[ESP32](https://www.espressif.com/sites/default/files/documentation/esp32_technical_reference_manual_en.pdf)  
[Pinout Reference](https://randomnerdtutorials.com/esp32-pinout-reference-gpios/)

[Pin Function Spreadsheet](https://github.com/SensorsIot/ESP32-Deep-Sleep/raw/master/ESP32.xlsx)

22 x I/O + 4 x input only = 26 usable pins

GPIO\_34 - GPIO\_39 have no internal pullup / pulldown.

The ESP32 chip has the following strapping pins:

* GPIO 0
* GPIO 2
* GPIO 4
* GPIO 5 (must be HIGH during boot)
* GPIO 12 (must be LOW during boot)
* GPIO 15 (must be HIGH during boot)

(Not including GPIO6 to GPIO11 which are used by the internal FLASH and are not useable)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Name** | **Type** | **GPIO** | **Mode** | **Function** |  | **Note** |
| 25 | IO00 | I/O | GPIO00 |  |  | Buzzer | Boot mode |
| 35 | TXD0 | I/O | GPIO01 | UART-0 | USB\_TXD |  | program / debug |
| 24 | IO02 | I/O | GPIO02 |  | LCD\_DC |  |  |
| 34 | RXD0 | I/O | GPIO03 | UART-0 | USB \_RXD |  | program / debug |
| 26 | IO04 | I/O | GPIO04 |  |  | PRESSURE\_CS |  |
| 29 | IO05 | I/O | GPIO05 |  |  | ESP32 LED | Optional ? |
| 20 | SCK/CLK\* | I/O | GPIO06 |  | Flash |  | Do not use! |
| 21 | SDO/SD0\* | I/O | GPIO07 |  | Flash |  | Do not use! |
| 22 | SDI/SD1\* | I/O | GPIO08 |  | Flash |  | Do not use! |
| 17 | SHD/SD2\* | I/O | GPIO09 |  | Flash |  | Do not use! |
| 18 | SWP/SD3\* | I/O | GPIO10 |  | Flash |  | Do not use! |
| 19 | SCS/CMD\* | I/O | GPIO11 |  | Flash |  | Do not use! |
| 14 | IO12 | I/O | GPIO12 |  |  | LCD\_LED | LCD brightness PWM |
| 16 | IO13 | I/O | GPIO13 |  |  | TOUCH\_IRQ | Optional? |
| 13 | IO14 | I/O | GPIO14 |  |  | TOUCH\_CS |  |
| 23 | IO15 | I/O | GPIO15 |  | LCD\_CS |  |  |
| 27 | IO16 | I/O | GPIO16 | UART-1 | O2\_RXD |  |  |
| 28 | IO17 | I/O | GPIO17 | UART-1 | O2\_TXD |  |  |
| 30 | IO18 | I/O | GPIO18 | SPI-0 | LCD \_SCK |  |  |
| 31 | IO19 | I/O | GPIO19 | SPI-0 | LCD \_MISO |  | Optional for LCD |
| 33 | IO21 | I/O | GPIO21 | I2C-0 | I2C-SDA |  |  |
| 36 | IO22 | I/O | GPIO22 | I2C-0 | I2C-SCL |  |  |
| 37 | IO23 | I/O | GPIO23 | SPI-0 | LCD \_MOSI |  |  |
| 10 | IO25 | I/O | GPIO25 |  | VALVE\_SCK | VALVE\_0 |  |
| 11 | IO26 | I/O | GPIO26 |  | VALVE\_MOSI | VALVE\_1 |  |
| 12 | IO27 | I/O | GPIO27 |  | VALVE\_MISO | VALVE\_2 |  |
| 8 | IO32 | I/O | GPIO32 |  | VALVE\_LATCH | VALVE\_3 |  |
| 9 | IO33 | I/O | GPIO33 |  | VALVE\_ALARM | VALVE\_4 | Optional? |
| 6 | IO34 | I | GPIO34 |  |  | Button | Optional? |
| 7 | IO35 | I | GPIO35 |  |  | POWER\_FAIL |  |
| 4 | SENSOR\_VP | I | GPIO36 |  |  | PRESSURE\_EOC | Optional? |
| 5 | SENSOR\_VN | I | GPIO39 |  |  | Color\_IRQ |  |
|  |  |  |  |  |  |  |  |
| 1 | GND | P |  |  |  |  |  |
| 2 | 3V3 | P |  |  |  |  |  |
| 3 | EN | I |  |  |  |  |  |
| 15 | GND | P |  |  |  |  |  |
| 32 | NC |  |  |  |  |  |  |
| 38 | GND | P |  |  |  |  |  |
| 39 | GND | P |  |  |  |  |  |

## [DRV-8806](https://www.ti.com/lit/ds/symlink/drv8806.pdf?ts=1595952995827&ref_url=https%253A%252F%252Fwww.bing.com%252F) Valve Driver

We may need 2 drivers, one for 12V and one for 24V. The DRV-8806 uses an SPI that can be daisy chained.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Pin** | **No** | **I/O** | **ESP Pin** | **GPIO** | **Description** | **Note** |
| SCLK | 13 | I | VALVE-SCK |  | Serial Clock |  |
| D-IN | 14 | I | VALVE-MOSI |  | Data In |  |
| D-OUT | 15 | OD | VALVE-MISO |  | Data Out |  |
| LATCH | 11 | I |  |  | RE => Data to output |  |
| nFAULT | 16 | OD |  |  |  |  |
| RESET | 9 | I | RESET/EN | EN |  |  |
| nENABLE | 8 | I | GND/Open |  | Enable Outputs |  |

## [ILI9341](https://www.pjrc.com/store/display_ili9341_touch.html) / ILI9488 Display:

The driver uses one SPI for the display and one SPI for the touch controller.

[ILI9341 module from AliExpress](https://www.aliexpress.com/item/33057812377.html)

[Bare ILI9488 320x480 display](https://www.buydisplay.com/serial-spi-3-5-inch-tft-lcd-module-in-320x480-optl-touchscreen-ili9488)

[Bare ILI9341 240x320 display](https://www.buydisplay.com/2-8-inch-240x320-ips-tft-lcd-display-panel-optional-touch-panel-wide-view)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Pin** | **No** | **I/O** | **ESP Pin** | **GPIO** | **Description** | **Note** |
| LCD-SCK |  | I | SCK | 18 | LCD Serial Clock |  |
| LCD-SDI |  | I | MOSI | 23 | LCD Data In |  |
| LCD-SDO |  | OD | MISO | 19 | LCD Data Out |  |
| LCD-DC |  | I |  |  | LCD Data/Command |  |
| LCD-CS |  | I |  |  | LCD Chip Select |  |
| RESET |  | I | RESET/EN | EN | LCD Reset |  |
| TOUCH-SCK |  | I | SCK | 18 | Touch Serial Clock |  |
| TOUCH-SDI |  | I | MOSI | 23 |  |  |
| TOUCH-SDO |  | OD | MISO | 19 |  |  |
| TOUCH-CS |  | I |  |  |  |  |
| TOUCH-IRQ |  | O |  |  |  |  |

## [Gasboard 7500E](https://52ebad10ee97eea25d5e-d7d40819259e7d3022d9ad53e3694148.ssl.cf3.rackcdn.com/W-Cubic_7500E_DS.pdf) Oxygen Sensor

UART (plus alarm?)

UART is 5V, but ESP32 is not 5V tolerant.

ESP32 has 2 UARTs. One is used for programming via USB.

Measures up to 10 lpm. The goal is 20 lpm

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Pin** | **No** | **I/O** | **ESP Pin** | **GPIO** | **Description** | **Note** |
| RXD |  | I | TXD\_O2 | 17 | Receive Data |  |
| TXD |  | O | RXD\_O2 | 16 | Transmit Data |  |

## [TE MS5837-30BA](https://www.mouser.com/datasheet/2/418/5/NG_DS_MS5837-30BA_B1-1130109.pdf) Compressor side Pressure Sensor

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Pin** | **No** | **I/O** | **ESP Pin** | **GPIO** | **Description** | **Note** |
| SCL |  | I | SCL | 22 | Serial Clock | 400 kHz |
| SDA |  | I/O | SDA | 21 | Serial Data |  |

## [Honeywell MPRLS0030PG0000**S**A](https://static6.arrow.com/aropdfconversion/38293a0a693558f3fe21a0d3d30d1c3a7208f20e/-board-mount-pressure-mpr-series-datasheet-32332628-d-en.pdf) Output Pressure Sensor

This is the SPI version. I2C versions are also available and would use fewer pins. This would make all sensors I2C. MPRLS0030PG0000**0**A

**SPI**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Pin** | **No** | **I/O** | **ESP Pin** | **GPIO** | **Description** | **Note** |
| SCLK | 3 | I | SCK |  | Serial Clock |  |
| D-IN | 2 | I | MOSI |  | Data In |  |
| D-OUT | 7 | OD | MISO |  | Data Out |  |
| CS | 1 | I |  |  | Chip Select |  |
| EOC | 8 | O |  |  | End of Conversion |  |
| RESET | 9 | I | RESET/EN | EN |  |  |

## Temperature / Humidity Sensor

Generic I2C for now:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Pin** | **No** | **I/O** | **ESP Pin** | **GPIO** | **Description** | **Note** |
| SCL |  | I | SCL | 22 | Serial Clock |  |
| SDA |  | I/O | SDA | 21 | Serial Data |  |

## [TCS34725](https://cdn-shop.adafruit.com/datasheets/TCS34725.pdf) Color Sensor

I2C plus maybe LED. Monitors if Silica Gel Desiccant needs to be refreshed.

[Module with LED](https://www.aliexpress.com/item/32978967625.html)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Pin** | **No** | **I/O** | **ESP Pin** | **GPIO** | **Description** | **Note** |
| SCL | 2 | I | SCL | 22 | Serial Clock |  |
| SDA | 6 | I/O | SDA | 21 | Serial Data |  |
| INT | 5 | O |  |  | Interrupt |  |
| LED | - |  |  |  | Light |  |
| Vdd | 1 |  |  |  | Power |  |
| GND | 3 |  |  |  | Power |  |

## EEPROM

We may need persistent running use counters. The ESP32 has no EEPROM. The FLASH program memory can be used to simulate an EEPROM but constantly writing counter updates would quickly exceed the erase/write cycle count. There may be a technique where erase cycles are greatly reduced, but it is not clear if it possible/easy to control the erase cycle when writing.

**It would be prudent to design for an external I2C EEPROM.**

## Proposed 26x2 header pinout

Uses only the bottom (closer to middle of board) 26x2 header. Pins are numbered as EAGLE shows.

|  |  |  |  |
| --- | --- | --- | --- |
| **Pin** | **Usage** | **Pin** | **Usage** |
| 1 | 3.3 V from controller board | 2 | 5 V from valve board |
| 5 | I2C SDA | 6 | 5 V from valve board |
| 9 | I2C SCL | 10 | Ground |
| 13 | Valve board shared fault line | 14 | UART TX from controller board |
| 17 | Ground | 18 | UART RX to controller board |
| 21 | Chip select #3 | 22 | Chip select #4 |
| 25 | Chip select #5 | 26 | Ground |
| 29 | Enable valve outputs | 30 | ADC input to controller |
| 33 | 3.3 V from controller board | 34 | ADC input to controller |
| 37 | SPI MOSI | 38 | Ground |
| 41 | SPI MISO | 42 | ADC input to controller |
| 45 | SPI SCK | 46 | Valve latch outputs, board #1 |
| 49 | Ground | 50 | Valve latch outputs, board #2 |
| 53 | Differential - ADC input to controller | 54 | Differential + ADC input to controller |
| 57 | Controller Digital I/O | 58 | Ground |
| 61 | Controller Digital I/O | 62 | Controller Digital I/O |
| 65 | Controller Digital I/O (if available) | 66 | Ground |
| 69 | Controller Digital I/O (if available) | 70 |  |
| 73 |  | 74 |  |
| 77 | Ground | 78 |  |
| 81 | 24 V RAW from valve board | 82 | 24 V RAW from valve board |
| 85 | 24 V RAW from valve board | 86 | 24 V RAW from valve board |
| 89 | Ground | 90 | Ground |
| 93 | Ground | 94 | Ground |
| 97 |  | 98 |  |
| 101 |  | 102 |  |