



PicsimLab_0_8_2

Luis Claudio Gambôa Lopes <lcgamboa@yahoo.com>

Download: [github](#)

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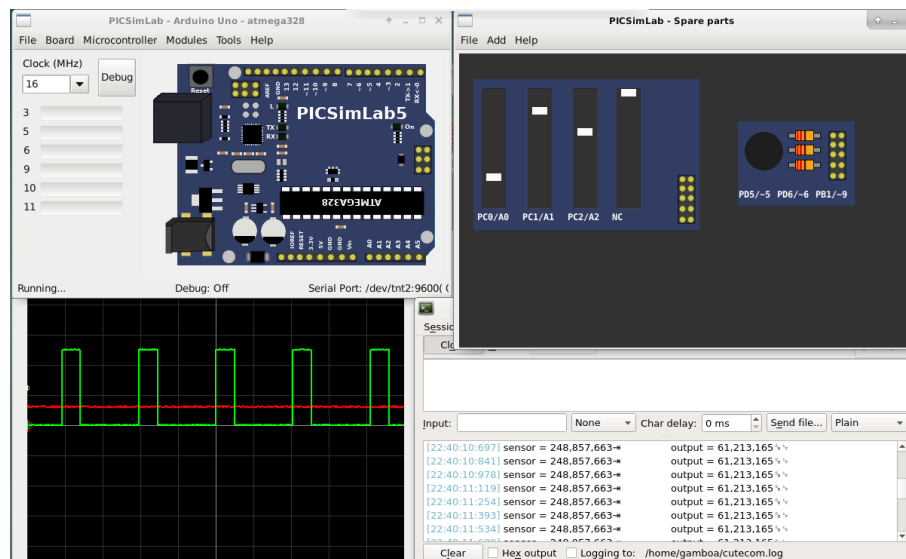
Chapter 1

Introduction

PICSimLab means PIC Simulator Laboratory

PICSimLab is a realtime emulator of development boards with integrated MPLABX/avr-gdb debugger. PICSimLab supports some [picsim](#) microcontrollers and some [simavr](#) microcontrollers. PICSimLab have integration with MPLABX/Arduino IDE for programming the boards microcontrollers.

The experimental version supports [uCsim](#), [gpsim](#) and [qemu-stm32](#) simulators in addition to the stable ones.



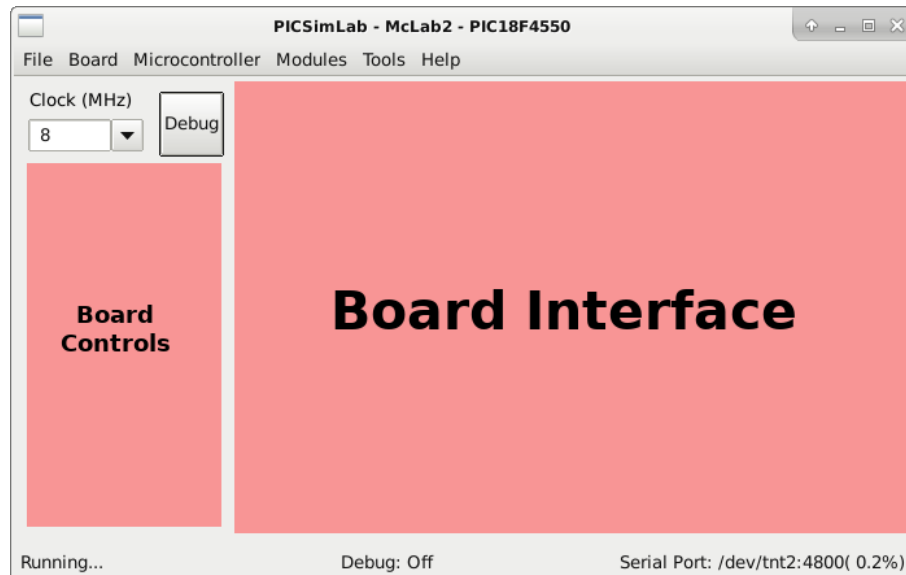
Chapter 2

Simulator Interface

2.1 Main Window

The main window consists of a menu, a status bar, a frequency selection combobox, an on/off button to trigger debugging, some board-specific controls and the part of the board interface itself.

In the title of the window is shown the name of the simulator PICSimLab, followed by the board and the microcontroller in use.



The frequency selection combobox directly changes the working speed of the microcontroller, when the “Clock (MHz)” label goes red indicates that the computer is not being able to run the program in real time for the selected clock. In this case

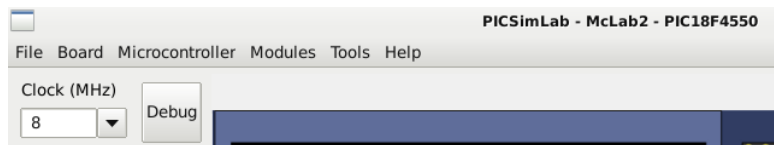
the simulation may present some difference than expected and the CPU load will be increased.

The on/off button to enable debugging is used to enable debugging support, with the active support there is a higher simulation load.

The menus and their functions are listed below:

- File
 - Load Hex - Load .hex files
 - Reload Last - Reload the last used .hex file
 - Save Hex - Save memory in a .hex file
 - Configure - Open the configuration windows
 - Save Workspace - Saves all current workspace settings to a .pzw file
 - Load Workspace - Loads saved settings from a .pzw file
 - Exit
- Board
 - Breadboard - Choose board Breadboard
 - McLab1 - Choose board McLab1
 - K16F - Choose board K16F
 - McLab2 - Choose board McLab2
 - PICGenios - Choose board PICGenios
 - Arduino Uno - Choose board Arduino Uno
- Microcontroller
 - xxxxx - Selects the microcontroller to be used (depends on the selected board)
- Modules
 - Oscilloscope - Open the oscilloscope window
 - Spare parts - Open the spare parts window
- Tools
 - Serial Terminal - Open the serial terminal [Cutecom](#)
 - Serial Remote Tank - Open the [remote tank simulator](#)
 - Esp8266 Modem Simulator - Open the [Esp8266 Modem Simulator](#)
 - Arduino bootloader - Load microcontroller with Arduino serial bootloader
- Help
 - Contents - Open the Help window

- Board - Open the Board Help window
- Examples - Load the examples
- About Board - Show message about author and version of board
- About PICSimLab - Show message about author and version of PICSimLab



The first part of the status bar shows the state of the simulation, in the middle part the status of the debug support and in the last part the name of the serial port used, its default speed and the error in relation to the real speed configured in the microcontroller.



2.2 Interaction with the Board

On the interface area of the board it is possible to interact in some ways:

- Click in ICSP connector to load an .hex file.
- Click in PWR button to ON/OFF the emulator..
- The buttons can be activated through mouse or keys 1, 2, 3 e 4.

2.3 Command Line

PICSimLab supports two command lines format:

One for load a PICSimLab Workspace file (.pzw)

```
picsimlab file.pzw
```

And Other for load .hex files

```
picsimlab boardname microcontroller [file.hex] [file.pcf]
```

Chapter 3

Boards

PICSimLab currently supports five backend simulators. The stable version supports [picsim](#) and [simavr](#). The experimental version supports [uCsim](#), [gpsim](#) and [qemu-stm32](#) in addition to the stable ones.

The Figure [3.1](#) shows which cards are based on which backend simulator:

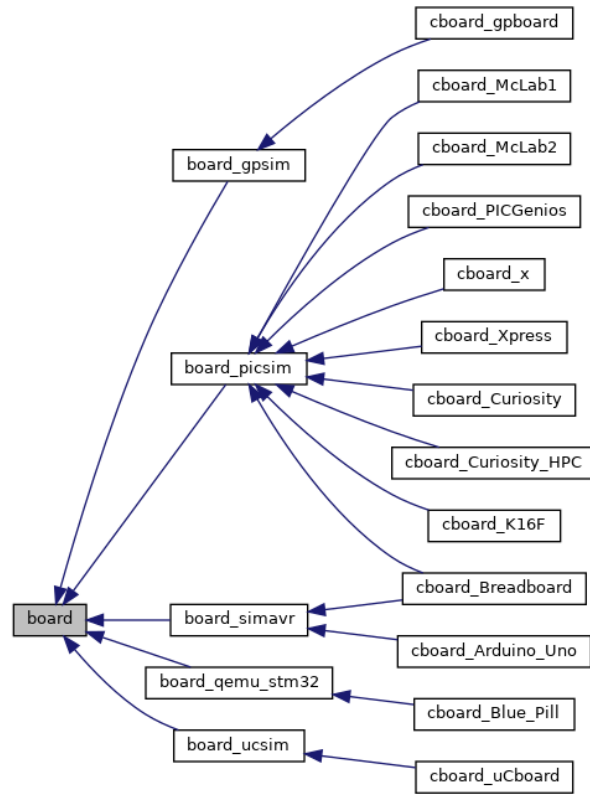


Figure 3.1: Boards backend simulators

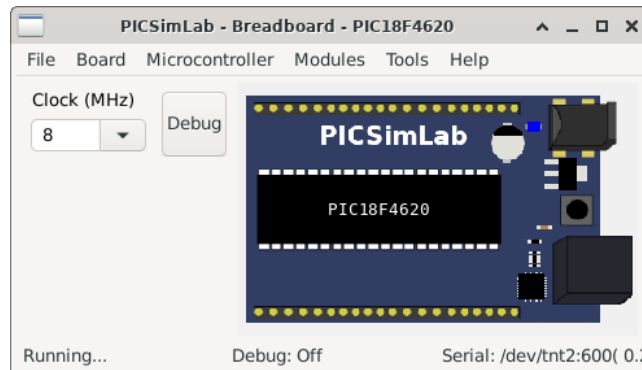
The below table show the supported debug interface of each simulator:

Backend	Debug Support
picsim	MPLABX Integrated Debug (see section 6.1)
simavr	MPLABX Integrated Debug (see section 6.1) and remote avr-gdb (see section 6.3)
qemu-stm32	remote arm-gdb (see Chapter 6.4)
uCsim	uCsim remote console (telnet) (see section 6.5)
gpsim	none yet

3.1 Features of Board Breadboard

TODO

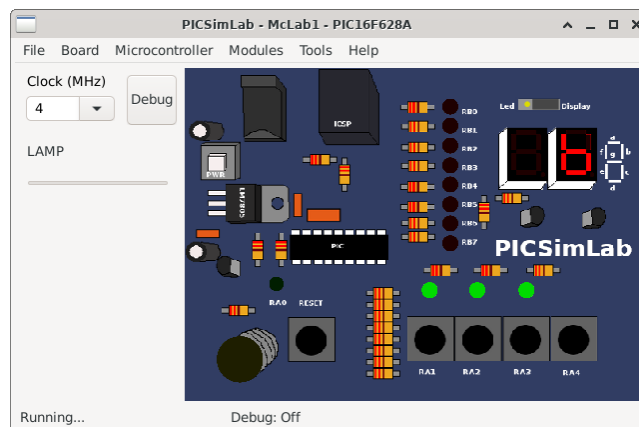
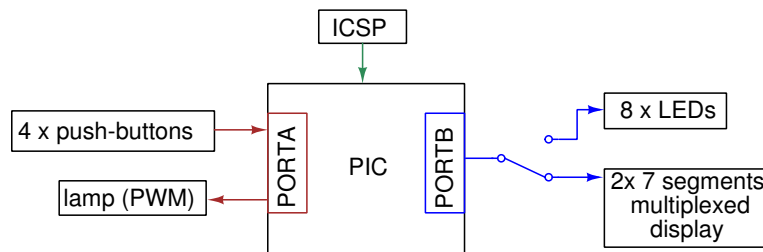
It is a generic board only with reset, serial and crystal circuits and support to multiple microcontrollers of [picsim](#) and [simavr](#).



Examples

3.2 Features of Board McLab1

It emulates the Labtools development board McLab1 that uses one PIC16F84, PIC16F628 or PIC16F648 of [picsim](#).



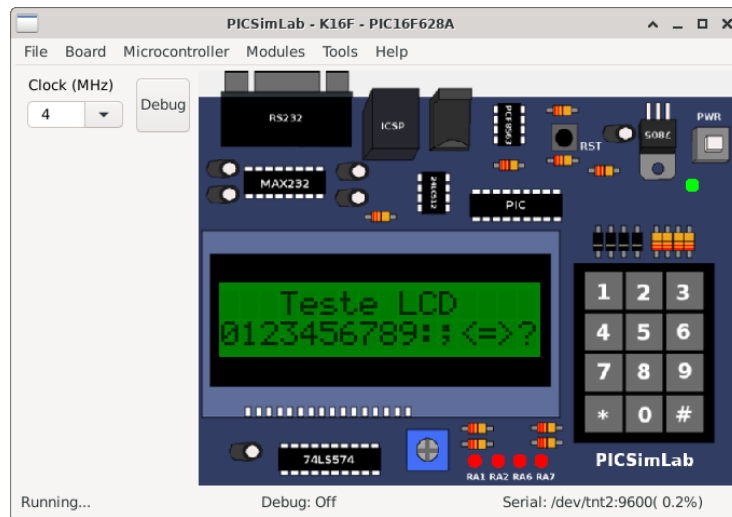
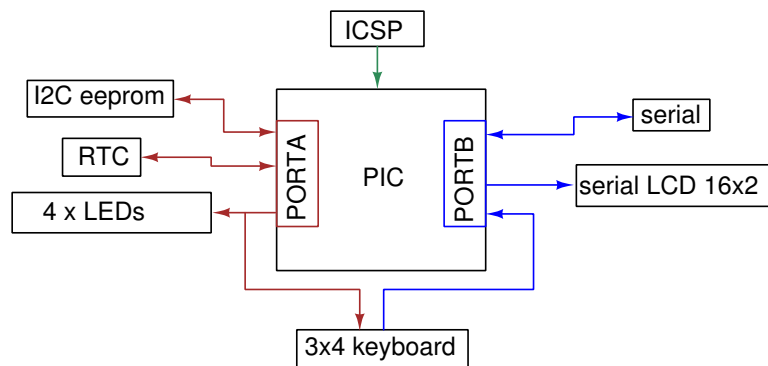
[Board McLab1 schematics](#).

The code examples can be loaded in PICSIMLab menu **Help->Examples**.

The source code of board McLab1 examples using **MPLABX** and **XC8** compiler are in the link: [board_McLab1](#).

3.3 Features of Board K16F

It emulates an didactic board developed by author that uses one PIC16F84, PIC16F628 or PIC16F648 of [picsim](#).



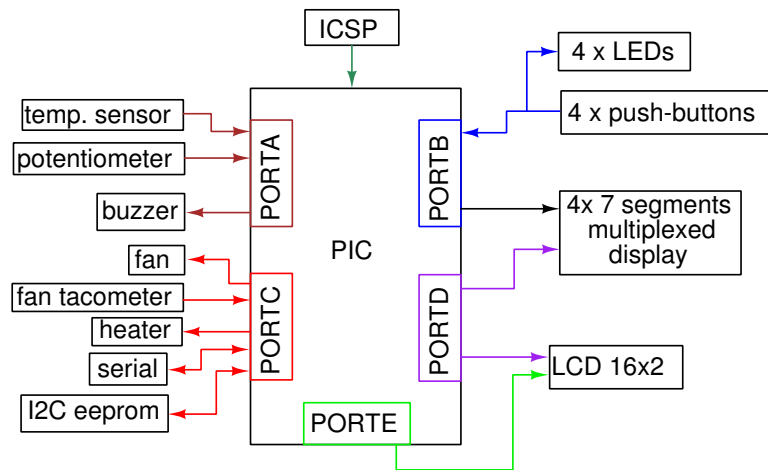
[Board K16F schematics.](#)

The code examples can be loaded in PICSIMLab menu **Help->Examples**.

The source code of board K16F examples using **MPLABX** and **XC8** compiler are in the link: [board_K16F](#).

3.4 Features of Board McLab2

It emulates the Labtools development board McLab2 that uses one PIC16F777, PIC16F877A, PIC18F452, PIC18F4520, PIC18F4550 or PIC18F4620 of [picsim](#).



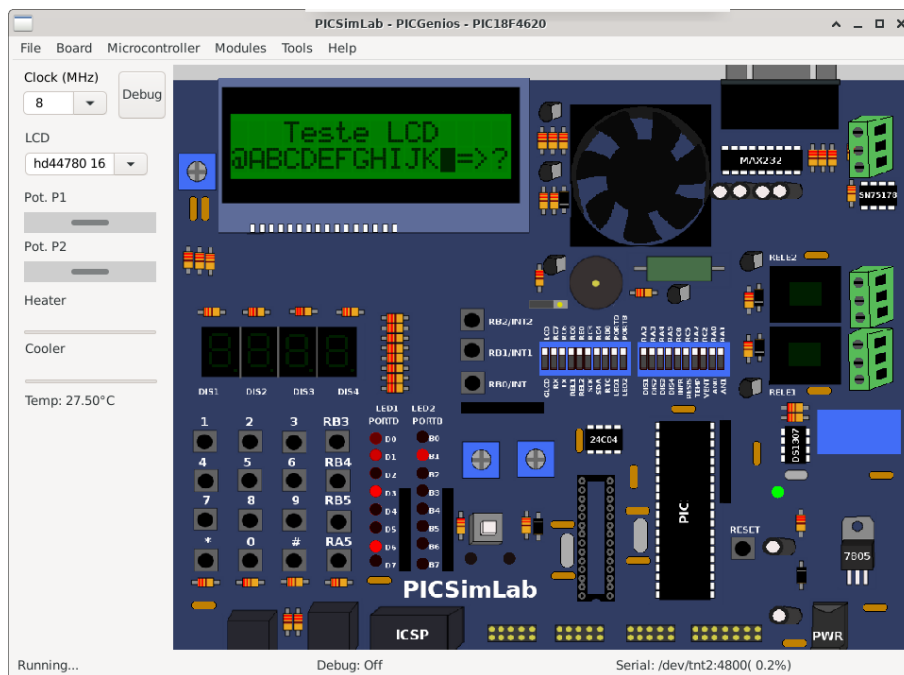
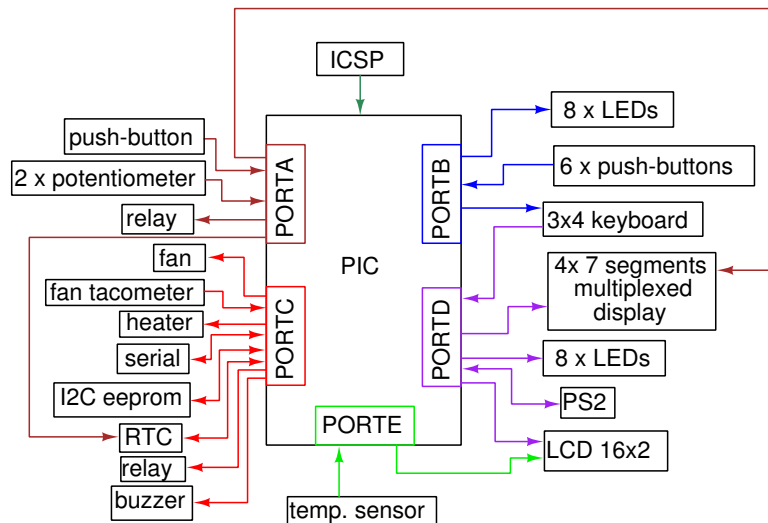
[Board McLab2 schematics.](#)

The code examples can be loaded in PICSIMLab menu **Help->Examples**.

The source code of board McLab2 examples using [MPLABX](#) and [XC8](#) compiler are in the link: [board_McLab2](#).

3.5 Features of Board PICGenios

It emulates the microgenius development board PICGenios PIC18F e PIC16F Microchip that uses one PIC16F777, PIC16F877A, PIC18F452, PIC18F4520, PIC18F4550 or PIC18F4620 of [picsim](#).



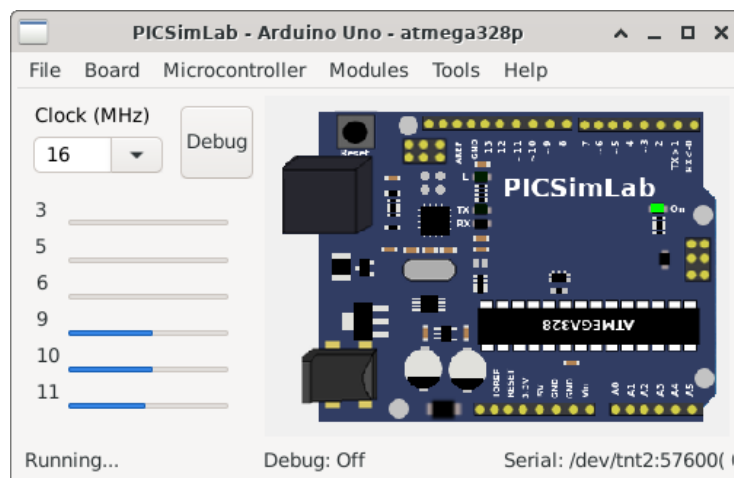
[Board PICGenios schematics.](#)

The code examples can be loaded in PICSimLab menu **Help->Examples**.

The source code of board PICGenios examples using [MPLABX](#) and [XC8](#) compiler are in the link: [board_PICGenios](#).

3.6 Features of Board Arduino Uno

It emulates the Arduino Uno development board that uses one ATMEGA328P microcontroller of [simavr](#).



[Board Arduino Uno schematics.](#)

The code examples can be loaded in PICSimLab menu **Help->Examples**.

The source code of board Arduino Uno examples using the [Arduino IDE with avr-gcc](#) are in the link: [board_Arduino_Uno](#).

More information about the Arduino in www.arduino.cc

Chapter 4

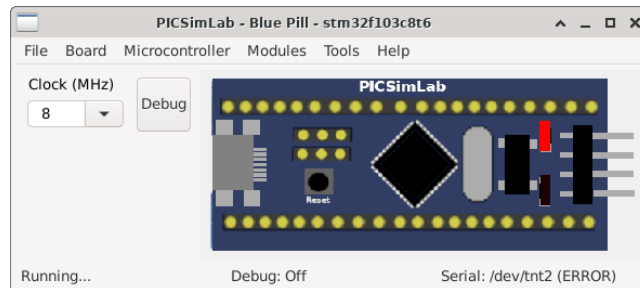
Experimental Boards

Boards in the experimental phase. Probably with some bugs and missing features.

4.1 Features of Board Blue Pill

TODO

It is a generic board only with reset, serial and crystal circuits and support to stm32f103c8t6 microcontroller of [qemu-stm32](#).

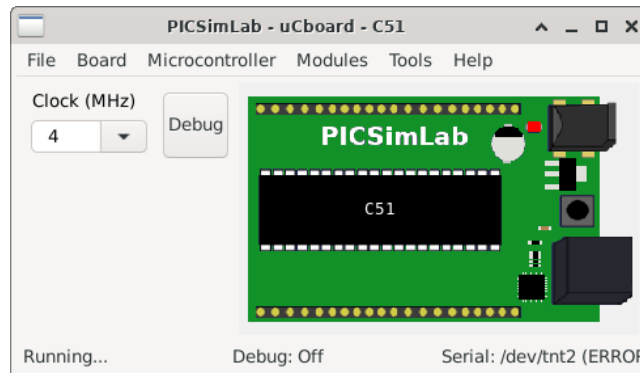


[Examples](#)

4.2 Features of Board uCboard

TODO

It is a generic board only with reset, serial and crystal circuits and support to multiple microcontrollers (initially C51, Z80 and STM8S103)of [uCsim](#).

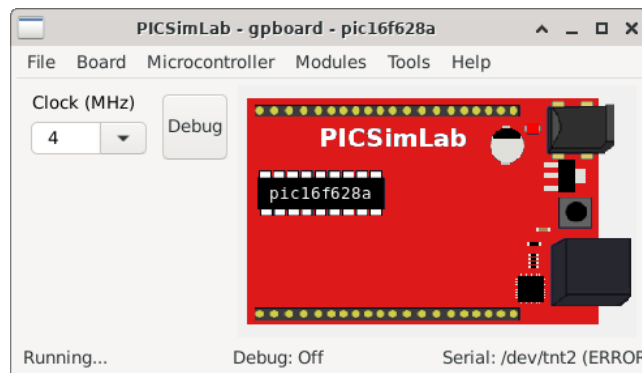


[Examples](#)

4.3 Features of Board gpboard

TODO

It is a generic board only with reset, serial and crystal circuits and support to multiple microcontrollers of [gpsim](#).

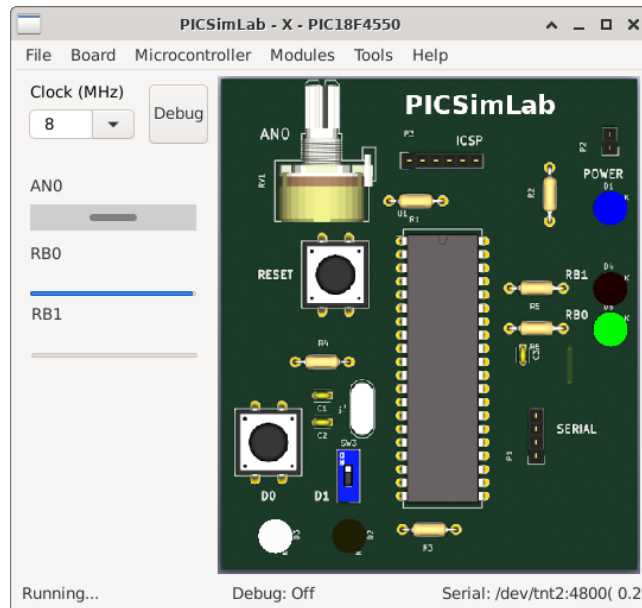


[Examples](#)

4.4 Features of Board X

TODO

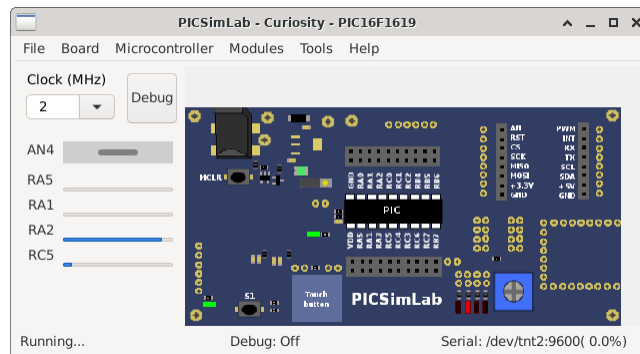
It is a generic board, used as example in [How to Compile PICsimLab and Create New Boards](#).



Examples

4.5 Features of Board Curiosity

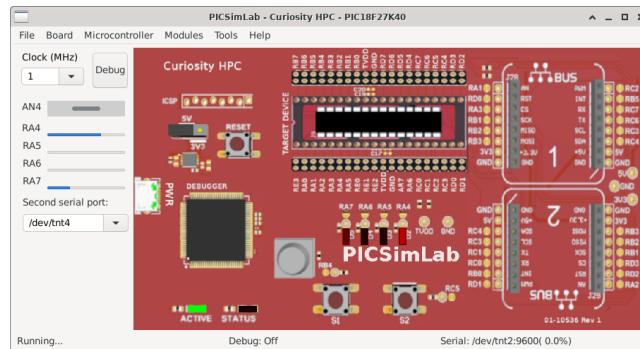
TODO



Examples

4.6 Features of Board Curiosity HPC

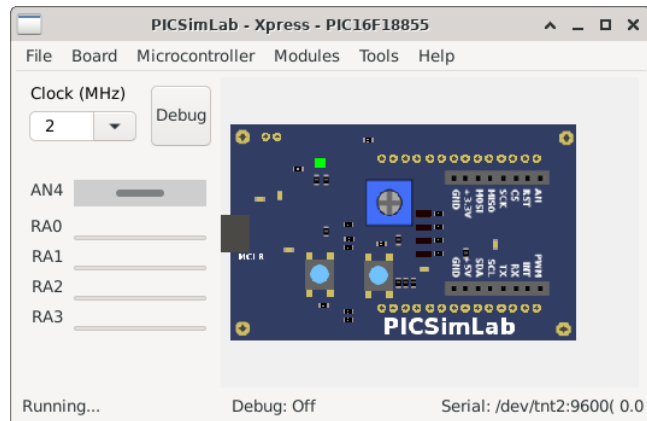
TODO



Examples

4.7 Features of Board Xpress

TODO



Examples

Chapter 5

Serial Communication

To use the simulator serial port, install a NULL-MODEM emulator:

- Windows: com0com <http://sourceforge.net/projects/com0com/>
- Linux: tty0tty <https://github.com/lcgamboa/tty0tty>

For communication the PICSimLab should be connected in one port of the NULL-MODEM emulator and the other application connected in the other port. Configuration examples linking PICSimLab to [Cutecom](#) for serial communication:

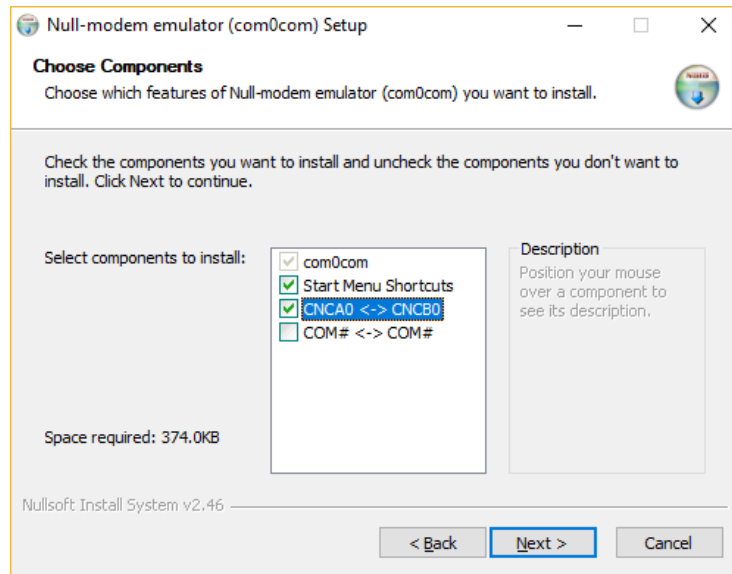
OS	PicsimLab port	Cutecom port	NULL-Modem prog.	Connection
Windows	com1	com2	com0com	com1<=>com2
Linux	/dev/tnt2	/dev/tnt3	tty0tty	/dev/tnt2<=>/dev/tnt3

5.1 Com0com Installation and Configuration(Windows)

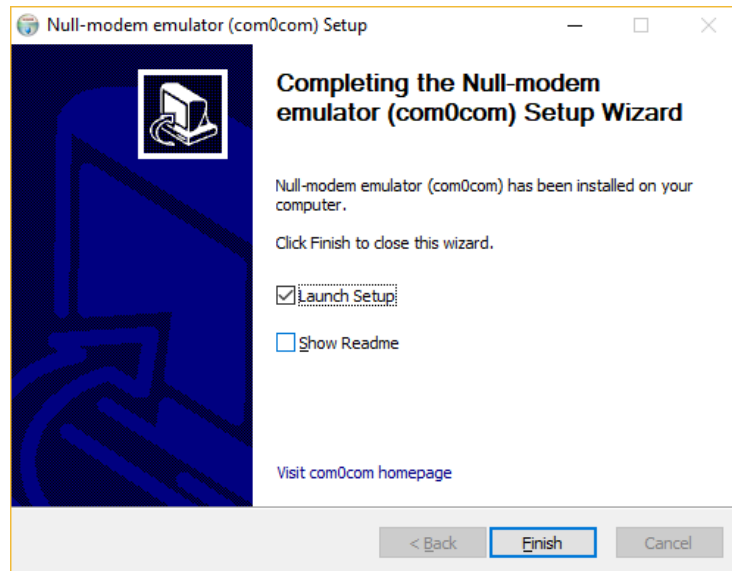
Download the signed version of [com0com](#).

Unzip the downloaded .zip file and run the specific installer of your operating system, x86 for windows 32-bit or x64 for windows 64-bit.

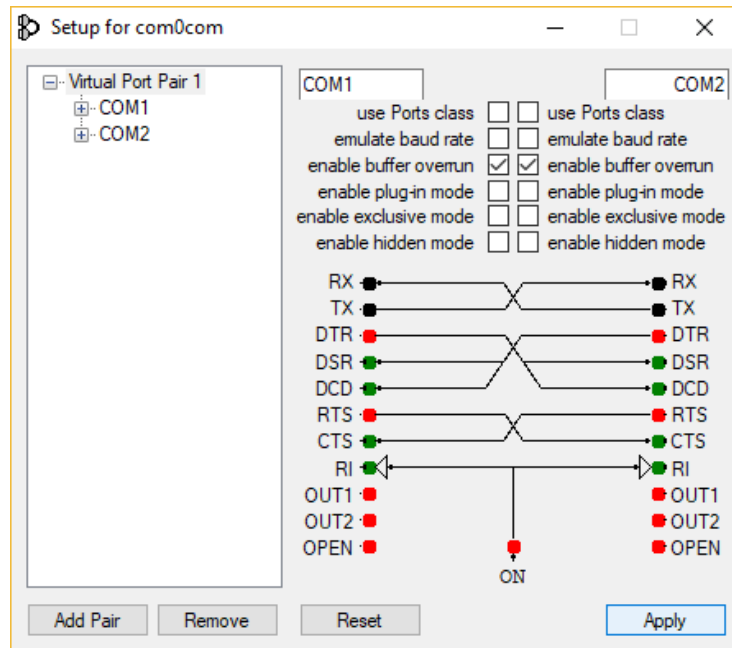
Configure the “choose components” window as the figure below:



In the last configuration window, check the “Launch setup” option:



In the setup window, change the port names to COM1, COM2, COM3 Just check the “enable buffer overrun” option on the two ports, click in the “Apply” button and close the setup. In the configuration shown in the figure below, the COM1 and COM2 ports form a NULL-MODEM connection, where one port must be used by the PICSimLab and another by the application with serial communication.



5.2 tty0tty Installation and Configuration (Linux)

Download the [href https://github.com/lcgamboa/tty0tty/archive/master.zip](https://github.com/lcgamboa/tty0tty/archive/master.zip) tty0tty. Unzip the downloaded folder.

Open a terminal and enter in the tty0tty/module/ folder and enter the following commands:

```
sudo apt-get update
sudo apt-get -y upgrade
sudo apt-get -y install gcc make linux-headers-`uname -r`
make
sudo make install
```

The user must be in the **dialout** group to access the ports. To add your user to **dialout** group use the command:

```
sudo usermod -a -G dialout your_user_name
```

after this is necessary logout and login to group permissions take effect.

Once installed, the module creates 8 interconnected ports as follows:

```
/dev/tnt0 <=> /dev/tnt1
/dev/tnt2 <=> /dev/tnt3
/dev/tnt4 <=> /dev/tnt5
/dev/tnt6 <=> /dev/tnt7
```

the connection between each pair is of the form:

```
TX    ->  RX
RX    <-   TX
RTS   ->  CTS
CTS   <-   RTS
DSR   <-   DTR
CD    <-   DTR
DTR   ->  DSR
DTR   ->  CD
```

Any pair of ports form a NULL-MODEM connection, where one port must be used by the PICSimLab and another by the application with serial communication.

Chapter 6

Programmer and Debugger Support

The type of debug interface depends on the backend simulator utilized.

6.1 MPLABX Integrated Debug (picsim and simavr)

To use the [MPLABX](#) IDE for debug and program the PicsimLab, install the plugin [com-picsim-picsimlab.nbm](#) in MPLABX.

The plugin connect to Picsimlab through a TCP socket using port 1234 (or other defined in configuration window), and you have to allow the access in the firewall.

[Tutorial: how to use MPLABX to program and debug PICsimLab.](#)

It's possible import and debug a Arduino sketch into MPLABX using the [Arduino import plugin](#).

6.2 Arduino IDE Integration (simavr)

For integrated use with the Arduino IDE, simply configure the serial port as explained in the section [5](#) and load the Arduino bootloader. The bootloader can be loaded from the “Tools->Arduino bootloader” menu.

In Windows, considering com0com making a NULL-MODEM connection between COM1 and COM2, simply connect the PICSimLab on the COM1 port (defined in configuration window) and the Arduino IDE on the COM2 port or vice versa.

On Linux the operation is the same, but using for example the ports /dev/tnt2 and /dev/tnt3.

In Linux for the virtual ports to be detected in Arduino it is necessary to replace the library lib/liblistSerials.jso of the Arduino with a version which support the detection of ttyOtty ports, that can be downloaded in the link [listSerialC with ttyOtty support](#).

6.3 avr-gdb Debug (simavr)

With debug support enabled you can use avr-gdb to debug the code used in the simulator. Use the configuration window to choose between MDB (MPLABX) or GDB to debug AVR microcontrollers.

Use avr-gdb with the .elf file as the parameter:

```
avr-gdb compiled_file.elf
```

and the command below to connect (1234 is the default port):

```
target remote localhost:1234
```

Graphic debug mode can be made using [eclipse IDE](#) with [Sloeber Arduino plugin](#).

6.4 arm-gdb Debug (qemu-stm32)

With debug support enabled you can use arm-none-eabi-gdb (or gdb-multiarch) to debug the code used in the simulator.

Use arm-none-eabi-gdb with the .elf file as the parameter:

```
arm-none-eabi-gdb compiled_file.elf
```

and the command below to connect (1234 is the default port):

```
target remote localhost:1234
```

Graphic debug mode can be made using [eclipse IDE](#) with [Eclipse Embedded CDT](#).

6.5 uCsim Debug

The uCsim debug console can be accessed with the telnet (1234 is the default port):

```
telnet localhost 1234
```

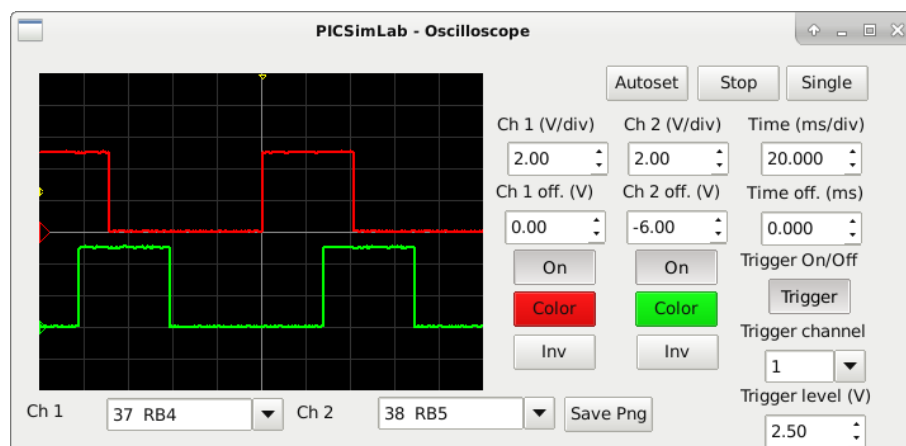
All [uCsim commands](#) are supported.

For windows users [putty telnet client](#) is a good option to access the uCsim console.

Chapter 7

Oscilloscope

The PICSimLab has a basic two-channel oscilloscope that can be used to view the signal on any pin of the microcontroller. The oscilloscope can be accessed through the “Modules->Oscilloscope” menu.



Chapter 8

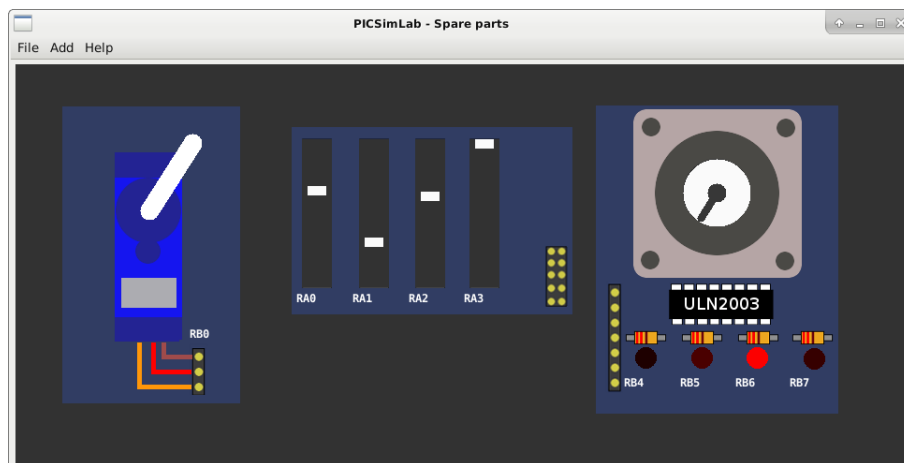
Spare Parts

The PICSimLab has a window that allows the connection of spare parts to the micro-controller, it can be accessed through the menu “ Modules-> Spare parts ”.

The main window has the menu with the following functions:

- File
 - New configuration - Clear the spare parts window
 - Save configuration - Saves the current settings of the spare parts to an .pcf file
 - Load configuration - Loads the settings of an .pcf file
- Add
 - 7 Segments Display - **TODO**
 - Buzzer - **TODO**
 - D. Transfer Function - **TODO**
 - Gamepad - Adds a gamepad
 - IO 74xx595 - **TODO**
 - IO MCP23S17 - **TODO**
 - IO PCF8574 - **TODO**
 - Keypad - **TODO**
 - LCD hd44780 - Adds a text display hd44780
 - LCD pcf8833 - Adds a color graphic display pcf8833
 - LCD pcd8544 - Adds a monochrome graphic display pcd8544
 - LED Matrix - **TODO**
 - LEDs - Adds 8 red LEDs
 - MEM 24CXXX - **TODO**

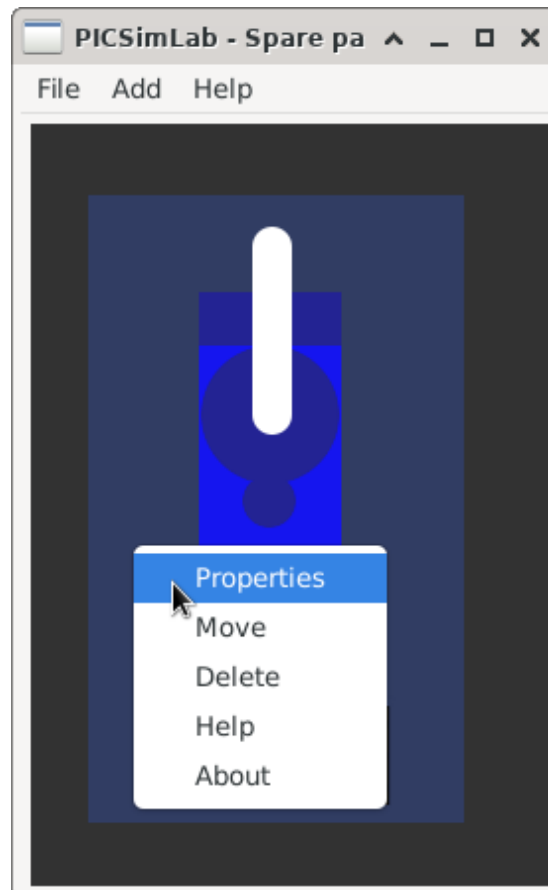
- Potentiometers - Adds 4 potentiometers
- Push Buttons - Adds 8 push buttons
- Push Buttons (Analogic) - **TODO**
- RGB LED - Adds 1 RGB LED
- RTC ds1307 - **TODO**
- RTC pfc8563 - **TODO**
- Servo Motor - Adds a servo motor
- Signal Generator - **TODO**
- Step Motor - Adds a step motor
- Switchs - Adds 8 switchs
- Temperature System - **TODO**
- VCD Dump - **TODO**
- VCD Dump (Analogic) - **TODO**
- Help
 - Contents - Open Help window
 - About - Show message about author and version



After adding the part, with a right click of the mouse you can access the options menu of the part with the options:

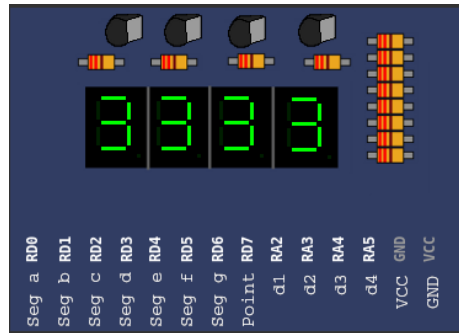
- Properties - Opens the connection settings window
- Move - Unlocks the part to move
- Delete - Remove part

- Help - Open Help window of part
- About - Show message about author and version of part



8.1 7 Segments Display

TODO



Examples

8.2 Buzzer

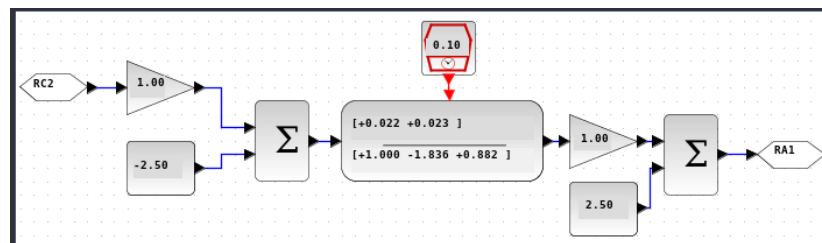
TODO



Examples

8.3 D. Transfer Function

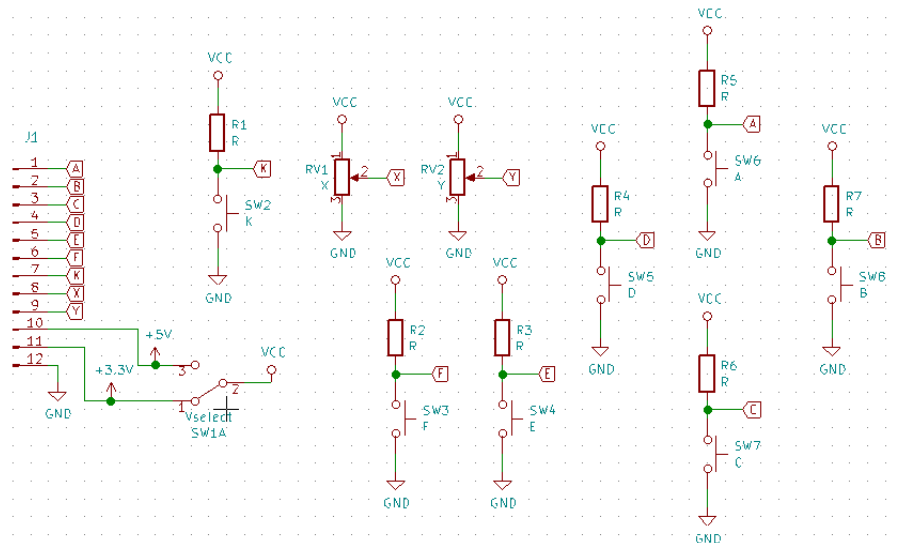
TODO



Examples

8.4 Gamepad

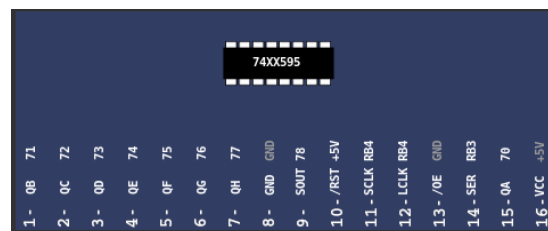
This part is a gamepad with two analog axis and 7 push buttons.



Examples

8.5 IO 74xx595

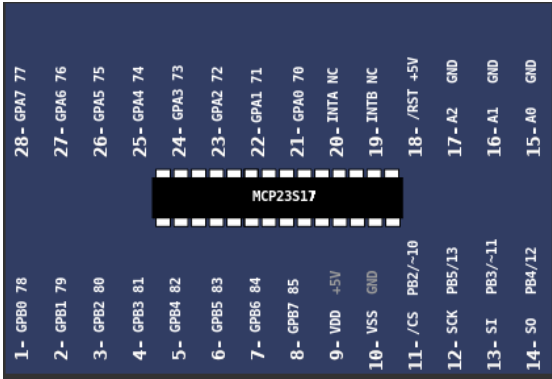
TODO



Examples

8.6 IO MCP23S17

TODO



Examples

8.7 IO PCF8574

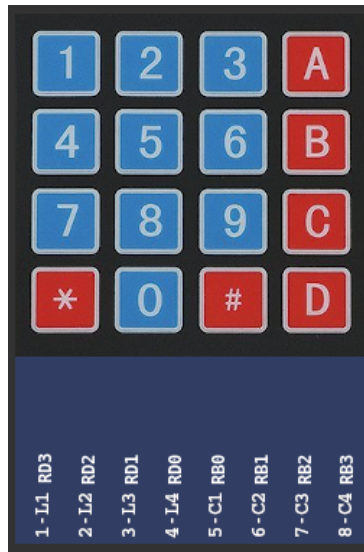
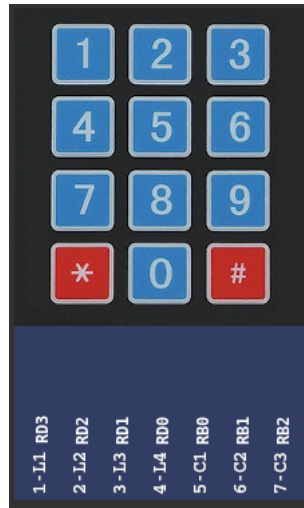
TODO

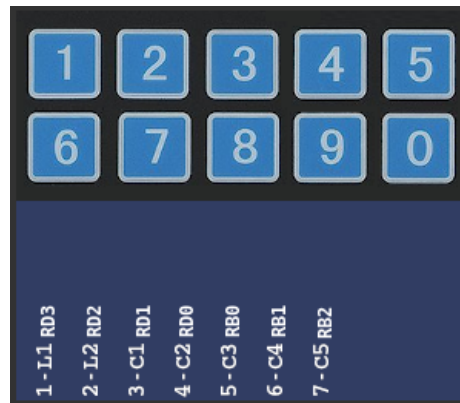


Examples

8.8 Keypad

TODO

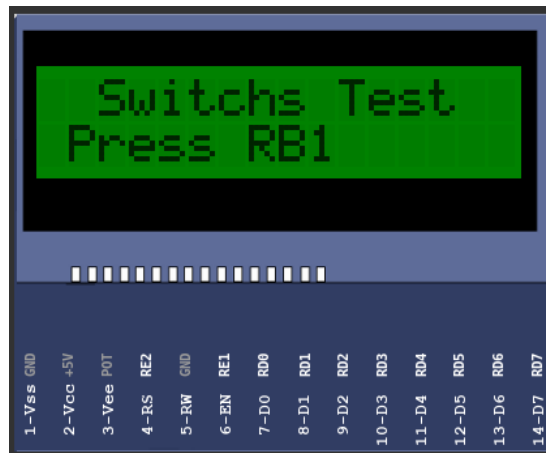




Examples

8.9 LCD hd44780

This part is a text display with 2 (or 4) lines by 16 (or 20) columns.



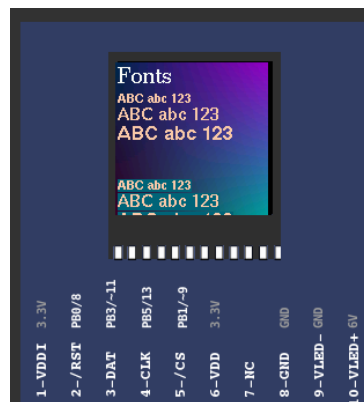




Examples

8.10 LCD pcf8833

This part is a color graphic display with 132x132 pixels.



Examples

8.11 LCD pcd8544

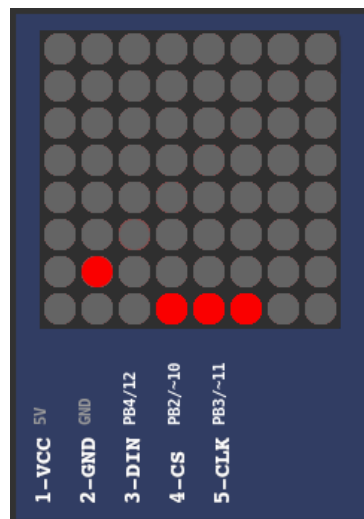
This part is a monochrome graphic display with 48x84 pixels.



Examples

8.12 LED Matrix

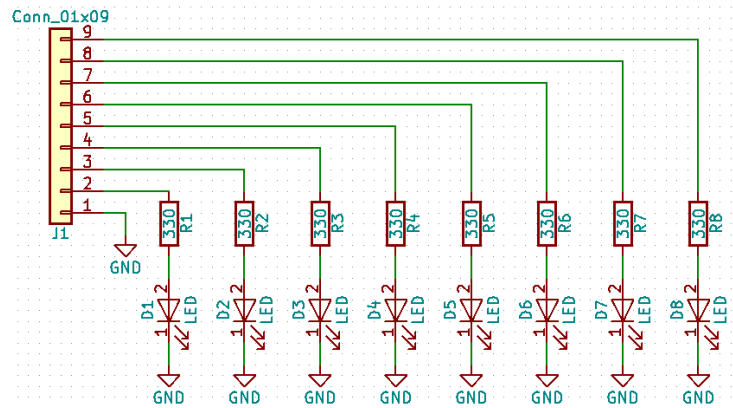
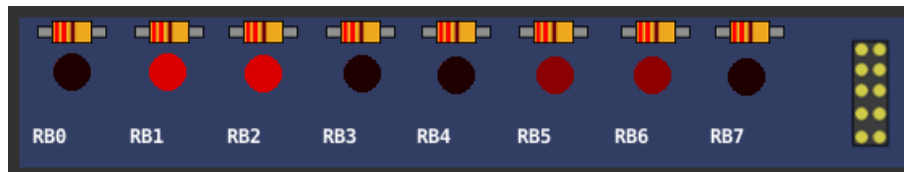
TODO



Examples

8.13 LEDs

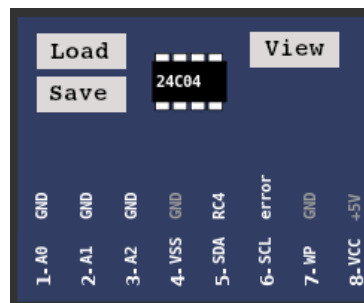
This part is a bar of 8 independent red LEDs.



Examples

8.14 MEM 24CXXX

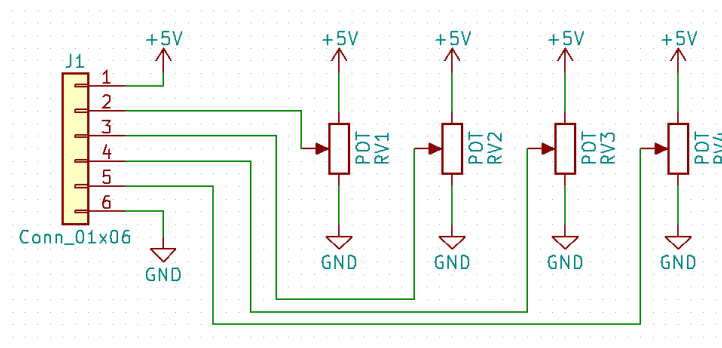
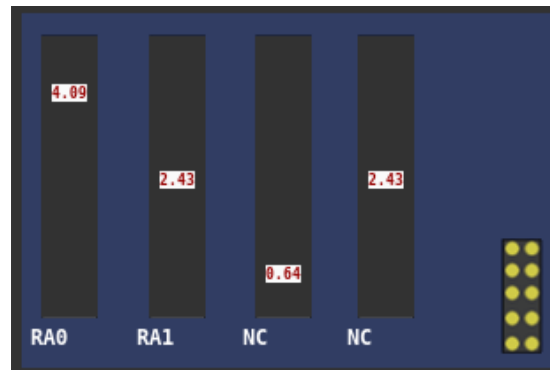
TODO



Examples

8.15 Potentiometers

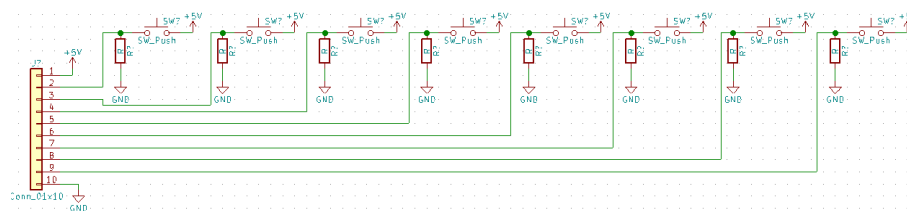
This part is formed by 4 potentiometers connected between 0 and 5 volts, the output is connected to the cursor and varies within this voltage range.



Examples

8.16 Push Buttons

This part consists of 8 push buttons. When pressed the output goes to logic level “1”.



Examples

8.17 Push Buttons (Analogic)

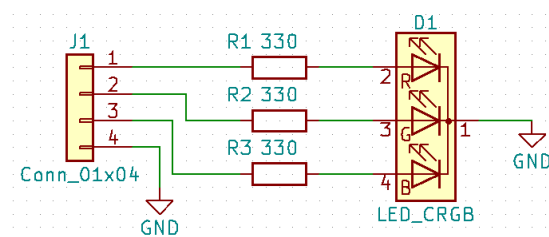
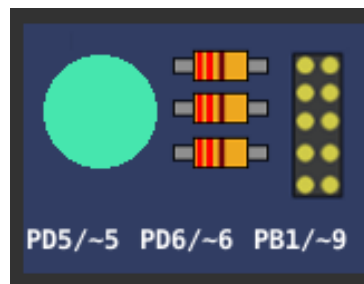
TODO



Examples

8.18 RGB LED

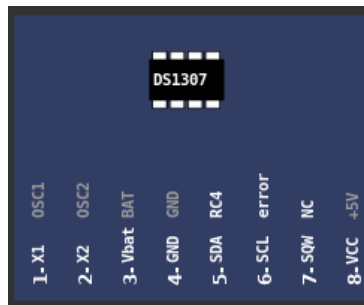
This part consists of a 4-pin RGB LED. Each color can be triggered independently. Using PWM it is possible to generate several colors by combining the 3 primary colors.



Examples

8.19 RTC ds1307

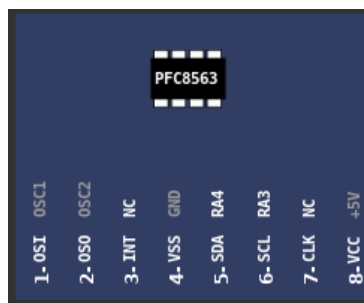
TODO



Examples

8.20 RTC pfc8563

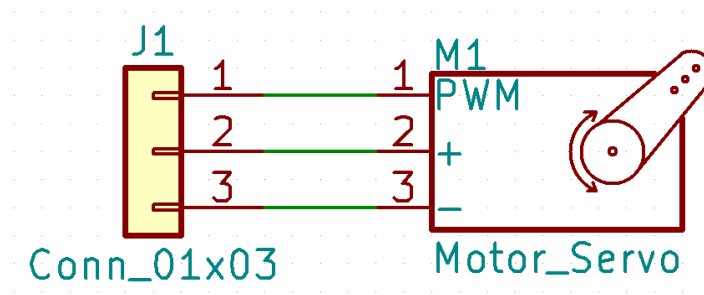
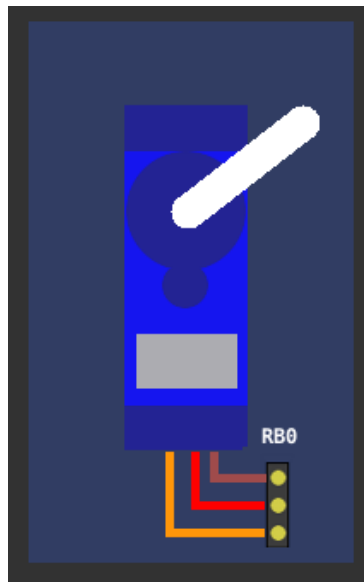
TODO



Examples

8.21 Servo Motor

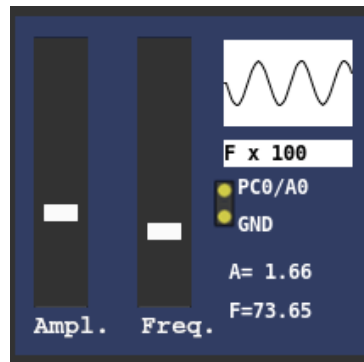
The servo motor is a component that must be activated with a pulse of variable width from 1ms to 2ms every 20 ms. A pulse of 1ms positions the servo at -90° , one from 1.5ms to 0° and one from 2ms to 90° .



Examples

8.22 Signal Generator

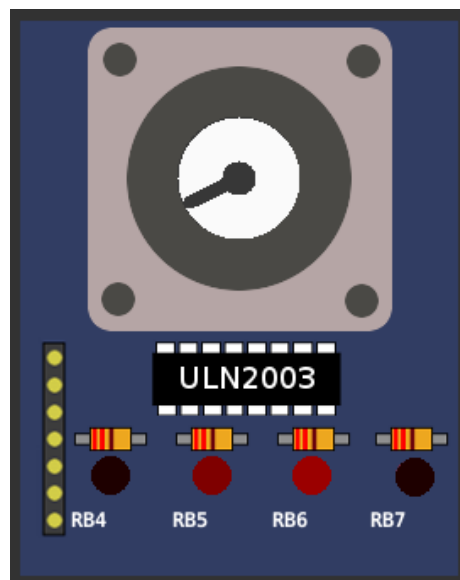
TODO

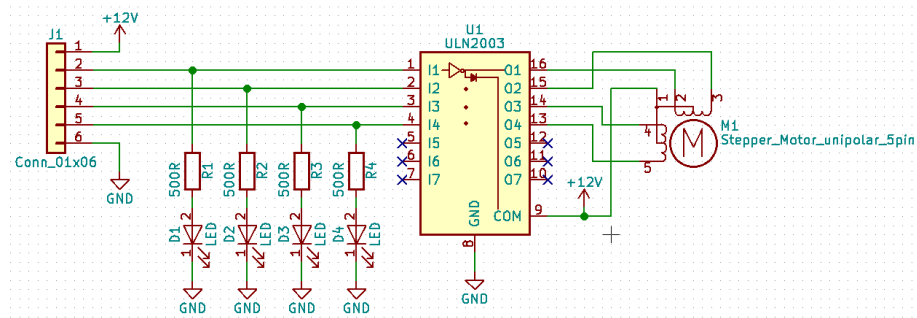


Examples

8.23 Step Motor

The stepper motor is a component with 4 coils that must be driven in the correct order to rotate the rotor. Each step of the motor is 1.8° .

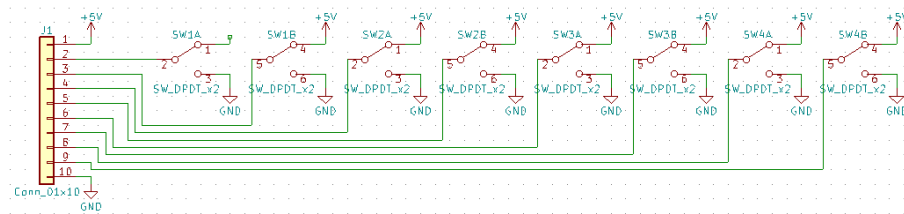




Examples

8.24 Switchs

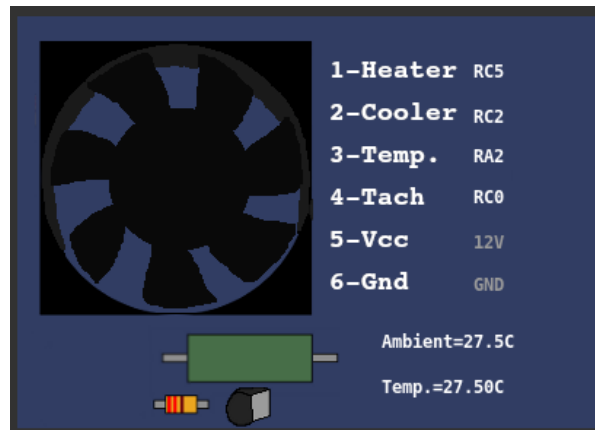
This part consists of 8 keys with on or off position (0 or 1).



Examples

8.25 Temperature System

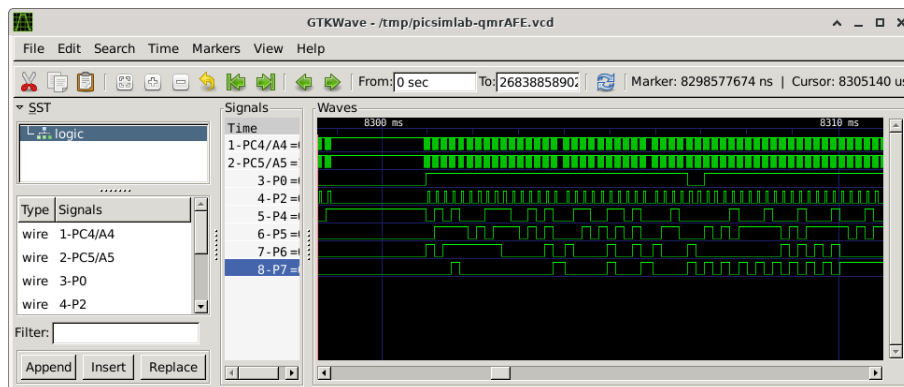
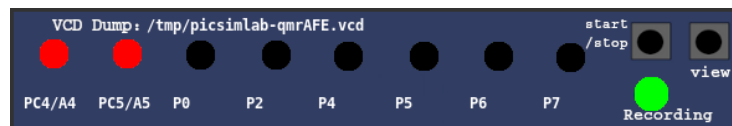
TODO



Examples

8.26 VCD dump

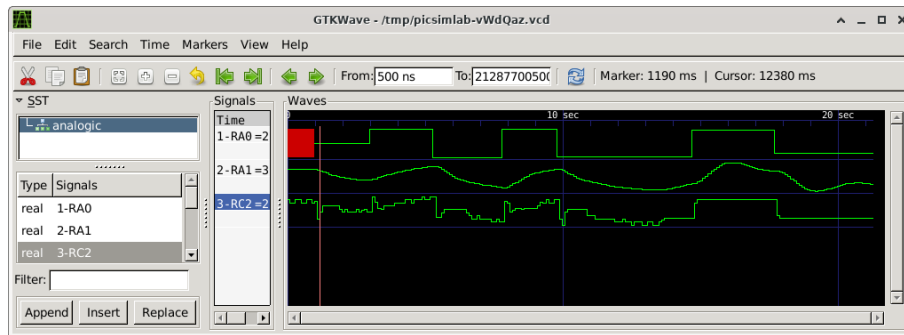
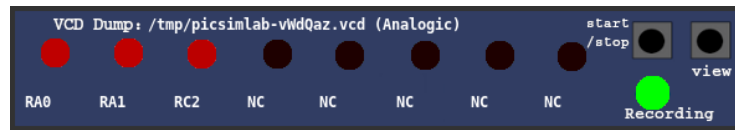
TODO



Examples

8.27 VCD dump (Analogic)

TODO



Examples

Chapter 9

How To's

- [How to use MPLABX to program and debug PICsimLab.](#)
- [How to Compile PICsimLab and Create New Boards.](#)

Chapter 10

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