Nanomade Lab

CapaForce© Kit user manual

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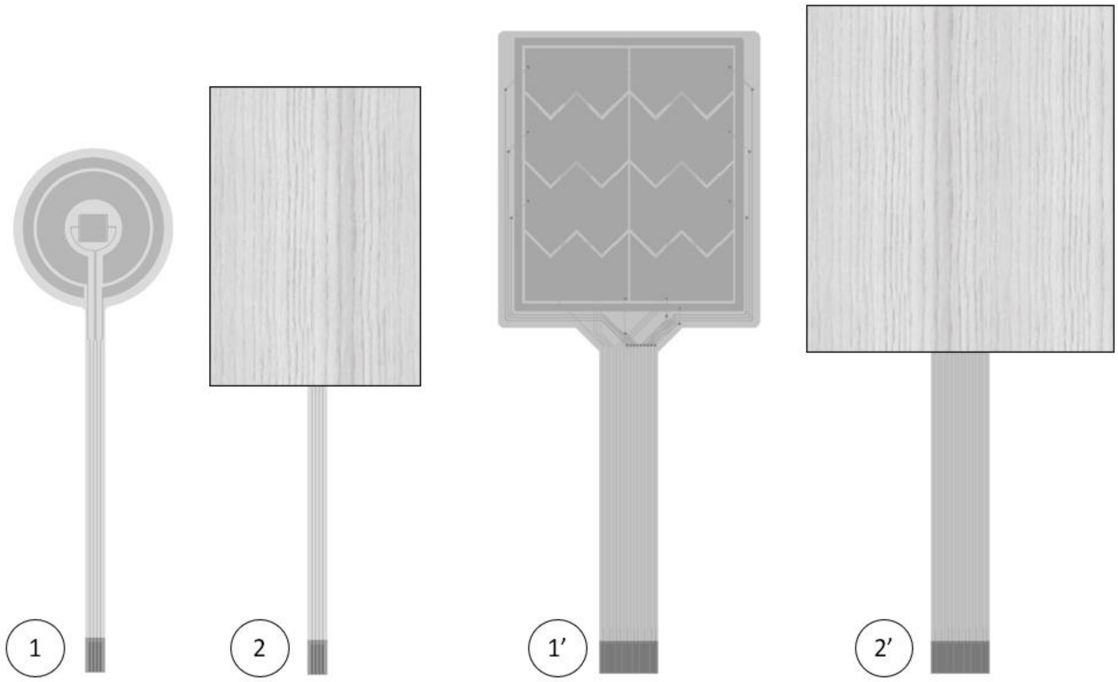
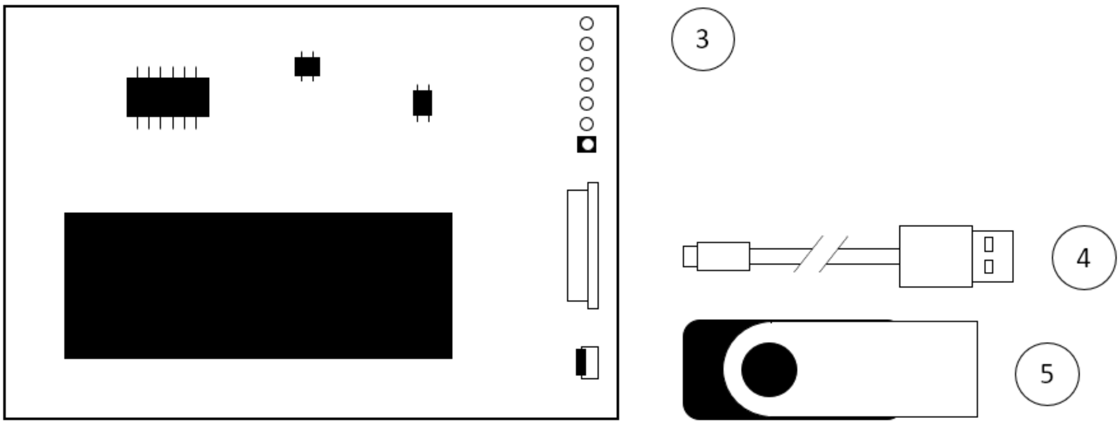
Record of revision

Revision number	Revision Date
1.0	**January 23, 2020**
1.1	**February 25, 2020**
1.2	**April 07, 2020**

Table of content

1. Package contents





1 - Nanomade single CapaForce© sensor (x4)

1’ - Nanomade matrix CapaForce© sensor (x4)*

2 - Integrated single sensor under wood

2’ - Integrated matrix sensor under wood*

3 - Electronic board

4 - Micro-USB cable

5 - USB key

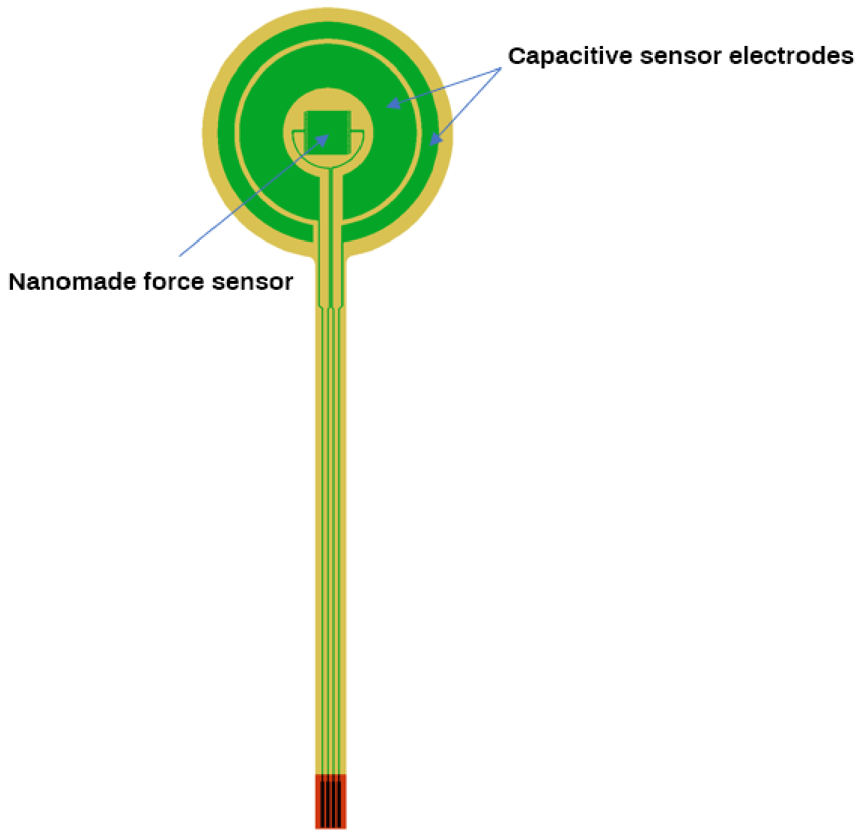
**contained only in the CapaForce© Matrix kit.*

This CapaForce© kit contains 4 non-integrated sensors, 1 sensor integrated under a wood trim panel, one electronic board to drive the sensor with its USB cable, and one USB key containing this user manual, the sensor datasheet, the electronic board drivers and the software to display and control the sensor output.

2. Sensors description

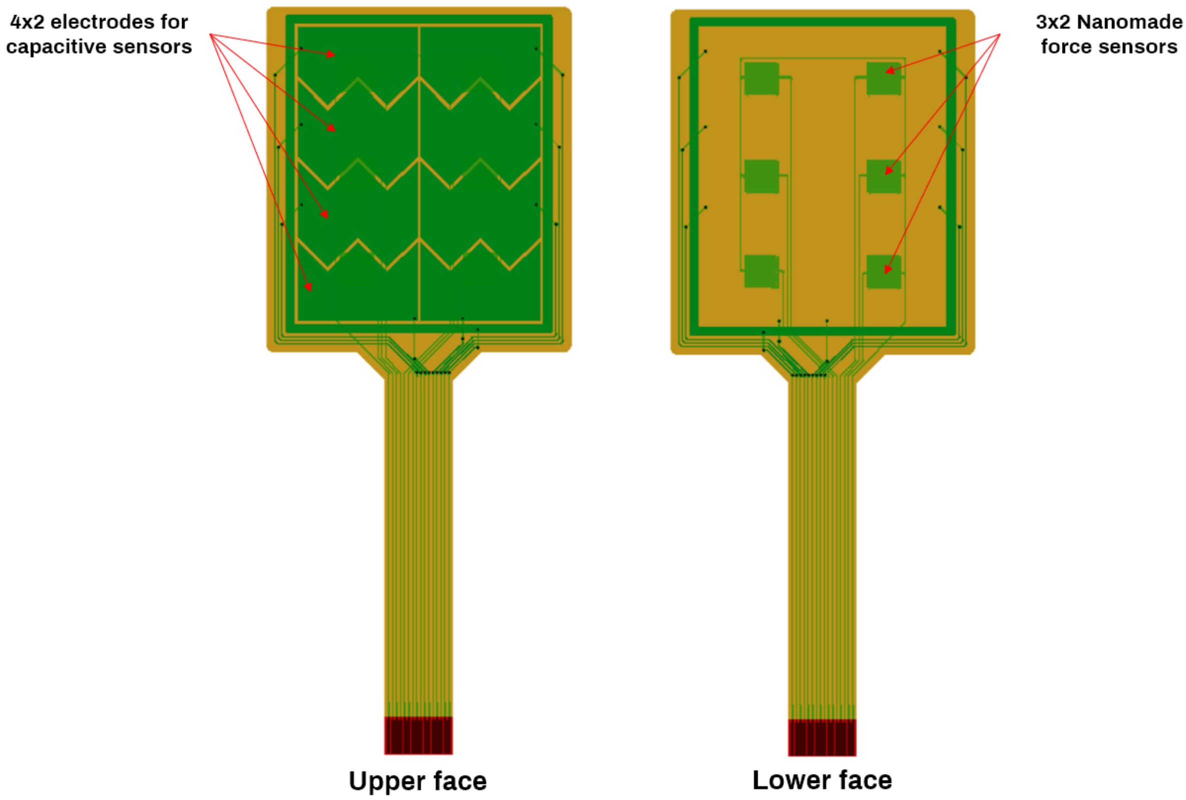
The Capaforce© sensor combines a standard capacitive sensor with a Nanomade force sensor. It allows soft touch detection and force touch with a single, thin, flexible sensor. Capaforce© is available in single or matrix version describes above.

- <u>**Capaforce© monolayer single sensor:**</u>



This sensor is composed of only one copper layer on polyimide substrate. Both capacitive and force sensors electrodes are designed on this unique layer.

- **<u>Capaforce© matrix sensor:</u>**

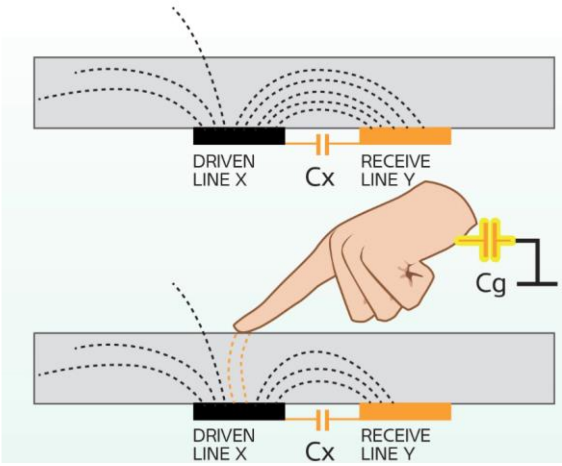


This sensor is designed on a double side FPC. There are 8 electrodes for capacitive sensor on the upper layer and 6 force sensors on the bottom layer. This configuration allows multipoint touch and force sensing.

This configuration can be adapted to larger surfaces with very high number of sensors.

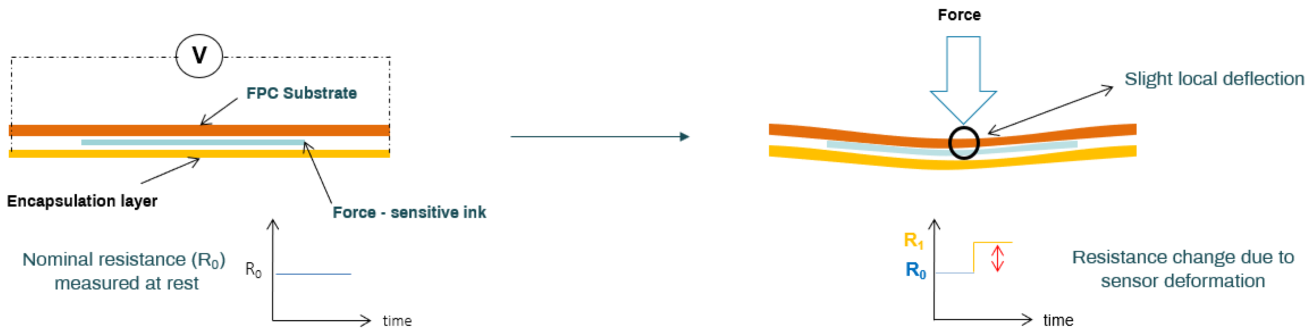
2.1 The capacitive sensor:

It is a proximity sensor that detects nearby objects by their effect on the electrical field created by the sensor. The sensor electrode is connected to a measurement circuit and the capacitance is measured periodically. The output capacitance will increase if a conductive object touches or approaches the sensor electrode. The measurement circuit will detect the change in the capacitance and converts it into a trigger signal.

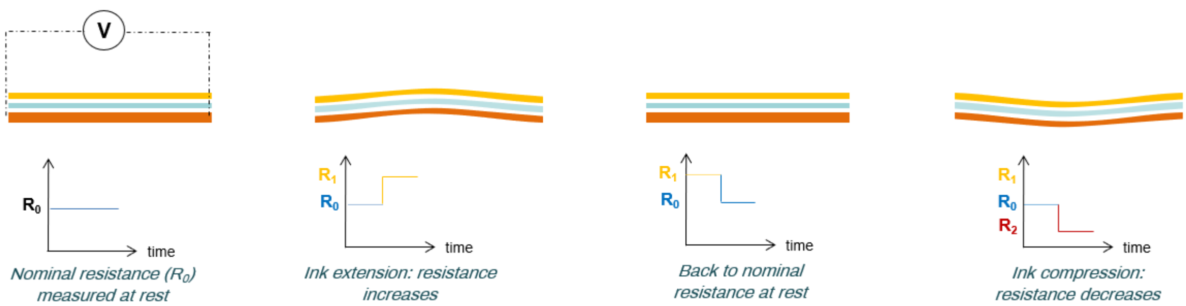


2.2 Nanomade force sensor:

Nanomade force sensor works as a very highly sensitive strain gauge, i.e. the sensor nominal resistance varies with the applied force. Its properties rely on a proprietary force-sensitive ink printed on a Flexible Printed Circuit (FPC) substrate.



When a strain is applied, a measurable change in the electrical resistance of the sensor is detected. The higher the pressure applied, the higher the resistance change.

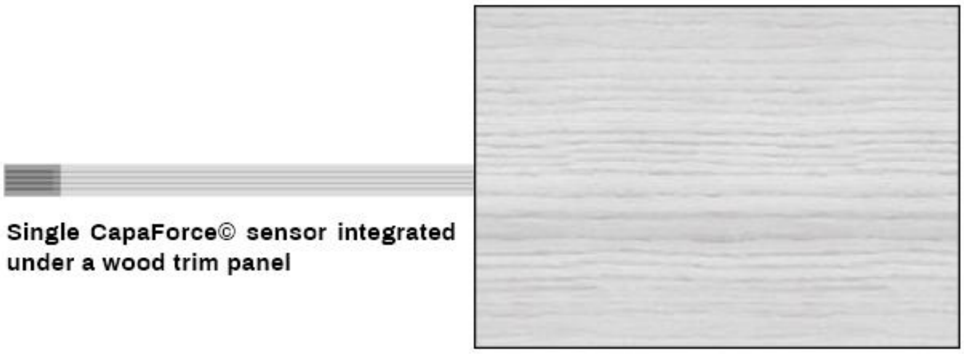


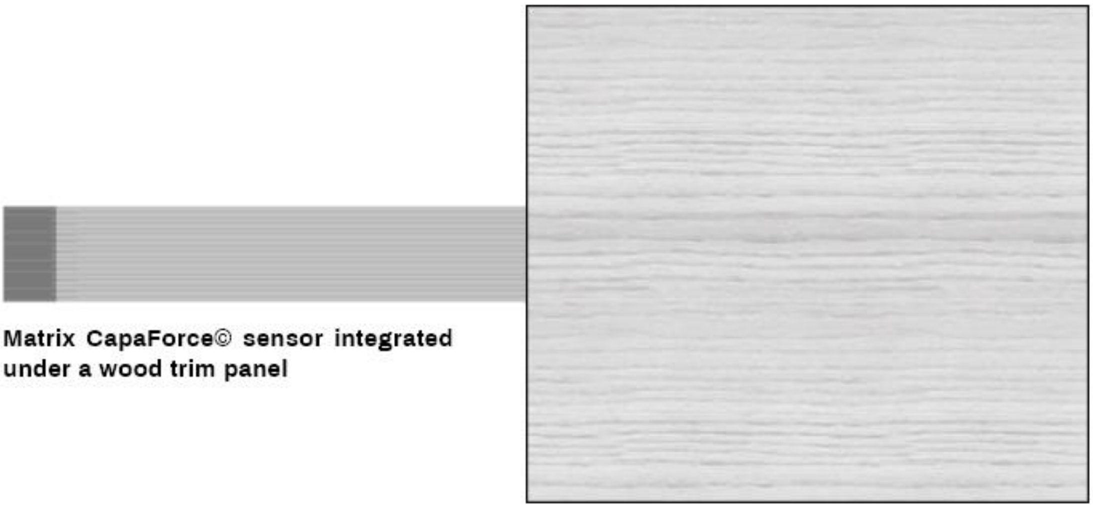
Nanomade Capaforce© sensors can be used as-is or integrated with other materials. The integration step is critical to get the best of Nanomade's Capaforce© sensors.

Detailed guidelines can be found in the Sensor integration section.

2.3 Sensor evaluation:

In order to start the evaluation, **integrated sensors are provided in these kits**.



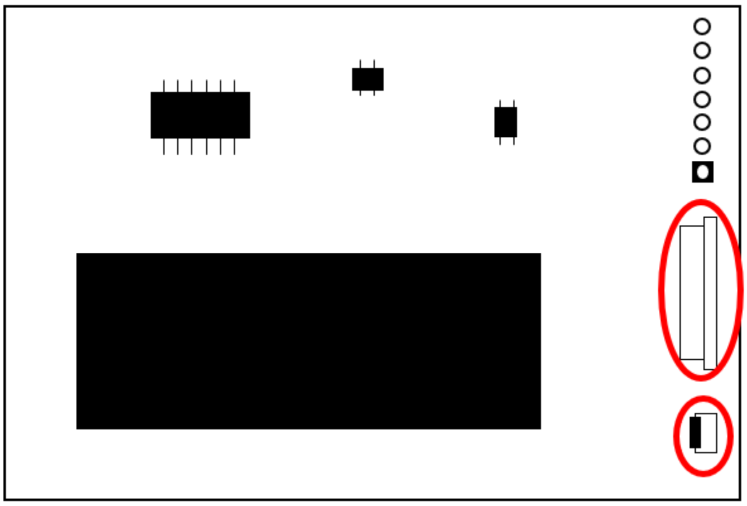


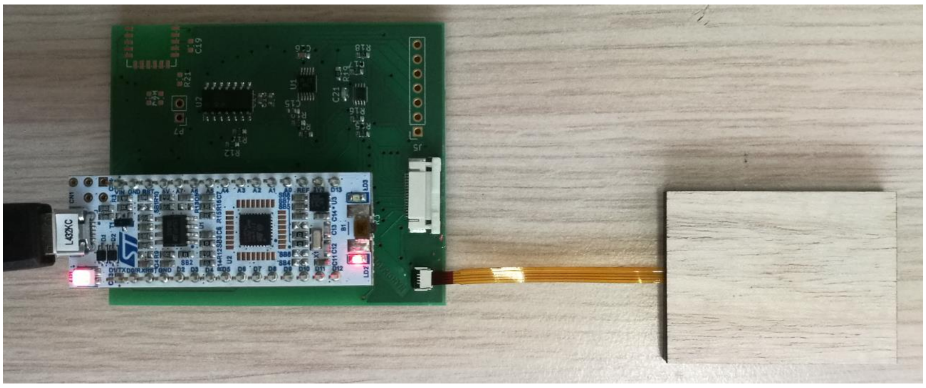
We recommend that users familiarize themselves with the kit by using these integrated sensors first.

3. Connections to the electronic board

3.1 Sensor connection

The sensors provided in the CapaForce© kits must be plugged in the corresponding ZIF connectors on the electronic board as shown below.





3.2 Connecting the electronic board to a computer

Before connecting the electronic board to the computer, make sure the sensor is properly connected.

To connect the electronic board to the computer, plug the USB cable into the micro-usb connector at the top of the board on one side and into an available USB port on your computer on the other side.

The electronic board is compatible with Windows 7, 8 and 10.

At the first connection, the electronic board should be recognized as a Virtual COM Port. If it's not the case, you can install the drivers provided in the kit. To do so, open the device manager and if the electronic board is not correctly recognized, update the drivers by indicating the folder on the USB key as the search folder.

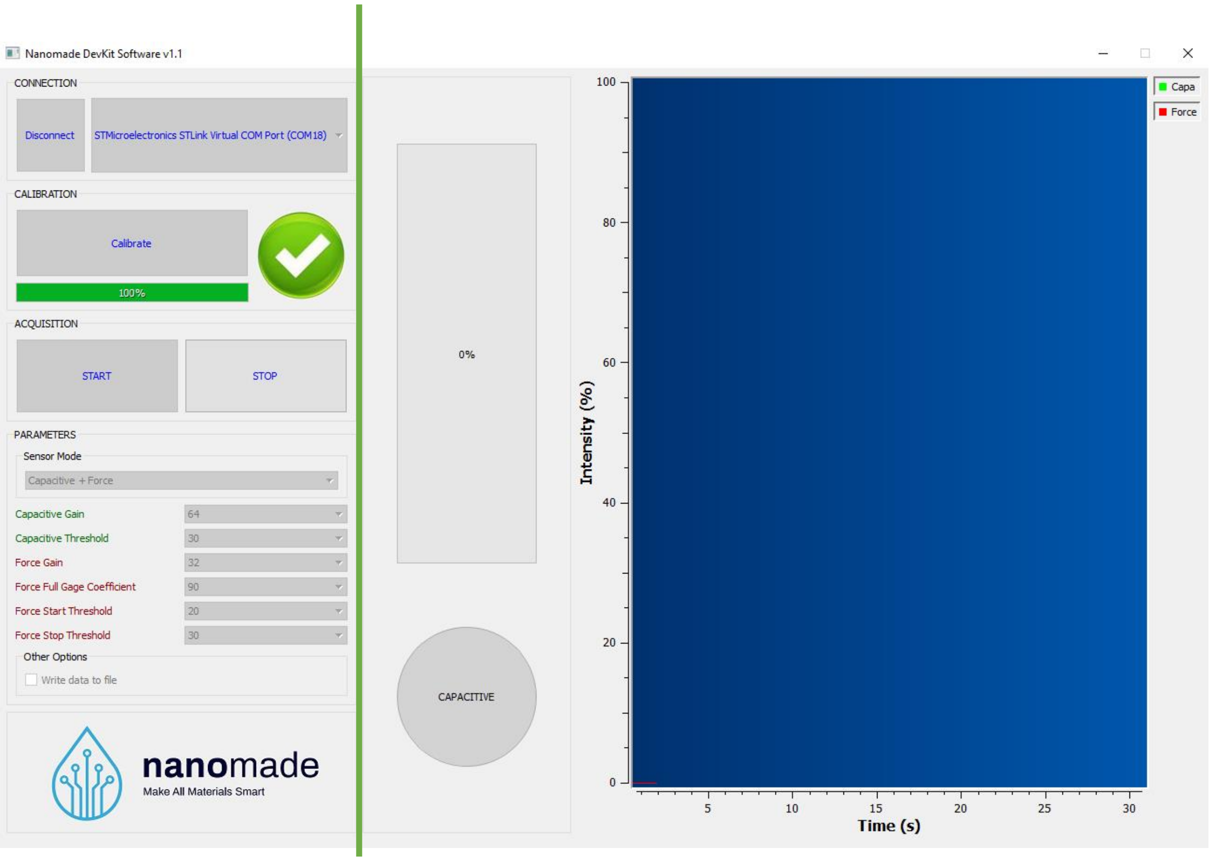
4. Software control

After connecting the sensor to the electronic board and the USB cable to the electronic board and to the computer, you can open the software folder from the USB key and double click on "***NanomadeLab_Software.exe***".

The software will recognize automatically if you have plugged a single or a matrix sensor and will launch the corresponding software.

4.1 Single sensor software

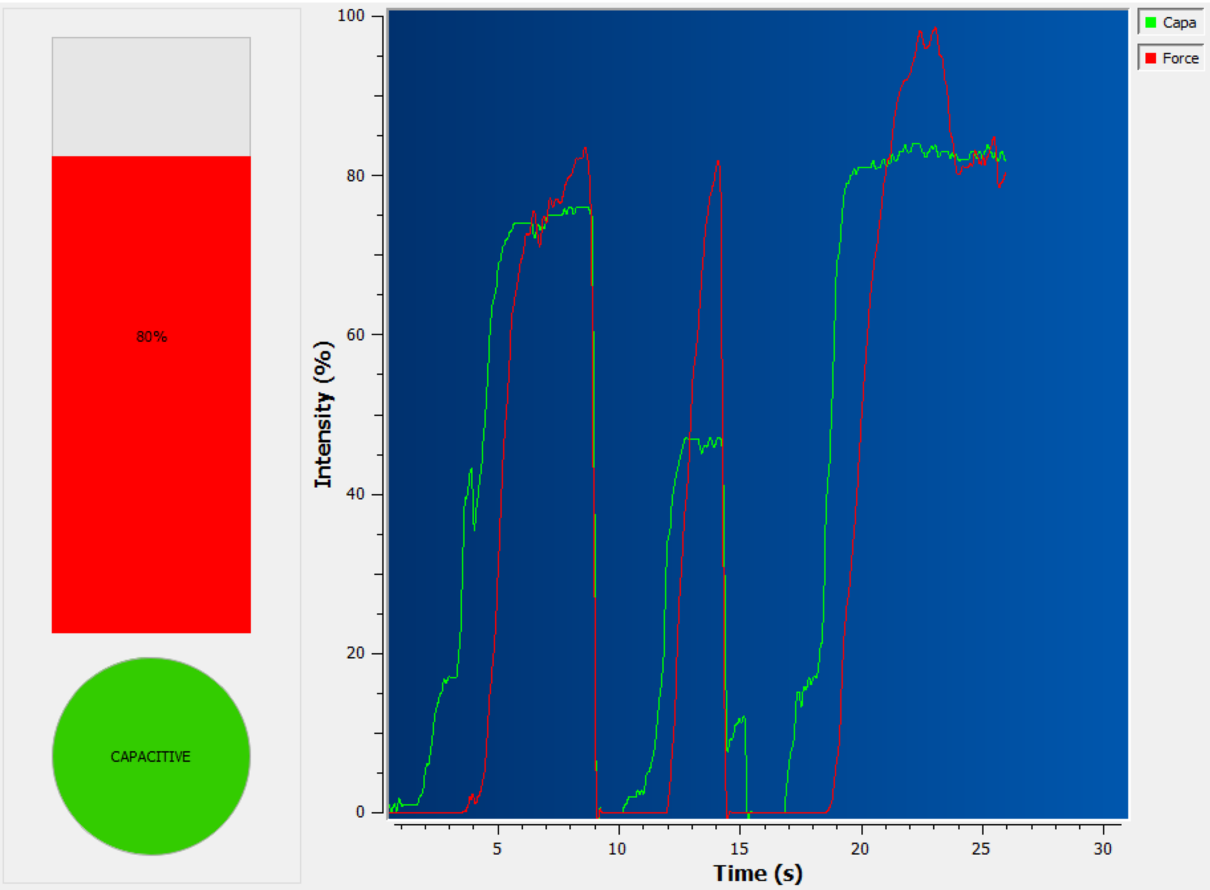
You should have the following window, after a few seconds of initialization.



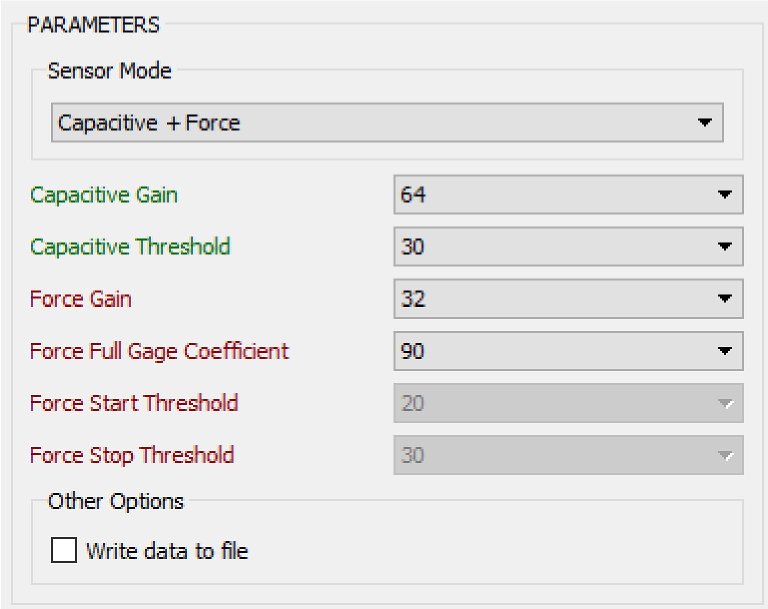
The window is divided into 2 parts: on the left side, the software and parameter controls which will be detailed further down, on the right side, the display part.

Regarding the display part, at the center of the window, the capacitive detection is illustrated by the green coloring of a disc, and the force detection by a red gage. Different parameters can be tuned (capacitive threshold, force full gage coefficient), and they will be described in the second step. At the right of the window, the capacitive (in green) and force (in red) intensities are displayed by graphics as a function of time. An example of these different displays is given below.

You have the possibility the show/hide each curve from the graphics part by clicking on the curve names (Capa & Force) at the upper right corner of the window.



To access the different parameters, you have to stop the sampling by clicking on the STOP button in the acquisition box. Then you can choose between 3 sensor modes, tune 6 different parameters (availability depending on the chosen mode), and save the data if you wish.



By default, the selected sensor mode is “Capacitive + Force”. You can choose to activate the force or the capacitive sensor only; in this case, the unselected sensor is automatically hidden.

Then you can tune several parameters in function of the sensor mode:

- **The capacitive gain:** you can select a value between 1 and 128; a higher value will increase the touch sensitivity; the capacitance variations are dependent on the properties of the material between the finger and the sensor and have to be tuned accordingly of it; the default value is 64.
- **The capacitive threshold:** it determines the value from which the disc will turn green, indicating that a touch has been detected; this parameter has no effect on the capacitive signal behaviour, it will just affect the display; the default value is 30.
- **The force gain:** you can select a value between 1 and 128; a higher value will increase the force sensitivity; the force variations depends on the properties of the material between the finger and the sensor and have to be tuned accordingly of it; the default value is 32.
- **The force full gage coefficient:** it determines the maximum variation between the resting position and the loaded position; the higher the value, the faster the variation in intensity; the default value is 90.

- **The force start threshold (in “Force Only” mode):** it determines the minimum pressure to apply to activate the force sensor; the lower the value, the more sensitive the sensor; the default value is 20.
- **The force stop threshold (with “Force Only” mode):** it determines the minimum release to apply to deactivate the force sensor; the lower the value, the faster the deactivation; the default value is 30.
- **Data recording:** by selecting this option, a recording file will be created in the software folder. Capacitive and force intensities values will be saved in this file after the restart and until the next stop; this option is deselected by default.

After defining the desired parameters, you must restart the sampling by clicking on the START button in the acquisition box.

The default values have been defined to optimize the variations of the pre-integrated sensor supplied in the CapaForce© kit.

If you want to **change sensors**, you have to follow the procedure below:

1. Click on the STOP button in the acquisition box.
2. Exit the application by clicking on the cross at the upper right corner of the window.
3. Unplug the USB-cable.
4. Replace the sensor.
5. Reconnect the cable.
6. Relaunch the application.

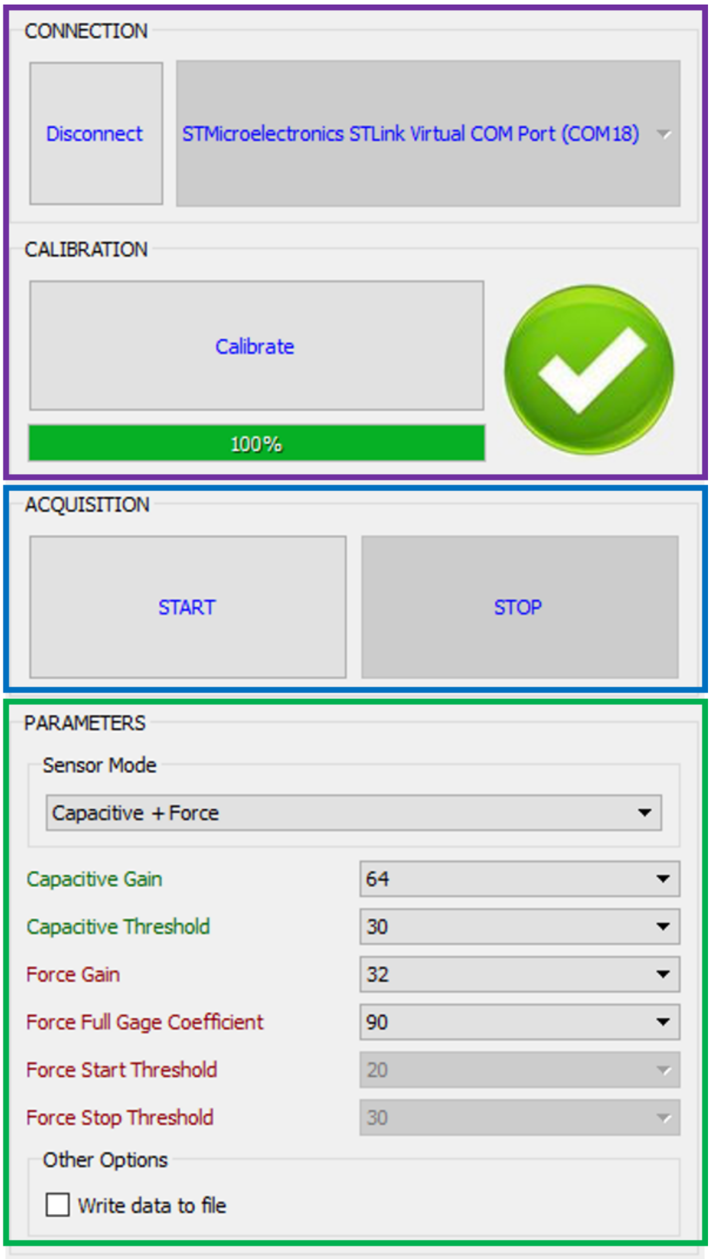
If you want to exit the application, you must **click on the STOP button** in order to stop the sampling **before clicking on the cross at the upper right corner** of the window.

The image below shows the different buttons described above.

The connection to the electronic board and the sensor calibration are automatically performed when the software is launched

The start and stop buttons provide access to parameters and control the sampling

Tune the parameter values to obtained the desire sensor behavior (in function of the sensor integration)

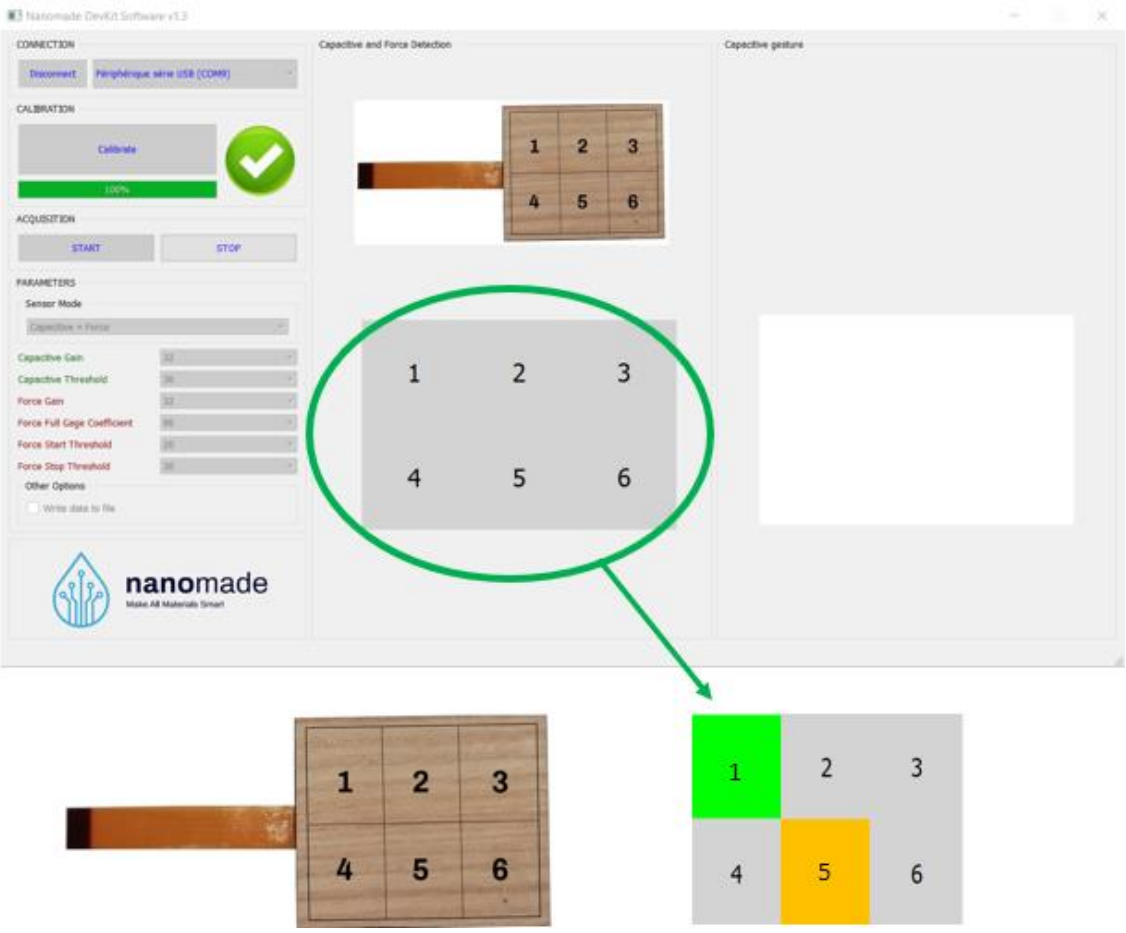


Provide access to parameters → give access to the sensor gain and threshold settings.

To obtain the desired sensor behaviour (depending on the sensor integration).

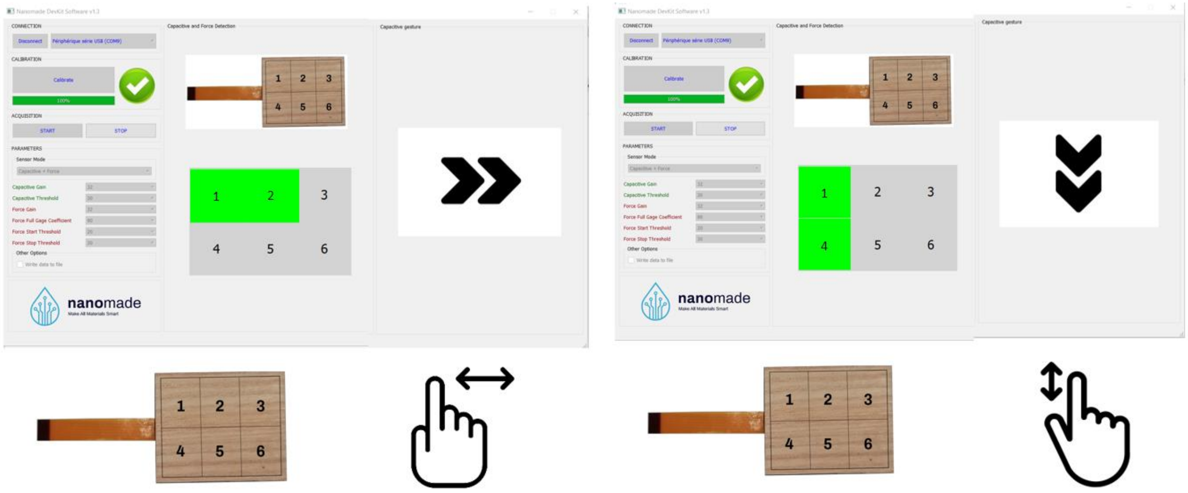
4.2 Matrix sensor software

You should have the following window, after a few seconds of initialization.



The sensor is divided in 6 touch and force areas (see picture above).

The first rectangle in the left side of the software, will display these six areas with a colour gradient from green to red function of the pressure applied: green = touch to red = high force.



The second rectangle in the right side of the software, will display gesture recognition. You can swipe on the sensor in several direction, and the corresponding direction represented by an arrow will be displayed.
The gesture recognition can be increase significantly by increasing the number of sensors.

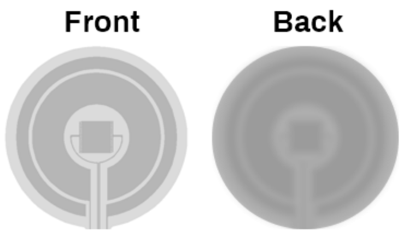
All the parameters (gain, threshold…) can also be tuned as described in the previous section for the single sensor software.

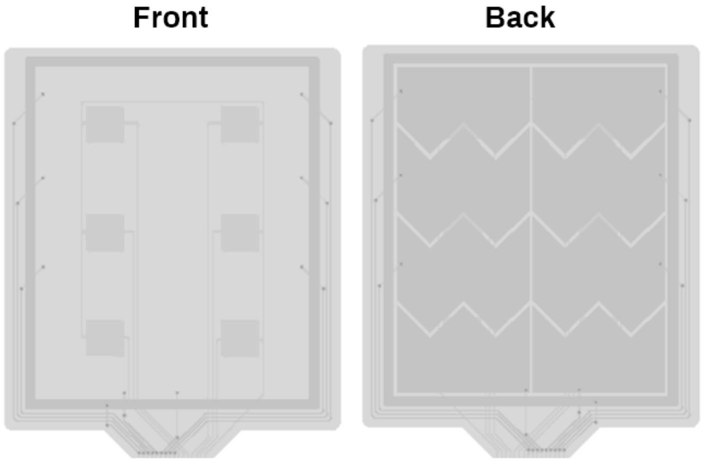
5. Sensor integration

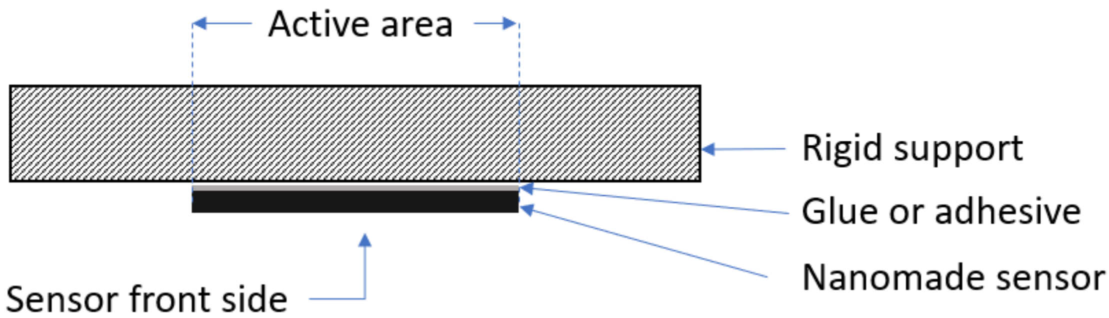
Nanomade force sensor works as a very highly sensitive strain gage, which means that, sensor nominal resistance will vary with the applied force.

The sensor must be placed under the piece of material the user wants to make touch and force sensitive. Any small and high deformations induced by the pression of a finger, for example, on the active area, will be translated into a change in the sensor resistance.

The sensor is placed directly behind the piece of material and glued to it by its back side as shown in the picture below:



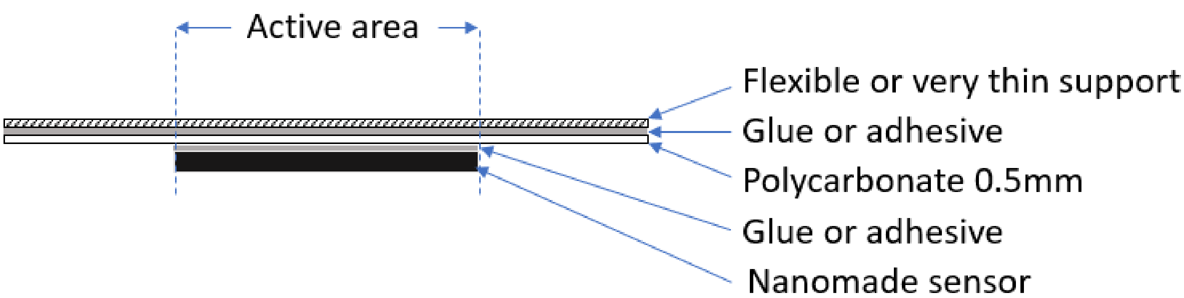




The higher the deformation transmitted to the sensor, the higher the variations of the sensor signal output. Thus, it is recommended to use rigid curing glue, as for example Cyanoacrylate. However, for an easier integration, it is also possible to use double sided tape adhesive, as for example 3M VHB F9460PC.

Several kinds of glue or adhesive can be used depending on the application and the material used.

In the case of very thin or semi rigid material like leather or wood, sensor can be glued on a thin intermediate substrate as polycarbonate 0.5mm or more:

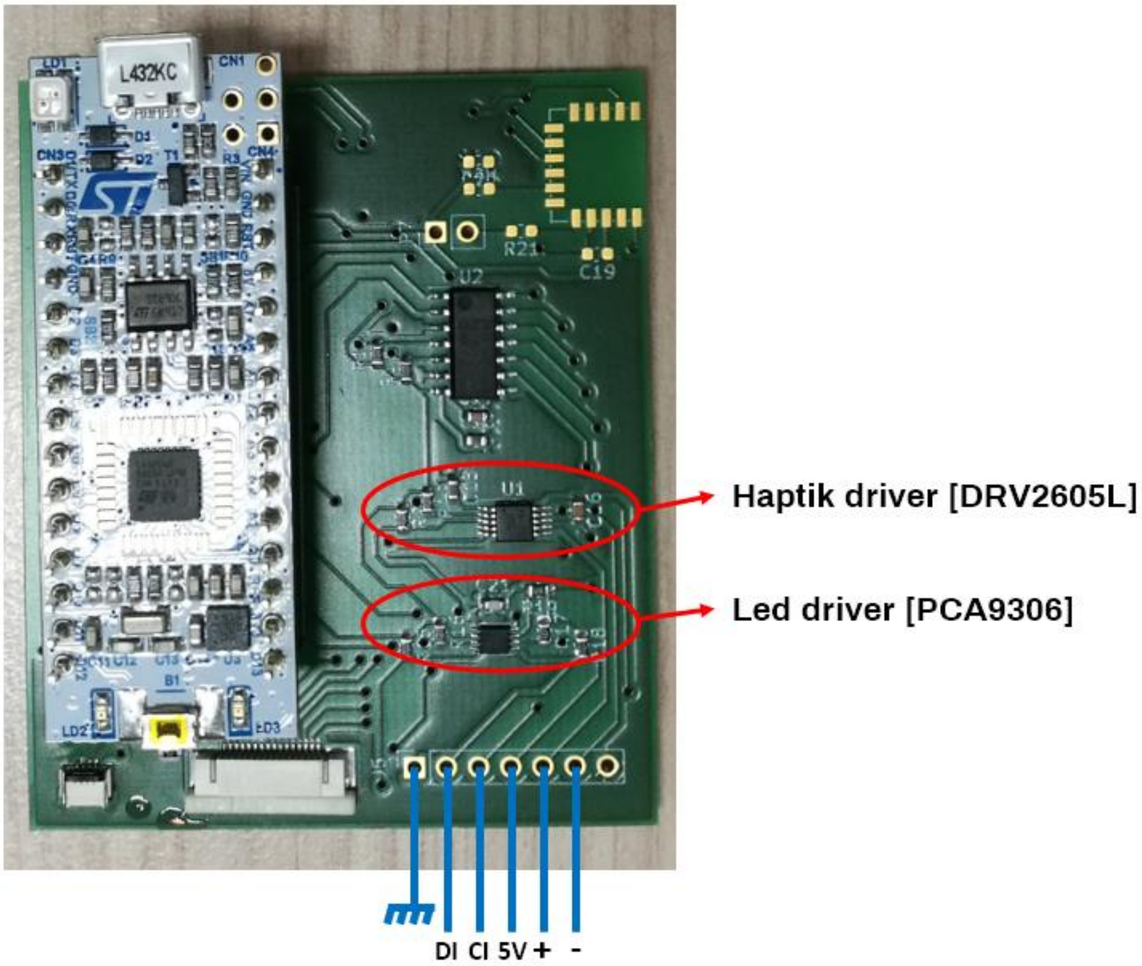


6. Make your own prototype

These evaluation kits have been developed to test our technology in your applications. For that, we have already integrated in the present Kit some components to drive haptic actuators and led.

Thus, you can build your own prototype combining our touch and force technology with haptic feedback and led lighting or a complete user experience.

Detailed drivers and connections to the board are described in the picture below:



Bluetooth options may be available on demand for a wireless apps connection.

Direct connections to your applications is also feasible.

7. Troubleshooting and FAQ

7.1 What should I do if the graphics do not appear when I launch the software?

You've probably previously exit the software without stopping the sampling in the acquisition box. Try to unplug/reconnect the USB-cable and relaunch the software.

7.2 What should I do if the capacitive intensity (in green) is blocked at 100% when I launch the software?

You've probably plugged the USB-cable before the sensor. Try to unplug/reconnect the USB-cable and relaunch the software.

7.3 The electronic board is not recognized by my computer:

The electronic board should be recognized as a Virtual COM Port. If it's not the case, you can install the drivers from the USB key. To do this, open the device manager and if the electronic card is not correctly recognized, update the drivers by indicating the folder on the USB key as the search folder.

8. Contact

Thank you for purchasing our products and trusting our company.

Don't hesitate to contact us for any questions on this product and other solutions via the options below:

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