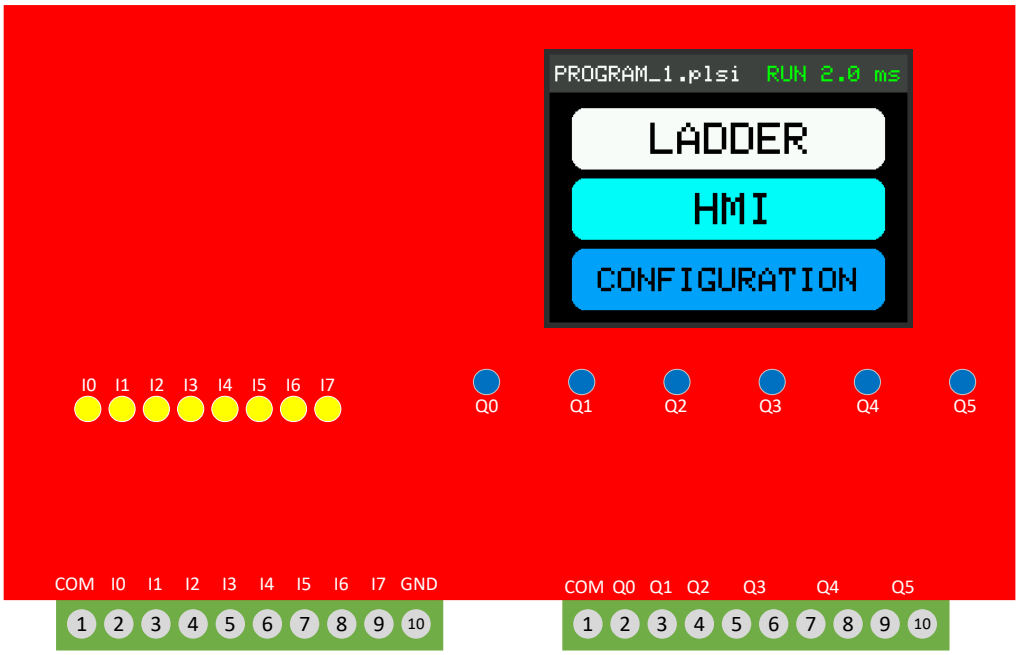
PLsi v0 Hardware Manual



Project page:

https://github.com/ElPercha/PLsi

Free as in Freedom

Purpose of this document

This PLsi manual provides you with information to build a PLsi v0 unit, it comprises the board assembly, firmware download and a series of tests to validate the main functionalities. For wiring, configuration and programming information use the "PLsi v0 User Manual" instead.

Please, create an issue in the PLsi repository if you see that this manual is not clear enough or has opportunities to improve.

Document information

Manual Name: **PLsi_v0_Hardware_Manual**

Revision: **A**

Date: **January 20, 2021**

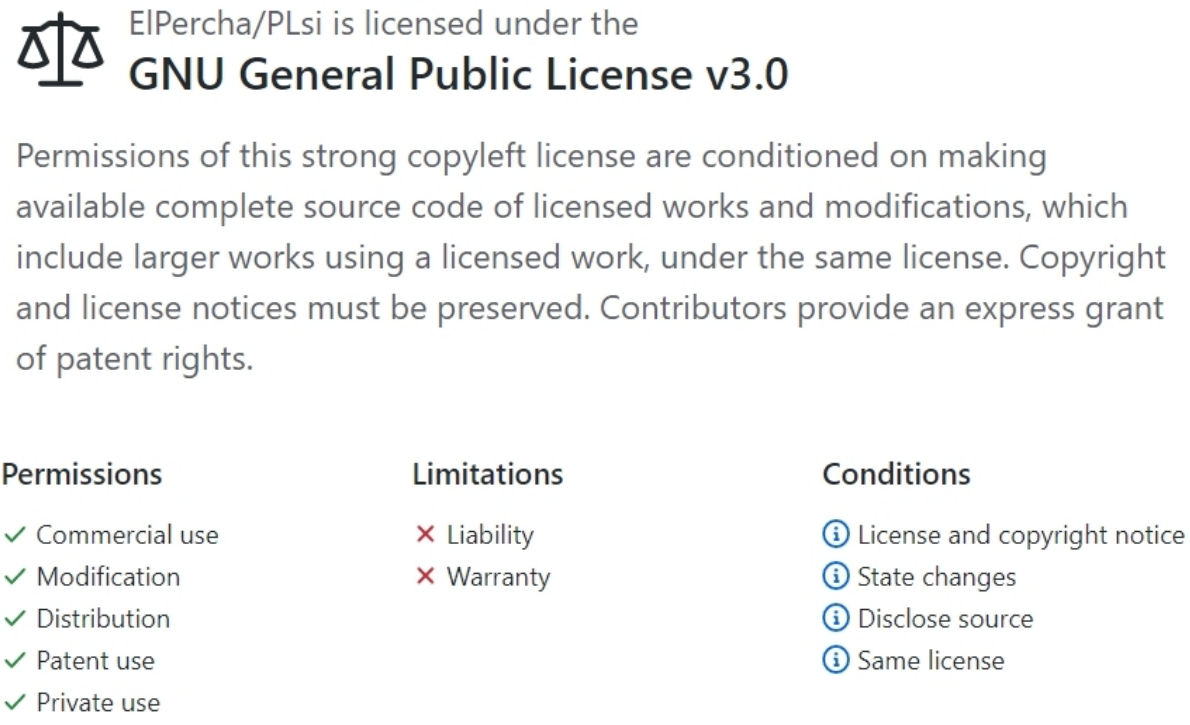
Revision history:

Revision	Date	Description
A	January 20, 2021	First Revision

License

The complete PLsi Project is under GPL v3.0 license.

This includes Hardware, Software, Documentation and all related contributions:



A full copy of the License is included on the Master branch of the project for reference:

https://github.com/ElPercha/PLsi/blob/master/LICENSE

Original copy with useful FAQ:

https://www.gnu.org/licenses/gpl-3.0.html

Disclaimer

THE PLsi PROJECT, INCLUDING HARDWARE, SOFTWARE, DOCUMENTATION AND ALL RELATED CONTRIBUTIONS, IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR HARDWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE OR HARDWARE.

Safety Guidelines

All applicable local and national codes that regulate the installation and operation of your equipment shall be followed in order to minimize the risk of potential safety issues.

PLsi is not fault-tolerant and must not be used to control equipment in hazardous environments where the failure of the system could lead to death, people injury, or severe environmental damage. Refers to the Disclaimer notice for more information.

This manual contains 3 levels of hints:

WARNING:
Death, serious harm to health or equipment damage can result if the stated measures are not followed !

CAUTION:
Harm to health or equipment damage can result if the stated measures are not followed

TIP:
Important information that requires your special attention

Table of Contents

1. Introduction

The hardware version 0 of PLsi system is designed to be cheap and easy to build. It does not have SMD components, what makes the building process easy, fast and feasible using basic tools. The components selection was oriented to use easy to get and cheap elements.

The PLsi v0 is mainly composed by:

- Main board
- ESP32 module
- TFT 2.8" SPI Display module with touchscreen
- Terminal blocks and common electronic components

Before to start, you have to select which version are you going to build, there are 2 main options:

1. All Digital Inputs and Outputs, it is:
    - 8 digital inputs
    - 6 relay outputs
2. Analog version which combines:
    - 6 digital inputs
    - 4 relay outputs
    - 2 Analog Inputs 0-10V
    - 2 Analog Outputs 0-5V

This definition will modify your component list. The details of which component is required on each version is covered on the following chapters.

1.1 Project documentation

The PLsi project is hosted on GitHub:

https://github.com/ElPercha/PLsi

The tree structure is divided in 3 main folders:

1. **doc**: Contains project documentation and auxiliary tools
2. **firm**: Contains the Firmware, it is designed using PlatformIO + Visual Studio
3. **hard**: Contains the Hardware documentation, mainly:
    - Circuit schematic
    - Component list
    - Board fabrication details
    - 3D Printed housing fabrication details

The most updated information is located on the master branch (link provided above), but it also might contain nightly builds of the firmware, hardware or any document. For this reason it is recommended to use the “releases”, they are a more trustworthy information source.

Each release contains a snapshot of the full project site by the moment of his creation, plus the required binaries to flash the ESP32 module.

By the time this document was created, only the “First Stable version” was available, indicated with the tag “v0.00.01” but it is recommended to use the latest available release to build your PLsi unit.

https://github.com/ElPercha/PLsi/releases

The details on how to use the binaries files are going to be covered in the next chapters.

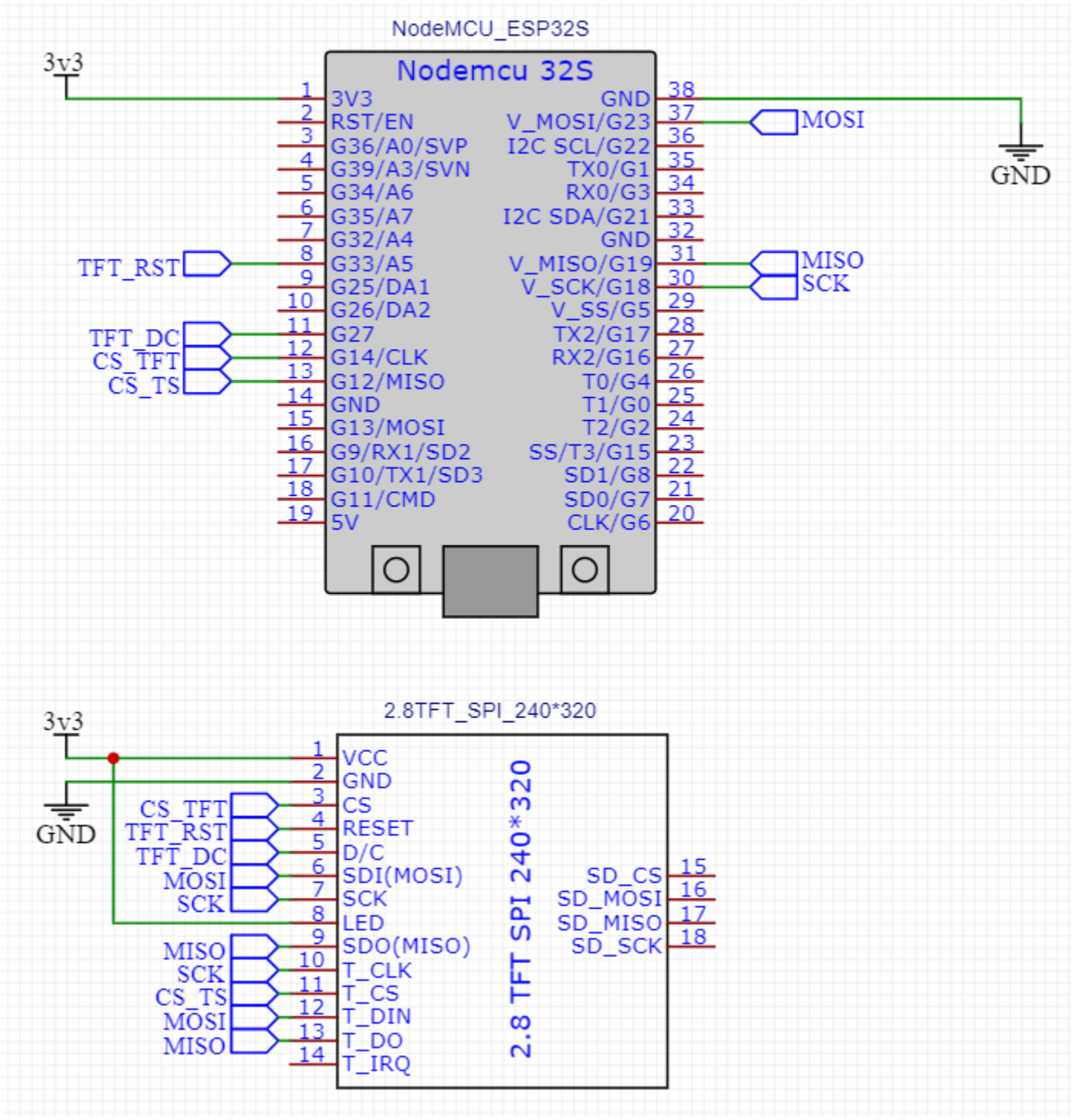
1.2 Minimum system

The easiest way to build a PLsi v0 is using the board designed for it, but for PLsi CPU testing purposes (with no Inputs Outputs) a limited system can be easily built.
It consist of:

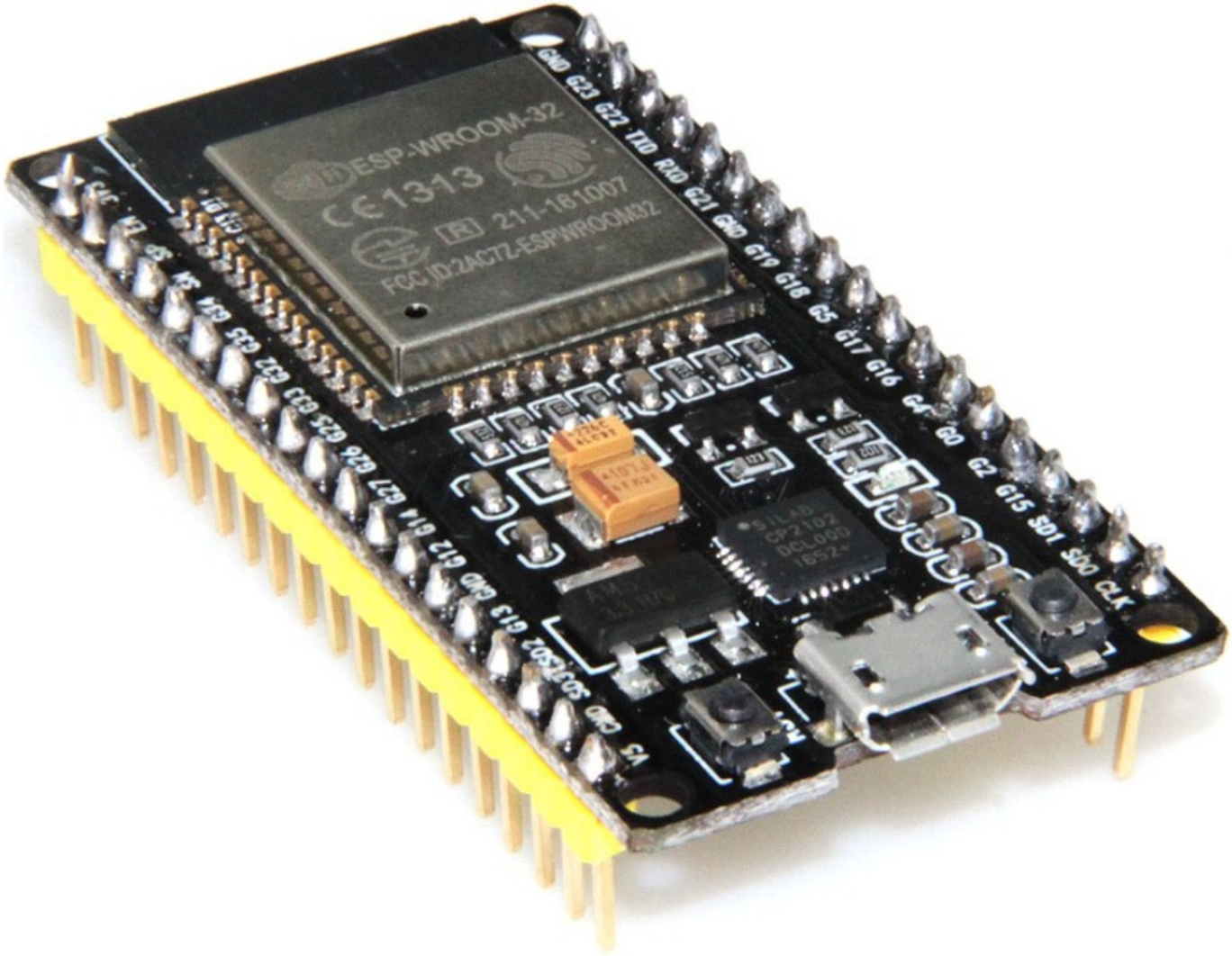
- ESP32 WROOM module
  - 38 pins version
  - They typically have yellow pin terminals
  - For test purposes you can use another ESP32 module as long as it has dual code, but the described model is required if you use the PLsi v0 board.
- 2.8" 320x240 SPI TFT Display – LcdWiki info
  - Driver ILI 9341
  - Touchscreen driver XPT2046
  - For test purposes you can use another display, as long as it has the same interface, resolution and drivers, but the described model is required if you use the PLsi v0 board.
- 9 Jumper cables for the ESP32 ← → Display connections.
- Micro USB cable and adapter with 1A capacity (recommended 2A)
  - This fed the ESP32 module and it is the main incoming supply voltage of the PLsi v0

The Firmware download procedure to ESP32 module will be the same and it is required. It is detailed in Firmware Download chapter.

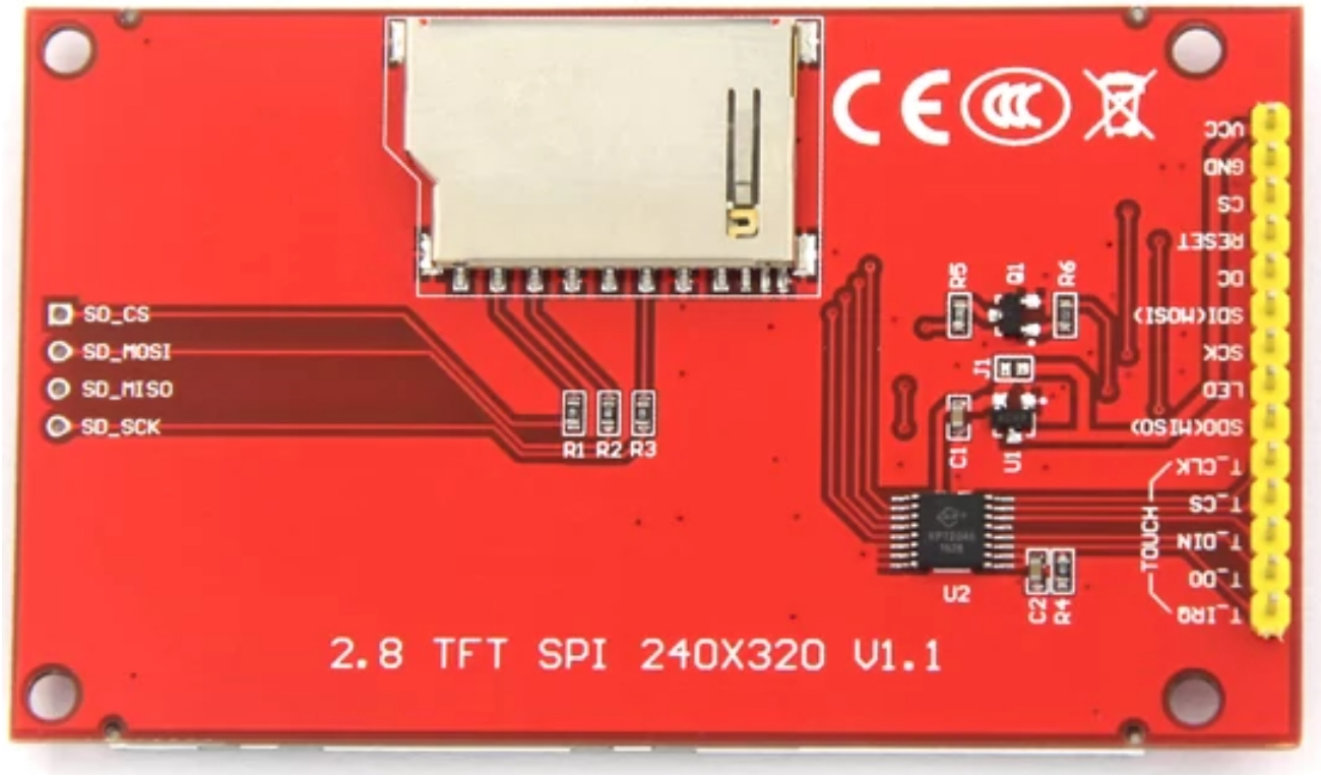
Required ESP32 ← → Display connections for minimal system:



Required ESP32 Module



Required display:



2. Board Assembly

The recommended way your PLsi is using the board designed for it.
All the required files to build the board are provided In the hard (hardware) folder:

- Gerber Files
- EasyEDA source
- Altium source (it is a beta export option of the EasyEDA platform, not tested)
- Drawings
- BOM

The EasyEDA project is also public and for this reason you can directly clone the project, download or open the files from here:

https://oshwlab.com/funnyautomation/PLsi_0

The Boards used to prototype the PLsi v0 were ordered to:

https://jlcpcb.com/

2.1 Board details (link and picture)

PLsi is not fault-tolerant and must not be used to control equipment in hazardous environments where the failure of the system could lead to death, people injury, or severe environmental damage. Refers to the Disclaimer notice for more information.

2.2 Digital version

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2.2.1 Component list

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2.2.2 Assembly

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2.3 Analog version

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2.3.1 Component list

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2.3.2 Assembly

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3. Hardware Validation

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3.1 Digital Inputs validation

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3.2 Digital Outputs validation

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3.3 Analog Inputs validation

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3.4 Analog Outputs validation

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4. Firmware Download

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4.1 Required files

PLsi is not fault-tolerant and must not be used to control equipment in hazardous environments where the failure of the system could lead to death, people injury, or severe environmental damage. Refers to the Disclaimer notice for more information.

4.2 Espressif download tool

PLsi is not fault-tolerant and must not be used to control equipment in hazardous environments where the failure of the system could lead to death, people injury, or severe environmental damage. Refers to the Disclaimer notice for more information.

4.3 Compile the source

PLsi is not fault-tolerant and must not be used to control equipment in hazardous environments where the failure of the system could lead to death, people injury, or severe environmental damage. Refers to the Disclaimer notice for more information.

4.3.1 PLsi customization

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