

Maintenance manual

PDP 12 - Jumper Machine

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In this document, there will be compill all of our problems encountered by our group during the project. This manual will also provide a protocol to disassemble some parts and our potential guidelines for futur developpement of the project.

[GitHub Link \(Click Here\)](#)

[OnShape Link \(Click Here\)](#)

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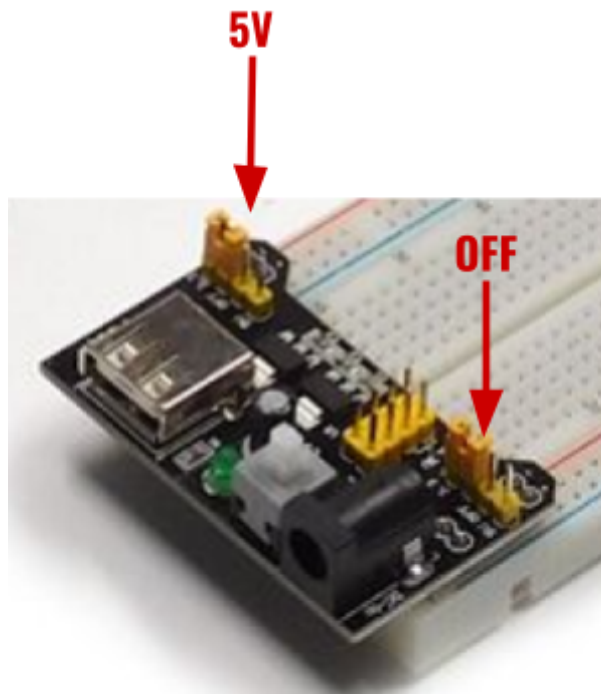
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Malfuction

The machine does not switch on?

Check if :

- the emergency button is unlock (rotate the button in the direction of the arrows)
- the switch is ON
- the breadboard's power system is ON (a green light should light on)
- both of external power supply are connected to the power
- Verify the pins of the breadboard's power alimentation, they should be like this :



- Verify the connections between the switch and the 12V tracks of the breadboard

The problem is fixed if the UI, green lights from each driver, leds on Nano and the green light of the breadboard's alimentation are lit.

If the issue persists, use a multimeter to test the continuity on each wire.

If the issue persists, there is a defective component you need to identify.

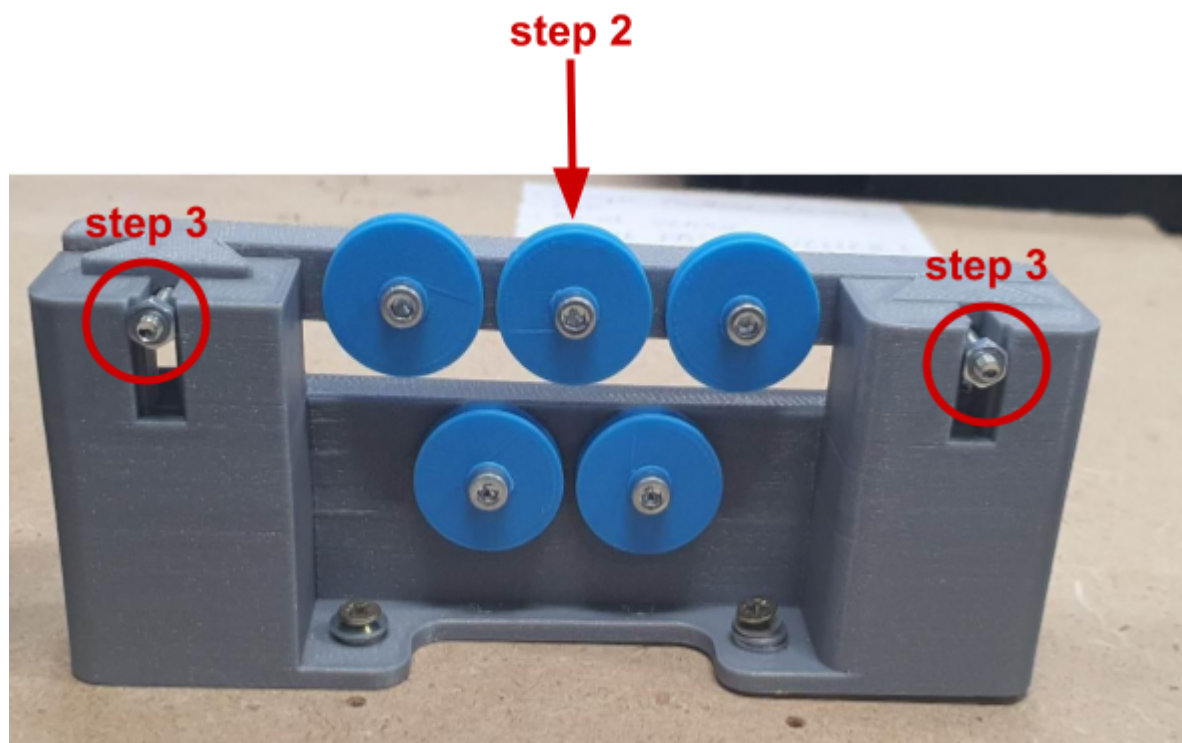
Does the UI switch off, display the wrong information or not respond?

- Verify the connections between components according to the Electrical Diagram (in User Manual).
- Look at the **pluggable wires**, there may be a connection failure.
- Check if the plug systems are correctly connected (the color should make sense between the two sides).

The thread does not come straight out of the machine

The tightened distribution system is perhaps a little loose. follow the steps :

- Loosen the 2 screws.
- press the **tensioner top** on the wire (not too much).
- keeping pressure on **tensioner top** while you tight the two screws



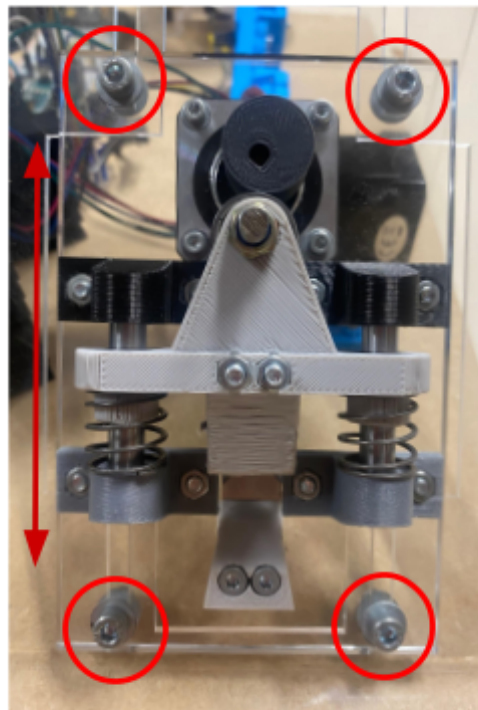
The wire dips between the hose and the blades

In some bad case scenarios, the wire could dive under the blade at the exit of the blade. This issue is often the result of a bad adjustment of the height above the guiding pipe.

To fix the problem, we advise to set the height offset of the **moving plate**.

To do this (easier if there are two of you) :

- loosen the 4 screws
- adjust the height of the **moving plate**, the wires should pass 1 mm above the bottom blade
- while keeping the **moving plate**, tighten the 4 screws (start by the diagonal)
- test if the machine works again with 1 jumper of length 3.



Note that we add under our **tube support with angle** some round plate washers to give us more flexibility in the setting of the **moving plate**.

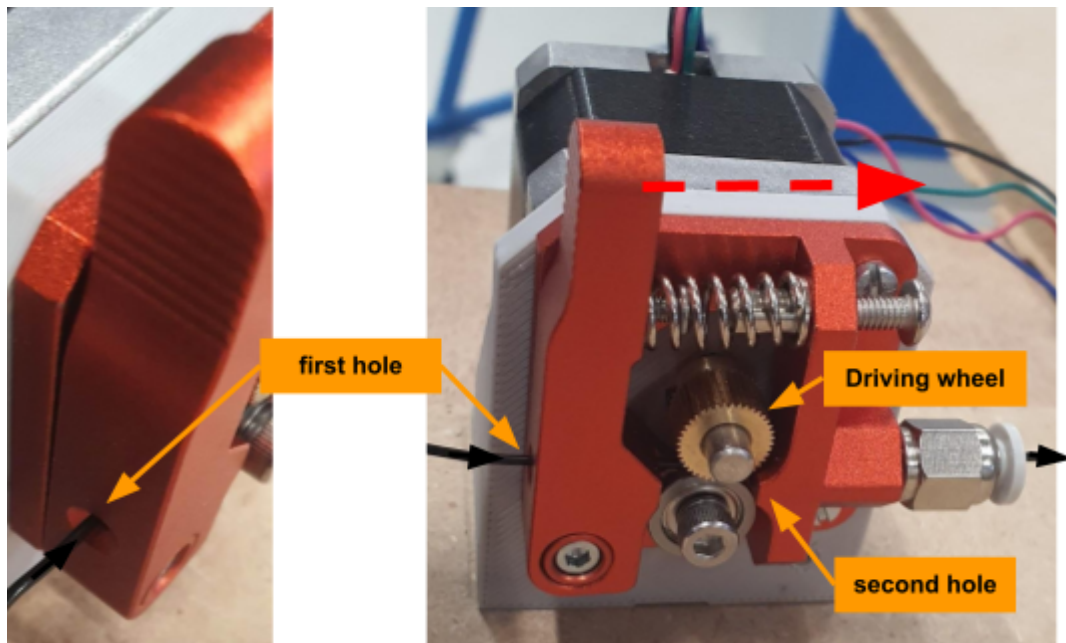
You need to loose the 4 screws of the “**moving plate**”. Then, set the height manually, the wire should pass 1 mm above the bottom blade.

How do you fit the wire into the system?

Currently, the system has been designed for **wire type AWG 23**, we aren't sure the machine will work well if another wire is used.

To set up the system, follows the steps in the right order :

- Install the wire reel on the reel rack
 - remove the **tensioner top** of the distribution system.
 - pass the wire through the distribution system.
 - put back **tensioner top** and keep pressure on it while you tight the two screws
 - with one hand, press the **extrudeur** to loose the grip of the counter driving wheel.
- With your other hand, push the wire inside the first hole until the end of the wire has passed the driving wheel and has entered the second hole.



- activate the “push wire” function with the UI.

The machine doesn't strip the wire

It's certainly caused by a malfunction of the stripping offset or an incorrect adjustment of the **“set denude”** sub-menu. (Available on GitHub → Documentation→ Design → Structural Model → Software → UI)

When you enter the “set denude” menu, you will be able to set the blade to the position of stripping, where it is just cutting the sheath.

The first step will be to ensure a small part of the wire is stepping out of the machine (it will be cut off when you run the program, so you don't need to much wire because it's waste).

Then once you enter the menu, you can move the cam with the joystick in one way, the way it will cut during the program (you can turn back of course but it will be blocked at its original position to avoid to turn in way to strip and another way to cut during the program). The more you push the joystick on its side, the more the cam turns, to get close faster but position it more precisely. The screen is showing the number of steps the wire moved from the origin.

Once you get the blades closer to the wire, move them until they can't move anymore unless the cut the core of the wire. If you found the stripping position, you can press the joystick. You will leave the menu; the cam will turn back to its origin and the screen will show the position of stripping (in number of steps).

It's recommended to run the program with only one jumper at the time of the desired length to check it's working, and repeat it once or twice. If it's not working, change the position of stripping (bigger from the previous position if not cutting enough the sheath, smaller than the previous position if cutting too much and biting into the core).

The movement of the wire is blocked by the blades

When something blocks the wire, the **driving wheel** of the extruder will slippage resulting in no movement of the wire. In the great majority of cases, it's due to the **V Blades** which attack the core of the wire during the stripping phase.

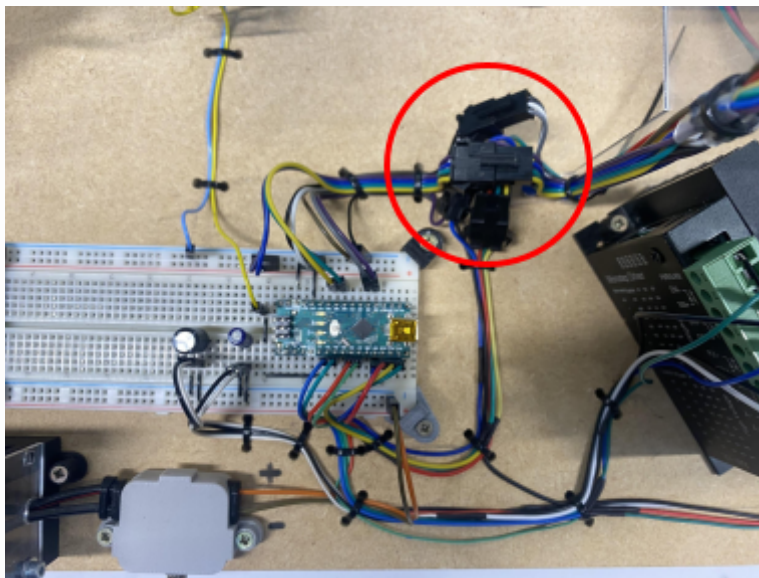
When you observe this phenomena, stop the process and redo the **set denude** process.

Disassemble

If you need access under the cutting support plate.

Follow the step in the right sequence:

- Be assured that the jumper Machine is power off (no led lit on the Arduino card and drivers)
- Disconnect the 4 plugs at the bottom of the cutting support plate, it will disconnect the UI.

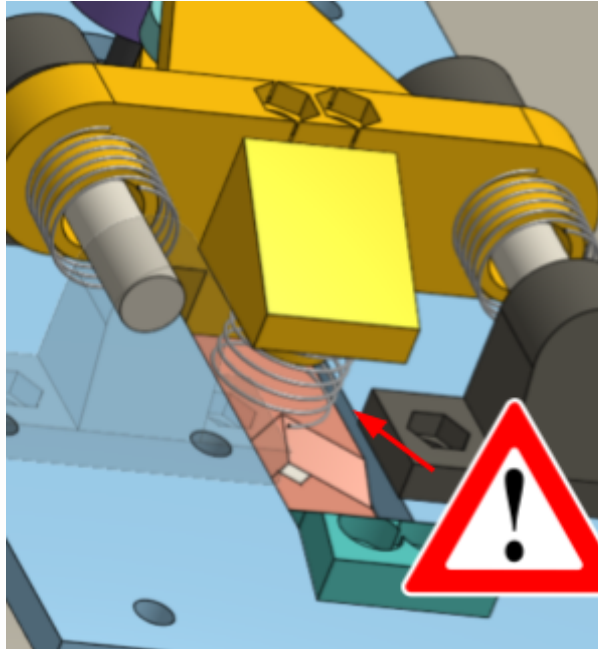


- Disconnect the wires of the motor by unplug the green plastic plug of the driver
- You can now loosen the 4 screws which maintain the cutting support plate fix with the base plate.
- For reassembling, make the steps in the reverse order. Don't forget the spacer for the 4 screws.

Replace worn blades with new ones

After some time, the blades may have worn down. To change them, Follow the step in the right sequence:

- Be assured that the jumper Machine is power off (no led lit on the Arduino ship and drivers)
- Disconnect the wires of the **motor** by unplug the green plastic plug of the driver
- Loosen the 4 screws from the **moving plate**.
- Loosen the 2 screws of the bottom **V Blade** and take it off.
- Then, loosen the 2 screws of the upper **V Blade**. **Be cautious during this step, there is a spring under tension behind the blade.** Take off the upper blade



- For reassembling, make the steps in the reverse order. The **V Blades** need a height adjustment during the reassemble. Our only solution to have a good adjustment for the moment is to do it by trial and error. Test with the process of one jumper length 3.

Line of research

The following is a non-exhaustive list of areas for improvement to make the machine more reliable and resilient in our opinion. Feel free to take it in consideration or not.

Refine the stripping system

The current stage of our stripping system was convenient for us because he uses the same motor to cut and strip the wire. However, the two functions could be separate physically with two motors instead of one. Moreover, the “set denude” system isn’t reliable:

- Firstly, it isn’t the same from one start to another with the reboot of the machine. We know that we use only wire AWG23 so there should be a way to always strip the wire to the same depth, regardless of the number of restarts.
- Secondly, we have an issue with the motor step with a slight offset created by each stripping (hence the addition of a micro-step in the code to try to cancel it out). See if the problem isn't due to driver step resolution. Read the final deliverable (on the GitHub) to know more about this issue.

Automate the bending system

Our first objective was to create a completely automatic system, due to our planning this wasn’t possible, and we focus on the cutting and stripping system. To automate the system, we need to **Automate bending**: we do a lot of knowledge to find a system which work manually, see if this can be transposed to automation

incorporated a sorting system at the machine output

Currently, everything exits the machine through the blades, whether it's sheaths or jumpers. It's not convenient and it can be a risk for the process (one jumper block between the blade for instance). We add a **slop** to the bottom **V Blade** for minimize the problem for a time. However, it's not a definitive solution at this issue. A reliable sorting system could be set up to separate sheath and jumper and secure the end of the process.

Creation of a machine housing around the blades and electronics

This machine is composed of blades, motors and electronic which can explode (we already blow up a capacitor for instance). If we want the machine to be implement in an environment with people, it shall not be a risk both for people and the machine. You need to find out about the standards for this type of machine and create protections/housing accordingly.

Improve the tensioner system

We don't find the system of tensioner convenient when you need to feed the system with wire at the start. Moreover, the tension applied on the wire by the rollers isn't the same at each set up. A standard force applied by a spring system should be way more resilient. And a system which opens like a chest, you pass the wire, then close it with a lock should be more convenient than the current system of disassembly.

Fixer le support

The current **cutting support plate** is attached with the **moving plate** by 4 screws. We did this to allow us to adjust the height of the blade accordingly for our future modification. But it's not a definitive system. The two plates should be merged when the functionalities of the machine will be done, and the best height knows. It will avoid another parameter to set up.