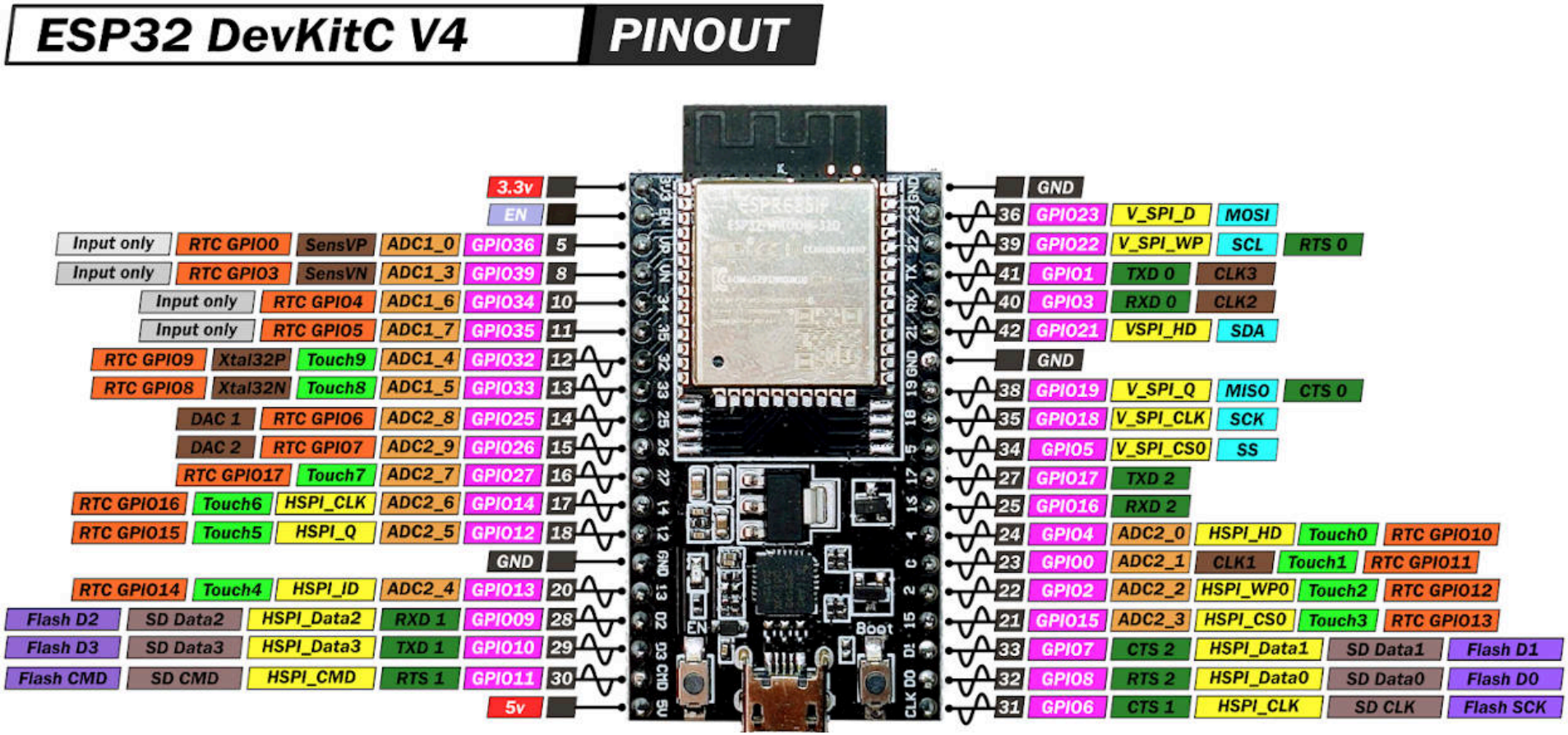
Pin No.	Symbol	External Connection	Function Description
1	VSS	Power Supply	Ground
2	VDD	Power Supply	Supply Voltage for OLED and logic.
3	NC	-	No Connect
4	SA0	MPU	Slave Address Selection signal.
5-6	VSS	Power Supply	Ground
7	SCL	MPU	Serial Clock signal.
8	SDA_{IN}	MPU	Serial Data input signal (pins 8 and 9 can be tied together).
9	SDA_{OUT}	MPU	Serial Data output signal (pin9 can be no connect).
10-14	VSS	Power Supply	Ground
15	NC	-	No Connect
16	/RES	MPU	Active LOW Reset signal.
17	VSS	Power Supply	Ground
18	NC	-	No Connect
19	BS2	MPU	MPU Interface Select signal.
20	BS1	MPU	MPU Interface Select signal.

USB2RC - OLED Displays

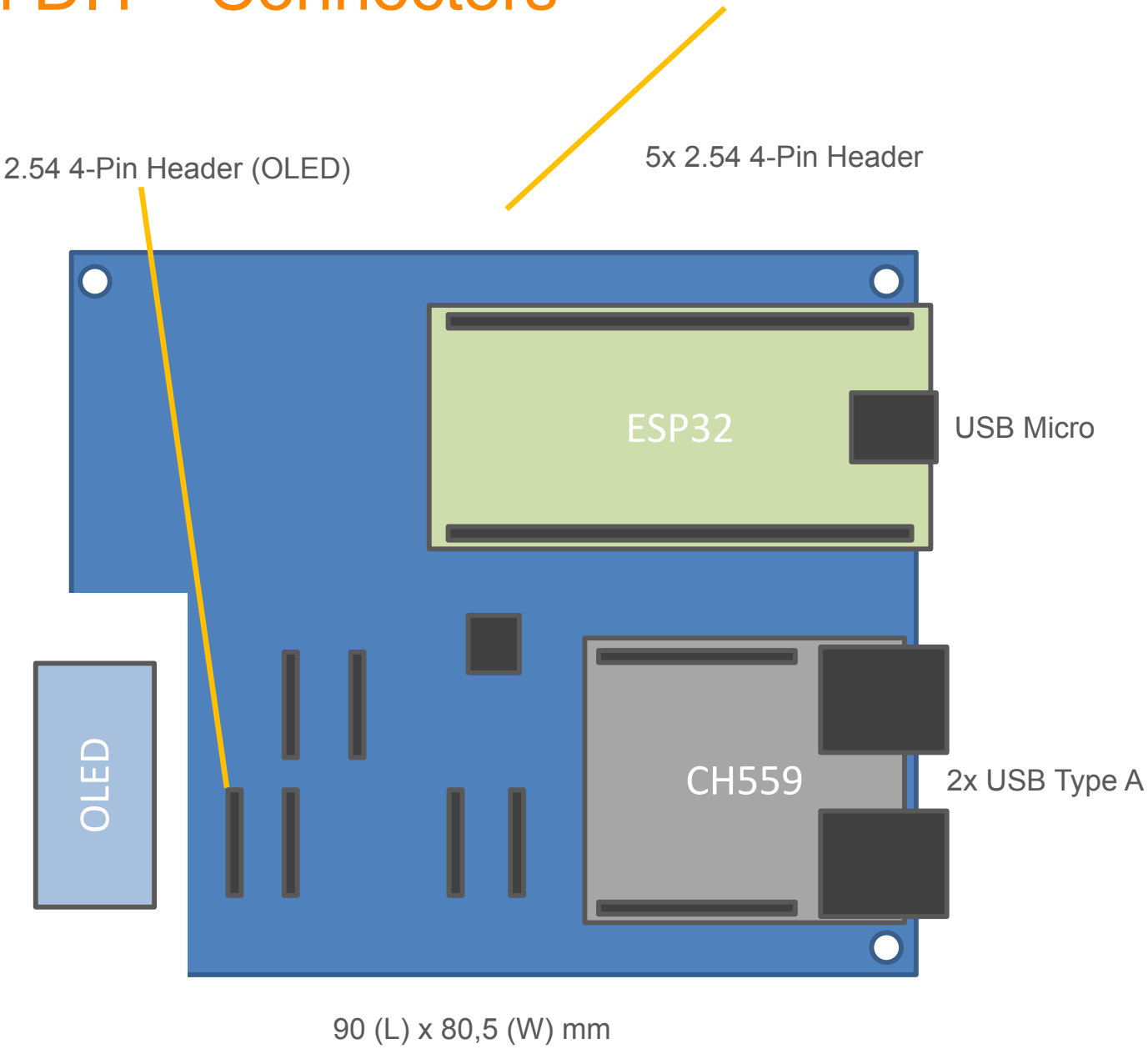
EA OLEDM128-6
SSD1306



USB2RC - Pin Definitions

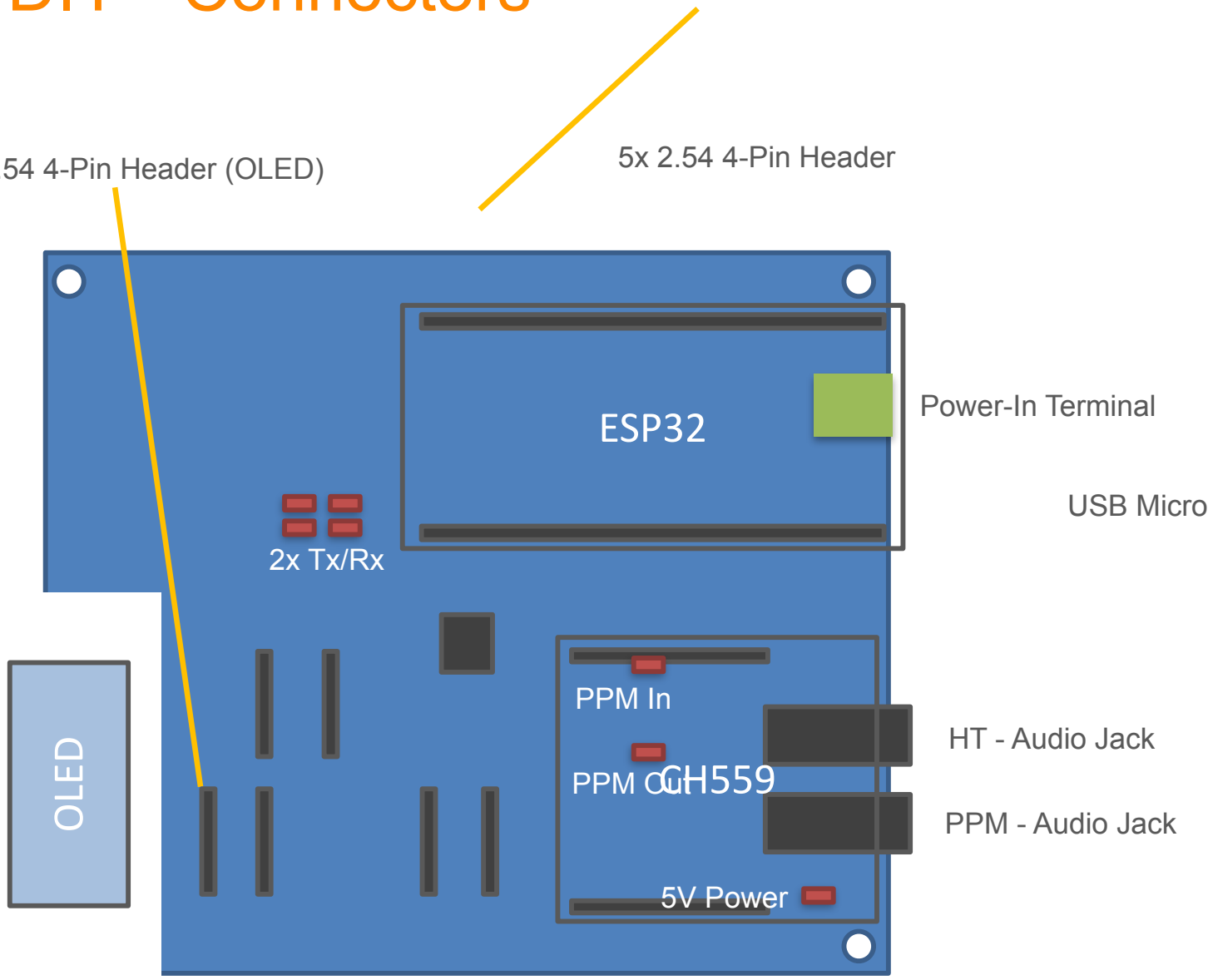


Version DIY - Connectors



Version DIY - Connectors

LED Color Policy:
TX = Green
RX = Blue
Power = Red



90 (L) x 80,5 (W) mm

Version DIY - Power Supply

Power In

- Input Range: 9-18VDC (2s to 4s); Reverse Protection and Fuse
- PCB Header: Phoenix MC 1,5/ 2-GF-3,5 - 1843790

Power Out

- 5VDC @ 1A - Internal Electronic Supply; Recom R-78E-1.0 (or similar)
- 5VDC @ 1A - USB Power; Recom R-78E-1.0 (or similar)
- 6VDC @ 0.5A - External RF Module Supply; Traco TSR 0.5-2465 (or similar)

USB-to-SERaero
CH559 Module

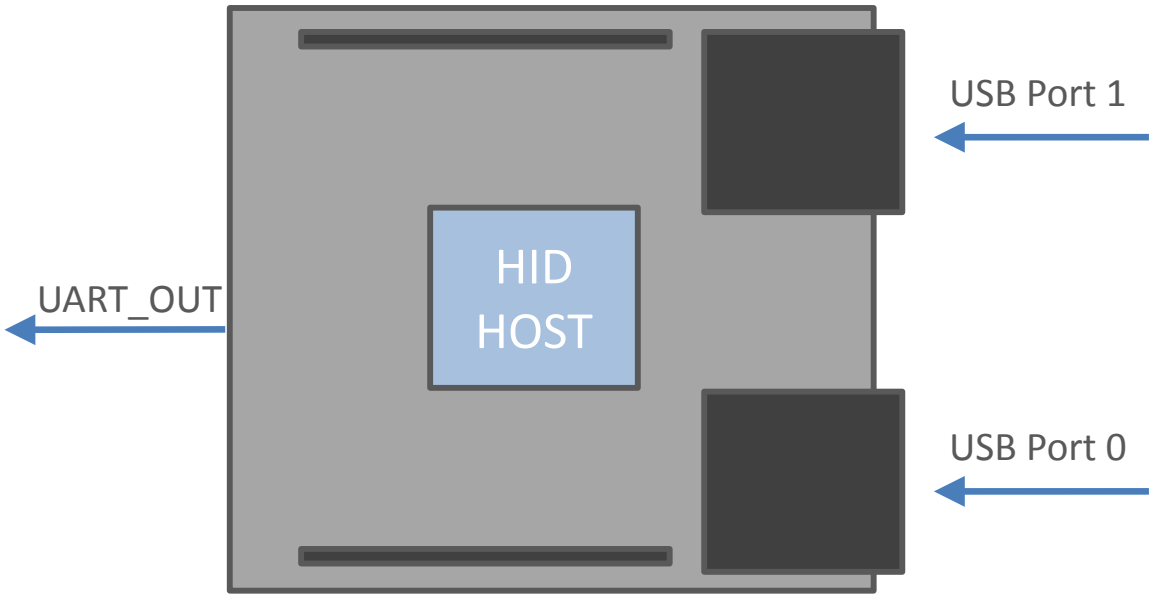
HID HOST Board

Power In

- Input Range: 5VDC

Jumpers

- Bootloader (PROG)
- Reset



Interfaces Overview

The HID HOST can managed simultaneously up to two USB devices connected through the embedded dual-port Root-HUB Port 0 and Port 1.

The UART supports programmable communication baud rate, supporting 115200bps and communication baud rate up to 3Mbps.

HID HOST Board HID to UART Functions

Functional Overview

The HID HOST can managed simultaneously up to two USB devices connected through the embedded dual-port Root-HUB Port 0 and Port 1.

A. The HID HOST will read the HID Device (Gamepad, Joystick, Steering Wheels, etc) and remap the variables X/Y/Z/Rx/Ry/Rz/etc into specific bytes position inside the SERaero C2-16B UART protocol.
B. The firmware will map the analog HID values 1:1 into the 16-bit wide position of each SERaero channel.
C. HID HAT-Switch values will be mapped to a predefined byte array specified in the SERaero protocol.
D. HID Buttons are mapped sequentially to 2x 32-bit byte arrays.
E. Each USB port will generate an independent SERaero C2-16B UART stream with different Node-ID in the header.
F. The firmware shall be device independent and to accept all devices listed in the „Supported HID Descriptor“ list.
G. The firmware shall follow the SERaero C2-16B specification.
H. The firmware shall have the possibility to set a „Deadzone“ for all analog channels in order to avoid to flooding the UART with useless data. The „Deadzone“ will be configured in the file „config.h“

HID HOST - Supported HID Descriptors

The HID HOST module will support the below USB Controller and Device Types. New Controller and Types will be added further based on use cases. For a complete list of Controller and Device Types please consult the link

https://www.freebsddiary.org/APC/usb_hid_usages

Controls Types:

- 0x05 0x01 „Generic Desktop“
- 0x05 0x02 „Simulation Control“
- 0x05 0x03 „VR Controls“
- 0x05 0x05 „Game Controls“
- 0x05 0x08 „Buttons“

Generic Desktop CTRL Types:

- 0x09 0x01 „Pointer“
- 0x09 0x02 „Mouse“
- 0x09 0x03 „Reserved“
- 0x09 0x04 „Joystick“
- 0x09 0x05 „Game Pad“
- 0x09 0x06 „Keyboard“
- 0x09 0x07 „Keypad“
- 0x09 0x08 „Multi-Axis“

Game CTRL Device Types:

- 0x09 0x24 „Move Right/Left“
- 0x09 0x25 „Move Fwd/Bck“
- 0x09 0x26 „Move Up/Down“

HID Axis:

- 0x09 0x30 „X“
- 0x09 0x31 „Y“
- 0x09 0x32 „Z“
- 0x09 0x33 „Rx“
- 0x09 0x34 „Ry“
- 0x09 0x35 „Rz“
- 0x09 0x36 „Slider“
- 0x09 0x37 „Dial“
- 0x09 0x38 „Wheel“
- 0x09 0x39 „HAT Switch“

Analog HAT Switch values shall be mapped on discrete buttons.

Version DIY - Connectors / LEDs

User Connectors

- 2x USB from Host Shield

PCB Connectors (2x 2.54mm Pin Header)

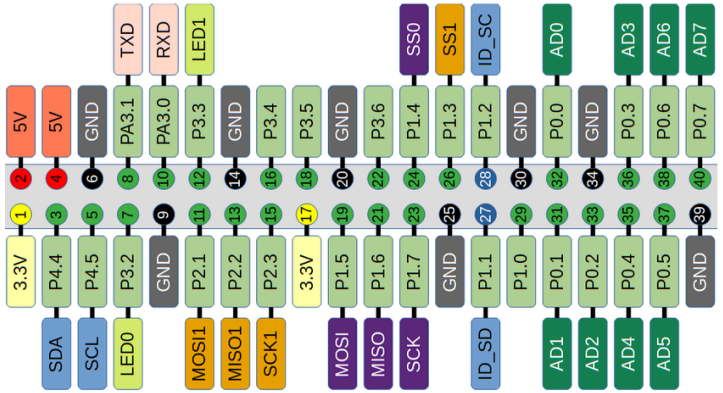
- 2-pin for UART0 (RX, TX) -> to ESP32 UART2
- 2-pin for UART1 (RX, TX)
- 4-pin for SPI (MOSI, MISO, SCK, SCS)
- 2-pin for I2C (SDA, SCL, GND)
- 2-pin for power (+5V, GND)
- 3-pin for LED (0, 1, GND)

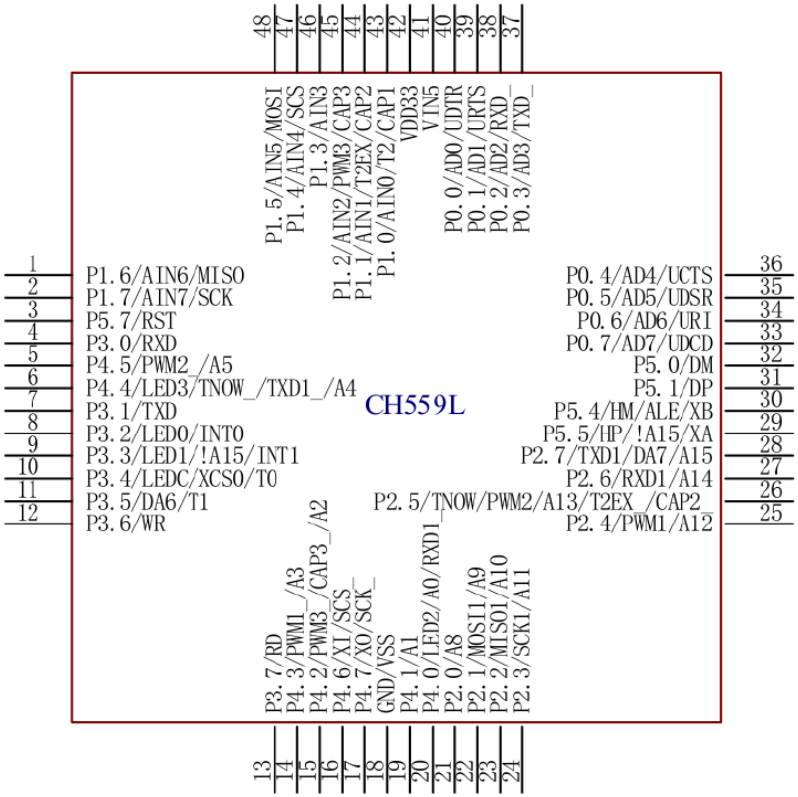
16 Pin in total = 2x 8 pin

On-Board LEDs

- Power 5V; UART0; UART1

LED Color Policy:
TX = Green
RX = Blue
Power = Red





USB2RC - Pin Definitions

CH559 GPIOs

- SPI: 1.4, 1.5, 1.6, 1.7
- UART1: 2.6, 2.7
- UART0: 3.0, 3.1
- LED: 3.2, 3.3
- I2C: 4.4, 4.5
- USB HUB 0: 5.0, 5.1
- USB HUB 1: 5.4, 5.5
- Reset: 5.7
- Power: VIN5, VDD33, GND/VSS

Head Tracker

Head Tracker

Controller Hardware

- Controller PCB (MCU Sockets, 4-Pole Audio Socket, Sensor Input Pin Header)
- PCB Size: 60 x 54.5mm (small as possible)
- Power Input 5V
- 5V Power LED
- I2C Pullup THT Solder Pads
- ESP-8266EX WEMOS LOLIN D1 Mini (https://www.wemos.cc/en/latest/d1/d1_mini.html)
- Enclosure Kit (TEKO TEKAL-11.29)
- 3D Printed Front and Back Panel for TEKO
- Sensor Socket (5V, GND, SDA, SCL)
- 4-Pole Audio Socket (5V, GND, RST, Serial TX); (BKL Electronic 1109300)

Sensor Hardware

- Sensor Board (GY-6500 / GY-9250)
- https://www.okystar.com/product-item/gyro-sensor-mpu-6500-gyro-board-oky3231-5/
- 3D Printed Enclosure
- Binder Cable (5V, GND, SDA, SCL)

Head Tracker - Connectors

CTRL User Connectors

- Data-Out: PCB 4-pole 3.5mm Audio Jack Socket for HT (+5V, GND, RST, SoftSerial RX); **BKL Electronic 1109300**
- Data-In: Panel Mount Snap-In (5V, GND, SDA, SCL); **Binder 0997653004**
- USB from D1 Mini Shield

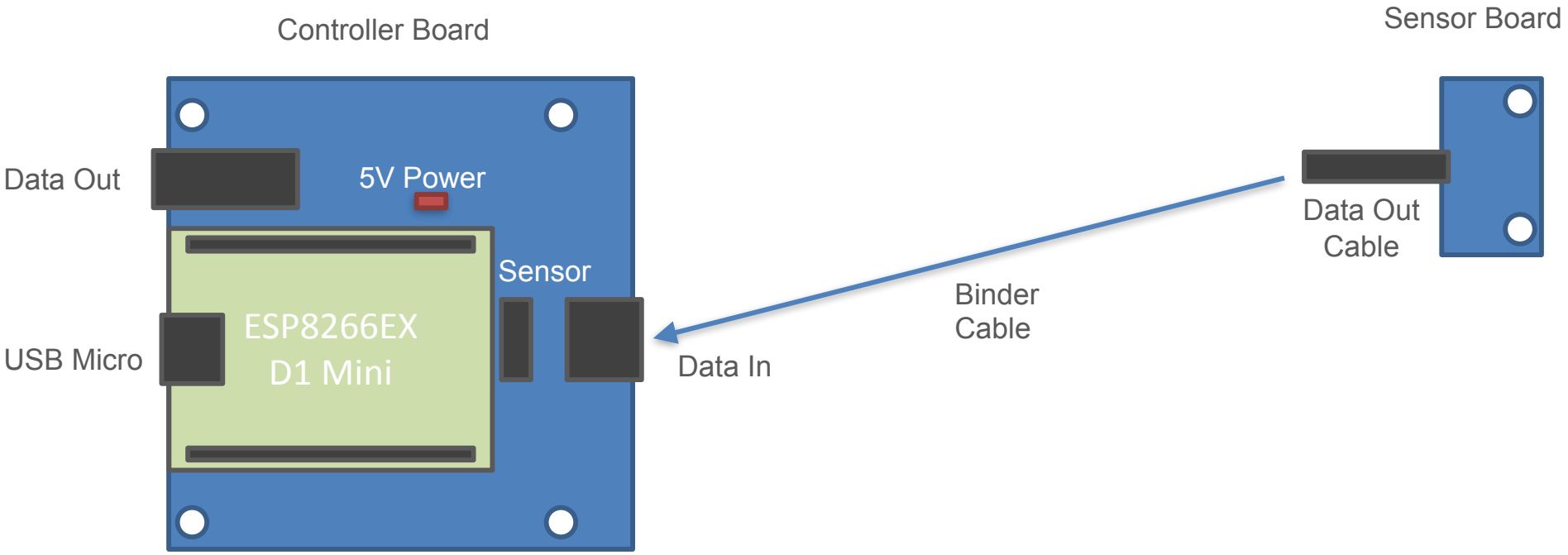
CTRL PCB Connectors (pinouts TBD)

- 4-pin Molex PicoBlade Header for Sensor (GND, +5V, SCL, SDA)
- 2x 8-pin 2.54mm Header for D1-Mini

Sensor User Connectors

- Snap-In 4-pole Cable Connector (+5V, GND, SDA, SCL); **Binder 7990041204**

Head Tracker - Connectors



60 (L) x 54,5 (W) mm
Mounting Holes: M2
Left/Right (W) Boundaries Spacing: 2mm

HT CTRL - Pin Definitions

ESP-8266EX D1 Mini

- I2C: D1, D2
- PPM Out/TX: D6
- RST/RX: D7
- VCC, GND