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ELECTRONIC GUIDEBOOK

Safety 101

Electronic equipment is generally safe to use and designed for learning. However, improper handling or wiring mistakes can cause short circuits, burns, or damage to components.

VAPOR

Soldering wires poduces toxic vapors. Always use the soldering fume extractor.

CUT

When handling sharp tools like pliers or cutter blades, be careful not to injure yourself

Heat

Soldering irons are extremely hot. Be careful when using them, never touche the tip.

Electric

Be careful when working with electricity. Always check your connections before using power and stop immediately if something overheats.

Few ground rules

1

Book your session before use.

2

Use breadboards to test your project before soldering it.

3

Always use DC, not AC. Don't plug anything in the wall socket without asking permission first.

4

If you have any doubts, don't hesitate to ask for help. It's better to ask for help than to do something wrong.

5

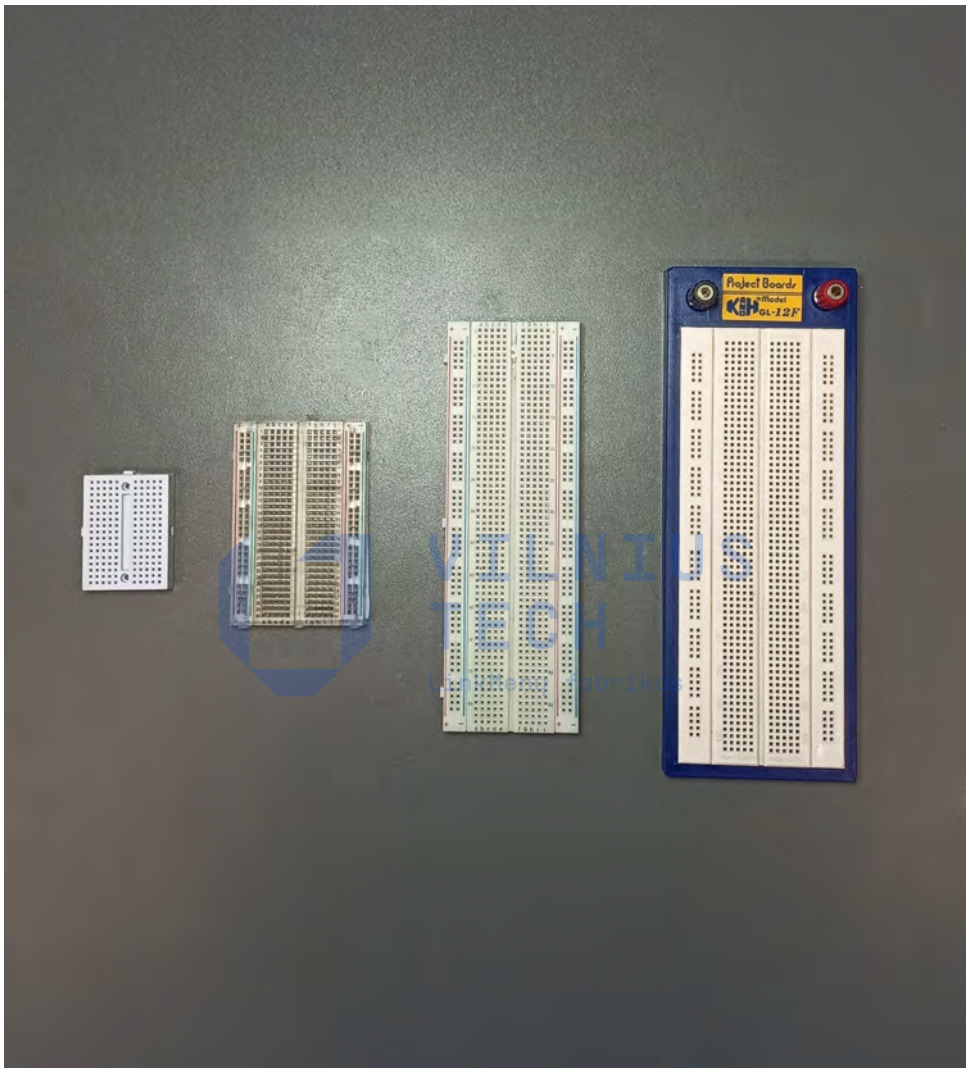
Always clean after you. Don't leave trash on the tables. It's always nice to work in a clean environment

Testing

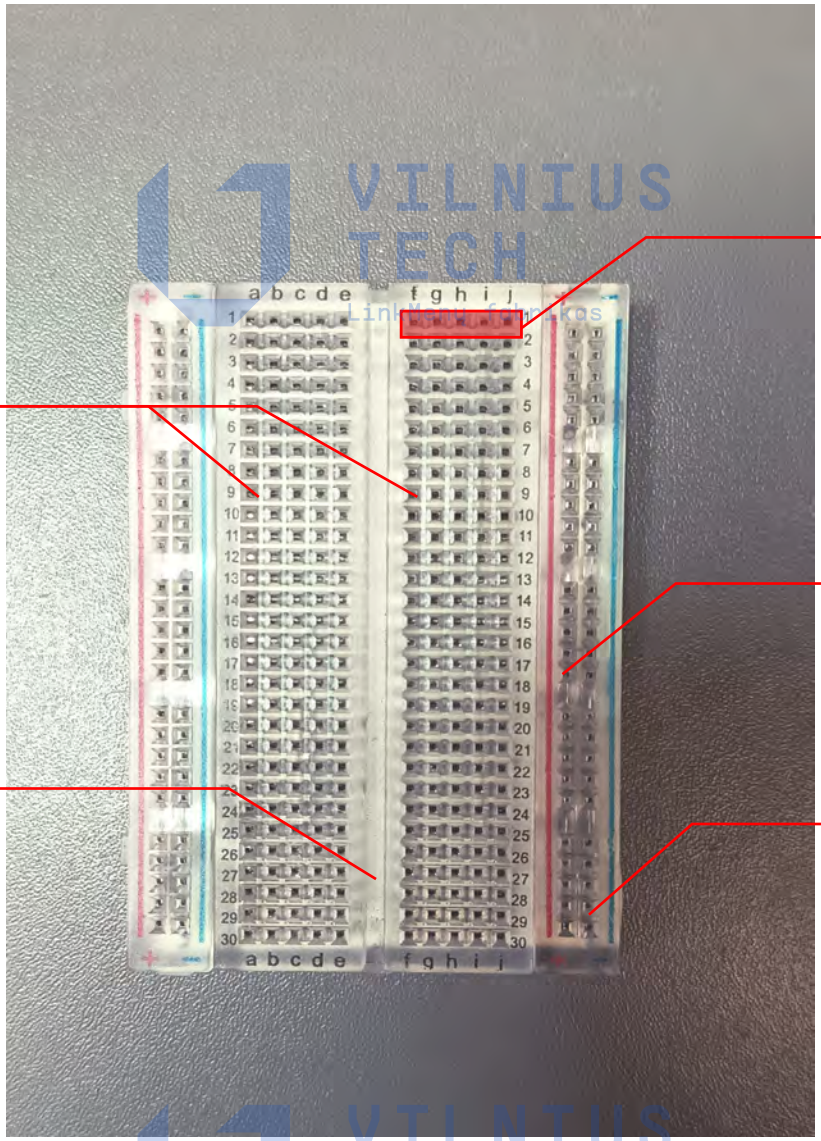
The basics

Breadboard

It is recommanded to you breadboards when doing your project, they are very useful when prototyping. They let you test your circuit before soldering the final version. You can easily add, remove, and rearrange components.



Anatomy of a breadboard



Component connectors:
Each breadboard hole contains a metal clip that holds and electrically connects the component leads inserted into it.

Horizontal rows:
Each series of five connectors (A–E and F–J) is internally linked. Any components placed in the same row are electrically connected to each other.

Center line:
This line divides the breadboard in half. It prevents electrical contact between one half and the other.

Power bus:
Each side of the breadboard has a pair of vertical connections marked – and +.

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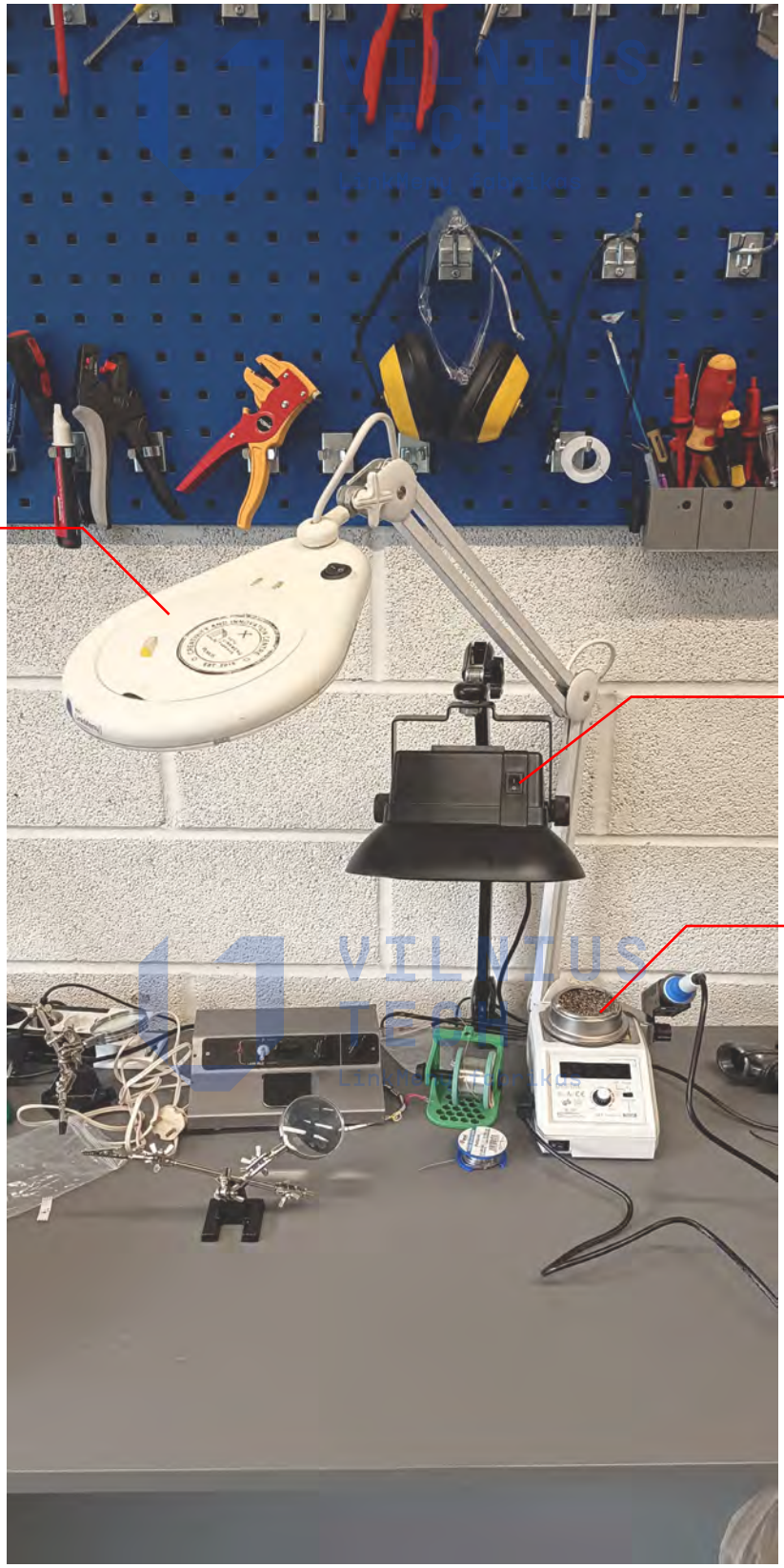
Soldering

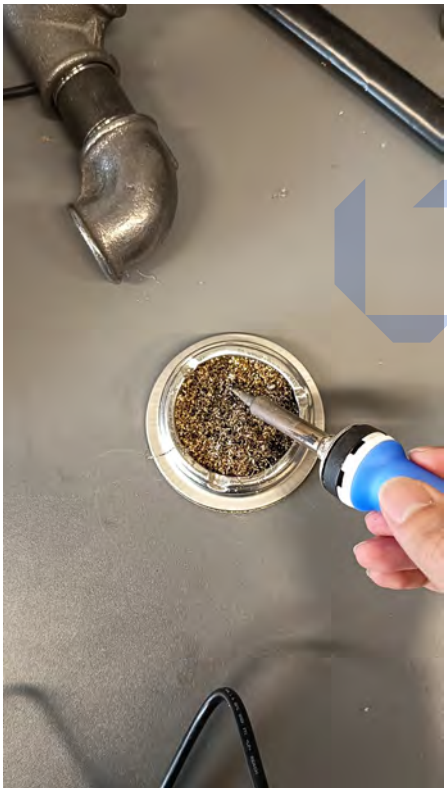
How does it work?

Soldering station



Control pannel on wich you set the temperature or the soldering iron.

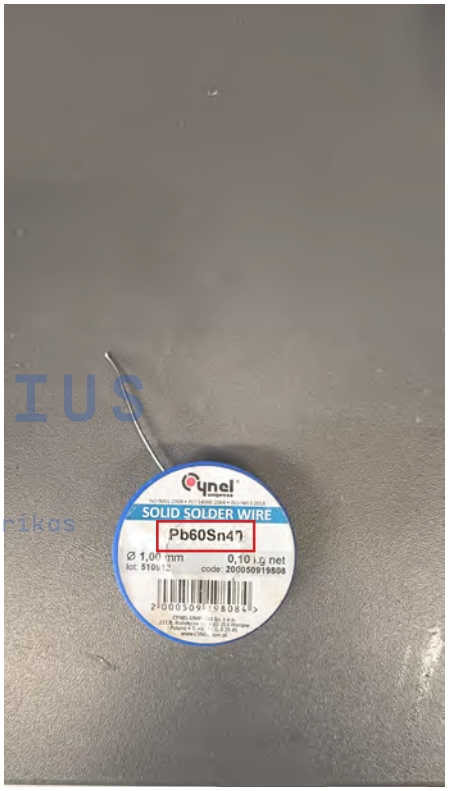
Soldering iron, don't touch the tip when turned on.



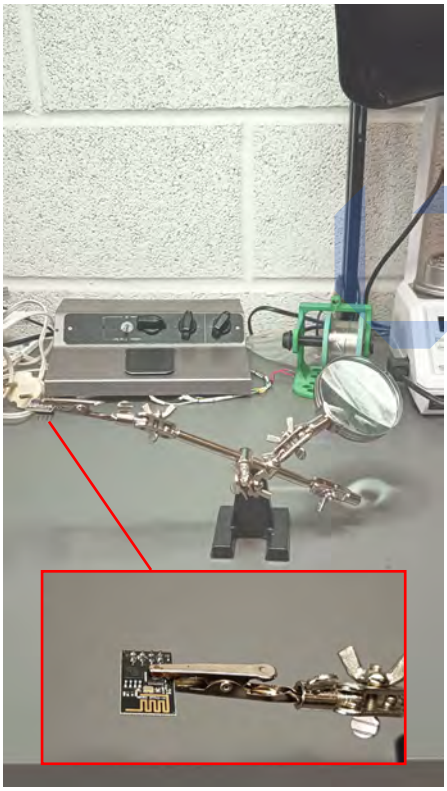
Clean the tip before and after soldering.

When soldering, always use the fumes extractor.

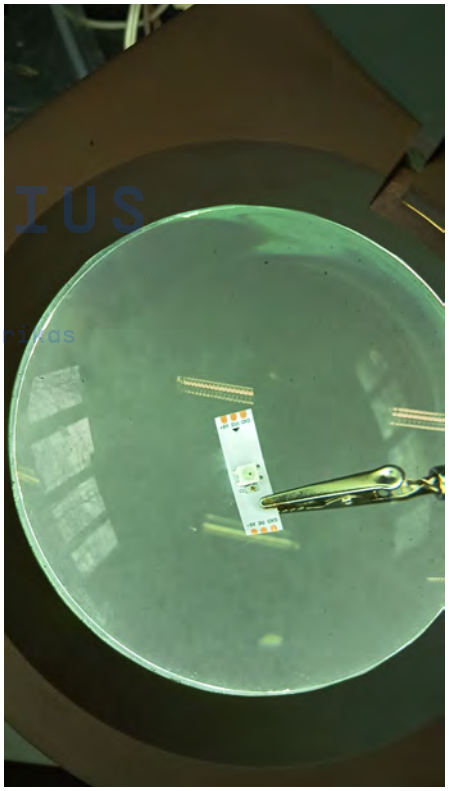
Always use Flux when soldering. It is used to clean and prevent oxidation on metal surfaces. (annex p.20)



Composition of the soldering wire (leaded or lead-free) suits different components and applications. (annex p.21)



For projects that require both of your hands, you can use soldering third hand.



For projects that require more precision, you can use the magnifier glass.

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Power up!

Power-Up Safety Checklist

Power-Up Safety Checklist

1

Make sure every wire and component is CORRECTLY connected and FIRMLY in place.

2

Ensure no BARE WIRES or METAL parts are touching each other.

3

DOUBLE-CHECK that positive and negative leads ARE NOT REVERSED.

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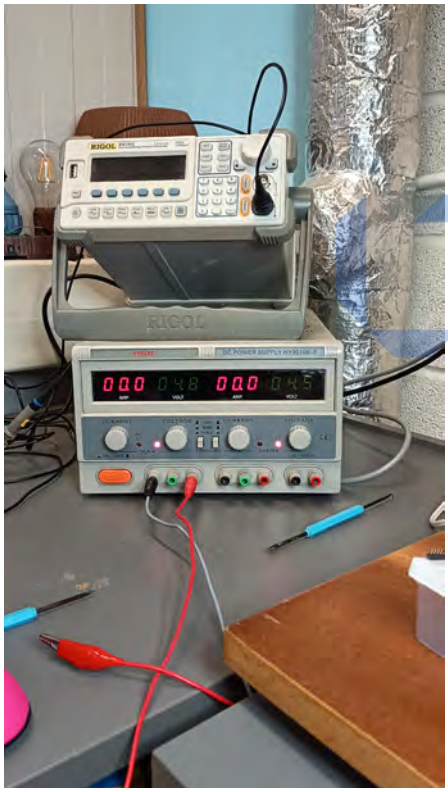
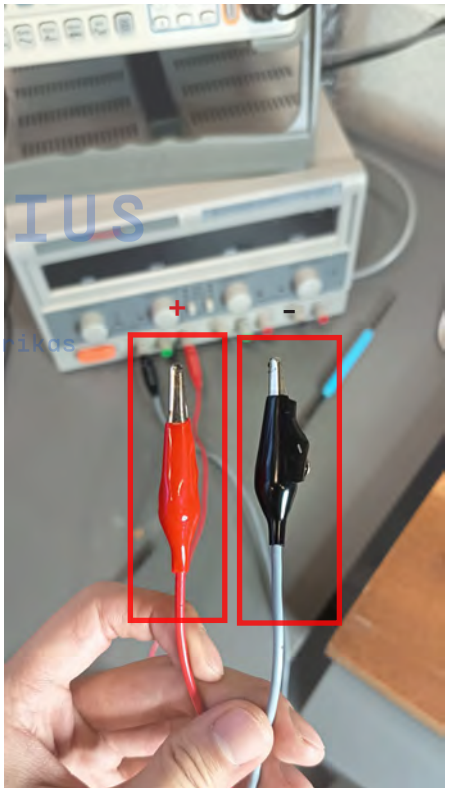
4

Set the power supply to the correct values for your circuit.

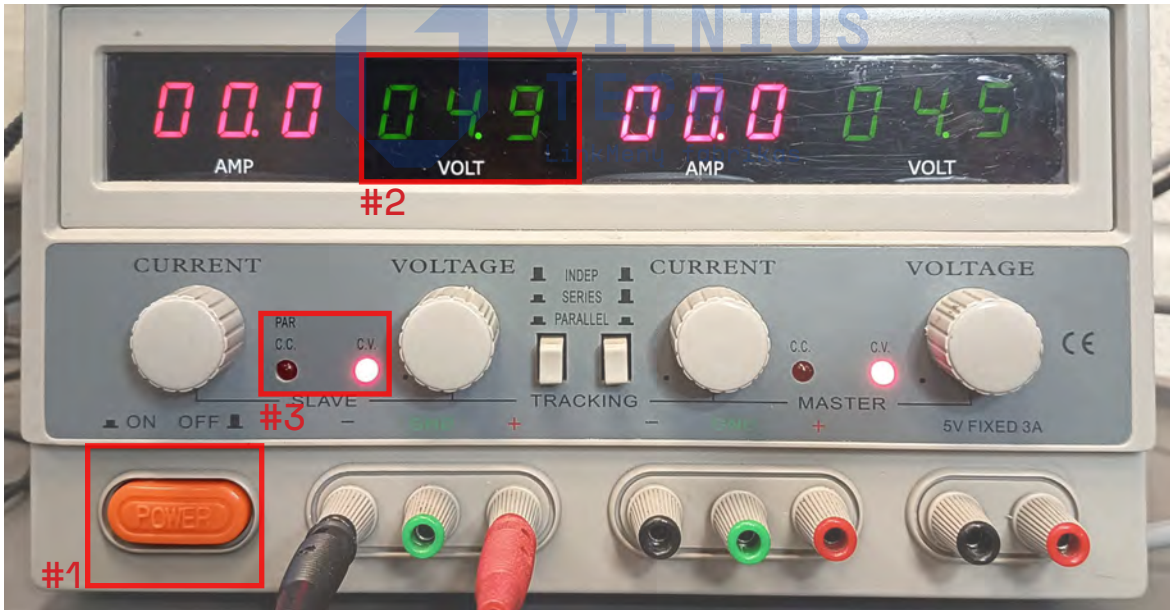
HY-3101E-3 power station



To power your project, you can use the HYELEC power supply.



Use the two clip probes to power your project. NEVER let them touch each other, as this creates a short circuit.



Before powering on (#1), cherck that VOLT or AMP (#2) is set to the desired value or it might fry your component. You can select between constant current CC or constant voltage CV (#3).

UT151E multimeter

To test your circuit, use a multimeter. It measure electrical values such as voltage, current or resistance.

Red probe goes to + and black one goes to ground. Inverting both will display a negative value.

Connections

COM – Common ground. Always plug the black lead here for every measurement.

V (Ω) Hz – For voltage, resistance, continuity, and frequency. Never measure current with this port.

mA °C – For low-current measurements (milliamp range) and temperature probes. Protected by a small fuse.

10A MAX – For high-current measurements up to 10A. Use when the current is unknown or above the mA range.

Connections

#1 Resistance
Checks the resistance of components or wires. Useful for verifying resistors, sensor values, or if a wire is damaged.

#2 DC Voltage
Measures DC voltage. Use this when checking 5V, 12V, USB voltage, etc.

#3 AC Voltage
Measures AC voltage (wall outlets, adapters). Only for trained users — AC mains is dangerous.

#4 AC Current
Measures AC current

#5 DC Current
Measures DC current drawn by a device (LED strip, motor, Arduino...).
Requires using the mA or 10A port and placing the meter in series.

#6 Frequency
Measures the frequency of AC signals or PWM outputs. Useful in signal testing and motor drivers.

#7 Capacitance (nF / µF range)
Measures capacitors. Used to verify if a capacitor is still good.

#8 Temperature
Used with the thermocouple probe connected to mA °C and COM.

#9 Continuity or Diode
Beep test, tells you if two points are electrically connected. Used for finding breaks, tracing wires, or checking solder joints. **OR** tests diodes and checks polarity. Also useful to detect bad components.

ANNEX

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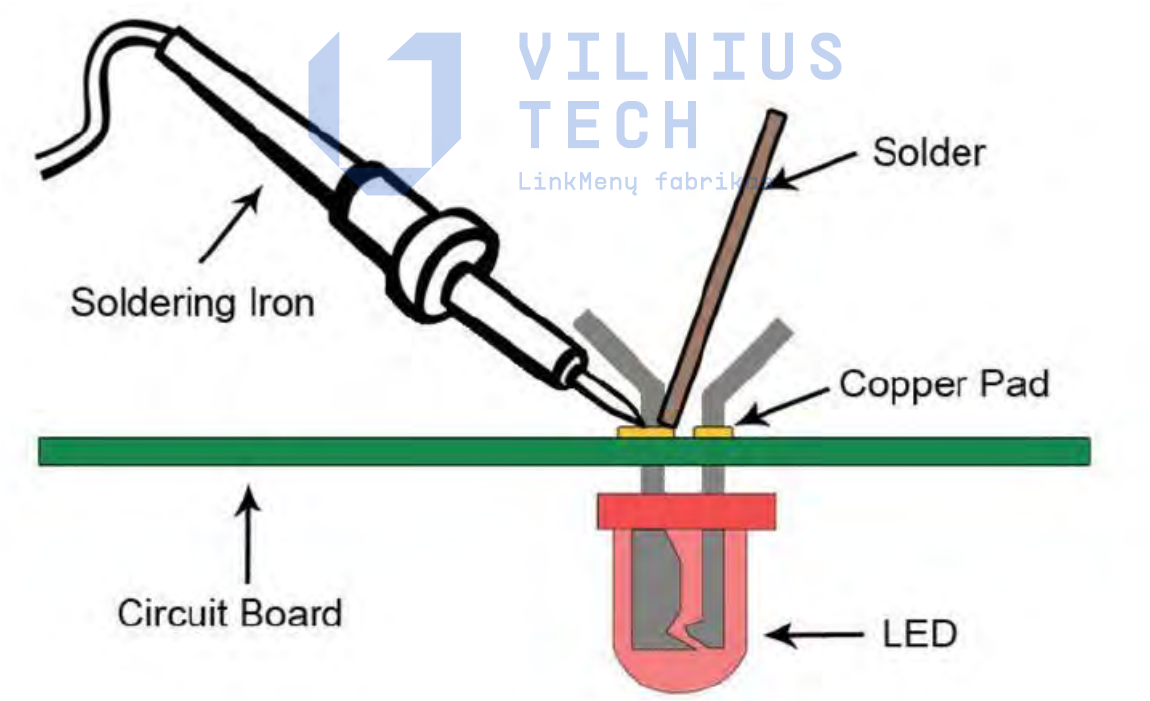
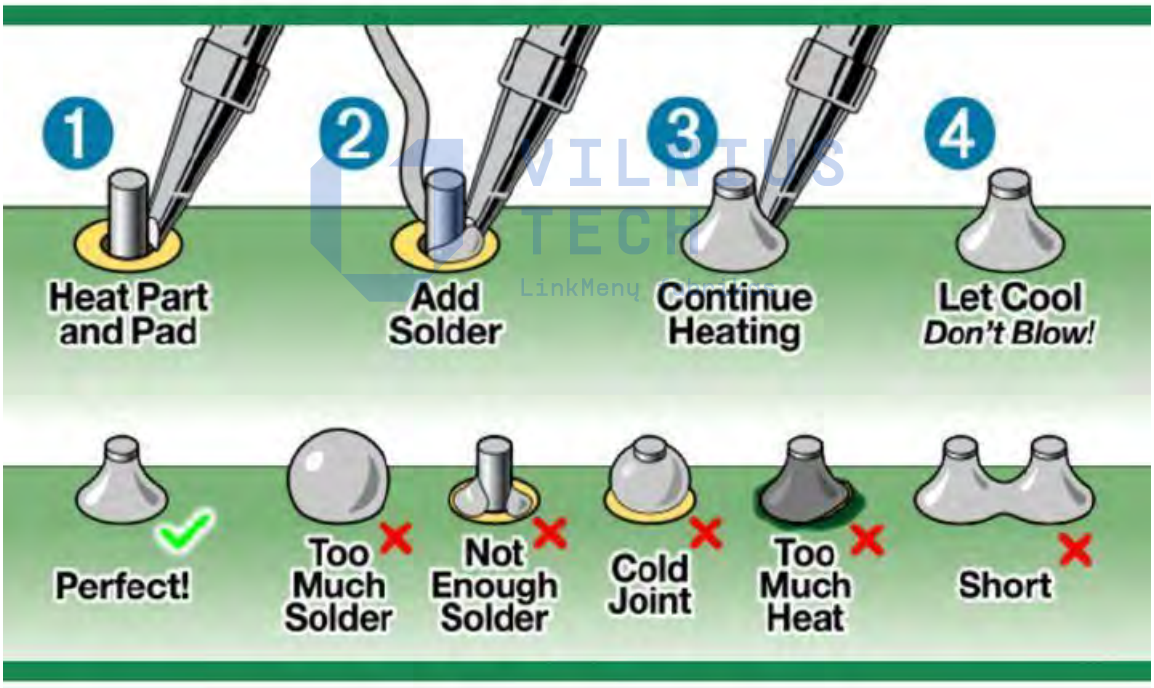
Soldering tips





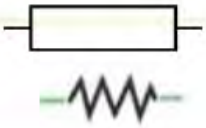
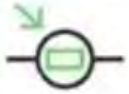
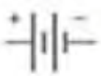
Soldering wire

When soldering electronic components, it is required to use an alloy to join other metal parts by melting and allowing it to flow into the joint where it solidifies to form a bond. This is what we call solder. The parts being joined are wetted by the solder but do not themselves melt.
Choosing the right type of solder mostly depends on the application such as the metals being joined or soldering method. In electronics, lead-free solder with low-residue, mildly activated flux is standard but there exist various types of solder wires and using the wrong solder alloy can promote corrosion in the joint or on the surrounding materials.

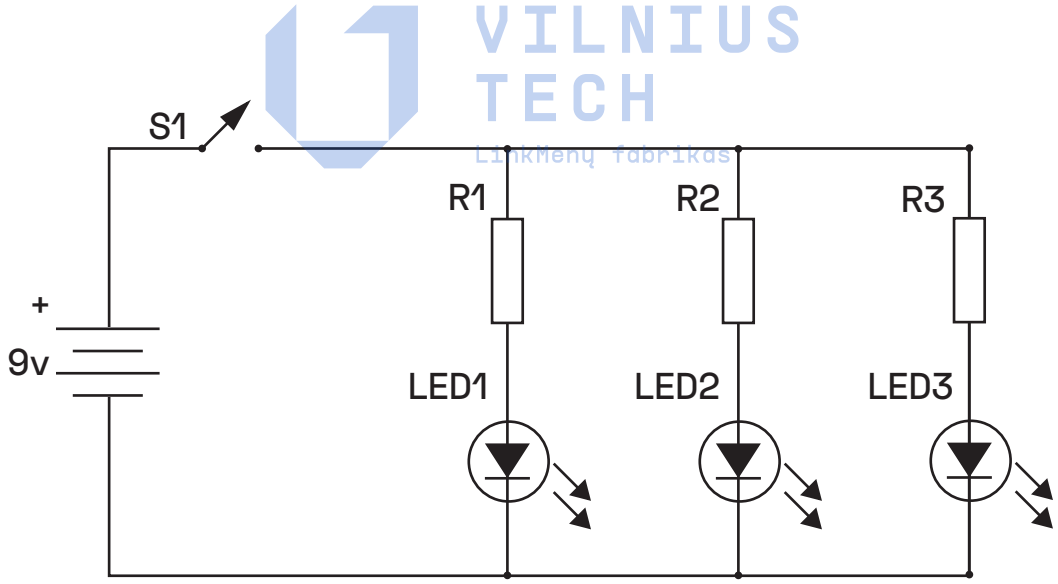
Choosing the right alloy matters: different metals, temperatures, and applications require different compositions, and using an inappropriate alloy can weaken the joint or accelerate corrosion.

Here you can find Pb60/Sn40 (60% lead, 40% tin). It melts at a relatively low temperature, flows very well, and produces reliable joints with excellent wetting which makes it easy to use and reliable.

Graphic Standards and Symbols

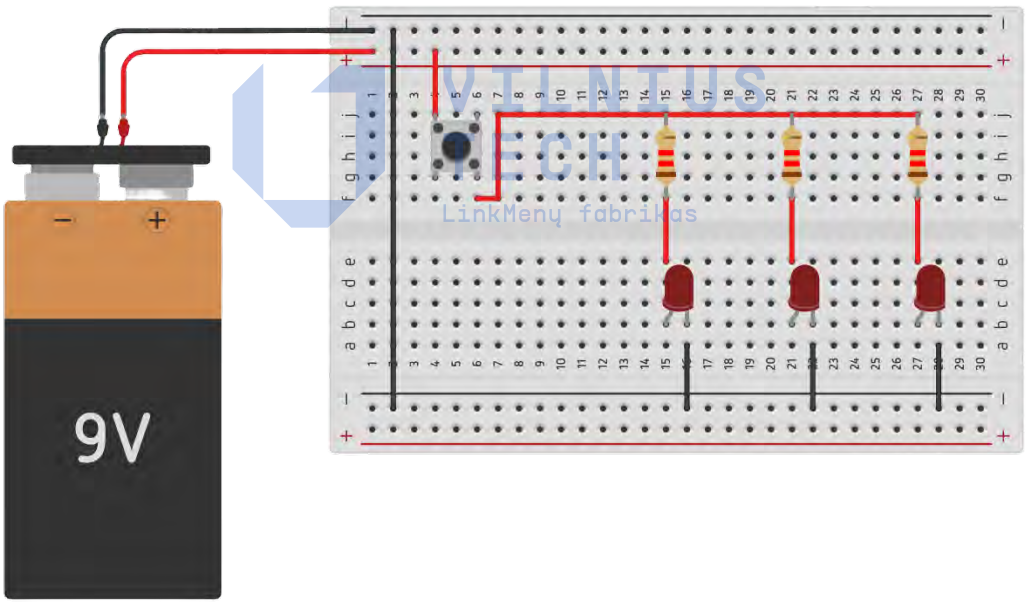
ACTIVE			PASSIVE		
Transistor			Resistor		
Diode			LDR		
LED			Thermistor		
Photodiode			Capacitor		
Integrated Circuit		-	Inductor		
Operational Amplifier			Switch		
Seven Segment Display			Variable Resistor		
Battery			Transformer		

Exemple of a simple circuit



Principle: LED1 to LED3 are connected in parallel, with one resistor for each LED.

Effect: LED1 to LED3 are on.



Tips: You can make simulation on https://www.tinkercad.com/ to test your ideas.

4 bands resistors color code charts

Color	Color	1st Band	2nd Band	3rd Band Multiplier	4th Band Tolerance
Black		0	0	x1Ω	
Brown		1	1	x10Ω	±1%
Red		2	2	x100Ω	±2%
Orange		3	3	x1kΩ	
Yellow		4	4	x10kΩ	
Green		5	5	x100kΩ	±0.5%
Blue		6	6	x1MΩ	±0.25%
Violet		7	7	x10MΩ	±0.10%
Grey		8	8	x100MΩ	±0.05%
White		9	9	x1GΩ	
Gold				x0.1Ω	±5%
Silver				x0.01Ω	±10%

5 bands resistors color code charts

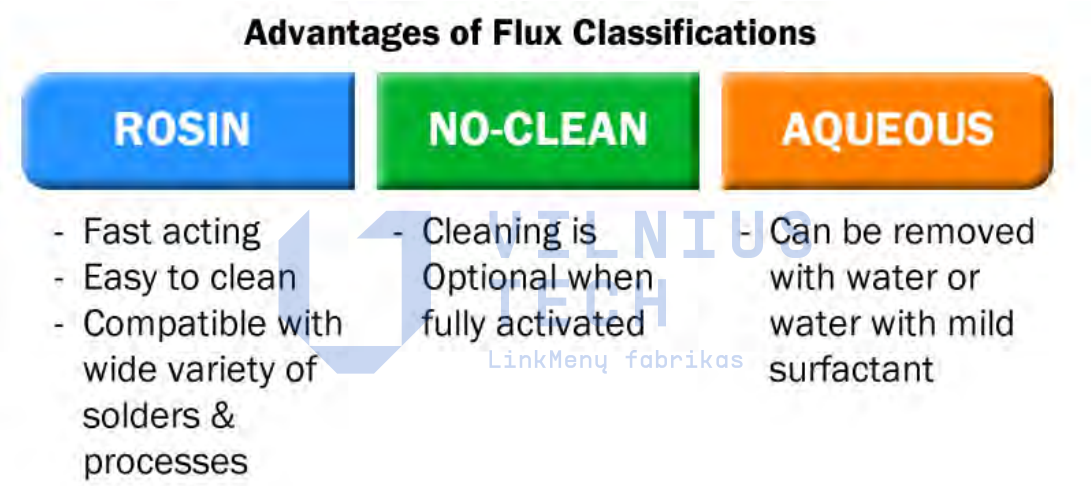
Color	Color	1st Band	2nd Band	3rd Band	4th Band Multiplier	5th Band Tolerance
Black		0	0	0	x1Ω	
Brown		1	1	1	x10Ω	±1%
Red		2	2	2	x100Ω	±2%
Orange		3	3	3	x1kΩ	
Yellow		4	4	4	x10kΩ	
Green		5	5	5	x100kΩ	±0.5%
Blue		6	6	6	x1MΩ	±0.25%
Violet		7	7	7	x10MΩ	±0.10%
Grey		8	8	8	x100MΩ	±0.05%
White		9	9	9	x1GΩ	
Gold					x0.1Ω	±5%
Silver					x0.01Ω	±10%

To FLUX or not to FLUX?

Flux is a **chemical** compound that helps prepare the metal surfaces for soldering. It typically comes in the form of a paste, liquid, or core within the solder wire.

When heated, the flux activates and starts to remove the **oxides**, preventing them from interfering with the soldering process. It also promotes **wetting**, which is the ability of the molten solder to spread and adhere to the metal surfaces. By reducing the surface tension of the solder, flux ensures that it flows smoothly and evenly, creating strong and reliable solder joints.

Flux uses the **IPC J-Standard** (Joint Industry Standard) classification system. They are rated as **RO** (rosin), **OR** (organic), **IN** (inorganic) and **RE** (resin/synthetic resin).



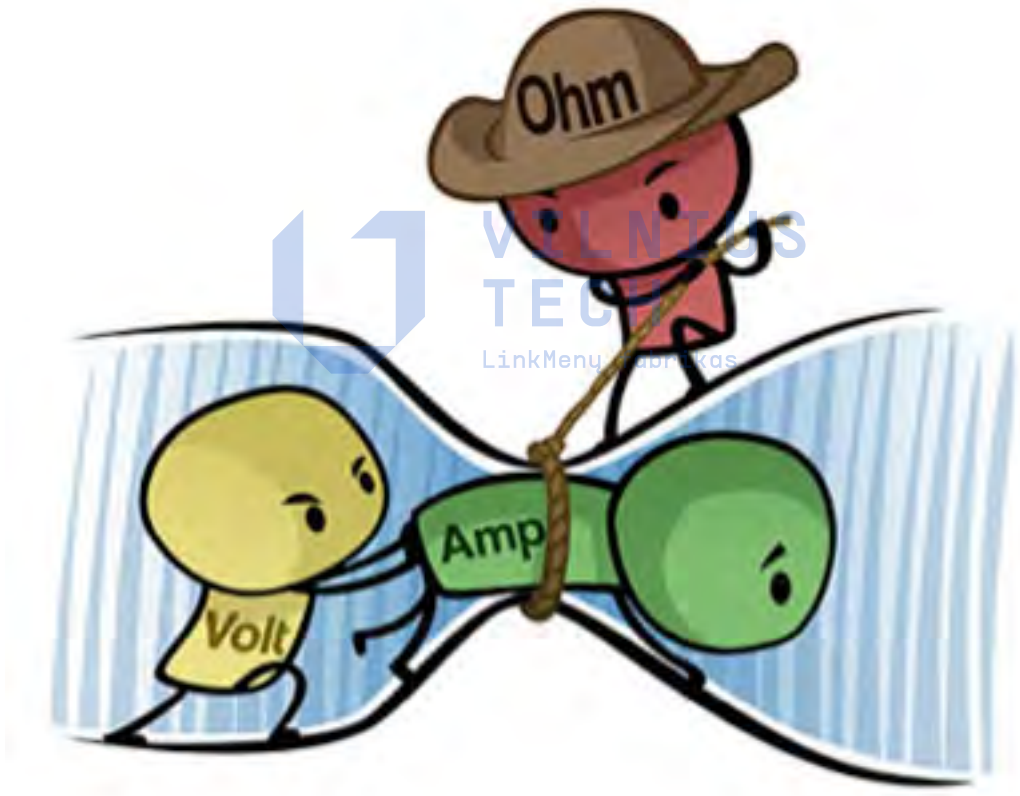
Flux removers are recommended for post-solder operations, PC boards, sensitive circuit components, component leads, SMD pads, chip carriers, plugs, sockets and heat sinks, and Through-hole, and SMT devices. Flux residue can cause short circuits and corrosion.

Ampere or Volt?

Volt is the measurement of the electromotive force that causes the flow of electrons through a conductor.
It can be compared to the pressure of water in a large pipe.
We measure it across two points in a circuit.

Ampere is the rate of flow through the conductor. It can be compared to the speed at which water flows through a pipe.
It can be measured at any point in the circuit. The current is basically the number of electrons flowing per second.

Ohm is the measurement of electrical resistance. It represents how much a component opposes the flow of electrons.
It can be compared to a narrow section of a water pipe that restricts the flow.
Higher resistance means less current can pass through.



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This manual was made by Dario Arrault,
at VILNIUS TECH „LinkMenų fabrikas“,
for internal VILNIUS TECH use and reference.

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