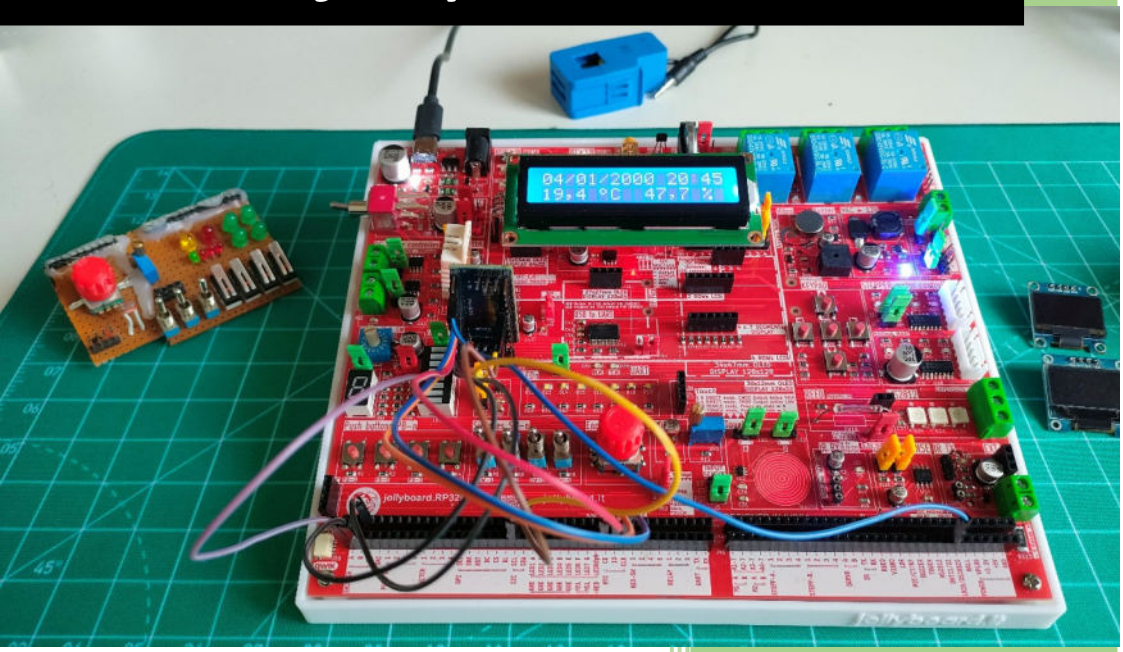
User manual

2026

jollyboard.RP328



Version 0.4

13/03/2026

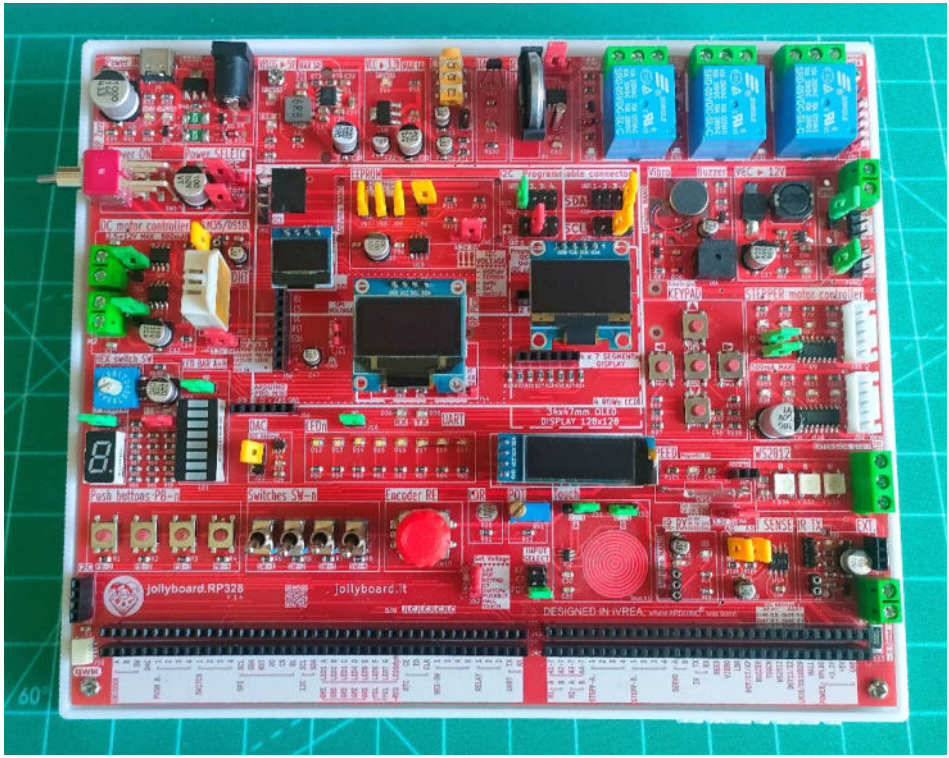
Note: The technical specifications and data provided are subject to change or updates without notice to improve the performance and reliability of the JollyBoard.RP328.

Last updated: *March 13, 2026*
Version: *0.4*

Summary

1. 1. Introduction to JollyBoard.RP328

Thank you for choosing the JollyBoard.RP328.



This board was designed to offer a complete, uncluttered, and ready-to-use environment, ideal for anyone who wants to experiment with electronics, sensors, actuators, and control systems.

One of the main goals of the JollyBoard.RP328 **is to simplify the prototyping process**.

In most cases, those working with microcontrollers like **Arduino, ESP32, or Raspberry Pi** find themselves having to create complex wiring on breadboards, with the risk of errors, unstable connections, or short circuits.

The **JollyBoard.RP328** solves this problem by integrating, in a single compact support, many of the most used modules and breakouts in electronics projects.

Thanks to this integration:

- You can focus directly on programming and operating logic;
- Drastically reduce wiring time;
- Increase the reliability of your tests by avoiding loose connections or poorly inserted components/false contacts;
- You have pre-wired sensors, inputs, and actuators available in a single location, ready to communicate with the microcontroller of your choice;
- Three power lines (3.3 V, 5 V, and 12 V) are available, generated directly by the board and can be supplied via the USB port, a power bank, or an external power supply, with voltages ranging from 6 V to 40 V.

The card provides a wide range of features:

- **input sensors** (temperature, humidity, light, current, potentiometer, buttons, switches, encoders, keypads, touch screens, reed switches, Hall sensors, IR receivers, etc.);
- **actuators and output devices** (LEDs, LCD displays, 7-segment displays, OLED displays, color displays, buzzers, vibration motors, relays, DC and stepper motors, servo motors, LED strips, bar graphs, IR transmitters, etc.);
- **direct connection lines** to the microcontroller pins, which receives only the input or output signals, without having to manage adapter circuits or separate modules.

In this way, the JollyBoard.RP328 becomes a **real compact laboratory**: a platform suitable both for those taking their first steps in electronics and

for those who want to create advanced prototypes in short times and with maximum reliability.

2. Getting started with the JollyBoard.RP328

This section guides you through the first steps to use your JollyBoard.RP328 correctly and safely.

2.1. Package contents

Inside the package you will find:

- 1 × **JollyBoard.RP328** Card.
- 1 × USB-C Cable.
- Any accessories if included in the kit (check the list of contents).

⚠ If any items are missing, contact the dealer immediately.

2.2. External requirements

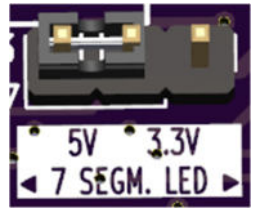
To use the card you will need:

- An external **microcontroller** (Arduino, ESP32, Raspberry Pi, or similar).
- A **PC** with a development environment (Arduino IDE, Thonny, etc.) or a programmed standalone board.
- A **USB cable** or external **power supply** (if you plan to drive motors or heavy loads).

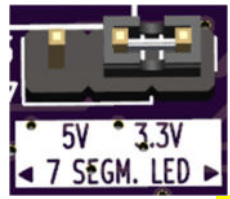
2.3. Practical note, selecting a jumper

To select a specific option via jumper, place the jumper on the desired pins. The markings on the board clearly indicate the jumper functions, in this example:

- **Pin 1 and 2 →** select the first option (here **5V**)

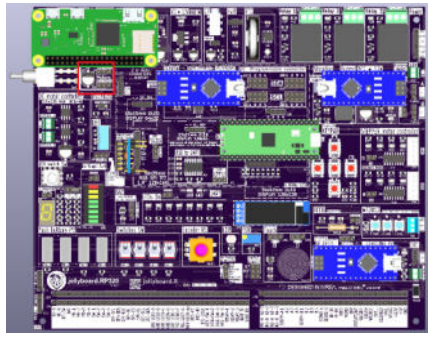


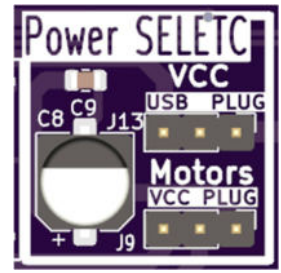
- **Pin 2 and 3 →** select the second option (here **3.3V**)



Tip: Always make sure to set the jumper **before connecting the power supply**, so as to avoid conflicts and incorrect voltages on the connected board which could be damaged.

2.4. Power Configuration





Before turning on the **JollyBoard.RP328** it is necessary to correctly select the power source using the dedicated jumpers:

- **Main jumper** (**VCC**, **board power**): allows you to choose whether the board's power supply voltage is taken from the USB port or from the **PLUG** connector.
- **Motor jumper**: allows you to decide whether to power the motors with the **VCC** voltage or directly from the **PLUG** voltage (useful for motors that require higher currents or different voltages).

⚠ An incorrect setting may compromise the operation of the card or connected devices: always select the jumpers **before connecting the power supply**.

2.5. Connecting the power supply

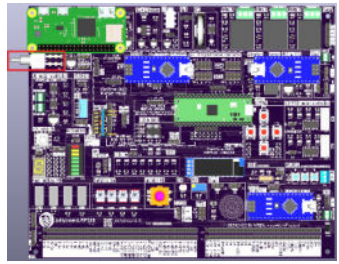
As we have seen, the card can be powered in two ways:

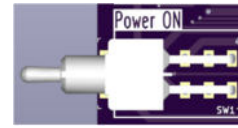
- Via USB: Connect the USB cable to:
  - a PC;
  - a 5V power supply (up to 3A);
  - a power bank.
- via **external PLUG**: connect a power supply with an output voltage between **6 V and 40 V** (5.5 x 2.1 mm central positive connector).

The **JollyBoard.RP328** features reverse polarity protection (red LED indicator) and self-resetting fuses, and it is good practice to use stable and certified power supplies.

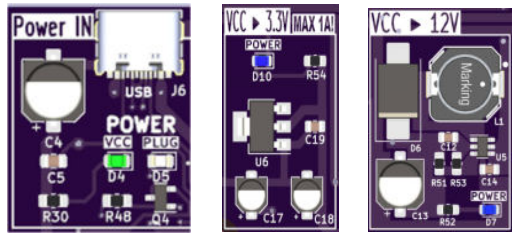
2.6. Turning on the JollyBoard.RP328

After connecting the power supply and **correctly configuring both the board's power jumpers and the 3.3V/5V selectors**, turn on the board using the **main switch** (up position).



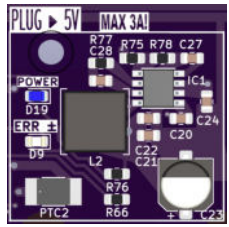


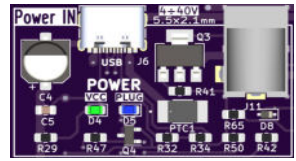
2.6.1. Power LED



The **ON** (VCC), **3.3V** and **12V** LEDs will light up to indicate that the board is operational and the various converters are working correctly.

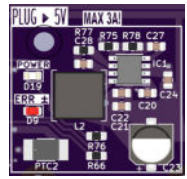
If the power comes from the **PLUG**, the **POWER LED** of the DC-DC converter **PLUG ▶5V** will also light up





and the **PLUG LED** next to the **VCC LED** will also light up.

⚠ If the **polarity of the PLUG is accidentally reversed**, the **ERR ± LED** will light up to indicate the inversion: when the polarity is restored, the LED will turn off and the **POWER LED** of the **PLUG ▶5V** and the **PLUG LED** next to the **VCC LED** will light up.



2.7. Connection to the microcontroller

On the **JollyBoard.RP328**, all sensors, inputs, and outputs are already connected and ready for use. Each signal is routed to two parallel connectors: the 40-pin connector has its own duplicate 40-pin connector, and the 30-pin connector has its own duplicate 30-pin connector. This way, the same signal is accessible from two positions of the same connector type, simplifying wiring.

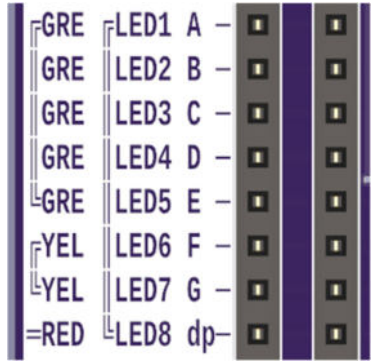
To use them:

1. **Identify the pin** (or pins) of the module you are interested in (sensor, actuator, display, LED, etc.) via the silkscreen **on the 40- or 30-pin connector**.
2. **Connect the pin(s)** to **your microcontroller** via Dupont cable.
3. **Connect the ground (GND) of the JollyBoard.RP328 to the ground (GND) of the microcontroller**, otherwise, since there is no reference between the two boards, the prototype will not work

Practical example:

- If you want to read the temperature, you will connect **ONLY the data pin** of the DHT sensor to the microcontroller.

- If you want to light an LED, you will **connect ONLY the pin of the chosen LED** to the microcontroller, where the first column indicates the LED of the LED bar, the second indicates the LED on the **JollyBoard.RP328**, while the letters from **A** to **G** plus **dp/H** indicate the display segments.



⚠ Practical note

To avoid forgetfulness, it is advisable to immediately connect one of the pins **no. 30** of the **30-pin connectors** (screen printed **GND**) to the **GND** of the microcontroller, so as to immediately establish the common ground reference as the first wiring connection .

3. Connectors and Terminal Blocks

This section provides an overview of the connectors and terminal blocks on the **JollyBoard.RP328**, essential for correct use of the board and correct connection with Arduino, ESP32, Raspberry Pi and microcontrollers in general.

3.1. Sensors and I/O on 40+30 PIN connectors

The board has **two main connectors** (40 and 30 pins) that provide access to all the signals from the integrated modules (sensors, actuators, buttons, LEDs, displays, relays, etc.).

Each pin of these connectors is **split onto a second parallel connector** (the same signal is available on two positions), facilitating connection to **Arduino, ESP32, Raspberry Pi, or other microcontrollers**.

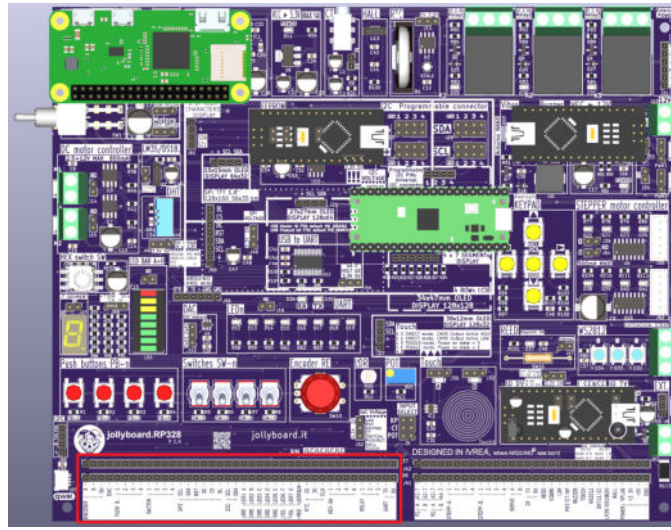
In practice:

- The signal from the sensor or device integrated on the JollyBoard.RP328 is taken from the connector;
- This signal is connected directly to the pin of the external microcontroller that will have to manage it;
- Conversely, a microcontroller pin can drive a device (such as an LED, a relay or a motor) via the corresponding pin of the same connector.

⚠ Practical note

It is always necessary to also **connect a GND** (ground) pin **between the board and the microcontroller**, so as to guarantee a common reference for all signals (otherwise the device will not work).

Connettori 40PIN



Rotary Encoder

ENCODER A and B → encoder signals (channels A and B).
ENCODER SW → the built-in encoder pushbutton.
The other encoder contacts are connected to GND.

DAC

Analog output signal from the DAC.

Push Buttons

Push Buttons B. 1, 2, 3, and 4 → signals from the four built-in pushbuttons.
The other pushbutton contacts are connected to GND.

Operation:

- Logic level **1** when the pushbutton is not pressed
- Logic level **0** when the pushbutton is pressed
- Selectable pull-up to **3.3 V** or **5 V**

Switches

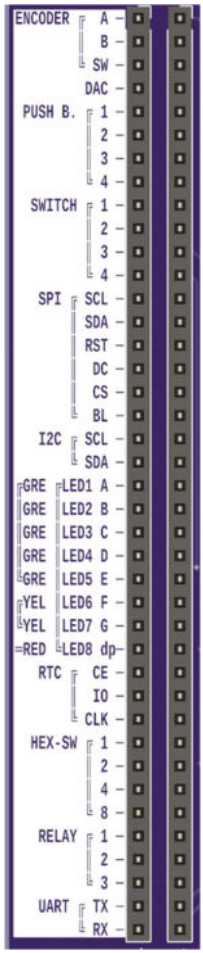
Switch 1, 2, 3 and 4 → state of the four built-in switches.
The other switch contacts are connected to GND

Operation:

- Logic level **1** when the switch is down
- Logic level **0** when the switch is up
- Selectable pull-up voltage of **3.3 V** or **5 V**

SPI Interface

- The **SPI-SCL**, **SDA**, **RST**, **DC**, **CS**, and **BL** pins carry **control signals** to the SPI connector. .



- **Note:** The signals do not have built-in pull-ups/downs; any pull-ups/downs must be handled by the microcontroller's I/O or by the device itself.
- The SPI device's **power supply is separate** and can be **selected at 3.3 V or 5 V** using the dedicated jumper.

I²C Interface

- **I²C SCL and SDA →** I²C interface clock and data signals.
- Both **signals are pull-up**.
- Logic levels can be set to **3,3 V** or **5 V**.

Bargraph, Discrete LEDs, 1 Digit and 4 Digit 7-segment display

- The card provides **4 different display devices**:
  - **8 LED graphic bar (5 GREEN, 2 YELLOW, 1 RED)**
  - **8 discrete LEDs (LED1–LED8)**
  - **7-segment display (A÷G) + decimal point (dp) of 1-digit display**
  - **7-segment display (A÷G) + decimal point (dp) of 4-digit display**
- **All four devices share the same set of 8 control pins.**
- The selection of the active device is done via the **enabling jumpers** positioned next to each module:
  - **Jumper on Graphic Bar → the 8 pins drive the LEDs on the bar.**
  - **Jumper on LED → the 8 pins drive the LEDs LED1 ÷ LED8.**
  - **Jumper on 1 or 4 digit display →** the 8 pins drive segments **A ÷ G + dp** of the selected display.

⚠ **Note:** Although multiple devices can be enabled at the same time, simultaneous use for a long time may overload the microcontroller's outputs.
To turn on an LED, bring the pin to logic level 0 (LOW).

Real Time Clock

The **JollyBoard.RP328** has a socket for a DS1302Z+, a battery-backed RTC (Real Time Clock) module that keeps the date and time accurate even when the board is switched off.

- **RTC-CE** → module enable chip
- **RTC-IO** → data line
- **RTC-CLK** → clock signal
- **Note:** these pins **have no internal pull-ups**, they only carry signals; the pull-ups must be managed by the microcontroller.

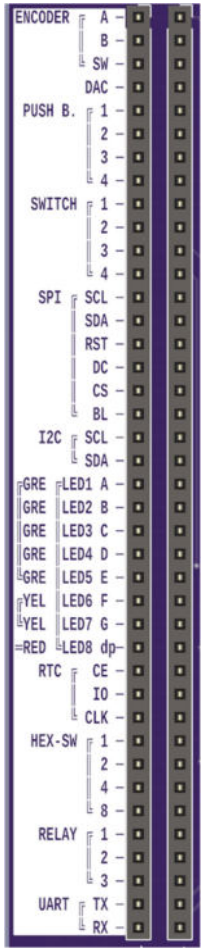
Hexadecimal Rotary Switch (HEX Switch)

The hexadecimal rotary switch (HEX Switch) allows you to select values from 0 to 15 (0–F) by rotating the slider, generating a **4-bit digital input**.

- **HEX-SW-1, 2, 4 and 8 outputs →** correspond to the hexadecimal output bits.
- The common pin is internally connected to a selectable 3.3V or 5V pull-up.

The output value is determined by the cursor position:

- **HEX-SW-1** → least significant bit (weight 1)
- **HEX-SW-2** → bit weight 2
- **HEX-SW-4** → bit weight 4
- **HEX-SW-8** → most significant bit (weight 8)



The total binary value corresponds to the sum of the active bits based on the switch position.

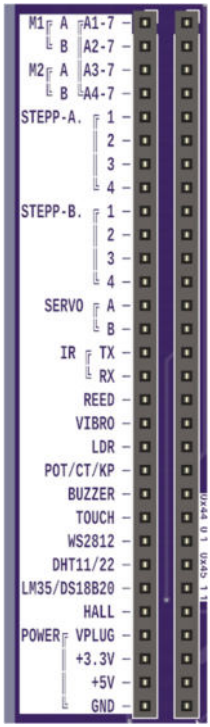
Relays (Relay 1, 2 and 3)

- The board has **3 electromechanical relays**.
- Each relay is equipped with a **changeover contact** (COM, NO, NC), with maximum voltage and current indicated on the relay itself.
- The relays are driven by dedicated transistors: one transistor for each relay, which allows it to be energized with a high level via the microcontroller.

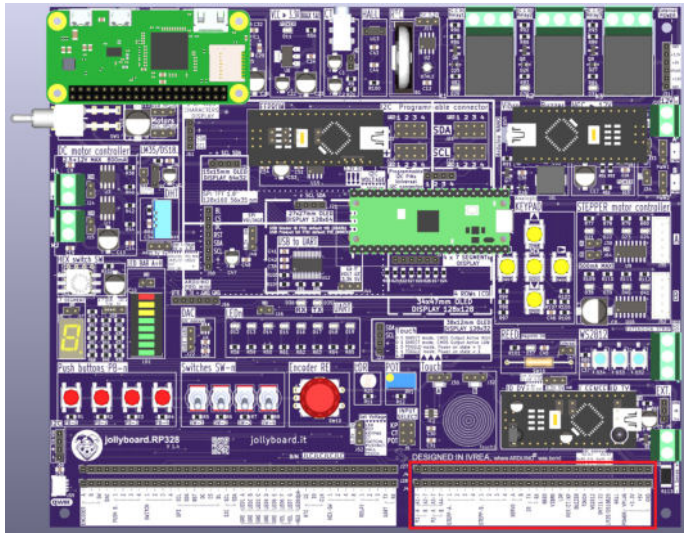
⚠ **Warning**: If connecting devices powered by **mains voltage** (230V or similar), be sure to **take all electrical safety precautions**, and never exceed the limits indicated on the relay.

Serial Signals (UART)

- The board uses **FTDI's FT232RL chip** to provide **RX and TX signals via USB**.
- The **RX** and **TX** pins carry serial signals, with selectable logic levels of **3.3V** or **5V**.
- This interface allows you to connect the card to serial devices without the need for external converters .



Connettori 30PIN



DC Motors and 4 x 7-segment Displays

- **M1 A/B, M2 A/B** → control lines of the two DC motors.
- The same lines are also used to drive the **4 columns of the 4x7 segment display** (common anode):
  - **A1-7, A2-7, A3-7, A4-7** → columns 1 ÷ 4 of the 4 x 7 segment display.
  - To make the display segments light up, the columns must be brought to a logic **level 1 (HIGH)**.

⚠ **Note:** always check the voltage and current required by the connected motors, so as not to exceed the driver specifications L9110S.
It is not possible to use DC motors and the 4x7 segment display at the same time, since the pins are shared.
It is therefore recommended to disable the motor jumpers (if connected) when you want to use the display. .

Stepper Motors (STEPP-A and B)

The board has controllers for **2 stepper motors** that can be controlled via the pins:

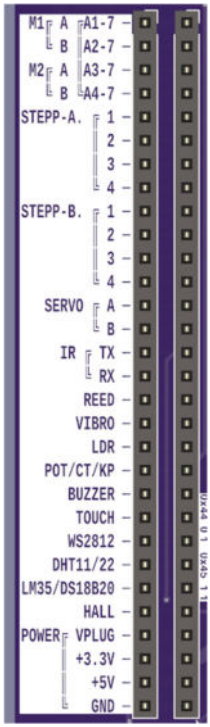
- **STEPP-A. 1, 2, 3,** and **4** → stepper **motor A**
- **STEPP-B. 1, 2, 3,** and **4** → stepper **motor B**

The motors are controlled via **ULN2003 drivers** integrated into the board.
Motor selection and activation are achieved via **dedicated jumpers**, which allow each motor to be activated individually.

⚠ **Note:** always check the voltage and current required by the connected motors, so as not to exceed the ULN2003 driver specifications.

Servo Motors (SERVO A and B)

The board has 2 connectors for SG90 type servo motors:



- **SERVO A** → first motore servo
- **SERVO B** → second motore servo

- The pins directly **supply the PWM control signal** to the motor, while **power and ground** are already provided on the connector.

⚠ **Note:** make sure that the connected servos do not exceed the maximum current that the board can supply, especially if multiple devices are used simultaneously (see paragraph **3.5. Power supply configuration**).

Infrared (IR) Receiver and Transmitter

- **IR-RX** → Infrared receiver output with integrated pull-up resistor. The signal is compatible with **3.3V** or **5V**, selectable via configuration jumpers.
- **IR-TX** → infrared transmitter, driven by a transistor to ensure the correct emission current.
  - Using the selection jumper, you can choose whether to use:
    - the **IR LED on board**, or
    - an **external IR LED** (EXT), which can also be connected remotely via wire.
  - The pin activates transmission with logic level 1 (HIGH), but the modulation must be managed by the microcontroller (ON/OFF).

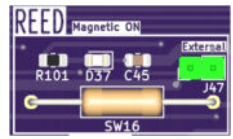
⚠ **Note:** the transmitter's range depends on the current supplied and the emission angle of the IR LED (R=33 ohm and V = 5V).

Magnetic REED Sensor

REED → reed contact equipped **with pull-up resistor**.

- The contact **closes in the presence of a magnetic field** (for example by bringing a magnet close).
- The closing of the contact is also signalled by an **on-board LED**, which lights up when the contact is closed.
- Logic output: **1 at rest, 0 when contact closes** (3.3V or 5V, selectable via jumper).

⚠ **Note:** a reed or remote switch can also be connected via a wire

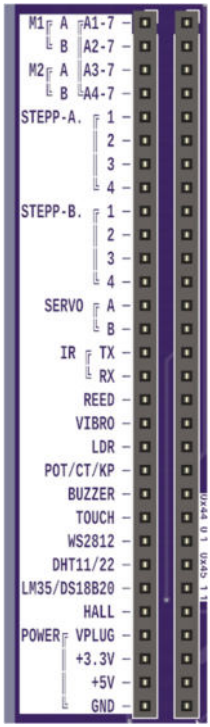


Vibration Motor (VIBRO)

VIBRO → connector dedicated to the vibration motor.

- The motor is **driven by transistors**, so as to ensure the supply of the necessary current without directly burdening the microcontroller.
- Activation occurs by bringing the control pin to logic level 1 (HIGH), regardless of the control voltage**, 3.3V** or **5V**.

⚠ **Note:** avoid prolonged use of the vibration motor.



Photoresistor (LDR)

LDR → photoresistor-based light sensor, connected to a resistive divider to provide an analog signal.
Output varies depending on ambient brightness:

- **high values** in low light conditions
- **low values** in the presence of strong lighting

The signal is available on the connector and can be read from an analog input on the microcontroller.
The operating voltage can be selected to **3.3V** or **5V** via configuration jumpers.

Shared entrance (POT / CT / KP)

POT/CT/KP → analog input pin shared by three possible sources:

- **POT** → multi-turn potentiometer: provides a variable analog signal based on the position of the knob.
- **CT** →current probe (Current Transformer SCT-013): produces a signal proportional to the measured current
- **KP** → 5-key analog keyboard: implemented via a resistive divider, it provides a voltage depending on the key pressed (5 levels, maximum level UP, LEFT, OK, RIGHT, DOWN key, minimum level).

- The **source selection** is done via **POT/CT/KP jumpers**.
- The **signal level** (3.3V or 5V) can be set via configuration jumpers.

Buzzer (BUZZER)

BUZZER → pin dedicated to the piezoelectric buzzer.

- Transistor driven.
- Operation via digital **frequency** control to generate tones and sounds, regardless of the control voltage, **3.3V** or **5V**.

Touch (TOUCH)

TOUCH → pin dedicated to the capacitive touch sensor.

- The sensor output and behavior are **configurable via two jumpers** (A and B), as also indicated on the board's silkscreen.

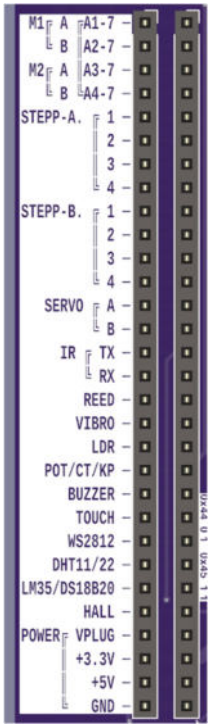
Available configurations:

Jumper A	Jumper B	Mode	Output behavior
0	0	DIRECT	CMOS Output, Active HIGH
0	1	DIRECT	CMOS Output, Active LOW
1	0	TOGGLE	Power-on state = 0
1	1	TOGGLE	Power-on state = 1

- **DIRECT** mode: the output directly follows the touch state, that is, it maintains it as long as the finger is on the sensor.
- **TOGGLE** mode: each touch changes the output state from the previous state (toggle).
- The signal is compatible with **3.3V** or **5V**, selectable via configuration jumper.

LED strip (WS2812)

The board integrates **3 WS2812 LEDs already mounted**, which correspond to the **first 3 LEDs** of the strip.



- Via the **3-pin terminal block** (VCC, DIO, GND) it is possible to connect an **external WS2812 LED strip** (**5V** power supply), continuing the sequence of the LEDs already present on the board.
- **DIO** → Strip data line, compatible with WS2812 LEDs.

⚠ **Note:** Pay attention to the **length of the strip**, as high current consumption may exceed the capabilities of the board.

Temperature and humidity sensor (DHT…)

The board has a **socket for DHT11 or DHT22 sensor**, interchangeable.

- The sensor provides a **digital signal** with information on **temperature and relative humidity**.
- It works with **3.3V** or **5V** supply voltage, selectable via **configuration jumper**.

Temperature sensor (DS18B20)

- **DS18B20** → 1-Wire digital signal, **close** pull-up jumper.
- The signal is compatible with **3.3V** or **5V**, selectable via configuration jumper.

Temperature sensor (LM35)

- **LM35** → analog output signal, **open** pull-up jumper.
- Non-selectable power supply fixed at 5V, analog output.

Hall sensor (HALL)

The board has a **Hall sensor socket**.

- detects the presence of a magnetic field and provides a **digital output signal**.
- The signal is compatible with **3.3V** or **5V**, selectable via configuration jumper.

Power pins

The board provides **4 power pins** for external devices:

- **VPLUG →** direct voltage coming from the external power supply;
- **+3,3 V →** 3.3V regulated output;
- **+5 V →** 5V regulated output;
- **GND** → common negative reference for all external circuits.

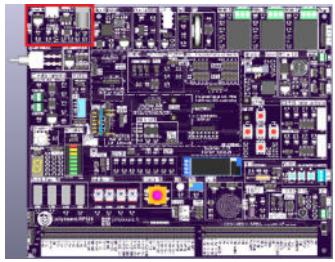
These pins allow you to directly power additional circuits on breadboards or external modules, without the need for additional power supplies.

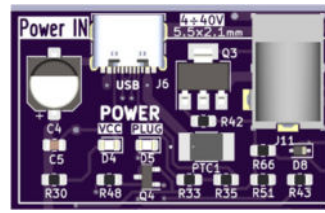
⚠ **Practical note**

It is advisable to **immediately connect one of the two silkscreened pins n° 30 GND to the GND of the microcontroller** and of the breadboards used for the tests; in this way the common ground reference is already established as the first wiring connection, thus **avoiding the malfunction of the circuit**.

3.2. Power connectors

3.2.1. How to power the board





Via USB connector

- Used for the board's **main power supply**;
- It provides **5 V** for the operation of the integrated modules;
- It provides a **UART port** (RX/TX) with selectable logic levels of **3.3 V** or **5 V**;
- It can also be used to connect the board to a **USB power bank**, making it suitable for portable projects.

Via PLUG DC connector (6–40V)

- It can be used when you don't have a USB connector available;
- offers a power alternative, useful for powering the card and connected devices independently from the computer.

Additional note:

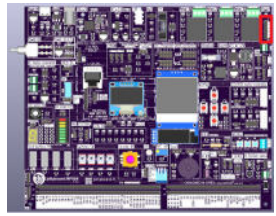
- **Both the USB connection and the PLUG** allow you to directly **generate voltages of 3.3 V**, **5 V** and **12 V**, available both for the modules integrated on the board and for external devices connected to the power pins.

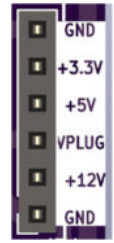
- Both power inputs are **protected by self-resetting fuses**, to protect the board and the connected loads.

⚠ **Note**: LED motors and strips **can generate peaks** in absorption that could affect the computer's USB port and/or the stability of the card's power supply.

For projects with high loads, consider using a dedicated external power supply via the **PLUG**.

3.2.2. Connector for powering **external modules**



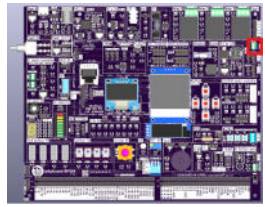


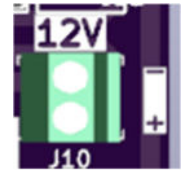
An additional, separate power connector is provided that **provides all the power supplies** provided on the JollyBoard.RP328 for external circuits.

- **3,3 V, 5 V, 12 V** and **VPLUG**: power lines made available for sensors, modules and external circuits;
- **GND**: common reference (mass) line.

⚠ **Note**: make sure that the total power consumption of the connected devices does not exceed the power supply capacity of the board.

3.2.3. **12V** terminal block



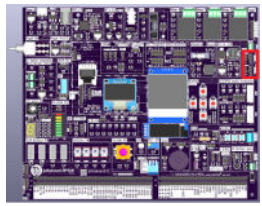


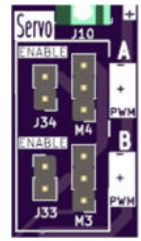
- It supplies **12V generated on board** via a DC-DC converter, **starting from the 5V** supplied by USB or the DC PLUG;
- the terminal block exposes +**12 V and GND**;
- It is intended to power external modules or devices that require 12 V;
- The maximum current that can be supplied cannot exceed **3 A**, as it is limited by the capacity of the upstream self-resetting fuses.

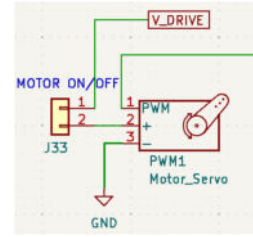
⚠ **Note**: make sure that the main power supply (USB or DC PLUG) is able to supply this current continuously.

3.3. Connectors for **motors**

3.3.1. Connector for SERVO Motors







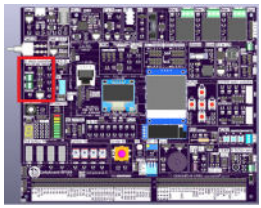
- The board has **2 connectors dedicated to servomotors** (type SG90), each with the pins: **+V, GND and Signal (PWM)**.

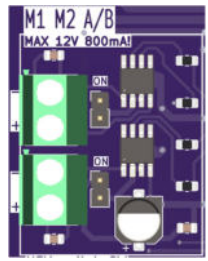
- The power source can be selected:
    - **5 V** from **USB**)
    - **External VPLUG** from **PLUG**

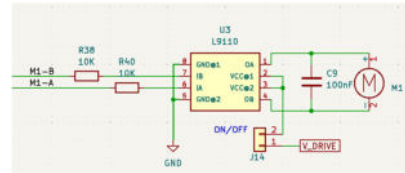
⚠ **Attention:** by connecting the Servos to **VPLUG**, the voltage applied to the PLUG connector reaches the connectors directly.

Do not exceed the operating voltage, otherwise the servomotors will be damaged, while the current is always limited by the self-resetting fuse.

3.3.2. Terminal Blocks for DC Motors





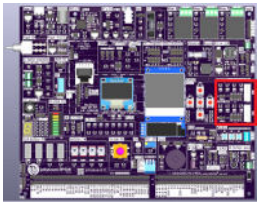


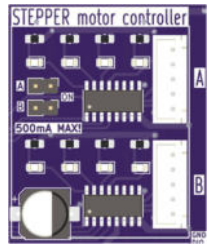
- The board has **2 terminal blocks** dedicated to the DC motors (A and B), each with the pins: **+** and **-**
- The driver used is the **L9110S**, it can be powered up to **12 V** with a maximum manageable current per channel of **800 mA continuously**, with **peaks up to 1.5 A** (short pulses).
- The power source can be selected:
    - **5 V** on board (VCC)
    - **VPLUG** (external voltage)

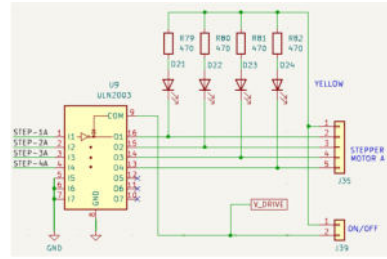
⚠ **Warning:** by connecting the motors to **VPLUG**, the applied voltage reaches the terminal blocks directly.

It is recommended not to exceed **600–800 mA** continuous to avoid overheating of the driver and not to exceed **12 V**, under penalty of damaging the driver.

3.3.3. Connectors for STEPPER Motors







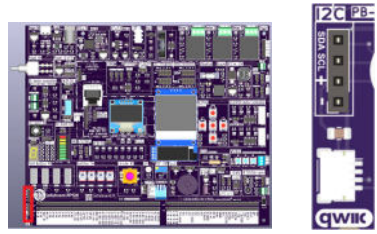
- 2 connectors dedicated to driving **STEPPER motors**.
- Driven by **ULN2003**, transistor array with integrated protection diodes
- Each STEPPER has an **enable jumper** to select the connection.
- Maximum current per channel: about **500 mA continuous** (up to **600-700 mA peak**), compatible with small standard STEPPERs such as **28BYJ-48** or similar
- The power source can be selected:
    - **5 V** on board (VCC)
    - **VPLUG** (external voltage)

⚠ **Attention**:

- Avoid exceeding the nominal currents of the **ULN2003** (500mA) to avoid overheating/damage
- If powered by PLUG, check that the connected motors are compatible with the set voltage and the maximum limited current.

3.4. Communication connectors

3.4.1. Connectors for external I²C modules



***I²C** connector*

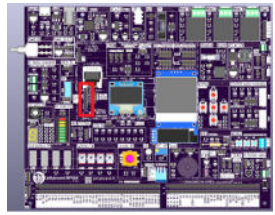
The board features a 4-pin header for connecting external devices, exposing the **SCL**, **SDA**, **VCC** (**3.3V and 5V jumper selectable**) and **GND** signals.

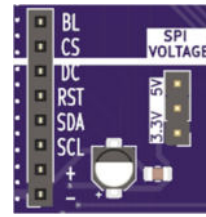
***qwiic** connector*

Another connector is the qwiicand allows you to daisy chain various available modules that use this Sparkfun connection standard.

⚠ **Note**: To avoid damaging the connected modules, ensure the pins (VCC/GND) are correctly matched to the connector and device being used. If the pin sequence differs from the printed circuit board, use the configurabile I²C connector.

3.4.2. **SPI** Connector

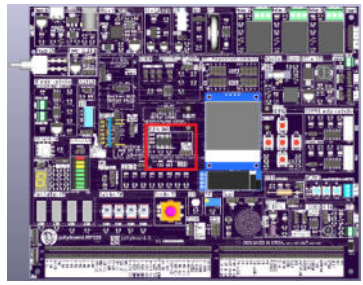


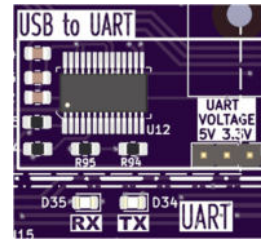


- The board has an **SPI connector** for connecting **LCD displays or other SPI devices**
- The available pins on the connector are **directly routed to the microcontroller**, without additional pull-ups, ready to be managed via standard libraries

⚠ **Note**: make sure the voltage of the connected device matches the jumper selection (3.3V or 5V) to avoid damage to the SPI modules..

3.4.3. **RX-TX** connector





- The board uses **FTDI's FT232RL chip** to provide **RX/TX signals via the USB port**.
- The **RX and TX** pins carry serial signals, with logic levels selectable at **3.3V** or **5V**.

⚠ **Note**: this interface allows you to connect the board to serial devices without the need for external converters; these pins are also connected directly to the pins of the on-board socket that houses the **Arduino PRO Mini**.

3.5. Display Connectors

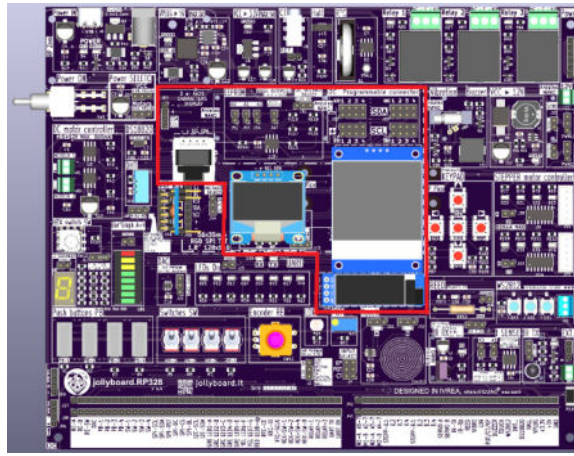
3.5.1. **4×7 Segment** Display Connector

- The board allows mounting a **4-digit 7-segment common anode module** (type CA56-12)
- **The segments** (**A÷G** + decimal point **dp**) are connected to the **LED1–LED8** pins.
- The display **column pins** are shared with the **4 DC motor pins** (A1-7, A2-7, A3-7 and A4-7), allowing the displays to be driven in multiplexing.
- **Display management** requires that the corresponding **column be brought to 1** (HIGH) and the desired **segment be brought to 0** (LOW)

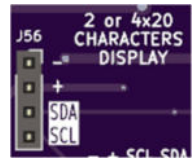
⚠ **Important note**

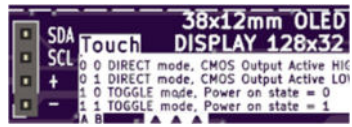
To avoid overloading the microcontroller output, make sure the bargraph, LED and single 7-segment display enable jumpers on the board **are disabled when using this display, which has no enable/disable jumpers** (pins direct to the microcontroller)..

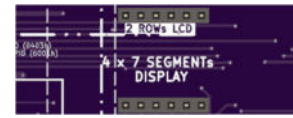
3.5.2. I²C Display Connectors



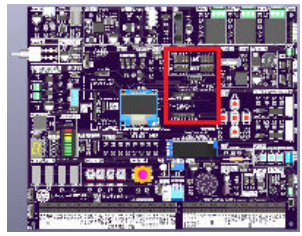
- The board has **5 I²C connectors** dedicated to connecting **6 types of displays** (or other I²C modules):
    - Graphic OLED displays: **64×32, 128×64, 128×128 e 128×32** pixel;
    - Character LCD display: **2×20 e 4×20**
- The **I²C connectors** can be powered via a **dedicated jumper**, which allows you to select the correct supply voltage for the connected displays.
- In addition to displays, other I²C compatible devices **can also be connected to the I²C connectors**.

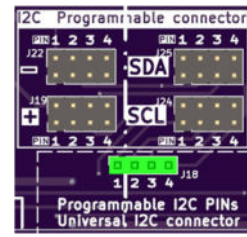






3.5.3. **Configurable** I²C display connector





The **JollyBoard.RP328** also features a **flexible I²C connector**, designed to adapt to different pinouts of external modules.

This connector has **4 configuration jumpers**: each allows you to **freely route an I²C signal** (SDA, SCL) and power (VCC, GND) **to the corresponding pin of the module** being connected.

In practice:

- using jumpers it is possible to "rewire" the pin layout without having to use flying wires;
- whatever the pinout of the I²C device, you can easily adapt the connection and the connection remains tidy and secure, reducing the risk of wiring errors.

💡 **Practical advantage:** thanks to this modular configuration, you can connect I²C displays with different pinouts directly using the socket, without having to resort to external adapter cards.

You can therefore also connect any I²C device with any pinout.

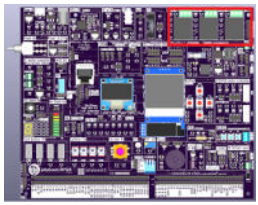
3.5.4. SPI connector

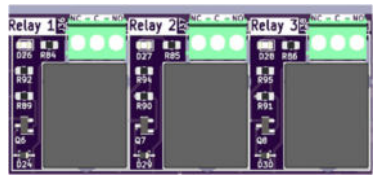
The board has a dedicated **SPI connector** for connecting a display or other SPI module.

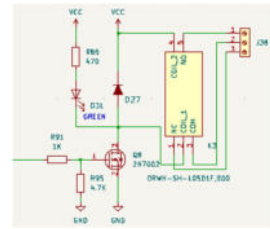
⚠ **Note**: make sure the voltage of the connected device matches the jumper selection (3.3V or 5V) to avoid damage to the SPI modules..

3.6. OUT

3.6.1. **Relay** terminal blocks



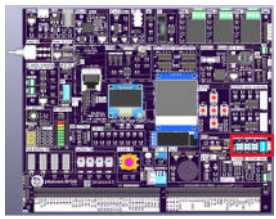


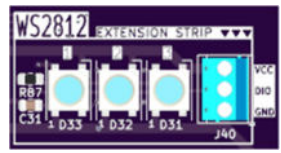


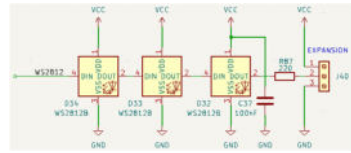
- The board is equipped with **3 electromechanical relays**.
- Each relay has a **3-terminal connector** with changeover contact: **COM** (common), **NO** (normally open), **NC** (normally closed).
- This allows each relay to be used for both opening and closing external circuits.

⚠ **Note**: pay attention to the voltage and current limits supported by the relays to avoid damage to the board or connected devices.

3.6.2. LED strip extension terminal block (external)





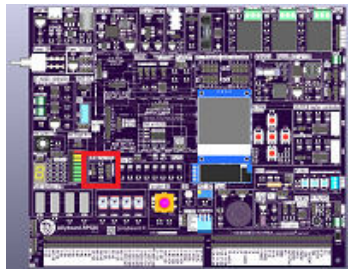


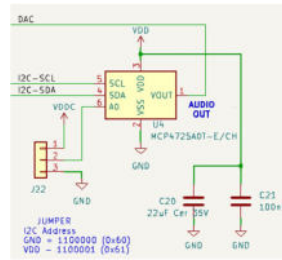
- The board integrates **3 WS2812 LEDs** already mounted, which correspond to the first 3 LEDs of the overall strip.

- Using the **3-pin terminal block** (VCC, DIO, GND) you can connect an external **5V powered** WS2812 LED strip, continuing the sequence of the LEDs already present on the board.
- **DIO** → strip data line, compatible with WS2812 LEDs.

⚠ **Note**: pay attention to the length of the strip, as high current consumption may exceed the capabilities of the card.

3.6.3. **DAC** converter output



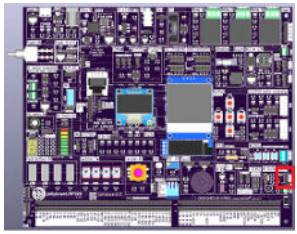


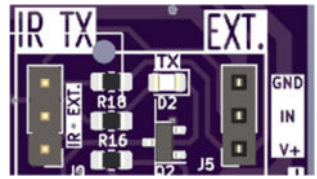
- The board features a DAC digital to analog converter using an **MCP4725**
- The power supply is **selectable via jumper**, compatible with 3.3V or 5V.
- The I²C address of the DAC is **configurable via jumper**, as indicated on the board's silkscreen: **0x60** or **0x61**.
- It allows you to obtain an **analog output signal** that can be controlled via I²C by the microcontroller.

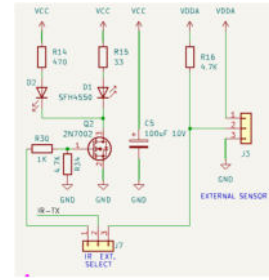
⚠ **Note:** always check the correct power supply and I²C address selection to avoid conflicts with other devices on the bus.

3.7. IN

3.7.1. External **I/O** line connector



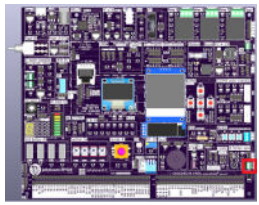


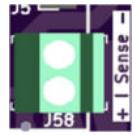


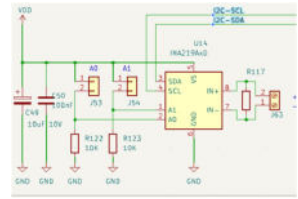
The board has a **3-pin connector** for connecting external I/O devices to the same line as the IR-TX.

- The available pins are:
    - **V+** → **positive power supply** of the external module (selectable at 3.3V or 5V)
    - **GND** → **GND**
    - **I/O** → data line, connected to the same line as the IR-TX with **integrated pull-up** (4K7)
- This connector is primarily intended for connecting a **remote IR TX** (to be added to the driver), but can also be used as an input for signals from external modules.
- Both **V+** and the pull-up line are configurable to **3.3V** or **5V**.

3.7.2. **Current Sensor** Terminal Block



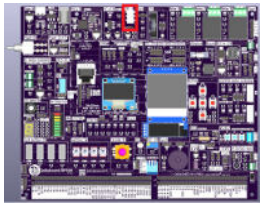


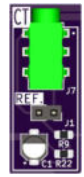


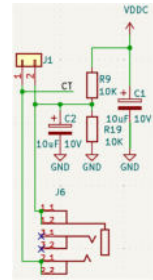
- The board has a dedicated terminal block for the **INA219B** current sensor, based on I²C interface
- It allows you to measure the current of the load connected to the terminal block.
- The terminal block exposes:
  - **+** → **positive** load connection
  - **-** → **negative** load connection
- The sensor power supply is **selectable via jumper**, compatible with **3.3V** or **5V**.
- The I²C address of the sensor is **configurable via 2 jumpers**, as indicated on the board's silkscreen.

⚠ **Nota**: make sure you set the power and I²C address correctly to avoid conflicts with other devices on the bus.

3.7.3. Jack Current Transformer



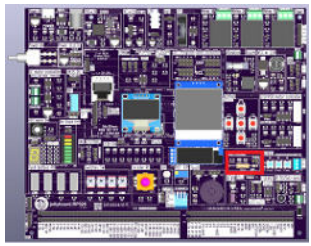


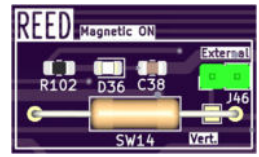


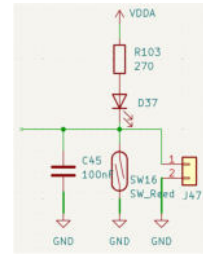
- The board has a **3.5mm jack** for connecting an **SCT-013** **power transformer**.
- There is also a **2-pin connector** to connect a remote current sensor or other sensor/device (NO REF pin).
- The signal converges on a dedicated connector pin; through this pin you select which source **is routed to the KP/CT/POT pin** of the 30-pin connector; in this case the selection must be on **CT**
- The sensor power supply is **selectable via jumper**, 3.3V or 5V.
- The connector **is connected and ready to use** for current reading, without the need for additional wiring.

👉 *The SCT-013 sensor is available in different versions, differentiated by the reading range, which can vary from 5A up to 100A.*

3.7.4. **REED** connector



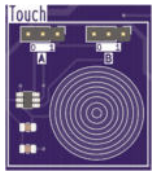


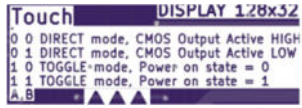


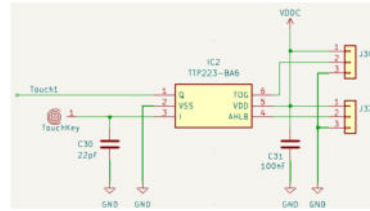
- There is also a **dedicated connector**, connected in parallel to the integrated **REED**, and allows you to connect an **external REED**, a remote magnetic contact or another compatible sensor capable of bringing the pin to ground.
- When the REED or external contact closes, the LED integrated on the board lights up, indicating that activation has taken place..
- The REED circuit power supply is **selectable via jumper**, compatible with 3.3V or 5V.

⚠ ***Important note**: as for the integrated REED, the external device also **closes the pin to ground** and must be able to operate with the voltage set via jumper.*

3.7.5. **Touch** sensor



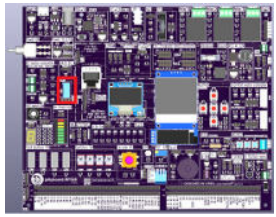


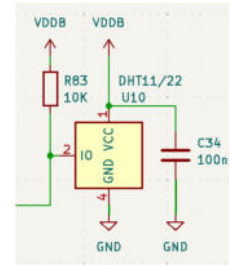


- Capacitive sensor that detects **surface touches.**
- The behavior is indicated on the screen printing and can be set via the 2 jumpers.

3.8. SOCKETS

3.8.1. **DHT** Sensor Connector

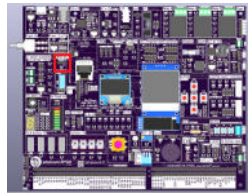


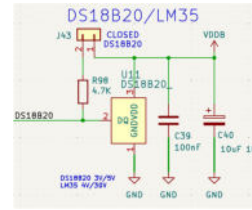



- The board has a **4-pin socket** that allows you to mount a **DHT11**, **DHT22** or any other compatible sensor with the same pinout.
- The sensor is **already connected** and ready to use on the board.
- The **sensor supply voltage** can be selected via the **dedicated jumper** (3.3V or 5V).

⚠ ***Note:*** *no additional wiring is required; simply insert the sensor into the socket with the grid on the left and set the jumper to the desired voltage.*

3.8.2. LM35 and DS18B20 Sensor Connector



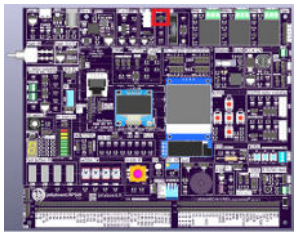



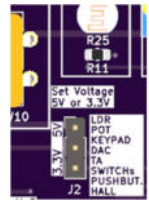
- The board has a dedicated socket for mounting a **DS18B20**, an **LM35** or other compatible sensors with the same pinout.
- The **supply voltage of the DS18B20 sensor is selectable via jumper** (3.3V or 5V), while the supply voltage of the **LM35 sensor must be 5V** (4V ÷ 30V).

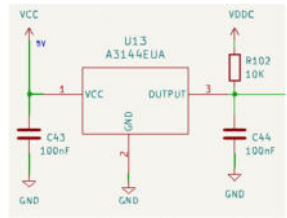
- For the **DS18B20 sensor the pull-up jumper must be CLOSED**, while for the **LM35 it must be OPEN**

⚠ ***Note:*** *no additional wiring is required; simply insert the sensor into the socket (pay attention to the direction) and set the jumper to the desired voltage..*

3.8.3. **Hall** Sensor Connector



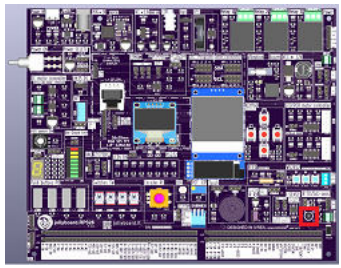
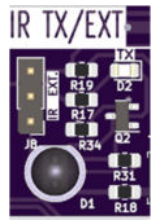



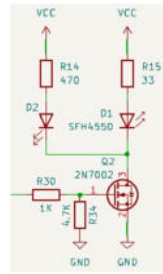


- The board has a **dedicated socket** for mounting an **A3144** Hall sensor, already connected and ready to use on the board
- The sensor supply voltage is fixed at 5V, while **the open collector output voltage is selectable via jumper** (3.3V or 5V).

⚠ **Note:** no additional wiring is required; simply insert the sensor into the socket and set the jumper to the desired voltage.

3.8.4. **IR-TX** Socket

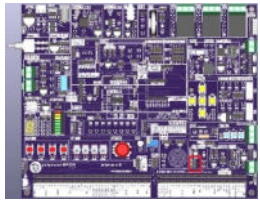


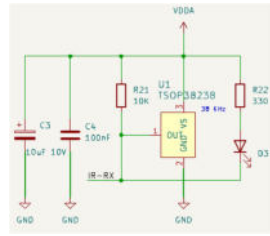
- The board has a **dedicated socket** for mounting an IR diode such as **SFH 4550** or the most suitable for the project in progress
- The sensor is already connected and ready to use on the board.

⚠ **Note:** there is no need to select the power supply; the pin is already correctly configured to drive the IR-TX diode.

Pay attention to the polarity of the diode: no damage will occur, but there will be no transmission. **Transmission must be pulsed!**

3.8.5. **IR-RX** Socket





- The board has a **dedicated socket** for mounting an **IR receiver** (e.g. TSOPxxx).
- Allows you to mount the most suitable receiver for the project in progress.
- The sensor is already connected and **ready to use on the board**.
- The **receiver supply voltage** can be **selected via jumper** (3.3V or 5V).
- Simply insert the receiver into the socket and configure the power jumper; no additional wiring is required.

⚠ **Attention:** pay attention to the **polarity and pinout of the receiver**; an incorrect connection can damage the component.

---

4. Sensors and input devices

The JollyBoard.RP328 includes numerous pre-wired input modules, ready to connect to your microcontroller.

This section helps you identify the available sensors and input devices, understand their operation, and know how to connect them correctly.

4.1. Sensors

Temperature and humidity

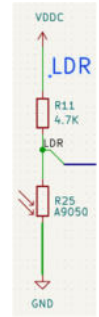
- **DHT11/DHT22 sensor**: detects temperature and humidity in digital format.
- **DS18B20 Temperature Sensor:** returns a **digital signal** of the detected temperature.

  Connections: **ONLY the data pin** goes to the microcontroller, VCC and GND are already connected on the board:

  - **DHT11/DHT22** pin of the 30-pin connector;
  - **LM35/DS18B20** pin of the 30-pin connector.

Light

- **Photoresistor (LDR)**: measures light intensity, useful for lighting or environmental sensing projects.



👉 **Connection:** only the data (analog) pin needs to be connected to the microcontroller. Power is already available on the board, via the LDR of the 30-pin connector.

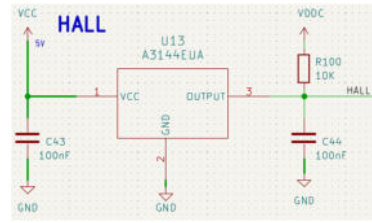
⚠ **Attention**: high voltage dark sensor, low voltage illuminated sensor.

Current

- **Current sensor**: detects current flows on a connected load.

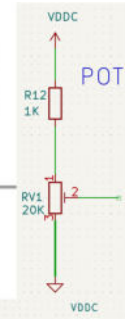
👉 **Connection:** the **INA219B** sensor is already connected to the **I²C** lines; it is therefore sufficient to connect the load via the dedicated terminal block and take the value readings directly via software.

Magnetism



- **Hall sensor**: for magnetic field detection, available on the **HALL** pin of the 30-pin connector.
- **Reed Switch**: **normally open** magnetic contact, available on the **REED** of the 30-pin connector.

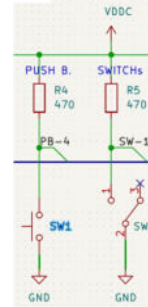
Potentiometer



- **Integrated multi-turn potentiometer**: allows precise analog adjustments directly on the board. Connection to the shared **POT/CT/KP** pin of the 30-pin connector.

4.2. Digital input devices

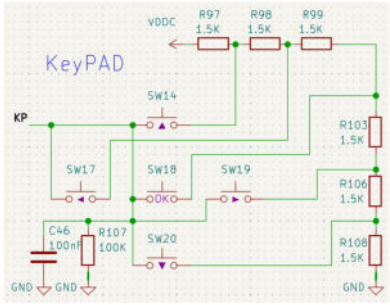
Buttons and switches



- **Single buttons and switches**: already wired on the board, available on the **PUSH B** pins **1**, **2**, **3** and **4**, **SWITCH 1**, **2**, **3** and **4** of the **40-pin connector**.
- Ideal for testing, manual input and direct control of digital signals.

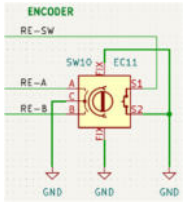
Keypad

- **5-key analog keyboard:** implemented with a resistive divider, connected to the **shared POT/CT/KP pin** of the 30-pin connector.
- It uses a single wire, and each key press corresponds to a different voltage.



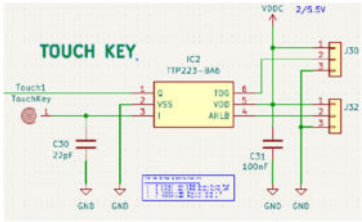
Rotary encoder

- **Integrated encoder:** allows **rotations and clicks** to be read, useful for selections or adjustments. Connect to the **ENCODER A**, **B**, and **SW** pins of the 40-pin connector.



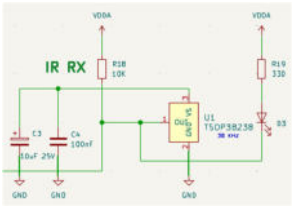
Touch sensor

- **Capacitive sensor:** detects **surface touches**, available on the **TOUCH pin** of the 30-pin connector.



IR receiver

- **IR RX:** receives infrared signals from remote controls or other compatible devices, available on the **IR-RX pin** of the 30-pin connector.



4.3. Connection to microcontrollers

All modules are already wired on the **JollyBoard.RP328**.

To use them:

1. Make sure **everything is turned off**, both the JollyBoard and the microcontroller.
2. Locate the **signal pin** corresponding to the sensor or input/output device (refer to the connector silkscreen).
3. Connect **the pin(s) to the microcontroller** (Arduino, ESP, Raspberry Pi, etc.).
4. Activate the **main switch** by pulling the lever upwards and check that the board is correctly powered (green LED on).

💡 **Note:** there is no need to add any other components, as the board already handles sensor connections and logic levels; these can be set according to the microcontroller used..

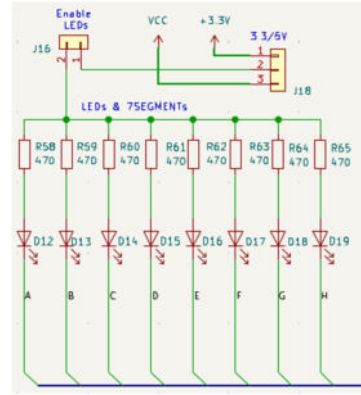
⚠ **Importante:** è indispensabile collegare il **GND** del microcontrollore al **GND** della jollyBoard.RP328, altrimenti il circuito **non funzionerà**.

5. Output devices

The **JollyBoard.RP328** integrates numerous **pre-wired output modules**, ready to be controlled directly by your microcontroller.

This section describes the available devices, how they work, and how to connect them correctly.

5.1. LEDs and indicator lights

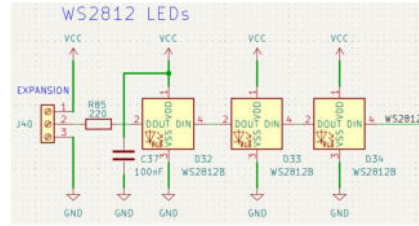


Single LEDs

- Small LEDs already wired on the board, can be used for ON/OFF indications, **0 to turn the LED on** (LOW).
- **Connection**: signal pin to the microcontroller, **LED1÷LED8** pin of the 40-pin connector.

Note: to turn on an LED, set its pin to 0 (LOW).

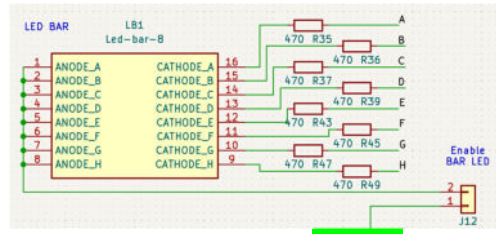
RGB LED (WS2812)



- Digitally addressable **RGB LEDs**: a single package with light-emitting diode and driver, controlled via a single data pin.
- **Connection**: **signal pin to microcontroller**, WS2812 pin of 30-pin connector.

Note: it is possible to continue the LED chain using the dedicated terminal block, paying attention to the current absorbed by the strip.

LED graphic bar

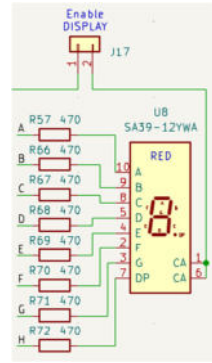


- Multi-LED visual indicator to represent analog or digital values.
- **Connection**: **signal pin to the microcontroller**, GRE/YEL/RED pin of the 40-pin connector, 21÷25 **GREEN**, 26÷27 **YELLOW**, 28 **RED**.

Note: to turn on an LED, set its pin to 0 (LOW).

5.2. Display

7-segment display

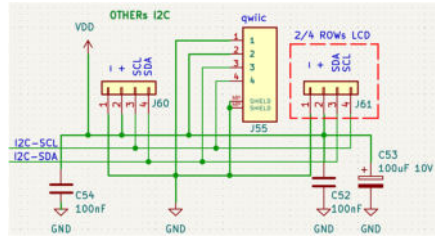


- Allows for simple single-digit numeric displays.
- Already wired and ready to use.
- **Connection**: **signal pin** to the microcontroller, **A÷dp pin** of the 40-pin connector

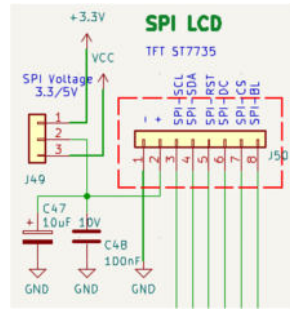
Note: to turn on an LED, set its pin to 0 (LOW).

SPI or I²C LCD display

- Supports displays and devices connectable via dedicated connectors:
  Connection: I²C pin **I²C SCL** and **I²C SDA** of the 40-pin connector.

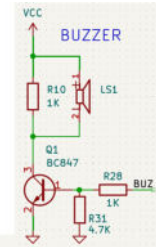


Connection: SPI pin **SPI SCL**, **SDA**, **RST**, **CS** and **BL** of the 40-pin connector.



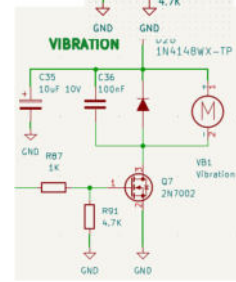
5.3. Actuators and acoustic signals

Piezoelectric buzzer



- Generates sounds or beeps via digital PWM control.
- **Connection**: signal pin to the microcontroller, **BUZZER pin of the 30-pin connector**.

Vibration motor

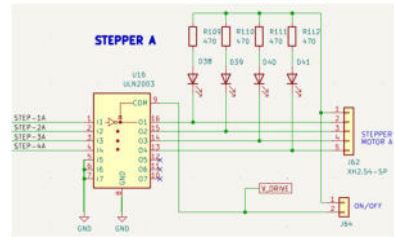


- Simple actuator for tactile signals or physical feedback.
- **Connection**: signal pin to the microcontroller, **VIBRO pin of the 30-pin connector**.

5.4. Engines and movement

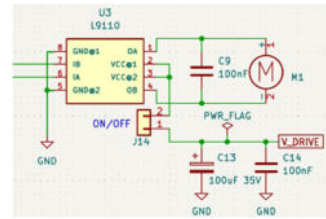
Stepper motors

- Two dedicated outputs, ready to drive stepper motors with microcontroller.
    - **Connection**: signal pin to the microcontroller, **pin STEPP.A 1, 2, 3** and **4**, **STEPP.B 1, 2, 3** and **4 of the 30-pin connector**.



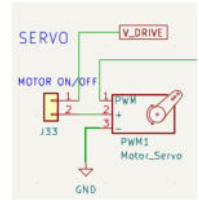
DC motors

- Two dedicated outputs, for DC motors.
    - **Connection**: signal pin to the microcontroller, pins **M1 A/B and M2 A/B of the 30-pin connector**.



Servomotors

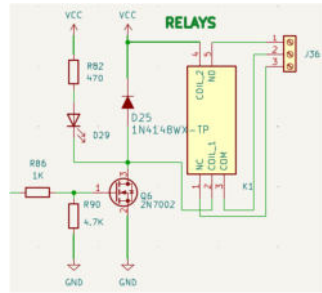
- Dedicated outputs for connecting up to two servomotors.
    - **Connection**: signal pin to the microcontroller, **SERVO A and SERVO B pins of the 30-pin connector**.



5.5. Relay and IR TX

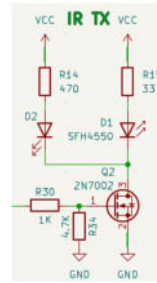
Relay

- Allows you to safely control external loads via digital signal.
- **Connection**: signal pin to the microcontroller, **RELAY pins 1, 2 and 3 of the 40-pin connector**.



IR Transmitter (IR TX)

- Allows sending commands to IR compatible devices (TV, decoder, home electronics).
- **Connection**: signal pin to the microcontroller, **IR-TX pin of the 30-pin connector**.



5.6. Microcontroller connections

All these devices are already wired and ready:

1. Locate the **signal** pin corresponding to the output device.
2. Connect the pin to the microcontroller.

3. The board already handles the necessary VCC and GND.

💡 **Note**: motors, LED strips, and relays may require more current than the microcontroller's USB can provide. If so, use a compatible external power supply.

---

6. Connection and integration

This section provides general guidelines for connecting the **JollyBoard.RP328** to external microcontrollers and combining input and output devices in your application.

6.1. General connection

6.1.1. Connection to the microcontroller

1. Locate the **signal pins** of the sensors and actuators you want to use.
2. **Connect each pin** to the corresponding microcontroller.
3. **Check** that VCC and GND are connected correctly, if necessary.
4. **Connect the GND** of the JollyBoard.RP328 to the GND of the microcontroller.

6.1.2. Power supply of the JollyBoard.RP328

1. Connect the card via **USB Type-C or PLUG**.
2. Turn on the main switch.

💡 **Note:** all modules are pre-wired: no additional resistors or logic adapters are needed.

Check load consumption (motors, relays, LED strips) and use external power if necessary.

6.2. Integration of input and output

- **Sensors** send digital or analog data directly to the microcontroller.
- **Actuators** receive digital or PWM control signals from the microcontroller.

- You can combine multiple devices at the same time: for example, read a button and turn on LEDs or drive motors.

💡 **Note:** the board is designed to simplify integration, reducing wiring and the risk of electrical errors.

6.3. On-board mounting of microcontroller boards

Although the **JollyBoard.RP328** was designed to be used alongside a microcontroller board, during development the need for a system that **could be easily repositioned on the desk** arose several times, i.e. moved as a single body without compromising the connections.

The first solution was to integrate a socket for **Arduino Pro Mini**, programmable and powered directly via the USB port from which it draws power. Subsequently, **holes were added** in various positions on the board to allow for the attachment, via spacers, of boards such as the Arduino Nano, Raspberry Pi Zero, and Raspberry Pi Pico.

These boards can be mounted with the pins facing upwards, so as to conveniently connect to the signals available on the **JollyBoard.RP328** connectors.

This way you get a compact and robust assembly, in which the **JollyBoard.RP328** and microcontroller **form a single body**, easy to move and without the need for additional wiring.

6.4. User Tips

- Always keep the connections between input and output pins clear.
- Document connections if you are doing complex projects.
- Always check the polarity and voltage of external loads.

---

7. Connection examples

This section provides practical examples of connection between the **JollyBoard.RP328** and an external microcontroller, illustrating the combined use of sensors and actuators.

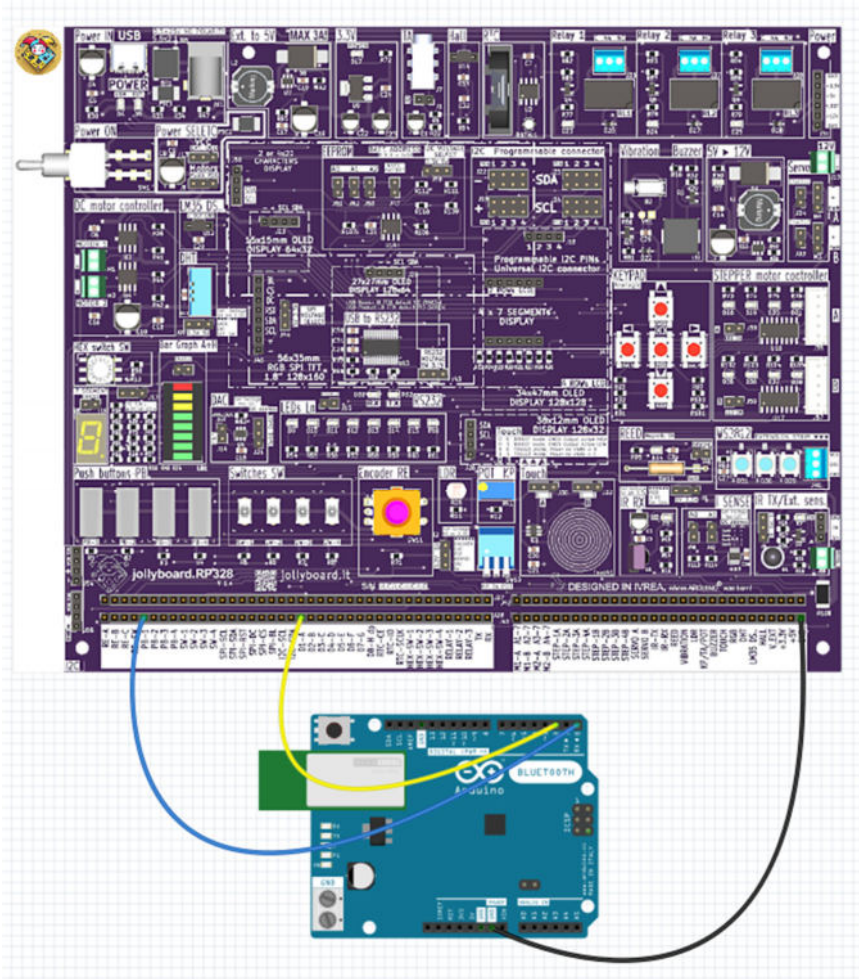
⚠ **Note:** the examples only show the connection logic. They do not include complete wiring diagrams; add any separate power supplies for heavy loads.

7.1. Turning on an LED with a button

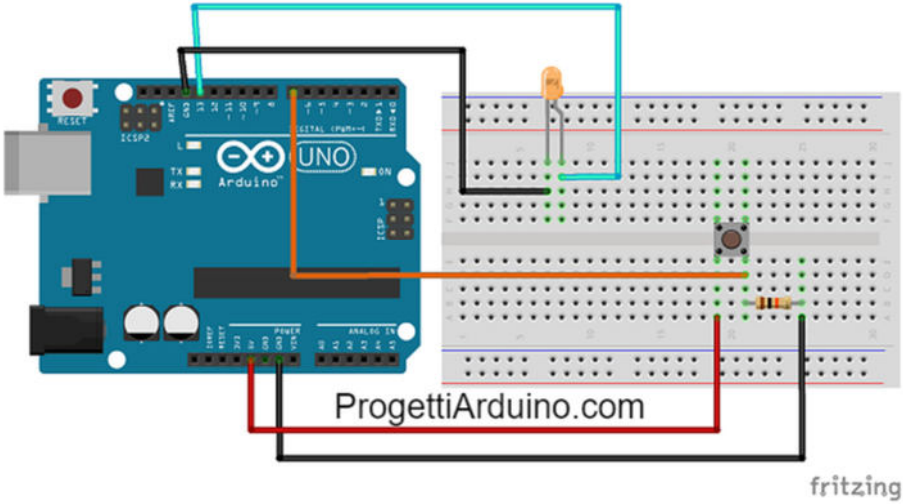
Goal: Read a button input and turn on an LED.

Connections:

- Button signal pin → microcontroller digital pin
- LED signal pin → microcontroller digital pin
- Connect the **microcontroller's GND to the JollyBoard.RP328's GND**; the board's VCC and GND are already handled.



With breadboard…

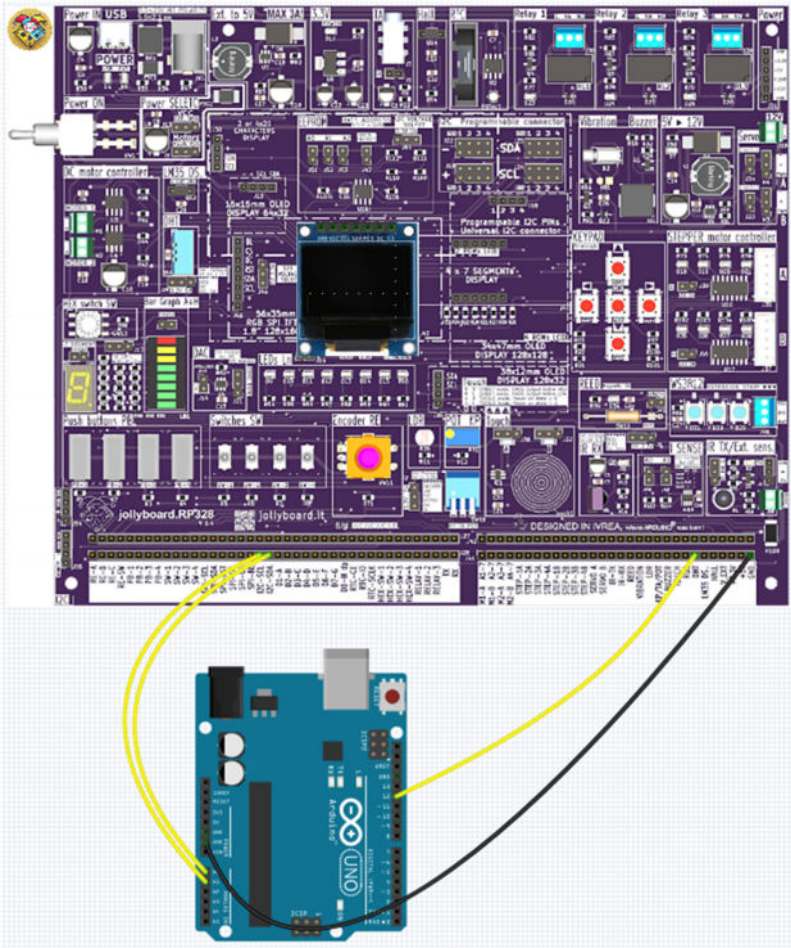


7.2. Reading a temperature sensor on LCD

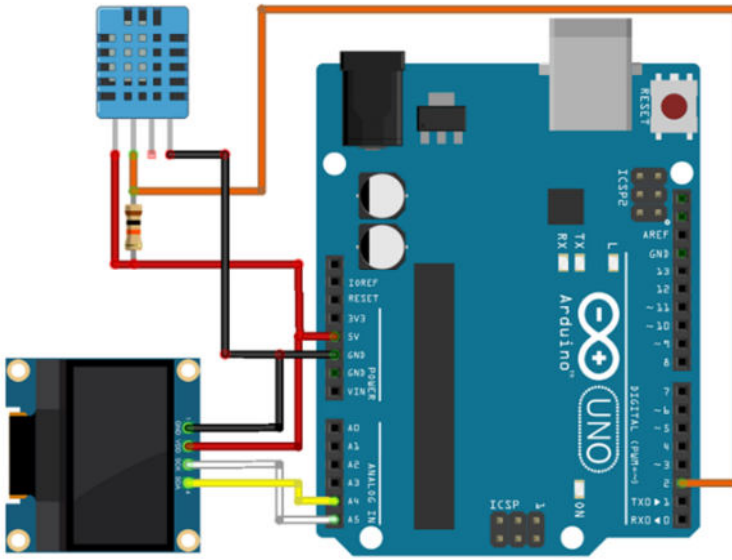
Goal: read the value of the DHT11/DHT22 sensor and display it on the OLED display **SD1306**.

Connections:

- Sensor Data Pin → Microcontroller Digital Pin
- I²C pin (2 wires)
- Connect the **microcontroller's GND to the JollyBoard.RP328's GND**; the board's VCC and GND are already handled.



With breadboard…

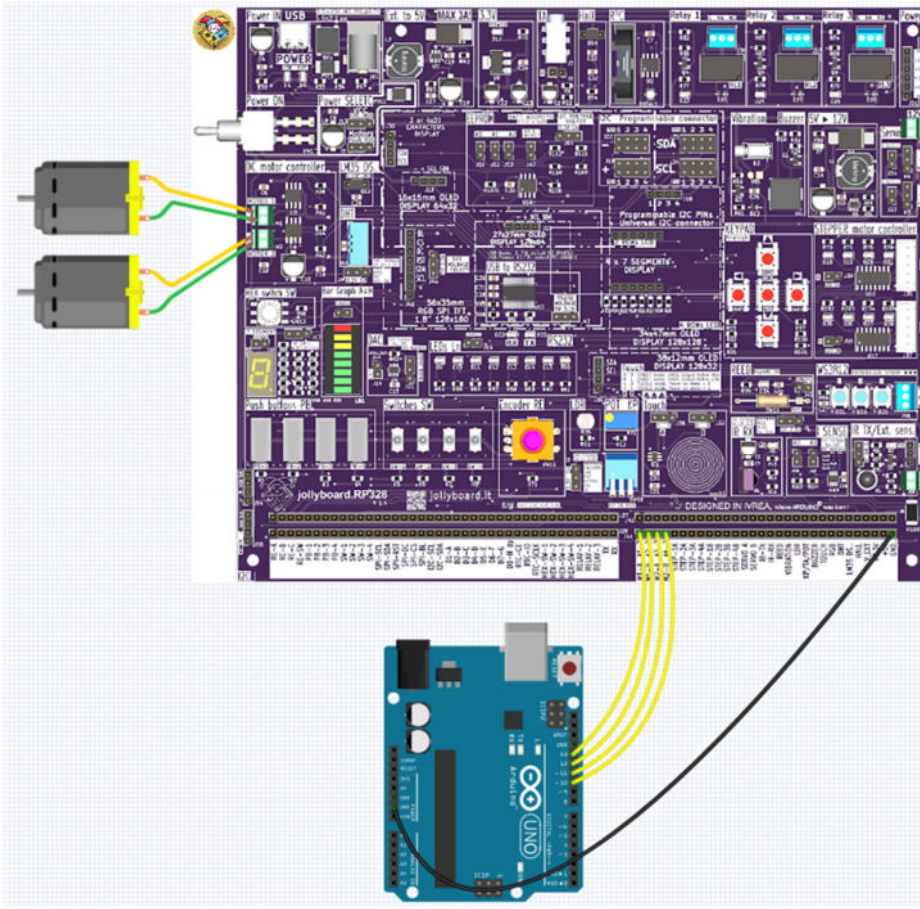


7.3. Pilotaggio di due motori DC

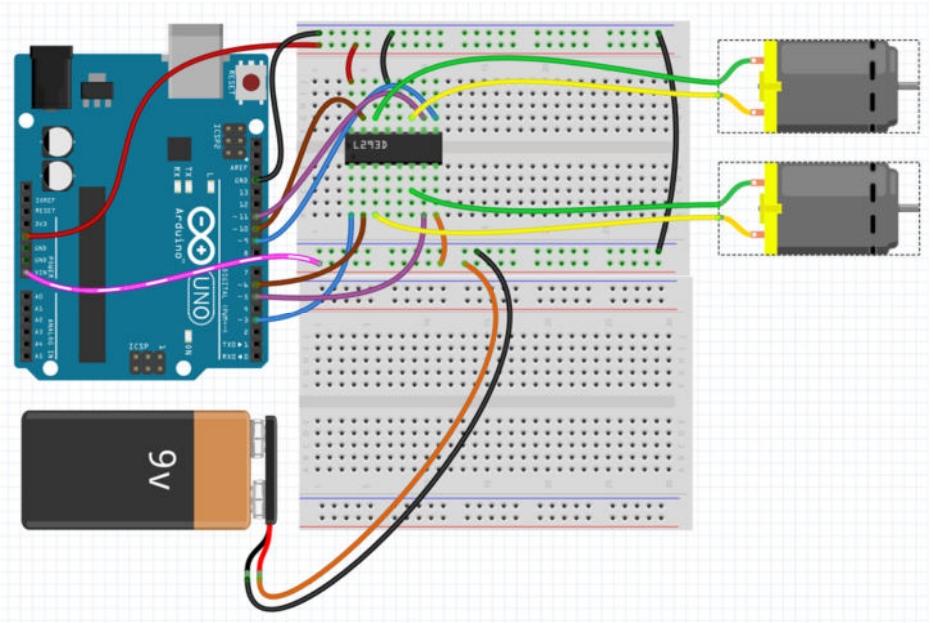
Goal: pilotare due motori DC.

Connections:

- Pin segnali dei motori DC → microcontrollore.
- Configurare i jumper di alimentazione (5V o VPLUG)
- Connect the **microcontroller's GND to the JollyBoard.RP328's GND**; the board's VCC and GND are already handled.



With breadboard…

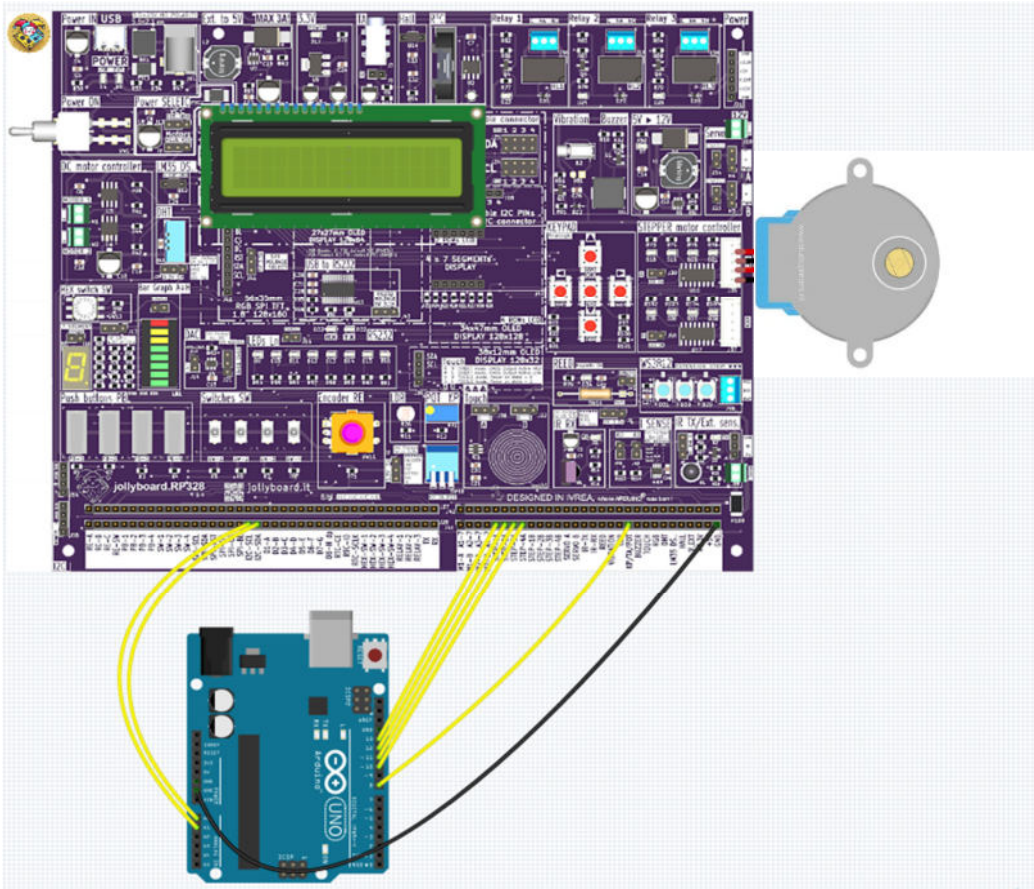


7.4. STEPPER motor control

Goal: adjust the speed of a motor via potentiometer and speed indication on a 2x16 character LCD display.

Connections:

- STEPPER data pins → microcontroller digital pins
- POTENTIOMETER pin → analog pin of the microcontroller
- I²C pin → I²C pin of the microcontroller
- Connect the **microcontroller's GND to the JollyBoard.RP328's GND**; the board's VCC and GND are already handled.



With breadboard…

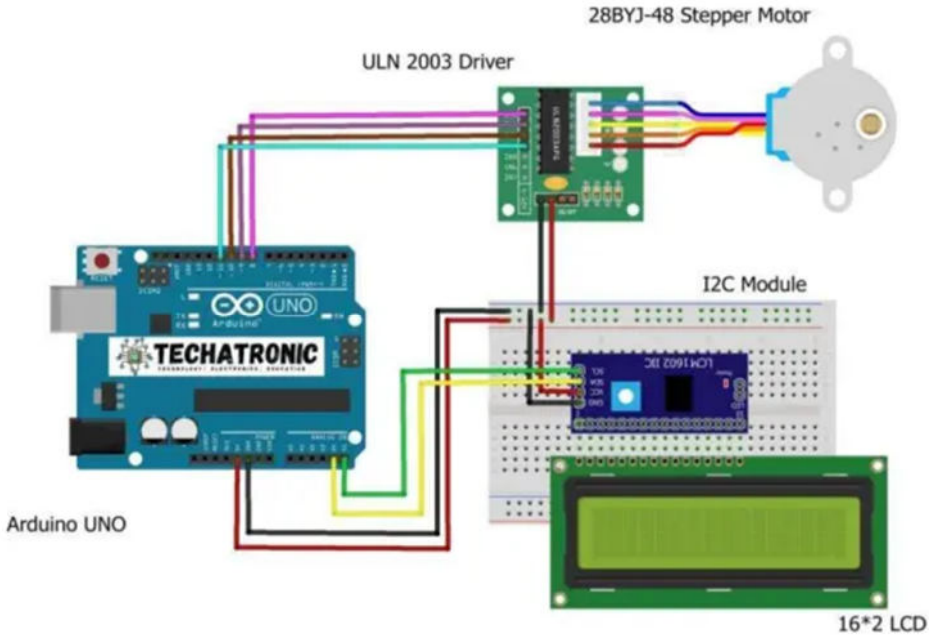


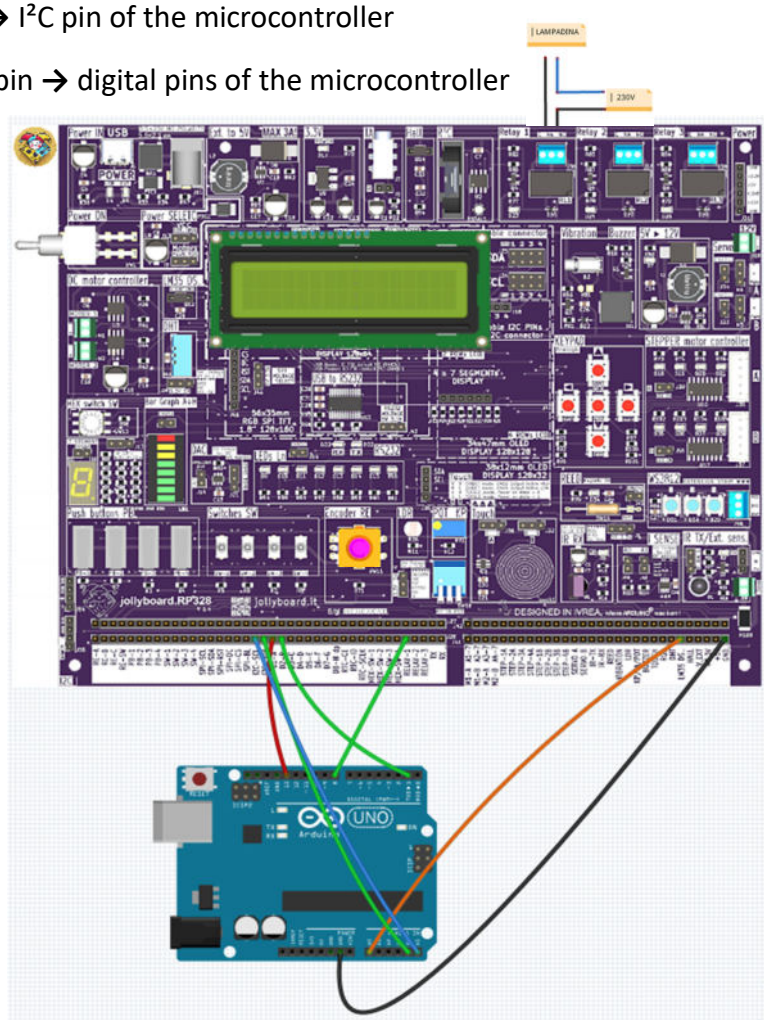
Image https://duino4projects.com/arduino-magic-driving-stepper-motors-using-uln2003-driver/

7.5. Menu management

Goal: 3-button menu, relay control, 2x20 character LCD display and 2 control LEDs.

Connections:

- Pin 3 KEYS → digital pins of the microcontroller
- Pin 2 LED → digital pins of the microcontroller
- LM35 SENSOR pin → microcontroller pin
- in I²C → I²C pin of the microcontroller
- RELAY pin → digital pins of the microcontroller



With breadboard…

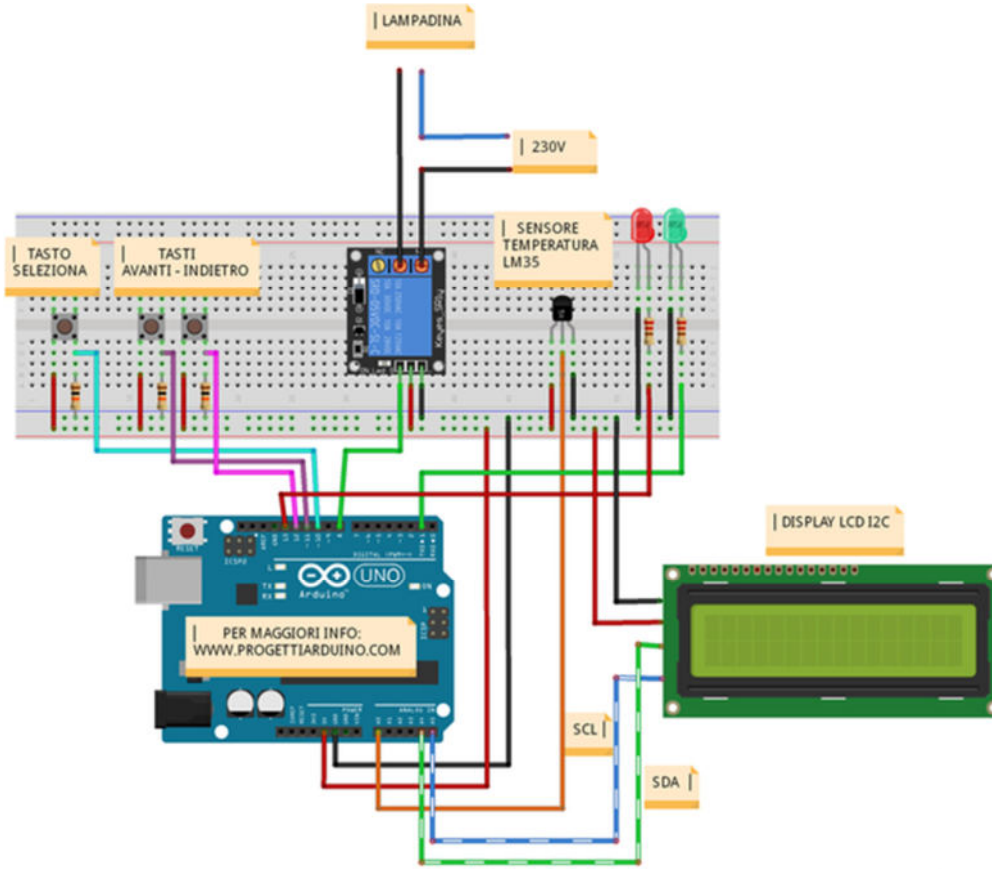


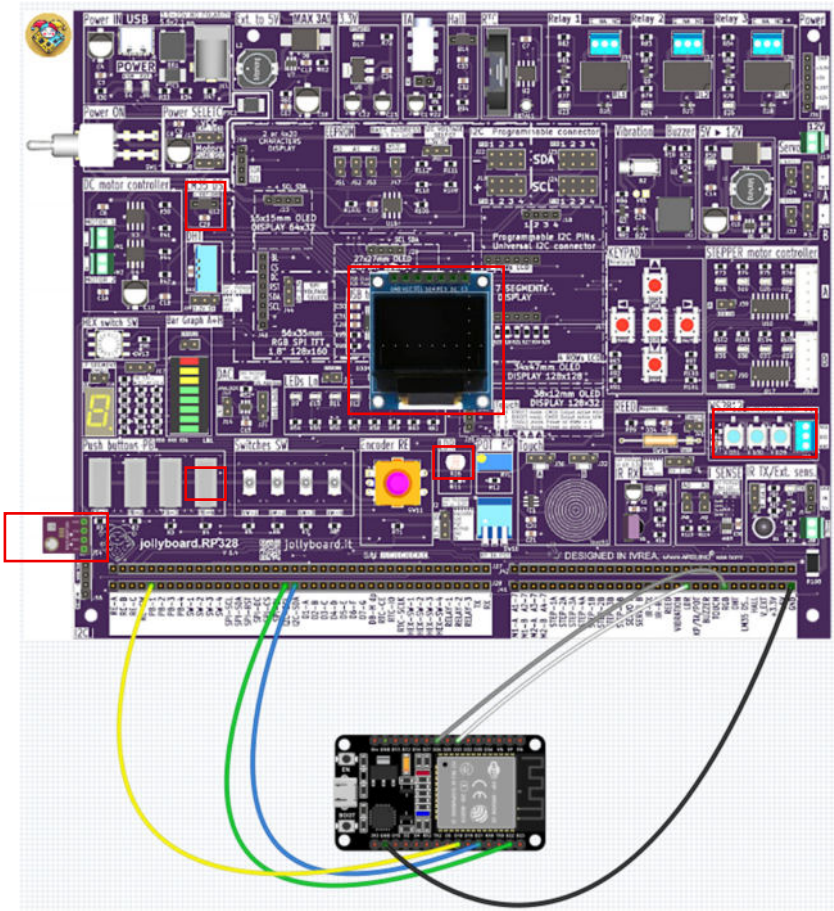
Image https://www.progettiarduino.com/67-arduino-menu-lista-opzioni-e-scelta-rapida.html

7.6. Weather station with ESP32

Goal: weather station with BME280 temperature, humidity and pressure sensor, a photoresistor, a button, an OLED display and several addressable WS2812B RGB LEDs.

Connections:

- KEY pin → digital pin of the microcontroller
- PHOTORESISTOR pin → digital pin of the microcontroller
- I²C pin → I²C pin of the microcontroller



With breadboard…

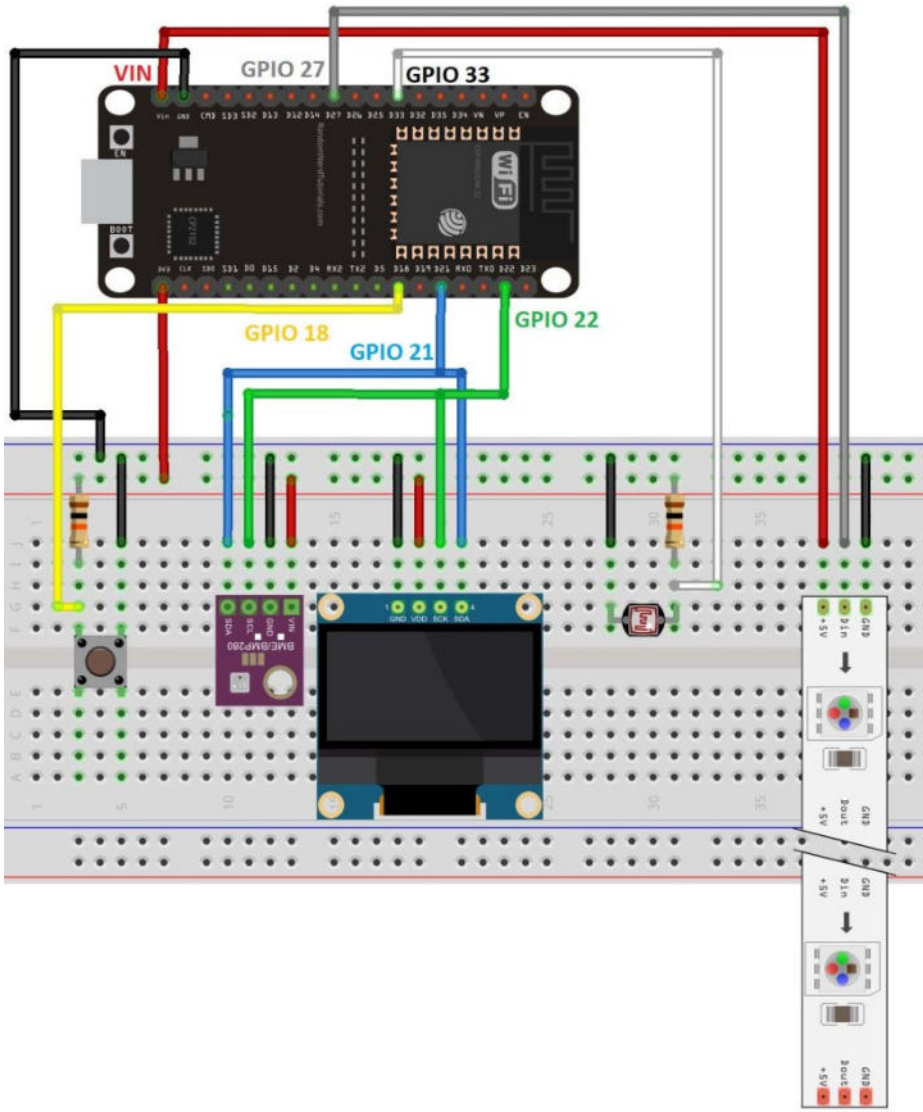


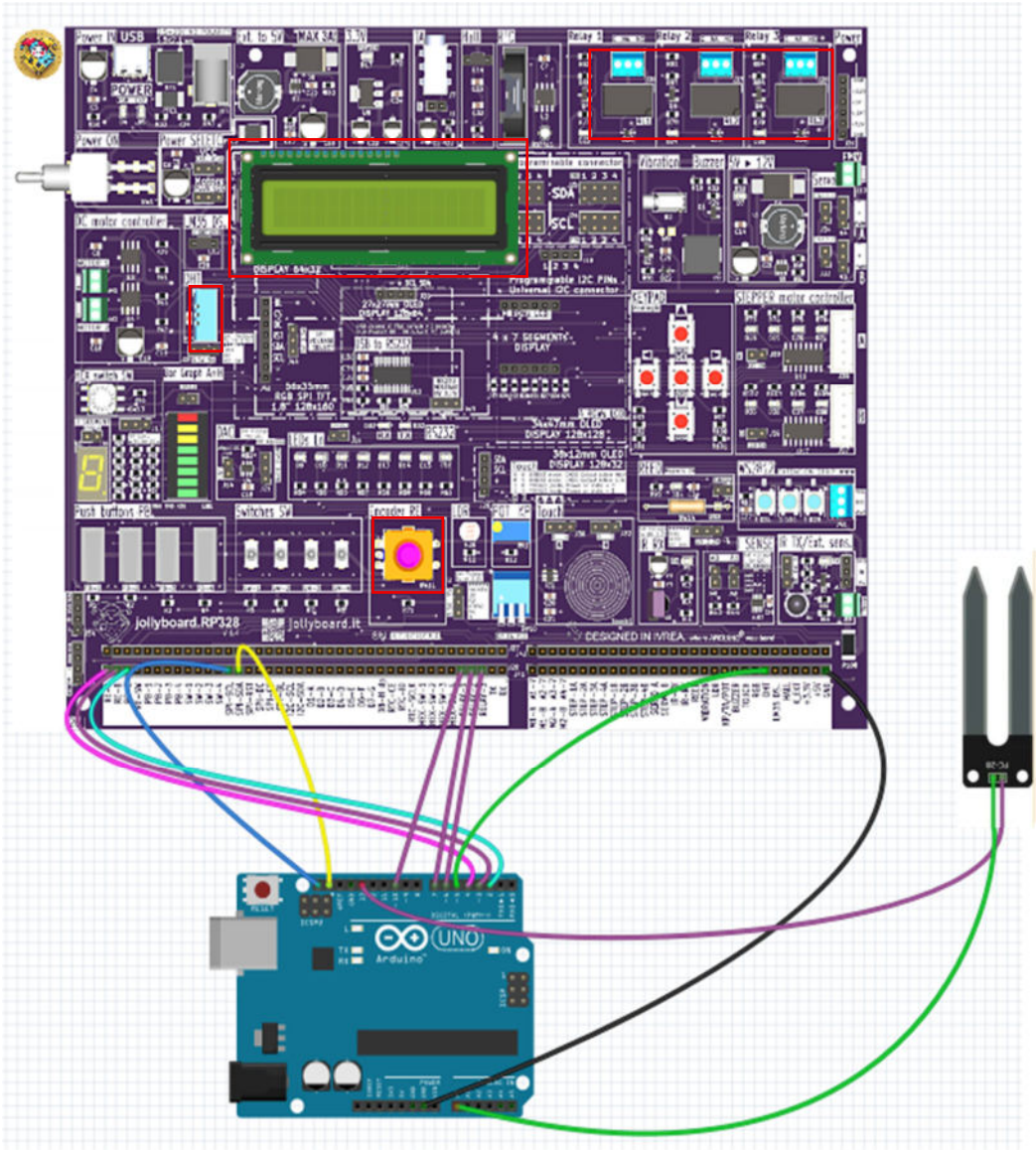
Image https://randomnerdtutorials.com/esp32-weather-station-pcb/

7.7. Greenhouse Management

Goal: greenhouse project focusing on LCD, rotary encoder, water pump, light, fan, humidifier control; soil moisture sensor; and air humidity and temperature sensor.

Connections:

- LCD **I²C** pin → 2 microcontroller I²C pins
- Pin **3 RELAY** → 3 digital pins of the microcontroller
- **DHT11** pin → 1 microcontroller pin.
- **ENCODER** pin → 3 digital pins of the microcontroller.
- **SOIL MOISTURE** pin → 1 analog pin of the microcontroller.
- **5V PLUG and 12V PLUG → NOT NECESSARY**, already present on the JollyBoard RP328
- Fan control to be made externally


jollyboard.RP328
jollyboard.it
DESIGNED IN VREA
UNO
Arduino

With breadboard…

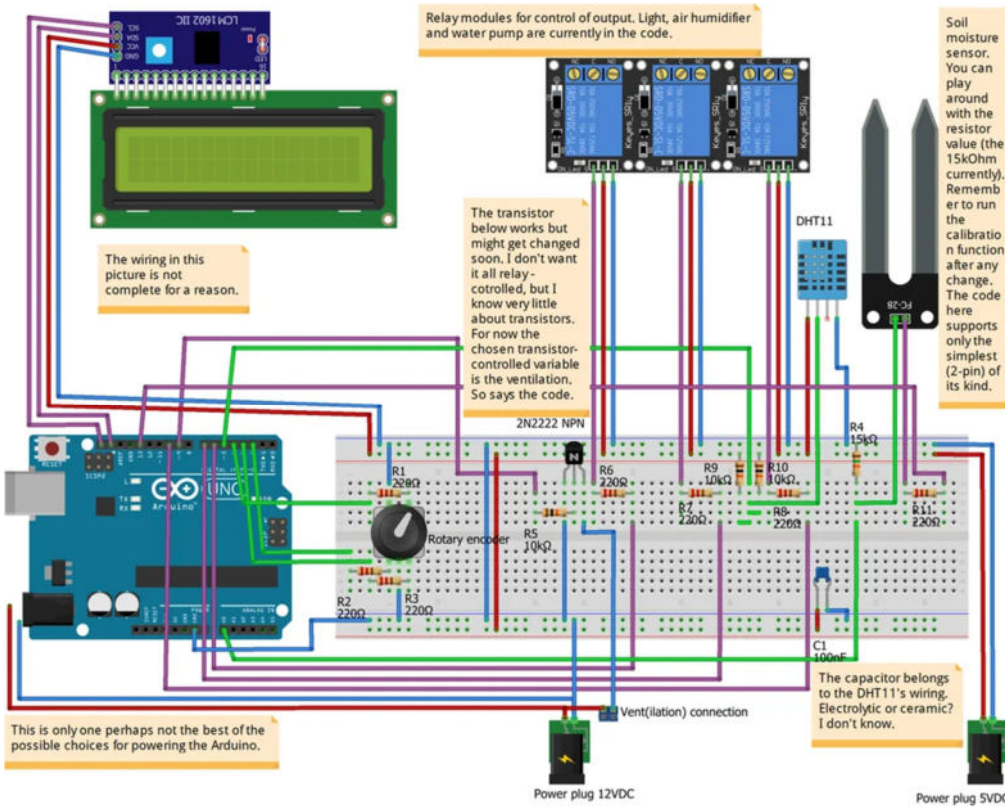


Image https://www.instructables.com/Arduino-UNO-LCD-16x02-and-Rotary-Encoder-Controlle/

8. Safety and maintenance

The **JollyBoard.RP328** is designed to be safe and reliable, but following some good practices will ensure the correct functioning and longevity of the board.

8.1. Electrical safety

- **Power**
    - Always use **USB** or external **PLUG** with correct voltage (5V USB, 6–40V PLUG).
    - Avoid exceeding the indicated current limits.
- **Load protection**
    - Motors, relays, and LED strips may require more current than USB can provide; in that case, use an external power supply.
    - Always check the polarity of external connections.
- **Signals and logic**
    - All sensors and actuators are compatible with 3.3V/5V logic (check the selection jumpers), but check the compatibility with your microcontroller.
    - Before connecting or disconnecting power to the **JollyBoard.RP328**, make sure the main switch is in the OFF position (lever at the bottom).

8.2. Routine maintenance

- Keep the board clean from dust and conductive residues.
- Periodically check Dupont connectors and connection pins for any oxidation or looseness.
- Avoid bending or stressing the components integrated into the board.

8.3. Troubleshooting

- **The card does not turn on** → check that the main switch is in the ON position (upward position), check the USB power supply (try with another cable), if powered by a PLUG check the polarity (check that the red LED is not on and if so change the power supply - **you need the central one**) and if correct try changing the power supply; check the power jumpers.
- **Input/Output not responding** → check pin connections, polarity and logic level, condition of the connecting cable and the correctness of the program.
- **Abnormal behavior under high loads** → use separate power supply for motors or LED strip.

9. Appendices and resources

This section contains additional information useful to the user, references, and any online resources to help you make the most of the **JollyBoard.RP328**.

9.1. Additional resources

- **Official website**: https://jollyboard.it
- **Technical documentation**, electrical diagrams, datasheets of sensors and integrated modules:
    - Arduino PRO MINI
    - Temperature and humidity sensor DHT22 DHT11
    - Temperature sensor DS18B20
    - Temperature sensor LM35
    - 4x7-segment display CA56-12
    - RTC DS1302
    - DC Motor Controller L9110S
    - Stepper motor controller ULN2003
    - Current sensor INA219B
    - EEPROM memory CAT24C256
    - Touch sensor TTP223-BA6
    - DAC MCP4725
    - Infrared receiver TSOP23...
    - IR LED SFH4550

- Current transformer SCT-013
- Addressable LEDs WS2812
- HALL sensor A3144EUA
- USB to UART FTDI232

9.2. Practical tips

- **Connection documentation**: always keep track of your wiring, preferably with photos and notes; this will be useful for both maintenance and for replicating the project.
- **Software Management**: regularly update your libraries and check for version compatibility, including noting the library version and author in the program. Clearly document the programs you develop and **create regular backup copies** of your files.
- **Reliable power supply**: use stable and protected power sources, especially for loads such as motors or LED strips, which can generate noise and current spikes.
- **Safety Habit**: always disconnect power before changing connections.
- **Order and modularity**: organize your wiring neatly and build your projects in modules: this makes testing, troubleshooting, maintenance and future modifications easier.

9.3. Contacts and support

For technical assistance, updates or clarifications:

- email or contact form from the official website **JollyBoard.RP328**.

10. Technical Specifications – JollyBoard.RP328

10.1. Power supply

- Power supply via **USB Type-C: 5V up to 3A**
- External power supply via **PLUG (DC jack)**, between **6V and 40V**
- Integrated protection against **reverse polarity** (LED indicator) and **overloads** via self-resetting PTC fuses.
- Motor power supply selectable in three modes:
    1. **5V from USB port**;
    2. **5V regulated via PLUG**;
    3. **Direct voltage supplied by the PLUG**.

10.2. Voltage regulators

- **Built-in 3.3V DC-DC regulator**, for internal power supply and also for external modules.
- **Integrated 5V DC-DC regulator from PLUG**, for internal power supply and also for external modules.
- **Built-in 12V DC-DC regulator**, useful for powering external modules.

10.3. Protections

- Both power inputs (USB and PLUG) are covered by **self-resetting fuses** (PTC) for electrical safety.

- There is a **main switch** to completely isolate the board from the power supply.

10.4. Connectivity and integrated modules

- **40- and 30-pin** connectors that group signals from each integrated module – sensors, actuators, buttons, displays, LEDs, relays, etc. Each signal is duplicated on two adjacent pins for ease of wiring.
- Interfaces:
    - Integrated **I²C**, **SPI**, **UART**, relays, touch, LEDs and much more ready to use right out of the box.
    - **qwiic** connector that allows you to cascade various available modules that use this connection standard.
- **6 onboard I²C connectors**, support up to **4 displays** and can also be used for other I²C devices.
- **SPI connector** available for displays and other SPI devices.
- **RTC** (Real Time Clock) with battery backup to maintain date and time.
- **256 KB (32 KB) I²C serial EEPROM** for persistent storage.

10.5. Sensors and control

- Integrated **multi-turn potentiometer** for precise analog adjustments.
- Supported **motors**:
    - **2 stepper motors**, with integrated drivers;

    - **2 DC motors**, with integrated drivers;
    - **2 servo motors**, with dedicated PWM connectors.
- **Various sensors** ready for use:
    - Temperature (analog and digital),
    - Magnetic reed,
    - Hall,
    - LDR,
    - Capacitive touch,
    - Rotary encoder,
    - Hexadecimal switch,
    - Various buttons and switches.

10.6. Visual and audio outputs

- Integrated **7-segment display** and **4x7 display socket**.
- Sockets for **OLED**, **LCD** or other **I²C displays** (e.g. e-paper).
- LED **graphic bar**.
- **3 RGB LEDs** + expansion.
- **LEDs**.
- **Built-in buzzer** for acoustic signals.
- Built-in **vibration motor** for tactile feedback.
- Integrated **relays** to control AC or DC loads in isolation.

- **USB → UART** Integrated with 3.3V/5V logic level management and status LEDs for RX/TX signals

11. Technical features

Dimensions 202 x 166 mm

PC Interface

- **USB Type-C** connector
- **USB converter ►UART on board** with FTDI FT232RL chip; **RX/TX compatible 3.3/5V** with jumper.

Alimentazione

- **USB** or **Power Bank** (VCC)
- **External** via **PLUG connector**, voltage **6÷40V** up to **3 A**, connector dimensions **5.5×2.1 mm**

Both power supplies are protected from **3A overload**

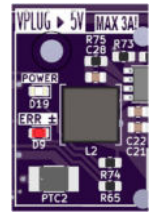
Integrated regulator for **PLUG voltage** (PLUG → 5V - VCC)

Integrated regulator for **3.3V** voltage (VCC → 3.3V)

Built-in **12V** voltage regulator (VCC → 12V): supplies voltage to external devices

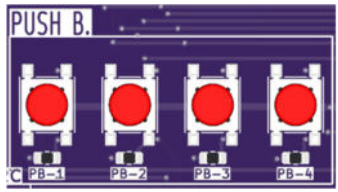
- Flexible jumper-selectable power supply:
  - **JollyBoard.RP328 power supply**
    - from **USB**
    - from **Power Bank USB**
    - from **PLUG**
  - **Motors Power Supply**
    - 5V (from USB or with **PLUG regulator)**
    - direct voltage **from PLUG**

🔋 The **JollyBoard.RP328** features reverse polarity protection (with LED indicator) and self-resetting fuses.

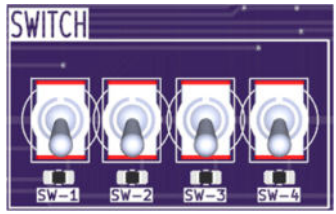


Keys and controls

- 4 Buttons (1 NOT pressed, 0 pressed)

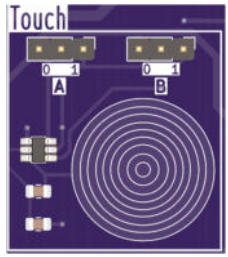


- 4 Switches (1 up, 0 down)

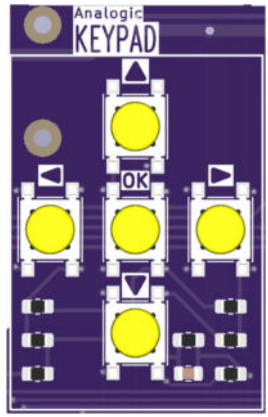


- 3 Relays (normally open and normally closed contacts, on 1)

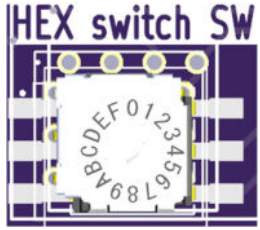
- 1 Touch Button



- 1 5-button keypad



- Rotary hexadecimal encoder (0÷F)



Motors

- Controller for 2 DC Motors
- Controller for 2 Stepper Motors with LED indicators (jumper-enabled)
- Connectors for 2 Servo Motors (jumper-enabled)

Acoustics

- Buzzer
- Vibration Motor

Regulation

- Multi-turn Analog Potentiometer

- Rotary Encoder with Switch

Indicators

- **8 LEDs** (enable jumper)
- **1 x 1-digit 7-segment display** (segments connected to the 8 LEDs, enable jumper)
- **Connector for 4-digit 7-segment display** (segments connected to the 8 LEDs (NO enable jumper).
- **8 LED Graphic Bar** (each bar is connected with the 8 LEDs, enable jumper)
- **3 RGB LEDs** + terminal block for LED strip expansion.

Sensors

- **TEMPERATURE**: DS18B20, LM35
- **TEMPERATURE/HUMIDITY:** DHT11/22
- **MAGNETIC**:
  - Hall sensor
  - Reed switch
- **LIGHT**: Photoresistor (LDR)
- **DAC** with MCP4725 chip
- **Current sensors** with INA219B and SCT-013 chips

Infrared

- **IR receiver**
- **IR transmitter** (connector for external transmitter or sensor)

Timing & storage

- **RTC** Real Time Clock with 2032 backup battery
- **EEPROM** 32K

I2C Connectors

- **1 programmable connector**
- **1 expansion connector**
- **1 qwiic connector**
- **4 I2C connectors for connecting DISPLAY**, compatible with:
  - 2×16 character LCD
  - 4×16/20 character LCD
  - 15x15mm 64×32 OLED
  - 38x12mm 128×32 OLED
  - 27x27mm 128×64 OLED
  - 34x47mm 128×128 OLED
- **Up to 4 simultaneous LCD displays**

SPI connector

- 1.8" 128×160 RGB SPI TFT display
- Other SPI devices

I/O Connections

- 40+30 PIN DOUBLE connectors for I/O and power to Arduino, Raspberry Pi, ESP, microcontrollers…
- 2 dedicated connectors for powering external devices:
  - **6 PIN** 2.54 mm pitch **GND, 3.3V, 5V, VPLUG, 12V, GND**
  - **12V** terminal block