# **Instructions Manual**



## Slurp'nPick+ / Pick+

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## Station overview



Figure 1 - Front view of the Slurp'nPick+ station



Figure 2 - Back view of the Slurp'nPick+ station

## Accessories

#### Footswitch

There are two versions of the footswitch, one is wired the other one is wireless.

The wired switch is very simple it has a 3.5mm jack just as the station has on the back, you take the included cable and plug one end to the pedal and the other to the station. For settings and plug diagram check <u>Settings – Triggers – Wired</u>.



Figure 3 - Wired footswitch and cable

As for the wireless footswitch you need to install a CR2032 battery. Remove the single screw on the bottom of the pedal, press the switch and slide the metal rod out, slowly release the pedal and carefully separate the two parts in order not to lose the spring. Install the coin cell in the holder taking care that the polarity is correct.



Figure 4 - Wireless footswitch disassembled

If you purchased the footswitch together with the station it will be ready to use (after installing the battery) and no pairing is required. Up to 10 footswitches can be paired at the same time and you can choose a specific function for each one (see trigger types).

#### Picking tool



Figure 5 - Picking tool complete with foam grip, silicone hose and quick connector, also needle tips

The picking tool is made of an aluminum pipe, on one side (I'll call it the front) is a luer adapter to connect the tip and on the other (the back) is a barbed connector that connects to the 1m long silicone hose.

Both ends are removable (it's a push fit sealed by two orings). If you pull the back (hose side) you will find a filter inside the aluminum pipe, this stops any solder paste or other debris from reaching the valves/pump. This filter can be removed with tweezers and a replacement is included in the package (filters are easily obtainable, it is a standard 8mm diameter filter used for roll-up cigarettes cut in half for increased air flow).

If you somehow suck a component (consider changing the tip to a smaller size) you can pull the front part of the tool and the component should just fall from the aluminum pipe.

The tip is secured by a small thread, removing/installing tips is very simple - remember, righty-tighty/lefty-loosey.



Figure 6 - Disassembled picking tool

#### Desoldering gun and inline air filter

The desoldering gun is an optional purchase and is used in conjunction with the <u>Slurp</u> option only available on the Slurp'nPick+ version of the station.

If you purchase the gun separately from another store (**only model ZD-552 is guaranteed to work as of now**), <u>make sure the connector has 6 pins</u> as a 7 pin version is also available.



Figure 7 - Desoldering gun

An inline air filter will be included in the package (already attached to the end of the gun's hose in case you purchase it from me).

This filter can be twisted open and consists of a 20mm diameter carbon filter and a metal mesh. A replacement carbon filter is also included.



Figure 8 - Inline air filter

#### Dispensing tool set

Used in conjunction with the <u>dispensing mode</u> to dispense solder paste, flux, glue or other similar products.

This set is an optional purchase and includes the following components:

- -Syringe with piston and back and front caps
- -Dispensing adapter with hose
- -10 short blunt syringe needles, 5 different sizes
- -Luer coupler (used to transfer product from one syringe directly to another)



Figure 9 -Dispensing tool set

#### Power adapter



The Slurp'nPick+ station comes with a 24VDC 5A power adapter.

Figure 10 - Power adapter

**Note:** A cord with an IEC C13 connector and a compatible plug for your country is not included and must be sourced separately. These cords are used for all kinds of appliances (like desktop computers, oscilloscopes, hot air stations, printers, etc.) so it is very likely that you already own a spare one that you can use.

### Interface

While in the carrousel menu turn the rotary encoder left or right until you find the desired option, each has its own animation that will run when highlighted, press the knob to enter.

There are 6\* options available:



Figure 11 - Option icons

- -Slurp, desoldering mode\*
- -*Pick,* pick and place mode
- -Dispense, solder paste/flux/glue/etc dispensing mode
- -Blow, blowing mode
- -Vacuum, suction mode
- -Settings, advanced settings

\**Slurp* option is only available on the Slurp'nPick+ station.

While inside one of these options you can always go back to the menu by selecting the first line on the display and pressing the knob. If you are in a deep level of the settings, you can either press the back button multiple times to go to the previous page until you reach the menu or you can press it for half a second to get to the menu in a faster way, if you have setup a footswitch to trigger a specific action (check trigger types) you can quickly switch to that action by pressing it, pressing the desoldering gun trigger always switches the station to *Slurp* mode.

The station will always boot in the last used option, if it was turned off while inside the settings, it will boot in the menu.

If you are using a wireless footswitch, its coin cell voltage and ID will be displayed in the upper right corner of the display as shown below. The battery icon will gradually turn black as the coin cell's voltage gets lower, if 2v or less an exclamation mark will be displayed, and the coin cell should be replaced.



Figure 12- Examples of the battery icon and footswitch ID

#### Slurp

The *Slurp* option is used in conjunction with the desoldering gun to desolder THT components. **Note:** This option is only available on the Slurp'nPick+ version of the station and the gun is an optional purchase.



#### Figure 13 - Slurp option layout

When you enter this mode, the heater will automatically start heating up to the set temperature and the real temperature will also be displayed. If the buzzer is on in the settings (check <u>buzzer</u> <u>settings</u>) the station will emit a small beep when it reaches the set temperature. You can change the set temperature by navigating to "Set:", pressing the knob and rotating right to increase, or left to decrease. If you press the "Set:" option for half a second the temperature unit will change between <sup>o</sup>C and <sup>o</sup>F, this can also be changed in the settings (check <u>temperature unit</u>).

**Note:** this is not a normal soldering iron where only the tip is heated, this is a desoldering gun where the entire path from the tip to the glass solder container must be at temperature so the solder does not solidify midway, clogging the passage. The thermal mass is quite big and therefore the gun takes a bit of time to reach temperature.

To avoid clogging the gun it is recommended to use a cleaning pin after every usage.



Figure 14 - Example of a cleaning pin

The minimum temperature is also limited to 250°C or 480°F in order to avoid clogging issues. If you press the trigger while the station isn't over the minimum threshold temperature, the pump won't turn on and you will see an error on the display: "Temp too low!", if the buzzer is on (check <u>buzzer settings</u>) you will also hear a little melody.

SLURP
Set:350°C
Real:350°C
Temp too low!

Figure 15 - Temp too low! error

You can use the gun trigger to activate the pump or a wireless/wired switch as long as it is configured to trigger "All" or "Slurp" in the settings (check trigger types).

If the connection to the temperature sensor is lost the station will stop/not start heating and an error will be displayed: "TC ERROR!" (meaning thermocouple error), if this happens check the related <u>troubleshooting steps</u>.



Figure 16 - Thermocouple error

In the *"Slurp"* settings page you can set the temperature unit, standby time and calibration values, for detailed instructions go to <u>*Slurp* settings</u>.

The desoldering gun must always be used with a ceramic filter that goes inside the glass tube, for details please check the instructions included with the gun.



Figure 17 - Desoldering gun, arrow points to ceramic filter

There is a serviceable inline activated carbon/metal mesh filter that is intended to filter any solder that might make it through, this should never happen so make sure you regularly clean the gun's glass chamber and replace its filter if needed. A replacement carbon filter is included.



Figure 18 - Inline air filter

If you wish to ground the desoldering tip for ESD protection, you can do so by connecting a standard 4mm banana lead (not included) to the yellow receptacle on the back of the station and connect the other end to your earth point.



Figure 19 - 4mm banana lead connected to the earth receptacle

#### Pick

This option is used to pick and place SMD components on a PCB.

When the footswitch is pressed the pump works at the set power creating vacuum at the picking tool tip allowing you to pick a component, when the footswitch is released the pump will create positive pressure for the amount of time in milliseconds set on "Push", positively dropping the part.

PICK
Power:40%
Push:110ms

Figure 20 - Pick option layout

There are two configurable values, "Power" and "Push". I recommend starting with the default settings and adjusting if needed.

"Power" sets the velocity of the pump and goes from 1 to 100%. The maximum power is not usually necessary to pick your average SMD components so I recommend experimenting and choosing the lowest power that works without stressing the pump, i.e. if the pump stops when creating vacuum or if it doesn't create enough vacuum to pick up your parts, this value must be increased.

"Push" sets the amount of time in milliseconds that the pump will work to push the part from the tip of the picking tool after releasing the footswitch. Personally, I also find this option very useful to flip resistors, a short press of the footswitch is usually enough to flip them around so the value is on top (example <u>https://youtu.be/mOqiC4d56NU?t=92</u>).

#### Dispense

This feature is used to dispense solder paste out of a syringe but can also be used for other products like glue or flux. An optional dispensing tool set can be purchased together with the station (check <u>dispensing tool set</u>).

Whatever product you intend to use this for, shouldn't be too thick nor too thin. If the product is too thick the station will have a hard time to dispense it, on the other hand if it is too thin it might just run out of the syringe with little control.

If you use solder paste, make sure it is fresh and at room temperature.

**Tip:** If your solder paste is a little older it might be too dry to dispense, you can mix in a few drops of pure isopropyl alcohol to freshen it up, from my experience I do NOT recommend adding flux as it tends to ruin the paste and it also changes its performance a lot. Alcohol will quickly evaporate and won't make any noticeable difference during or after reflow (please note: this is <u>based on my experience with my particular solder paste, your results may vary</u>).



Figure 21 - Dispense option layout

For this mode there are 3 configurable settings: "Power", "Pump", and "Vacuum". When the footswitch is pressed the pump will create pressure at the current set "Power" and will continue doing so for the number of milliseconds set on "Pump" - this will dispense the product, after that the pump will continue working but now creating vacuum for the number of milliseconds set on "Vacuum" - this will release the pressure to keep the syringe from oozing.

As always, I recommend starting with the default settings and changing according to your needs. This mode has 3 variables and therefore it takes a little experimenting to find the right settings. In order not to waste your product while testing, I suggest dispensing on a surface where you can easily pick it back up in the end.

There are also several tip sizes included with the optional dispensing kit (see <u>dispensing tool set</u>) that you can try.

#### Blow

This mode is useful to blow dust from various surfaces. I also find it useful to fill up air column bags commonly used to protect packages.



Figure 22 - Use example, air column bag



Figure 23 - Blow option layout

There are two settings, "Power" and "Latch".

"Power" adjusts the pump speed and "Latch" changes the behavior of the footswitch, if off, the pump will work while the footswitch is pressed and turn off when released, if on, the pump will continue to work when releasing the footswitch and turn off after pressing it again.

#### Vacuum

This mode is useful for example to suck air out of small storage bags used for 3d printing filament spools.



Figure 24 - Use exemple, vacuum storage bag



Figure 25 - Vacuum option layout

Just as the blow mode there are two settings, "Power" and "Latch". "Power" adjusts the pump speed and "Latch" changes the behavior of the footswitch, if off, the pump will work while the footswitch is pressed and turn off when released, if on, the pump will continue to work when releasing the footswitch and turn off after pressing it again.

#### Settings

Here you can find advanced settings, these are divided into several levels as the following diagram shows.



Figure 26 - Settings menu tree

#### Buzzer

System -> Miscellaneous -> Buzzer



Figure 27 - Buzzer settings

Turn buzzer ON or OFF. Default is "ON".

**Note:** Not being a fan of buzzers myself, I tried to make it the least intrusive possible, it will only sound for errors, when the desoldering iron reaches temperature and while changing some settings.

#### Carrousel menu encoder direction

System -> Miscellaneous -> Menu rotation



Figure 28 - Encoder direction setting

Inverts direction of carrousel menu movement in respect to knob rotation direction. Default is "Normal".

Factory reset

System -> Miscellaneous -> Factory reset



Figure 29 - Factory reset confirmation prompt

After confirming, resets the settings to factory defaults and reboots the station. All the wireless settings remain unchanged.

#### Firmware update

System -> FW Update



Figure 30 - Firmware update display

After entering this setting, the microcontroller will be put into bootloader mode and will be ready to accept a firmware update. Connect the station to a computer with a USB cable and drag the firmware file (ending in ".unf") to the drive named "RPI-RP2", the station will quickly reboot with the new firmware.

**Note:** If you entered this setting but don't intend to update the firmware a reboot is required to get the microcontroller back to normal working mode, use the switch in front of the station to turn it off and back on.

About

System -> About



Figure 31 - About page

Shows the firmware version that is currently running on the station.

#### Edit wireless switch

Triggers -> Wireless -> Remote -> Edit remote



#### Figure 32 - Edit remote settings page

Allows you to change the function of each paired remote switch or delete it entirely. First select the ID of the remote you intend to change then select it's trigger type (see trigger types) or delete it.

#### Add wireless switch

Triggers -> Wireless -> Remote -> Add remote



Figure 33 - Add remote settings page

Allows you to pair a new remote.

A new ID will automatically be assigned for the new remote but you can also change it to a specific ID from 0 to 9 (IDs must be unique so the ones already in use will be omitted).

A specific trigger option can also be directly assigned during this process (can also be changed after the remote has been paired, check <u>edit remote</u>).

To pair the remote just press it, if the buzzer is on (check <u>buzzer settings</u>) you should hear a quick beep and the message "Waiting..." will change to "Paired!".

**Note:** If you purchased the remote together with the station it will already be paired and ready to use. If you purchased it on a later date as long as you did not change the station's ID or channel you will be able to add it by following the above process, otherwise you will need to follow the failsafe method described below.

#### Failsafe pair wireless switch

Triggers -> Wireless -> Remote -> Failsafe pair



Figure 34 - Failsafe pairing settings page

Allows you to pair a new remote after having changed the station's default ID or channel.

#### Procedure:

Start by opening the failsafe pair page and leave it open. Now disassemble the footswitch you want to put into failsafe pairing mode and remove the coin cell. Now press the microswitch and keep it pressed while reinstalling the coin cell, keep pressing it for 2 seconds and release it, if the buzzer on the station is on you should now hear a beep and the message "Waiting..." will change to "Paired!", you can now exit the page and put the footswitch back together.

#### Wireless station (channel/ID)

Triggers -> Wireless -> Station



Figure 35 - Station wireless settings page

These settings should only be changed in case you are experiencing cross communication with other Slurp'nPick+ or Pick+ stations or poor range due to other nearby wireless devices working on the 2.4GHz band.

If you have multiple Slurp'nPick+ or Pick+ stations near each other using wireless switches, each station should have its own ID to avoid cross communication.

If there is strong 2.4GHz interference, the range of the remote switches might be reduced and changing the channel to a less crowded one can help improve it.

After changing any of these settings a message "Press remotes!" will appear and every single paired remote should be pressed. If you want to cancel you can go back before pressing a remote and the settings will stay unchanged.

**Note:** If you forget to press one of the paired remotes you can pair it again by following the "Failsafe pair" section (check <u>failsafe pairing</u>) or by setting the station's ID back to the previous one (pressing only the remote that you changed) exiting the Triggers -> Wireless -> Station menu and going back in and changing the ID once again to the new one, this time pressing all the remotes.

#### Wired switch

Triggers -> Wired



Figure 36 - Wired trigger settings page

Allows you to change the debounce time for the wired switch (connected to the 3.5mm jack on the back of the station) and the trigger type (check <u>trigger types</u>).

You can also use your own switch by following the diagram below.



Figure 37 - 3.5mm plug pinout



Figure 38 - Wired button example

Slurp temperature unit

Slurp -> Temp unit



Figure 39 - Slurp temperature unit settings page

Sets the temperature unit, Celsius or Fahrenheit. Default is Celsius.

**Note:** This can also be changed "on the fly" inside the Slurp feature with a long press on the "Set: XXX" line.

#### Slurp standby time

Slurp -> Standby time



Figure 40 - Slurp standby time settings page

Allows you to set the time it takes for the station to disable the heater. If set to 0 the heater will stay on indefinitely (**not recommended**).

**Note:** Time starts counting only after the station reaches the set temperature and is reset every time the desoldering gun trigger (or footswitch if set to trigger "Slurp" or "All") is pressed.

#### Slurp temperature calibration

Slurp -> Calibration

Warning! Changing these settings is not recommended, if you still feel like you need to change them make sure you know what you are doing!! Failing to do so can lead to unexpected behavior of the temperature control loop which can lead to premature failure of the desoldering gun.

Slurp -> Calibration -> Sensor vs Tip



Figure 41 - "Settings vs Tip" page

Calibration values for what the temperature sensor reads vs. what the actual temperature at the tip of the desoldering gun is.

If the temperature at the tip is different by a few degrees with what the station reads and this difference stays more or less the same through the whole range you can change the offset, this can either be positive or negative.

If the difference varies greatly throughout the whole range you might need to change the factor.

Slurp -> Calibration -> PID



Figure 42 - PID settings page

<u>Only change this if you are absolutely sure what you are doing.</u> This allows you to change the individual values of the PID loop.

#### Trigger types

Each switch (wireless or wired) can trigger different modes. If a switch is set to a specific mode but the station is currently in another mode it will automatically change to the set mode after getting triggered.

The trigger type for the wireless switch can be set while <u>adding a new remote</u>, <u>editing a</u> <u>remote</u> or <u>failsafe pairing a remote</u>. As for the wired switch it can be set in the <u>wired trigger</u> <u>settings</u>.

There are 8 different trigger types:

- Slurp triggers/changes to desoldering gun
- All works on all modes (default)

- Pick triggers/changes to pick mode
- Dispense triggers/changes to dispense mode
- Blow triggers/changes to blow mode
- Vacuum triggers / changes to vacuum mode
- iBom sends 'n' keystroke through USB, used in conjunction with Interactive Html Bom (<u>https://github.com/openscopeproject/InteractiveHtmlBom</u>)
- Menu goes to menu

## Troubleshooting

#### Wireless footswitch not working at all or not working reliably

If the wireless footswitch is not working at all make sure the CR2032 coin cell is installed and isn't depleted. If it still does not work after installing a (new) battery it might not be paired with the station, check <u>Triggers -> Wireless -> Remote -> Add remote</u> or <u>Triggers -> Wireless -> Remote -> Failsafe pair</u>.

If the footswitch is only working sometimes, the battery might be running low or there might be too much interference on the 2.4GHz band, if this is the case you can change the channel to a less crowded one, see <u>Triggers -> Wireless -> Station</u>.

#### Slurp

#### "TC Error!"

If the connection to the temperature sensor is lost the station will stop/not start heating and an error will be displayed: "TC ERROR!" (meaning thermocouple error), this also happens when the desoldering gun is not connected to the station, if this is the case connect the gun and restart the station, otherwise you need to look for the broken connection which can be either inside the gun (loose connection or faulty heater element), through the gun's cable, or less likely inside the station itself.

#### Lack of suction power

If you feel a lack of suction power make sure the path from the tip of the desoldering gun up to the glass tube is completely unobstructed, use a cleaning pin while the desoldering gun is hot to clean any obstructions. If after cleaning the path the suction remains low you might need to replace (or clean) the ceramic filter located inside the desoldering gun, also make sure the inline carbon filter is clean.



Figure 43 - Inline air carbon filter

#### Pick

#### Can't pick up components/lack of suction power

Increase the power percentage, if the problem persists check if the filter inside the picking tool is clean and the tip isn't clogged with solder paste or other debris.

Choose the appropriate tip for the type of components you want to pick, for bigger components use bigger diameter tips. If the component is very heavy or has an irregular/textured surface you might need to use a tip with a little rubber cup (not included).

#### Blows components away after releasing footswitch

Reduce the value of milliseconds for the "Push" setting.

#### Dispense

#### Lack of power/unable to dispense my product

Increase "Power" setting and/or "Pump" time. If you still aren't able to dispense your product make sure it isn't too dense for the needle tip you have installed on the syringe.

If trying to dispense solder paste make sure it is fairly new and isn't too cold, if you just grabbed it from the fridge let it reach ambient temperature before trying to dispense.

**Tip:** If your solder paste is starting to get dry add a few drops of pure isopropyl alcohol and mix well to get it back to the correct consistency.

Product oozes out after dispensing Increase "Vacuum" time setting.

#### Blow/Vacuum

Pump continues to run after releasing switch Turn of latch setting.

## Specifications

Slurp'nPick+: Dimensions 155 x 135 x 73mm Weight 1015g Display 1.3" OLED Pump positive pressure 350kPa, negative pressure 80kPa, 12L/min flow

## Project history

Slurp'nPick+ started as two completely different projects on two separate breadboards back in 2017. I bought a desoldering gun and a pump and mounted an Arduino, an oled display, a rotary encoder, a thermocouple amplifier, a mosfet, a triac and some passives on a breadboard and was using a gigantic UPS 24v transformer as the power source. I quickly wrote a simple code that would display the set temperature and the actual temperature on the display and would bang-bang the heater to control the temperature. I soon realized that bang-bang wasn't a feasible approach as the temperature wasn't very stable so I started looking into PID loops which I later implemented. It worked OK-ish but the gun would clog very easily, this made me suspect that the temperature at the tip wasn't the same as the temperature read by the thermocouple which turned out to be the case, this was an easy fix in code. I was just starting to get more interested in electronics and hadn't bought half of aliexpress yet so I really enjoyed salvaging components from old boards, it was like a hobby by itself. From day one I started calling it slurp as a joke between friends because of the slurp sound it makes when sucking the solder.

A few months later I started getting more interested in SMD stuff and I saw on the internet that people would use aquarium pumps to pick and place components. I had a tiny pump and a syringe dispensing adapter so I decided to give it a try, I just made a hole on the syringe which I would cover with my finger to pick up a component and uncover to drop. It worked but I didn't like the idea of uncovering a hole to drop the component, not only did it take some time to release the vacuum but I would also unwillingly move the syringe slightly when moving the finger, this would result in misplaced components, it also wasn't very comfortable to use, it was in fact a bit awkward. I used this method for a few weeks, I thought I would get used to it but I never did and I noticed that some parts (mainly ceramic capacitors) would also magnetically attach to the tip on the syringe which was frustrating, this got me thinking -what if I get some solenoid valves and arrange them in a way I can create vacuum but also switch to positive pressure to physically push the components to the board? So I looked for some valves on aliexpress and also bought another pump, the same model I already was using with the desoldering project. A few weeks later the orders arrived so I got a breadboard and mounted some mosfets, an oled display and a rotary encoder and wrote some code that would initially create vacuum when pressing a button I had attached to the syringe and after releasing it would create positive pressure for a set period of time which I could configure with the rotary encoder and display. After finding the correct timing this worked beautifully! I was really happy, but one issue remained, when releasing the button I would still move the syringe and misplace the component so I got a footswitch. It took some time to get used to the footswitch but soon it got second nature.

One day while I was applying solder paste to some pads on a board with a syringe I thought maybe I could do this with the pump as well, the pump is strong, a bit of an overkill just to pick components and I knew I could generate vacuum and positive pressure on command so I could pressurize the syringe to dispense solder paste and then create vacuum so it wouldn't continue to ooze out. I wrote some code and gave it a try, it was a bit fiddly, my solder paste was old and the solenoid valves I was using didn't handle the pressure well so I got new paste and beefier valves and after some tweaks to get the timings right, it worked!

My bench was cluttered with stuff (as they tend to be) and it was then that it hit me... I had two breadboards for two different projects that used pretty much the same components and could

be easily combined so I did just that and decided to call it Slurp'nPick, these two being what I believe to be the main features. I later added the blow feature to the firmware, by now I would do a lot of smartphone screen replacements and would always use this feature to blow the camera lenses as well as dust from all kinds of things. I later also added the vacuum feature which I find useful to suck the air out of 3d printing filament bags. So with all these additional features I just added a "+" sign to the end of the name, Slurp'nPick+.

In the meantime I had made a remote sensor for my mailbox which would notify me whenever I got new mail, this would use very little current, about 1.2uA in standby (I have as of now not changed the CR2032 coin cell and it is still at 2.95v), since I hate cables in general I decided to take one of those boards and thought of designing a little box to attach it to the footswitch somehow but thankfully I opened the footswitch and realized that If I replaced the microswitch for a smaller one, I could easily fit the board inside which not only would make it a lot easier but it also wouldn't increase the size of the footswitch. I later designed a board specifically for this.

And the rest is history... a lot of challenges searching for, waiting for, testing and choosing the right components, a lot of time tweaking the firmware, drawing animations, looking for bugs, a few revisions of the board (initially started with an atmega 328p, later changed to the RP2040), a lot of time designing a box and tweaking a cheap laser cutter to cut the acrylic, some time designing the parts for the picking tool, some time learning about silkscreen printing and a lot of time later doing all kinds of things that no one really thinks about when looking at the finished product, like looking for packaging materials and writing documentation, it was finally ready!