Node-RED for the UniPi Neuron

Step-by-step guide

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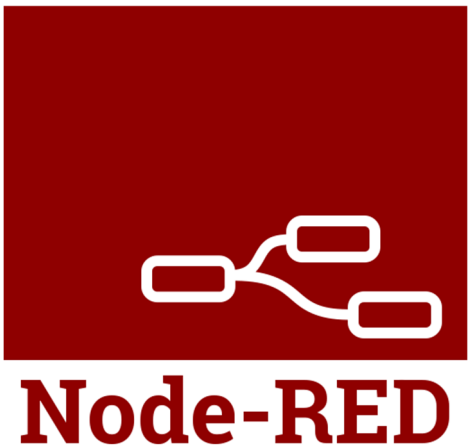
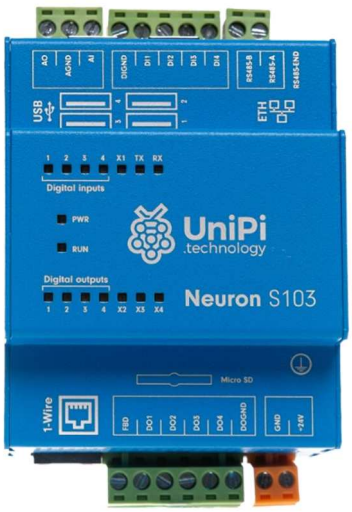




Introduction

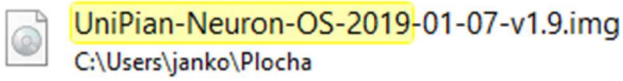
This step-by-step guide will lead you through the complete process of installing the Node-RED into your UniPi Neuron programmable logic controller. For more information about Node-RED or UniPi Neuron controllers, please visit the **UniPi Knowledge Base** or the UniPi.technology **product catalogue**.

Preparations

UniPi Neuron controllers are based on the Raspberry Pi computer using a microSD card as its memory storage. Any software installations thus require a microSD card; in the case of Neuron PLCs, you can purchase the card as a part of the controller's package. Alternatively, the card can be purchased separatedly or you can use any microSD card you already own. The size of the complete Node-RED + OS package is around **2.5 GB.** 4GB microSD cards can be used, but **it is strongly recommended to use 8GB or 16GB cards** with the class of at least **Class 10**.

The second required component is the **UniPian OS image.** The image is accessible on this link where you can find the latest release of the image (1.9 at the time of publication of this guide). The image is downloaded as a RAR archive

Extract the archive to get an *.img* file with the same name as the RAR archive.



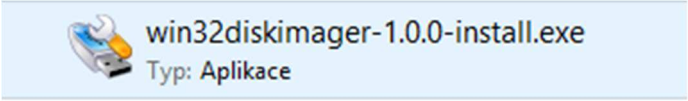
Note: A standard Raspberry Jessie or Raspberry Stretch image can be used instead of UniPian.

We also recommend to format the microSD prior to its use, using the **SD Card Formatter** tool

OS installation

Installation on the Windows OS

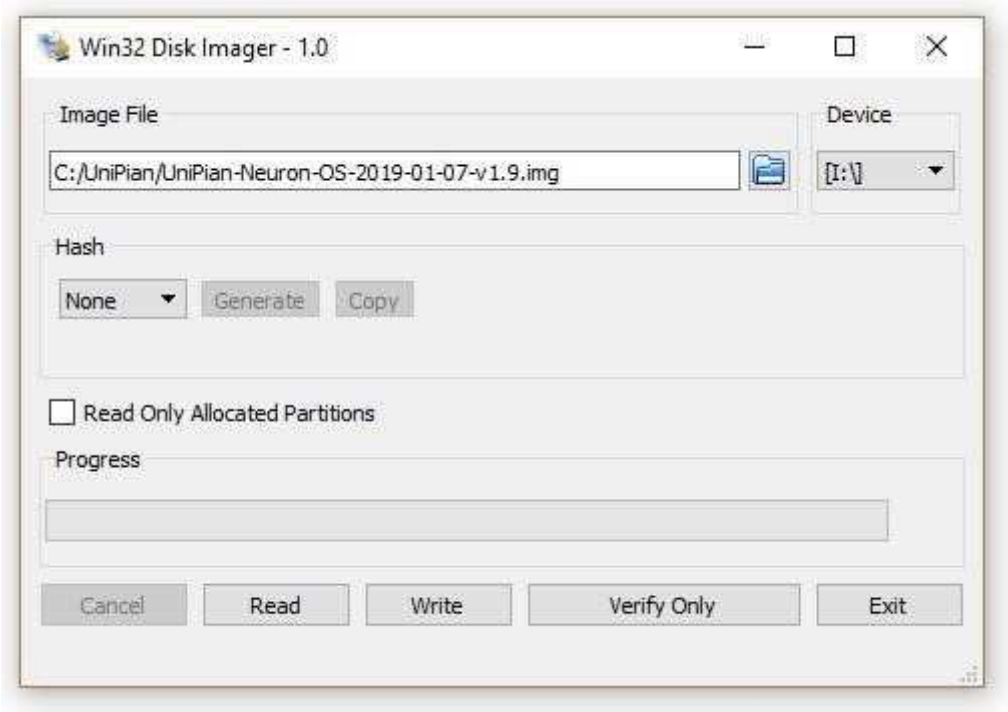
The first step is to download an application for writing the UniPian OS image onto the SD card. For the purpose of this guide, the **Win32DiskImager** was used.



Install the program using its installer and launch it **with administrator privileges.**

In the program, select the UniPian file – in the example below, the image is placed on the C:/ drive. In the *Device* drop-down menu, choose the drive with the microSD (I:/ in the example below) and click on *Write* for confirmation.

WARNING: Make sure you selected the correct drive in the *Device* menu! A mistake could result in overwriting your computer's hard drive!



Pozn. Image write will create two partitions on the microSD. One of them is not accessible, as it is formatted as an ext4 *(eg. a Linux file format).*

Installation on the Linux OS

On Linux, the installation process utilizes the **dd** utility for low-level file copying. Various extensions can be also used (such as *Image Writer* for Ubuntu), the full functionality is however guaranteed only for **dd**.

Perform the install by following these steps

1. Unzip the downloaded archive with the *.img* file using the **unzip** command (
   (ie. `unzip UniPian-Neuron-2019-01-07-v1.9.zip`)
2. Enter the **df -h** command to display the list of all connected drives. The SD card is displayed either as **/dev/mmcblk0p1** or as **/dev/sdd1**. The resulting card designation then can look like this:
   `dev/mmcblk0p1 7,3G 4,0K 7,3G 1% /media/user/SDkarta`
3. After finding the SD card directory, unmount it using the **unmount** command (ie. `unmount/dev/sdd1`)
4. Enter the **dd** command itself. The command consists of following main parameters
   a. input file (**input file if=)**: enter the name of downloaded image file. The resulting parameter will look like the following: : `if=UniPian-Neuron-2019-01- 07v1.9.img`
   b. output file (**output file of=**): enter the SD card directory. **Caution:** It is necessary to enter the full path of the SD card, not only its partition (ie. **sdss1** or **sddp1**). The resulting parameter will look like the following: `of=/dev/mmcblk0` (the last digit represents the directory)
   c. block size (**block size bs)**: this parameter determines the size of blocks in which the SD card will be written on. The default size is 4 MB; in case of issues, it is possible to select 1 MB.
5. Using above-mentioned parameters, the complete command should look like this:
   `sudo dd bs=4M if=UniPian-Neuron-2019-01-07-v1.9.img of=/dev/mmcblk0`

Writing of the OS image may take up to 5 minutes. As the **dd** utility does not indicate its progress, we recommend waiting until the system displays any results. Upon the write's completion, two partitions should be visible on the microSD; you can check their presence with **df h-** command. If all steps were performed correctly, the microSD will load as **boot** when inserted to the PC. If the process failed, we recommend consulting with the microSD preparation process manual on **this link.**

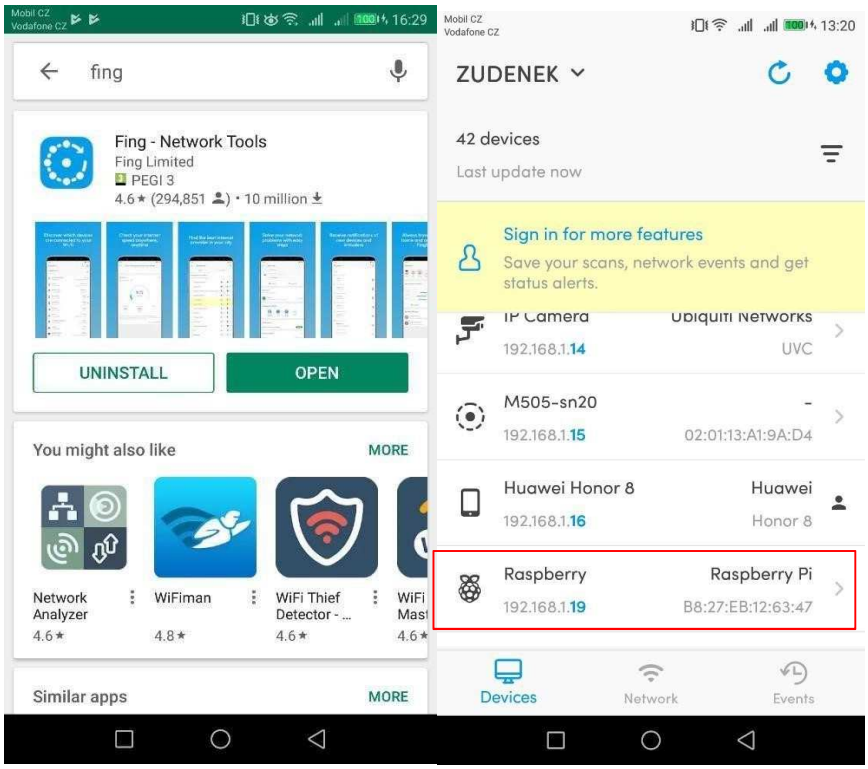
Editing the SD card root directory + inserting the card

In the microSD's root directory, create a text file named **ssh.** Remove the card from the PC and insert it into Neuron controller. **WARNING: Insert the card only with the controller's power supply unplugged!!**

Hint: Use pliers for easier insertion/removal of the microSD.

Detecting Neuron's IP address

The next step is to detect the controller's IP address. The easiest method is to use the **Fing** mobile app, available at Google Play (Android smartphones) or App Store (iOS smartphones)



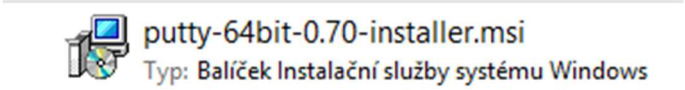
In Fing, the controller will appear in the list of available devices as **Raspberry Pi**

The IP address can be also detected by Windows IP lookup tools, or by using any other IP lookup application.

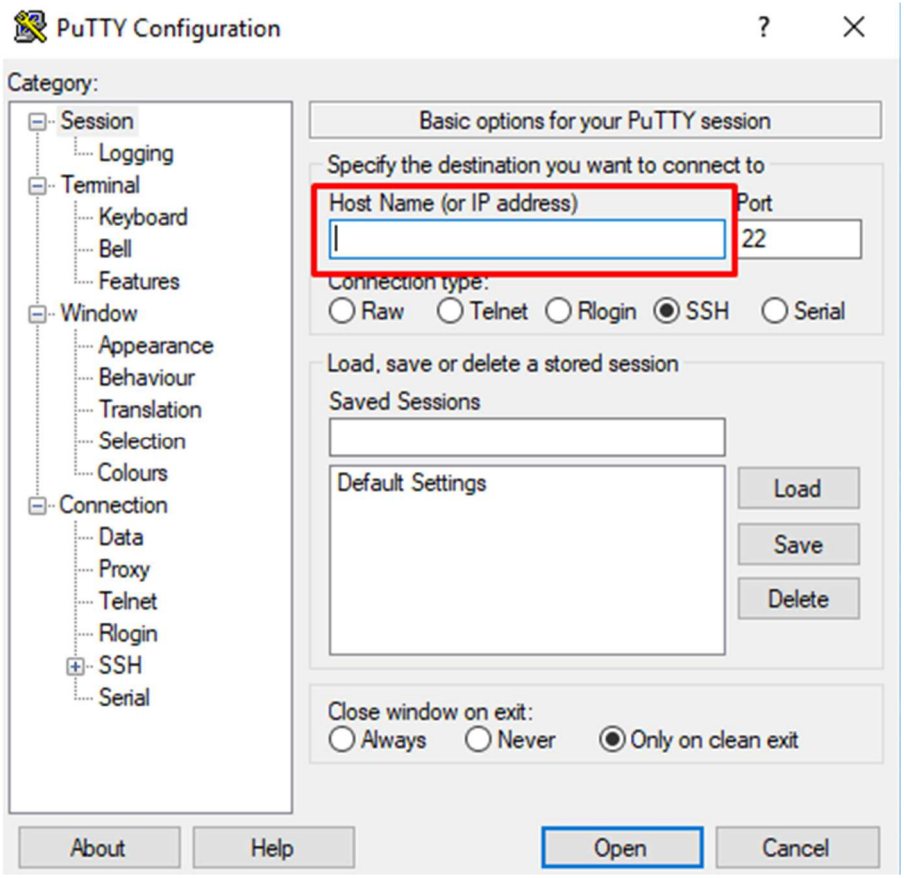
Communication with the controller through SSH/PuTTY

After detecting the controller's IP address, you can communicate with the controller using an SSH terminal. To create one you need to download **PuTTY** application (available for download on **this link**). PuTTY is the most suitable choice for Windows OS and was used for the purpose of this manual. You can, however, use any other available SSH utility.

Install PuTTY through its installer and launch it.



A following window will appear. Enter the controller's IP address to the *Host Name* box (see the image below)



Confirm by klicking *Open*. A security alert will appear – confirm it as well by clicking *Yes*.

The SSH control console will appear

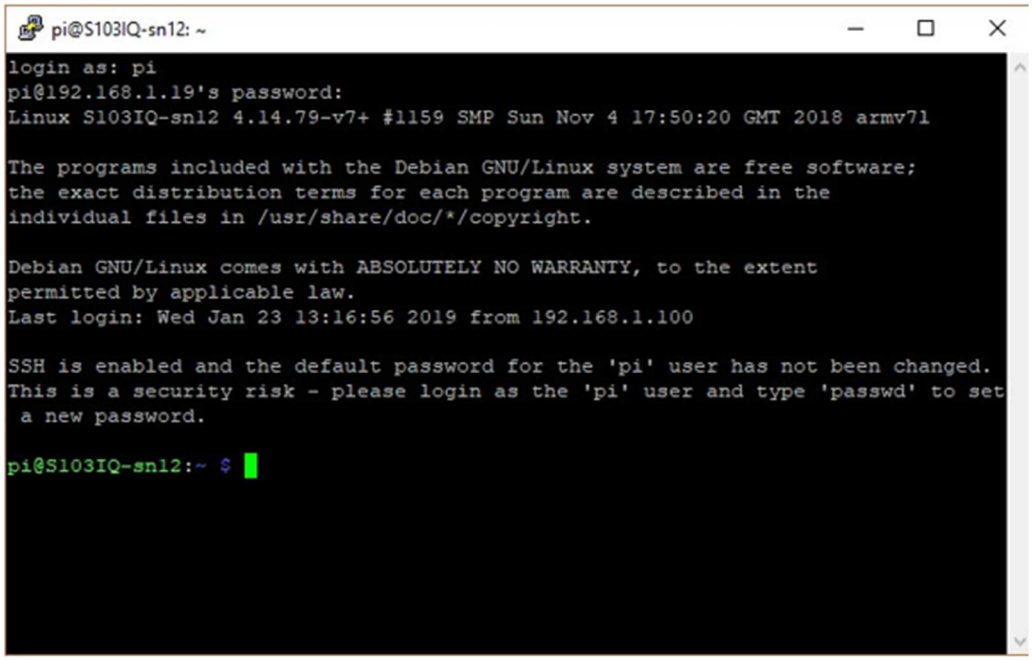
Enter login and password.

- login: **pi**
- password: **raspberry** (*the password is written as invisible; cursor not moving is not an error)*

Confirm the login by pressing *Enter*

Caution: Login has a security time out. If the time runs out, the login will not be possible. If you failed to enter login and/or password in time, repeat the process by restarting PuTTY

If you entered the login info correctly, a following message will appear



The SSH is now active and ready to receive commands for the next step of the installation process.

Installation of the EVOK

EVOK is an open-source application programming interface (API) allowing a basic access to I/Os of UniPi controllers. EVOK is freely accessible on its **GitHub repository,** containing general info and installation instructions. You do not need to study them though – all you need to do is to enter a string of commands below. We recommend to simply copy and paste the commands directly into the SSH terminal (paste by clicking the right mouse button)

EVOK + UniPian OS image

If you used UniPian OS image, **EVOK is already included and you do not need to install it.** The only required step here is to ensure you have the latest EVOK release. You can check this by entering the following commands into the SSH terminal:

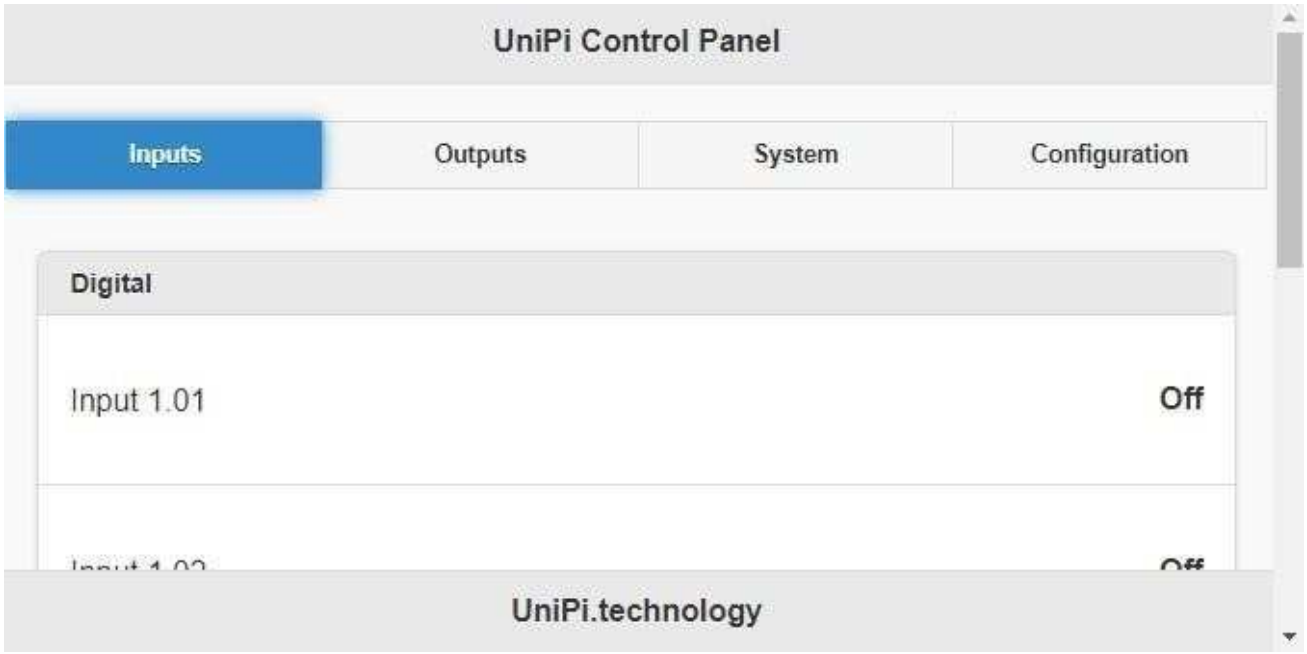
```
sudo su
apt-get install evok
apt-get update
reboot
```

EVOK + other OS images

If you used any other OS image than UniPian, **you need to install EVOK manually.** The installation process is described in detail at the EVOK [GitHub repository](#).

Launching EVOK

With the EVOK installed, open a web browser and enter the controller's IP address in the address bar. If the installation was successful, a following interface will appear.



This interface gives you a basic control over the controller's I/Os. Proper function of the interface can be tested simply by switching one of the I/Os; if everything works fine, a corresponding LED indication will light up on the controller.

Node-RED installation

With the EVOK installed, you can finally install the Node-RED itself. **Caution: Node-RED requires EVOK version 2.0.7g or higher!"**

Node-RED install is again performed through the SSH terminal by following these steps:

- enter the `sudo apt-get install build-essential` install command. The installation does not require any input. You can see its progress in the SSH terminal window

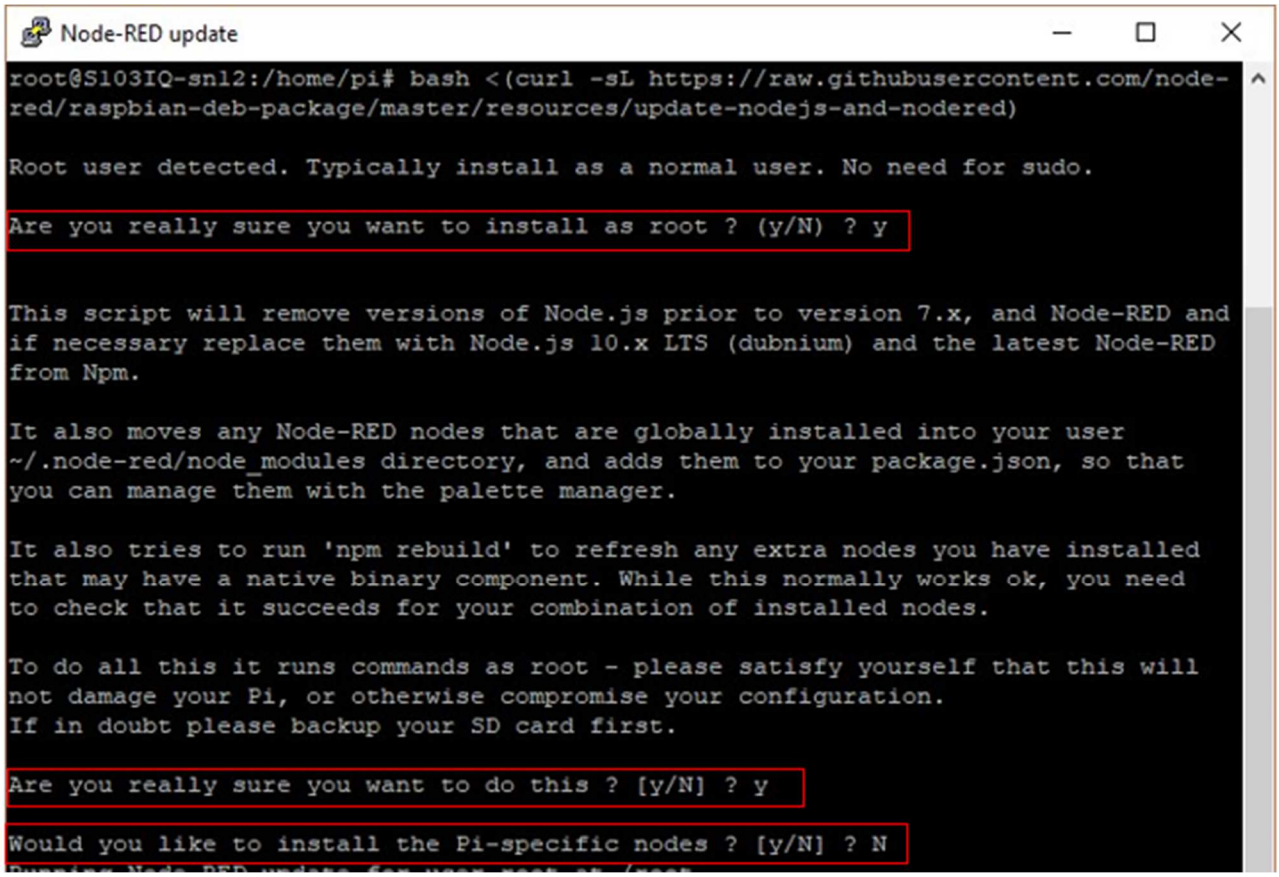
- after finishing the previous step, enter the following command:

  ```
  bash  <(curl -sL  https://raw.githubusercontent.com/nodered/raspbian-deb-package/master/resources/update-nodejs-and-nodered)
  ```

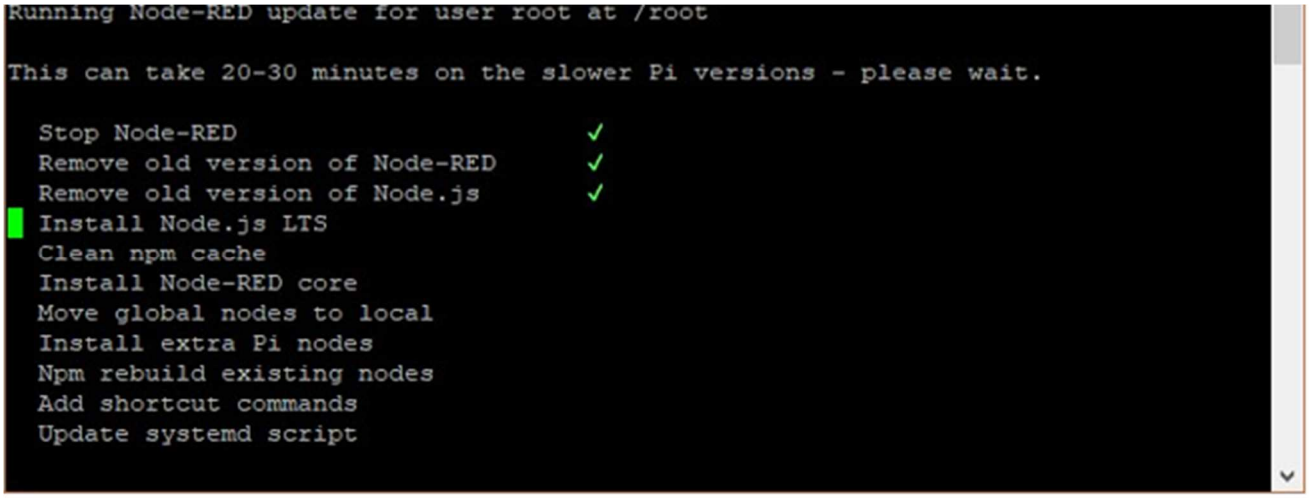
Three questions will appear in a following sequence:

```
Are you really sure you want to install as root? [y/N]?
Are you really sure you want to do this? [y/N]?
Would you like to install the Pi-specific nodes? [y/N]?
```

Enter answers in a following order: **Y,Y,N.** (see the picture below)



Upon entering all the answers, the Node-RED installation will begin automatically. Its progress is visualised with green ticks appearing next to each step. The installation is completed when all steps are ticked.



If the installation is successful, the whole process is completed. All you need to do to launch Node-RED is to enter `node-red` command.

Node-RED launch on device start up

By default, the Node-RED must be launched by `node-red` command each time the controller is started. To ease the start up, you can enter the following command upon Node-RED launch

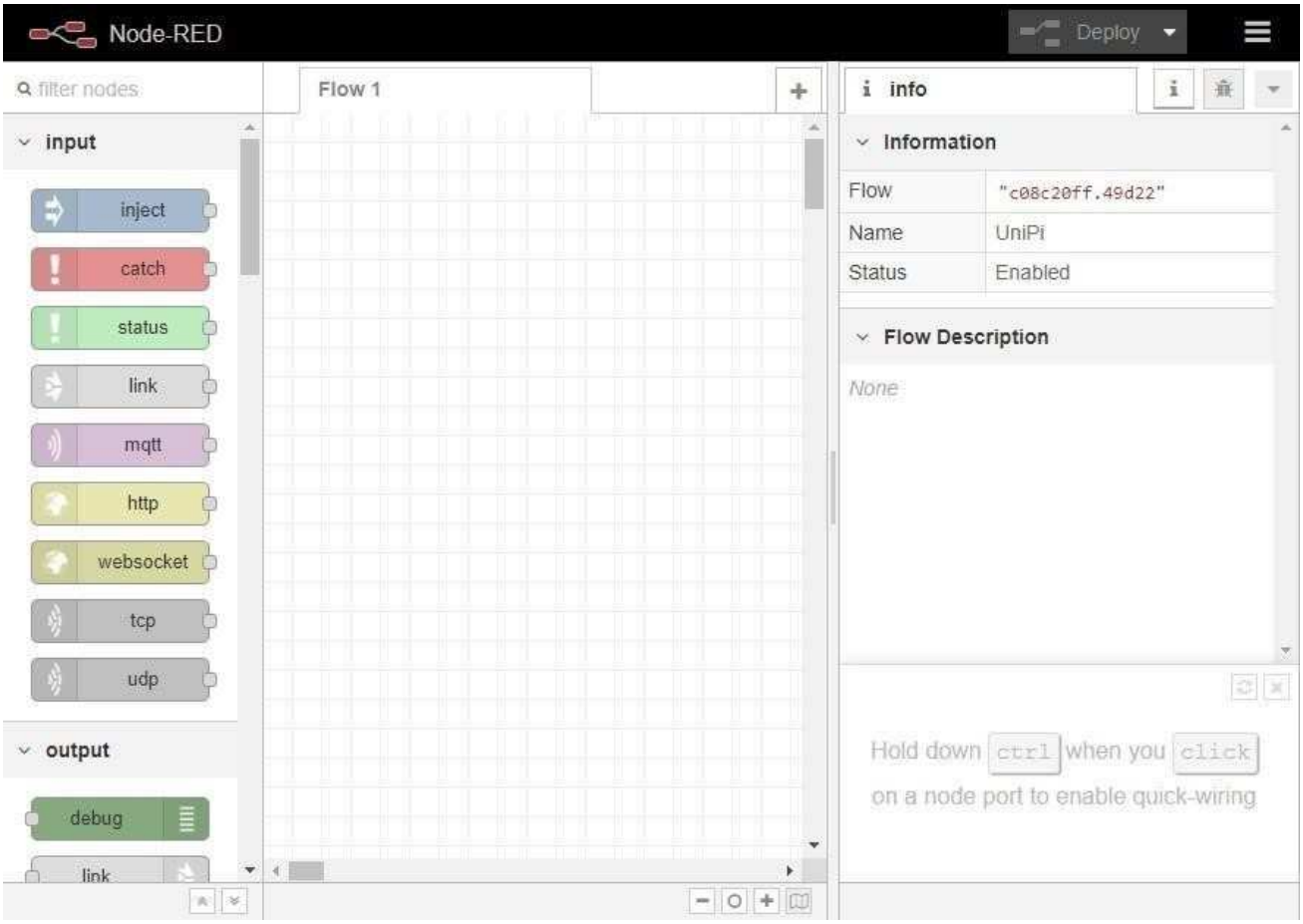
```
sudo systemctl enable nodered.service
```

Node-RED will now automatically launch on controller's startup.

First Node-RED start up

With the Node-RED installed, open your web browser and enter the IP address of your controller into the address tab. Add the **:1880** behind the IP address as on the picture below

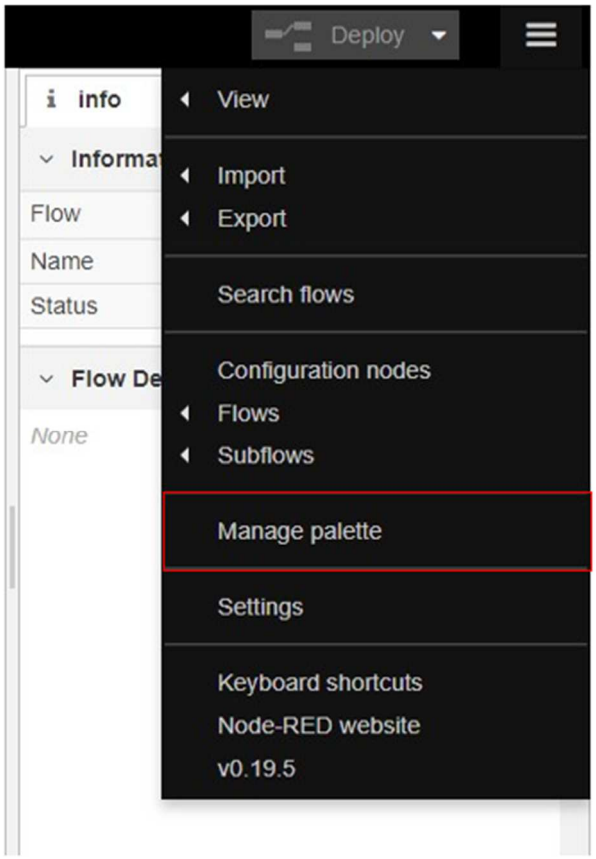
If the IP address is correct, a following interface will appear:



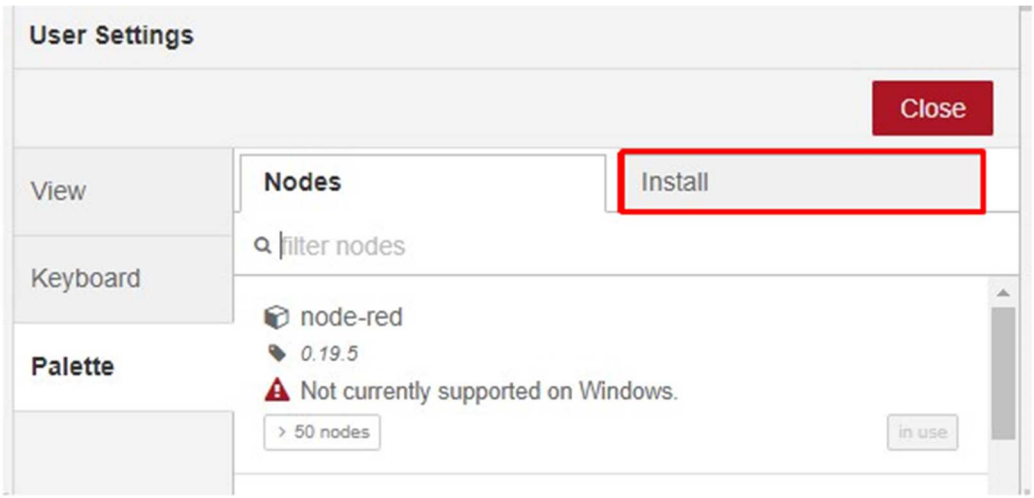
Node-RED is now fully functional

Connecting Node-RED with UniPi Neuron controllers

To communicate with the controller, you need to add corresponding UniPi nodes to the node palette. Click on the menu symbol in the upper right corner of your screen. A following menu will appear. Click on *Manage Palette.*



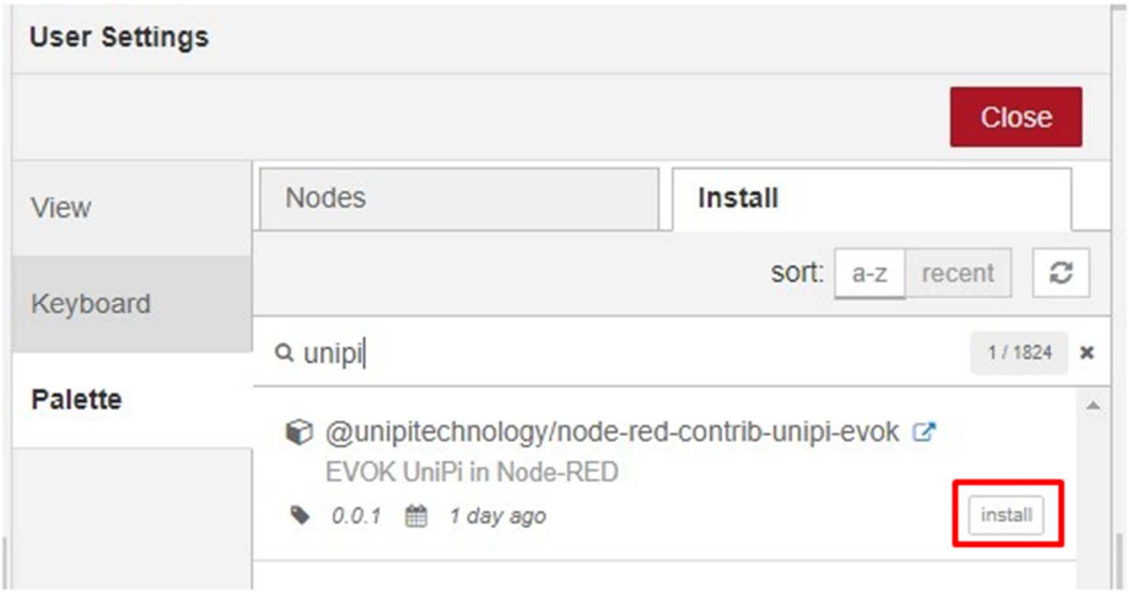
A following window will be displayed. Click on *Install* tab.



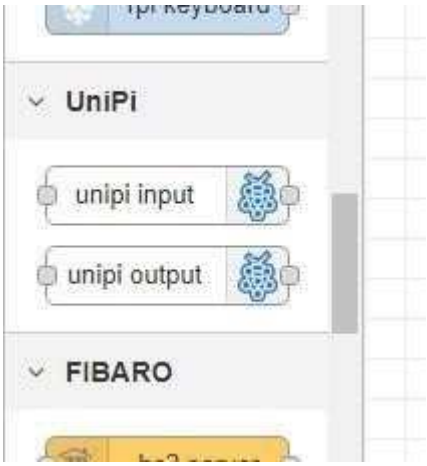
A node install interface will appear. Here, you will need to find and install the following sets of nodes:

- **@unipitechnology/node-red-contrib-unipi-evok**
- **node-red-dashboard**

Enter the node's name into the search bar. After that, simply click on the *Install* button.



Check new nodes that appeared in your node palette

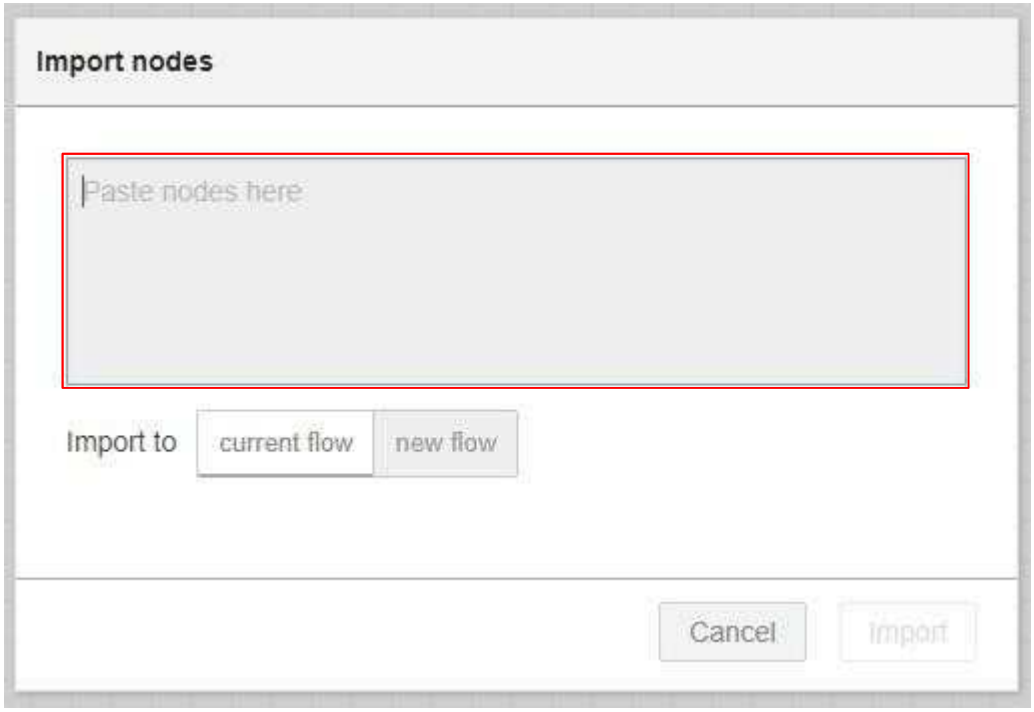


Node-RED is now ready to communicate with the Neuron.

Node-RED demonstration

For a better orientation in Node-RED and its interface, a simple showcase project was created to help you understand the Node-RED basics.

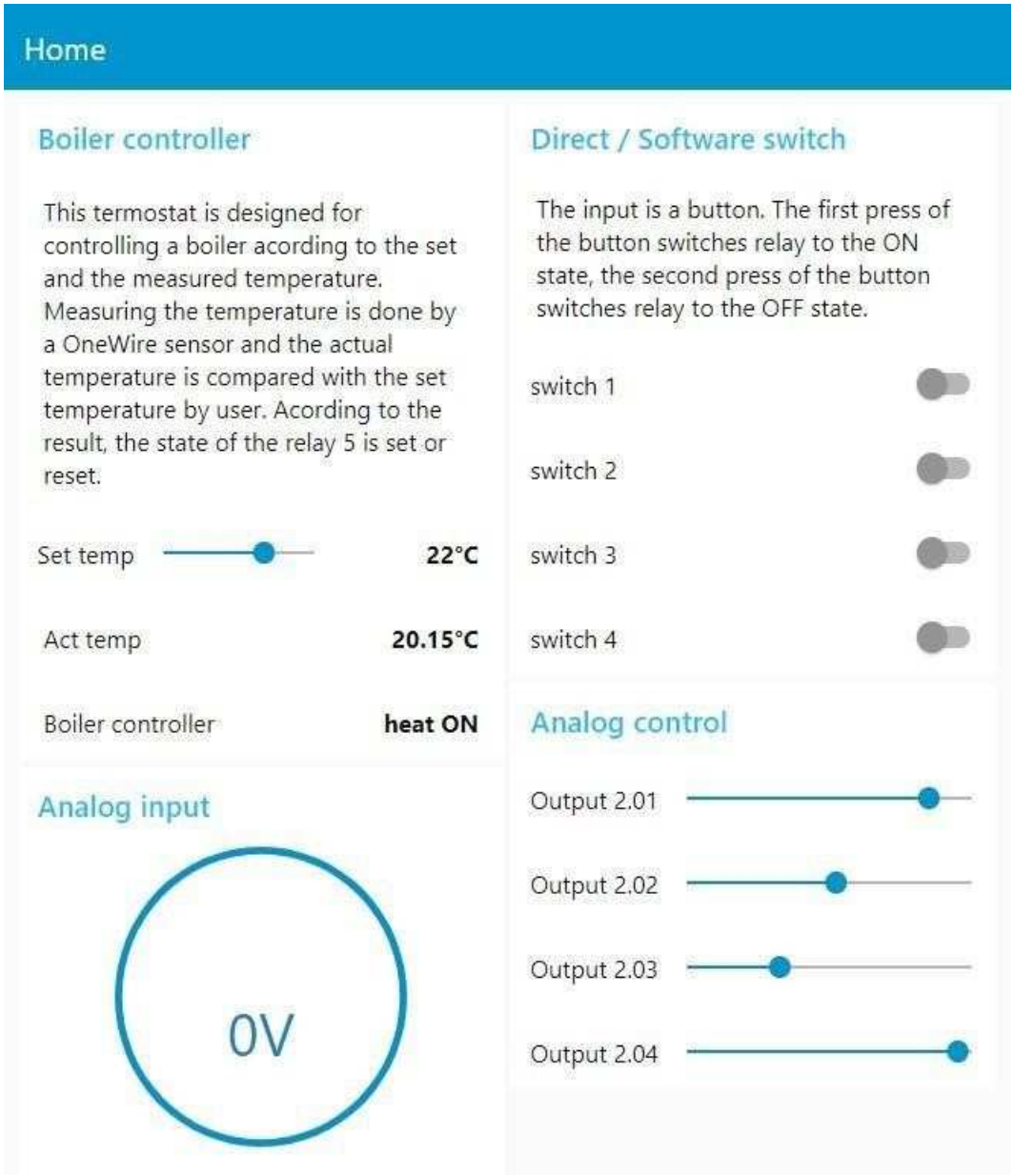
In the Node-RED main menu, click on *Import.* A following window will appear



Open the **demo_flow_1.0.json**. file, copy all its contents and paste it into the Paste nodes here text field. Then click on the *Import* button

The last step is to display a user interface by adding **/ui** after the IP address. See the picture below:

A following page shows a simple interface that will appear upon entering the **/ui** suffix.


Home
Boiler controller
This termostat is designed for controlling a boiler acording to the set and the measured temperature. Measuring the temperature is done by a OneWire sensor and the actual temperature is compared with the set temperature by user. Acording to the result, the state of the relay 5 is set or reset.
Set temp
22°C
Act temp
20.15°C
Boiler controller
heat ON
Analog input
0V
Direct / Software switch
The input is a button. The first press of the button switches relay to the ON state, the second press of the button switches relay to the OFF state.
switch 1
switch 2
switch 3
switch 4
Analog control
Output 2.01
Output 2.02
Output 2.03
Output 2.04