P1 Shield Board

Version 1.0

Hardware document

Contents

1. Elevator pitch statement - Introduction

The P1 Shield board is used in the smart home system. The board's function is to process essential data and manage elements of the home installation.

On the P1 Shield board there are several modules that make up the whole, the modules are: POE, MCU, PSU, USB to Serial, Ethernet and P1 port.

2. Hardware considerations

P1 Shield board is made of:

1. MCU;
2. PSU;
3. POE;
4. USB to Serial converter;
5. Ethernet;
6. P1 Port;
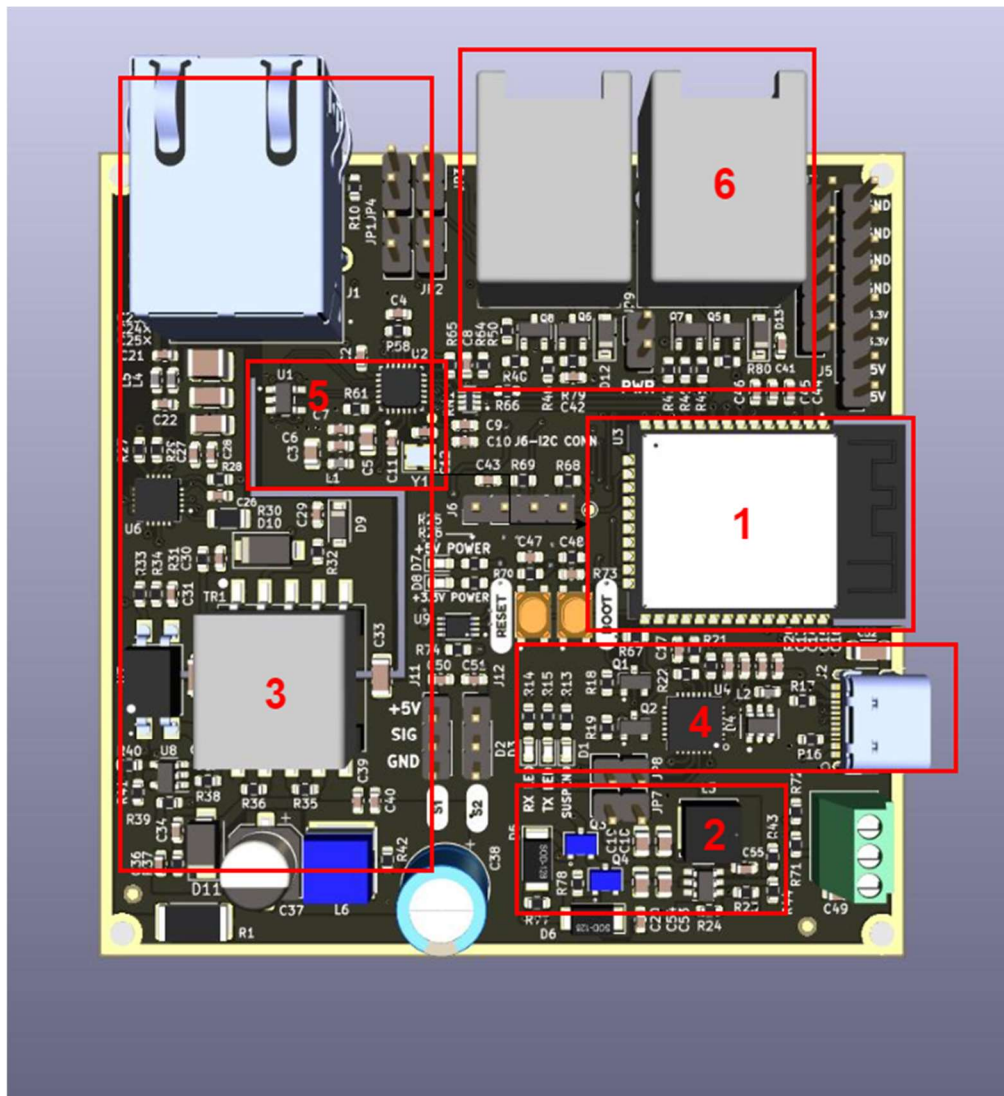
PSU:

The power supply of the entire board is realized with DC-DC converter (AP62200WU-7) which works in BUCK configuration. The output voltage is +3.3V, the maximum output current is 2A. 5V source is input to the DC-DC, input has 3 different sources that control the power switch, implemented using two P-type mosfets. The source with the highest priority is POE, followed by USB, and the lowest priority is P1 Port. Source selection is done automatically.

POE:

One of the ways of powering the board is using a POE module. This part is realized using an IC (SI3404) whose role is to convert the input voltage from RJ45 and adjust it for use. The POE standard applied to the board is IEEE 802.3 Type 1 and the board is galvanic isolated (1.5kV) using a transformer.

USB to Serial:

This module is used for communication and programming of the microcontroller that is placed on the board. Its role is to convert communication between USB and UART. An important item added to this module is the autoboot function. The autoboot function represents programming without pressing the boot button, you only need to connect the USB and start programming, the board will do everything by itself and inform you when the programming is finished.

# 3. Software consideration

MCU-ESP32:

      MCU is the most important part of the board, it controls and communicates with the modules. ESP32 has integrated Wi-Fi and Bluetooth communication. Programming of the controller is done using USB through a USB to Serial converter.There are two testers on the board, BOOT and RESET. The reset button serves to reset the controller, while the boot button is used during programming.
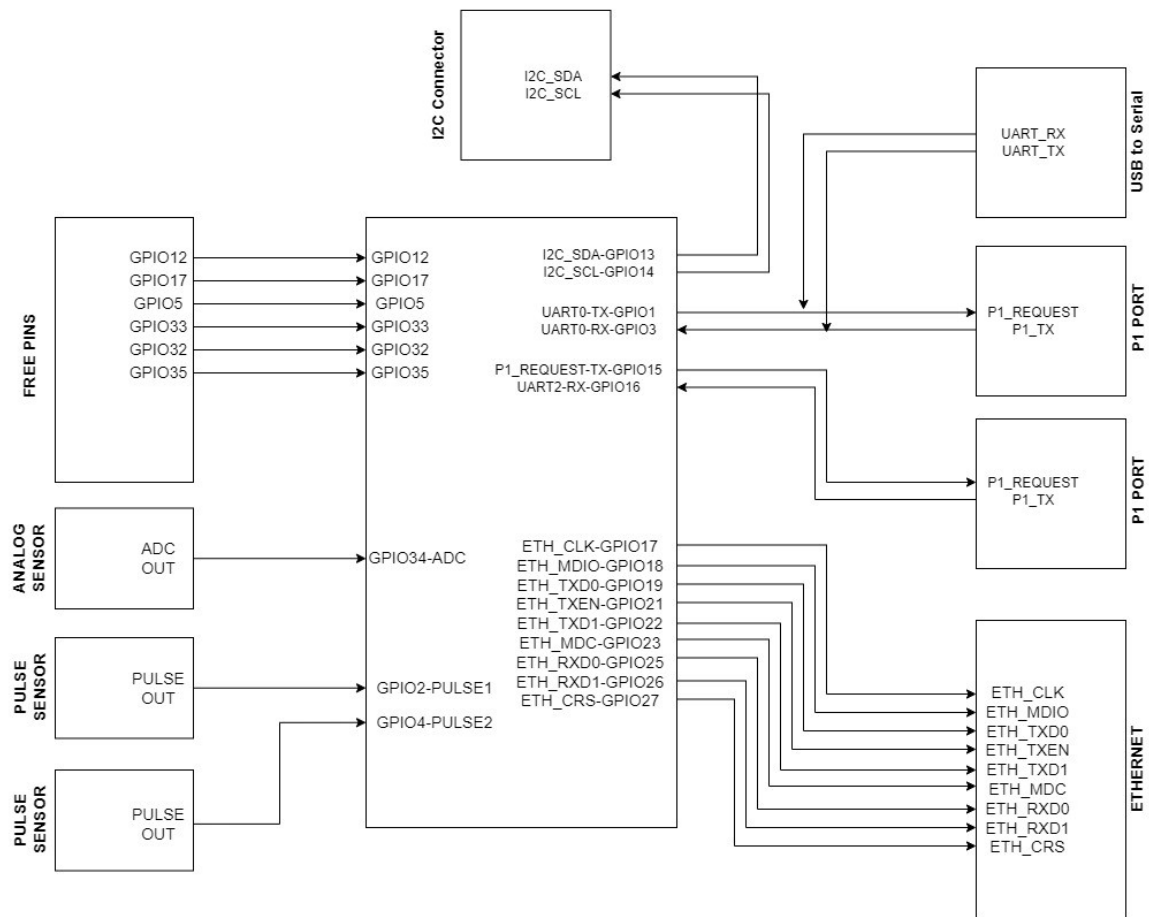
ESP32 uses UART, I2C and RMII interface (Ethernet) for communication with modules.

When programming the board, jumpers JP7 and JP8 must be connected, UART0 is used for programming.
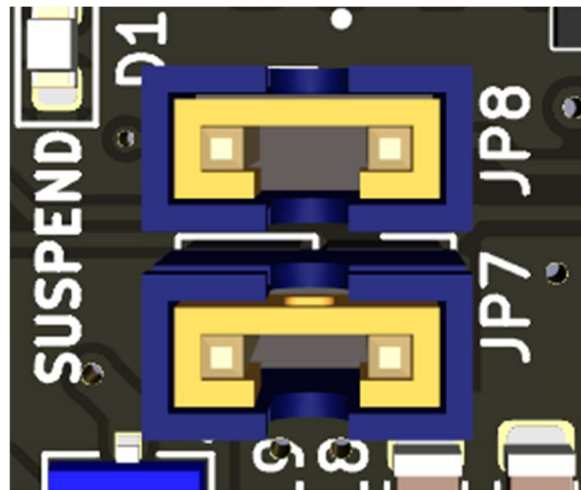

UART0 can be used for PC and board communication and then these two jumpers must also be placed.

On a board also placed I2C connector (J6). I2C communication can be used to add displays or sensors. There is a +3.3V power supply on the connector, communication voltage level must be +3.3V.
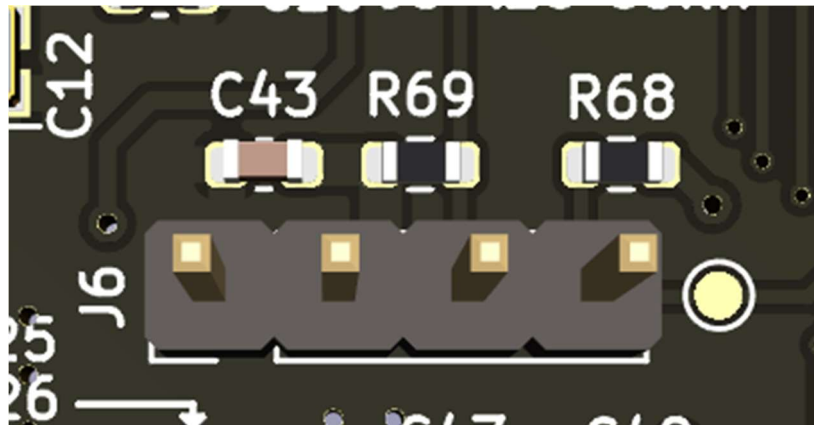

Board has the possibility of connecting one analog sensor. Sensor is connected to the terminal block connector (J10), the connector has a +5V power supply.
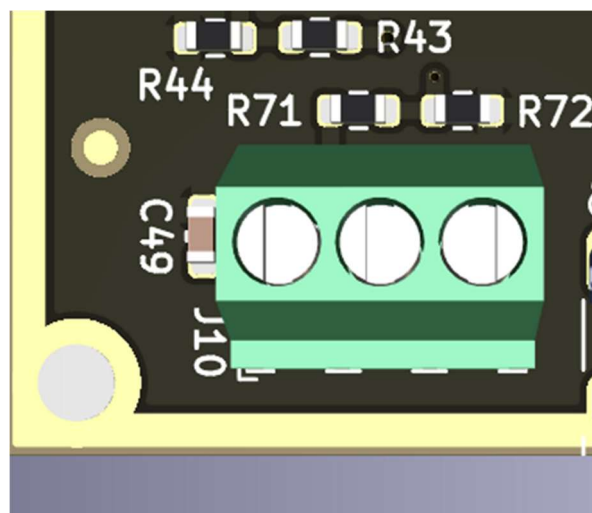
Pulse sensors can be connected to the header connector (J11 and J12). The power supply at the connectors is +5V.
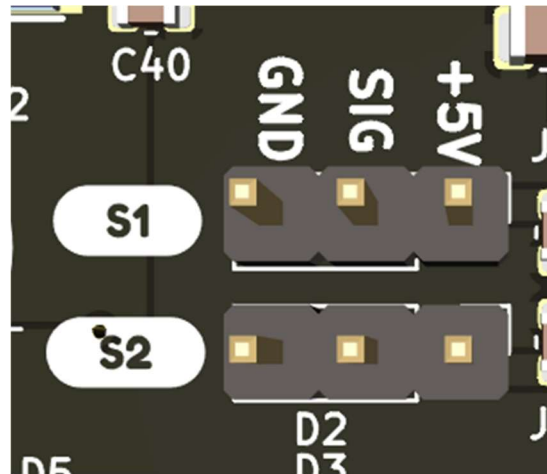

Pins that are not used are connected to the header connector (J7), the power supply for these pins is placed on the header connector (J5) and has 2x+3.3V and 2x+5V power supply.
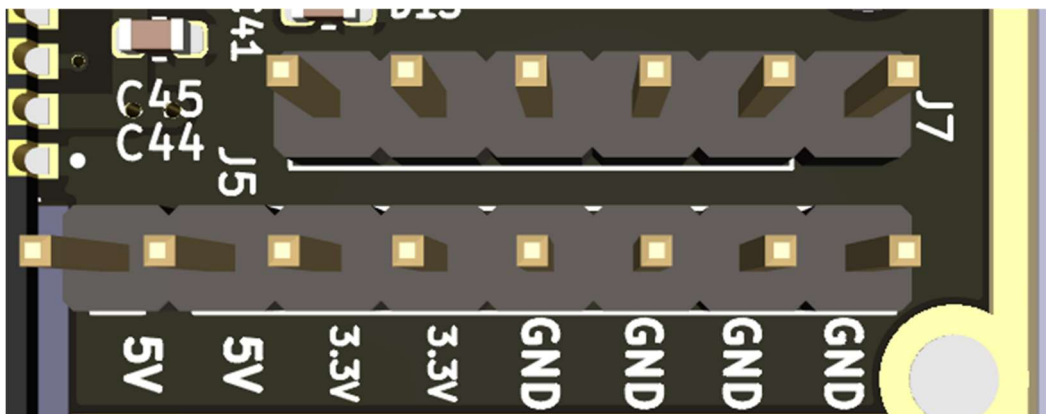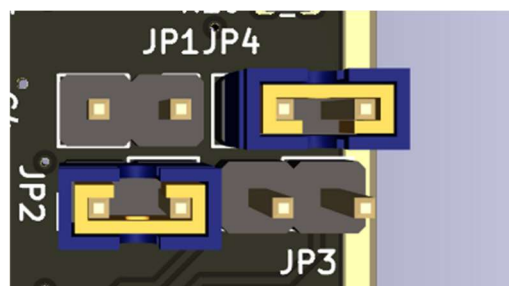
P1 Port:

P1 Port used for communication with external modules that send data on consumption and the status of devices connected to them. There are two P1 ports on the board.

One P1 port (J4) is the main one and it has direct communication with ESP32 via UART2. The second P1 port (J3) can be separate, sharing UART0 with the programming part, but it can be a continuation of the main P1 Port.
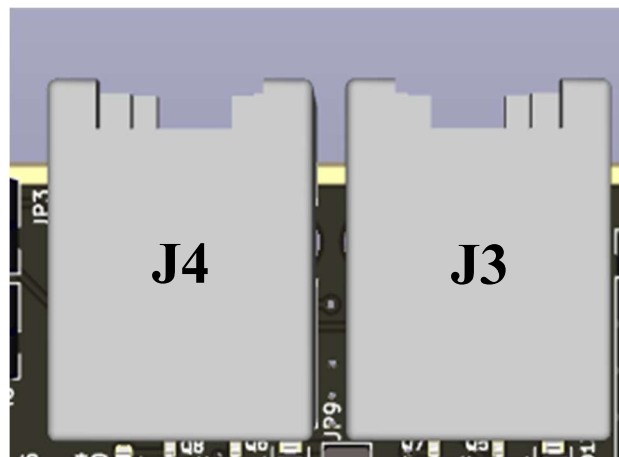

In the configuration when the second P1 Port is independent, it is necessary to place jumpers (JP2 and JP4). In that configuration, it is necessary to **remove the USB jumpers (JP7 and JP8)**. Communication between ESP32 and P1 Port is done via UART0.

In the configuration when the second P1 Port is an extension of the main P1 Port, the information coming to the main P1 Port is also forwarded to the second one. Then it is necessary to place the jumpers (JP1 and JP3), as well as the jumper for the power supply (JP9) if necessary.
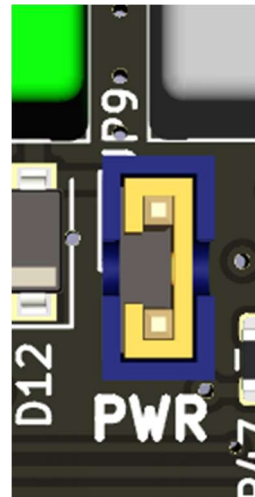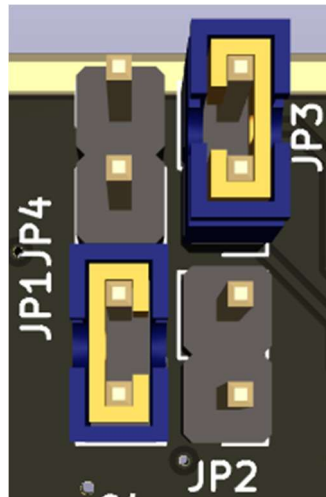
4. Datasheets

MCU-ESP32:

https://www.espressif.com/sites/default/files/documentation/esp32-wroom-32e_esp32-wroom-32ue_datasheet_en.pdf

POE-SI3404:

https://www.skyworksinc.com/-/media/Skyworks/SL/documents/public/data-sheets/si3404-datasheet.pdf

Ethernet-LAN8720:

https://ww1.microchip.com/downloads/aemDocuments/documents/OTH/ProductDocuments/DataSheets/00002165B.pdf

USB to Serial-CP2102:

https://www.silabs.com/documents/public/data-sheets/CP2102-9.pdf

PSU-AP62200WU-7:

https://www.diodes.com/assets/Datasheets/AP62200_AP62201_AP62200T.pdf