FRUITLAB

1. Introduction

The Fruit Texture Analyzer has been designed by end 2020, updated in 2022 and in 2026 (new AGROSTA FRUITLAB software, and a fork replacing the spring that was used on former versions).

It comes with the best technology for measuring the firmness / softness, size and weight of quite any kind of fruit or vegetable. It is a statistic instrument for measuring the crispiness of apples, pears, potatoes, mangos, apricots, papaya, cucumber, peaches, kiwi, and the firmness of oranges, lemon, pomelo, cherry, strawberry and many other fruits and vegetables.



Figure 1 - The Agrosta Fruit Texture Analyzer measuring an apple: the fruit sits on the measuring table, under the tip and the fork



Figure 2 - Measuring table with the force sensor (left) and weighing pan (right), here with avocados

Many thanks for having acquired an Agrosta instrument.

2. Your package

Your package contains:

- The instrument itself, with its **weighing pan** (to be mounted, see chapter 5) and its **fork**
- 2 tips: **8** and **11** (one mounted on the instrument), other tips on demand
- A USB stick with the **AGROSTA FRUITLAB** software for Windows (installer, including the USB driver)
- A power supply
- A certificate of conformity

- A manual

The FruitLab is provided with 2 tips: a tip of 11 and a tip of 8, plus specific tips according to your requirements:

- The tip of **11** is recommended for: APPLE, PEAR, PEACH, KIWI, PAPAYA
- The tip of **8** is recommended for: MANGO, CUCUMBER, APRICOT, POTATO
- Other tips on demand (ORANGE, CHERRY, STRAWBERRY, MELON, AVOCADO...)

> Each tip has its own length. After changing the tip, enter the new **Initial length** in the software (see chapter 9), otherwise the size of the fruit will be wrong.

3. Main characteristics of the machine

- Using Stepper Motor Nema 23
- Stepstick (motor electronics) from Asia
- Main electronic processor based on dual core ESP32
- Electronic shield for pressure testing made in Hong Kong (based on HX711, 24 bits precision)
- Design and software made by Agrosta in France
- Precision force sensors
- Resolution: 1 gram
- Max pressure: 20 000 grams (capacity 20 kg). The software stops the carriage above an **overload limit**, 17 kg by default (adjustable)
- Min pressure measurement: 31 grams
- Precision: 0.2 grams
- Built-in lab scale (weighing pan) in the same instrument
- Software compatible with Windows 8, 10 and Windows 11 (64 bits)

4. Know your instrument

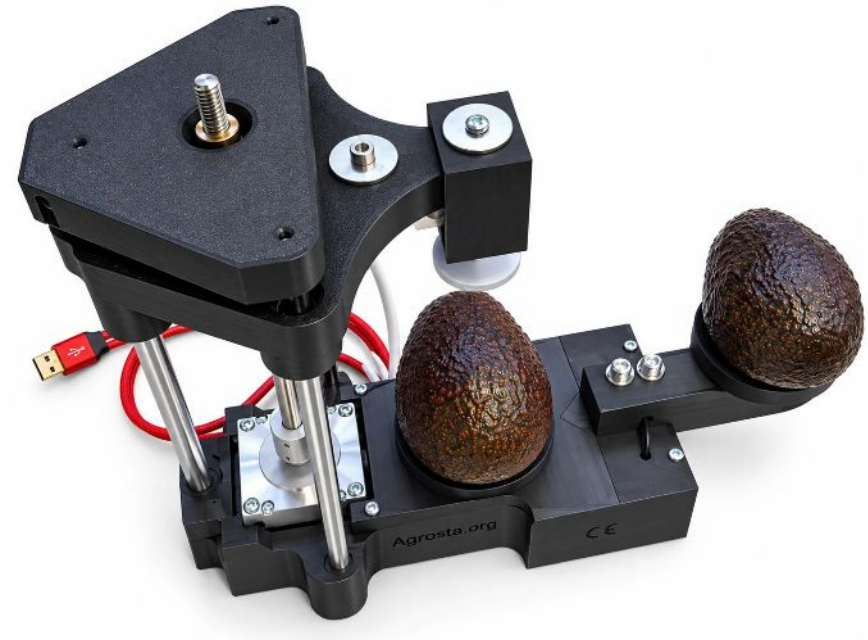


Figure 3 - Top view: carriage with the tip (above the fruit on the measuring table), weighing pan on the right

- **Measuring table**: the fruit is placed here, centred under the tip, for the firmness measurement.
- **Carriage with force sensor and tip**: it moves down along the column, touches the fruit, penetrates it and measures the force. The tip is interchangeable.
- **Fork**: it retains the fruit when the tip withdraws (see chapter 6).
- **Weighing pan (lab scale)**: the fruit is weighed here. The weight is recorded automatically.
- **Top limit switch**: the carriage stops at the top of the column; this is the "home" position where every measurement starts by default.
- **USB cable and power supply**: both must be connected to use the instrument.

5. Mounting the weighing pan

The weighing pan has to be mounted on the load cell (the silver bar with the number engraved on it) before the first use, as shown on the photo:

1. Locate the **threaded hole** at the free end of the load cell, as in the photo.
2. Screw the **threaded standoff** (hexagonal stud) into this hole by hand, until it is tight. Do not force: the load cell is a precision part.
3. Hold the **black pan** flat, lower it onto the standoff and fit it as shown.
4. Check that the pan sits flat and that nothing touches it from the side.
5. In the software, with the pan empty, press **Tare balance** (see chapter 8).



Figure 4 - Mounting the weighing pan: the threaded standoff is screwed into the load cell, then the pan is fitted onto it

6. The fork

The fork replaces the spring that was used on former versions of the FruitLab. When the tip withdraws after the penetration, friction can lift the fruit together with the carriage. The fork is placed just above the fruit and retains it, so that **the fruit stays on the measuring table**.



Figure 5 - An apple on the measuring table, under the fork

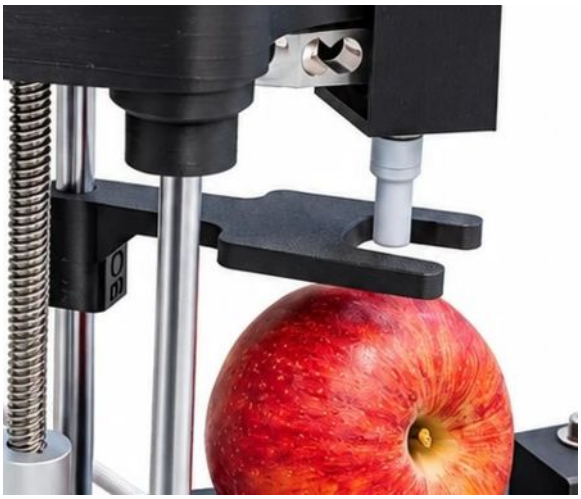


Figure 6 - Detail: the tip goes through the opening of the fork, which rests just above the fruit

Place the fruit on the measuring table so that the tip is **centred in the opening of the fork**. The spring module of former versions is no longer used.

7. Installing the software

1. **Do not connect the instrument yet.** Insert the USB stick in your computer and double click on `AGROSTA_FRUITLAB_Setup_1.0.0`.
2. The program is not digitally signed: Windows may show a blue window "Windows protected your PC" (unknown publisher). Click **More info**, then **Run anyway**.
3. Choose the language of the installer (English or French) and keep the proposed installation folder.
4. Keep the box **Install the USB driver (CH340) for the FRUITLAB board** ticked. At the end of the installation the driver window opens: click **INSTALL** and wait for the confirmation message.
5. Connect the **USB cable** between the instrument and your computer. Wait a few seconds until Windows recognises it (in the Device Manager the instrument appears as "USB-SERIAL CH340 (COMx)").
6. Connect the **power plug** of the instrument.
7. Start **AGROSTA FRUITLAB** (icon on the desktop or in the Start menu). The software finds the instrument by itself: "Connected: COMx" is displayed at the top right. At start, the carriage goes up to its top position.

> Always connect the power supply before starting the software: the carriage needs it to reach its top position.

8. The software window

The window is organised in three tabs: **Measure** (daily use), **Batches** (saved series) and **Settings** (trained users). The numbers on the picture below are explained in the table.



Figure 7 - AGROSTA FRUITLAB, Measure tab, at the end of a test

#	Element	Description
1	Tabs	Measure, Batches (saved series of fruits) and Settings (protected by a password).
2	Pressure unit	g (gram-force), N (newton) or mlb (milli-pound). All displays, tables and exports follow this choice.
3	Connection	Shows the instrument found on the USB port ("Looking for CH340..." while searching). The software reconnects by itself if the cable is unplugged.
4	Live readouts	**Pressure** (mean of the last measurements, displayed as "--" while the sensor is zeroed), **Travel** (position of the tip in mm from the top position), **Weight** on the pan, last peak pressure and last fruit size.
5	Commands	**Start test**, **Stop** (stops the test at any time; the carriage goes back), **Home** (carriage to its top position), **Tare balance**, **Tare pressure**.
6	Arrows	**Up / Down** move the carriage by 8 mm at each click (also with the keyboard arrows), see chapter 11.
7	Test parameters	Penetration speed, penetration depth, trigger and initial length. They are saved in the instrument with **Save to machine**.
8	Graph	Pressure against penetration after contact, drawn in real time on millimetre paper. The dotted line is the trigger.
9	Measurements	One line per fruit: number, time, weight, peak pressure (firmness), size and a free **Notes** column (double click to type).
10	Table buttons	**Save batch...**, **Delete selected**, **Erase / new batch**, **Export to Excel...**
11	Statistics	n, mean, standard deviation, minimum and maximum of peak pressure, weight and size, for one batch or for all batches.
12	Calibrate balance	Calibration of the scale with a known weight (chapter 12).

9. Measuring a fruit, step by step

9.1 Set the test parameters

The four test parameters are in the frame **Test parameters** of the Measure tab. Type the values, then click **Save to machine**. They are stored in the instrument and come back identical each time the software is started.

Parameter	Meaning
Pen. speed (mm/s)	Speed of the tip while it penetrates the fruit.
Pen. depth (mm)	How far the tip goes into the fruit after the contact (for example 8 mm for an apple).
Trigger (g)	Force at which the software considers that the tip touches the fruit. The unit follows the pressure unit chosen at the top.
Initial length (mm)	Distance between the bottom of the tip (carriage in its top position) and the top of the measuring table, in mm. It depends on the tip fitted. The size of the fruit is calculated as: **size = initial length - distance travelled by the tip before the contact**.

9.2 Weigh the fruit

Place the fruit on the weighing pan. The weight is displayed instantly in the **Weight** readout. As soon as it is stable and above 5 grams, it is **recorded automatically** and a new line appears in the table. Remove the fruit: the scale goes back to zero by itself (use **Tare balance** if the reading stays slightly off with the empty pan).

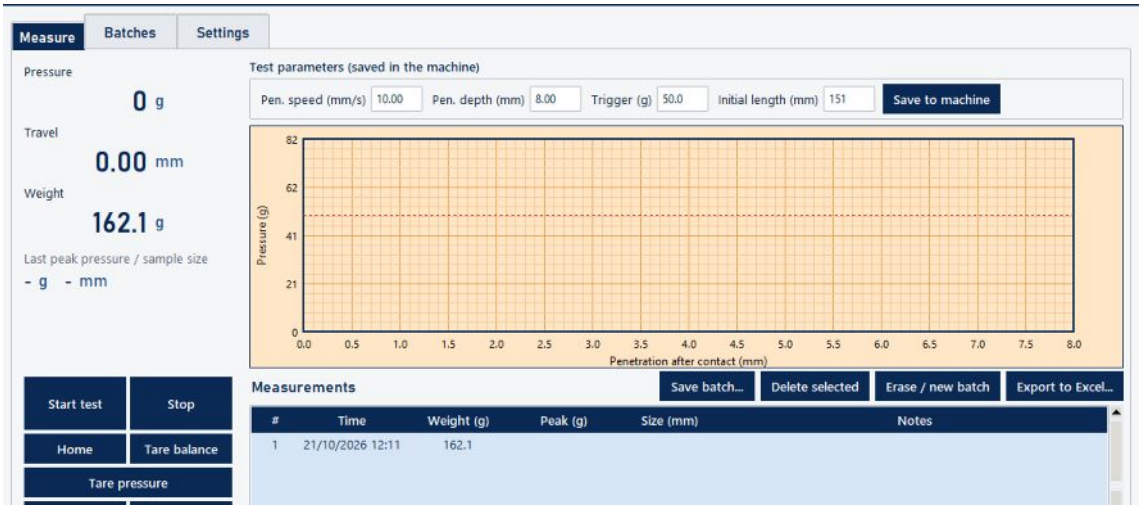


Figure 8 - The fruit has been weighed: 162.1 g, a new line is added to the table

9.3 Place the fruit and start the test

Place the fruit on the measuring table, centred under the tip and under the fork, then click **Start test**. The test goes through the following phases.

9.4 The phases of the test

1. **Zeroing.** The message "Zeroing pressure..." is displayed and the pressure shows "--" for about a second: the force sensor is set to zero.
2. **Fast descent.** The carriage goes down quickly. The pressure is not displayed during the first 5 mm of the descent.

3. **Contact and slow approach.** When the trigger is reached, the carriage backs up slightly, then approaches again slowly to find the exact contact point (message "Fast contact: 65 g at 69.0 mm"). This position is used to calculate the size of the fruit.
4. **Penetration.** The tip penetrates the fruit at the chosen speed, down to the chosen depth. The curve is drawn in real time.
5. **Return and result.** The carriage goes back to its starting position. The **peak pressure** (firmness) and the **size** appear in the table and on the left.

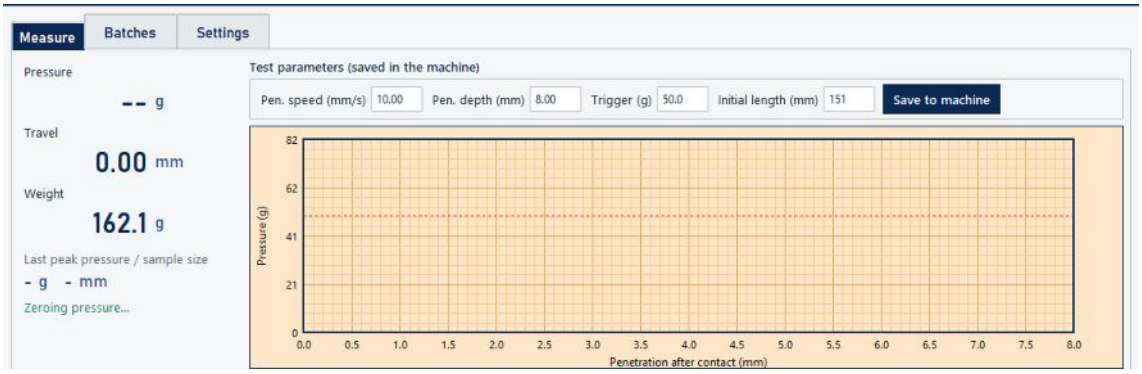


Figure 9 - Phase 1: the sensor is zeroed, the pressure is not displayed ("--")

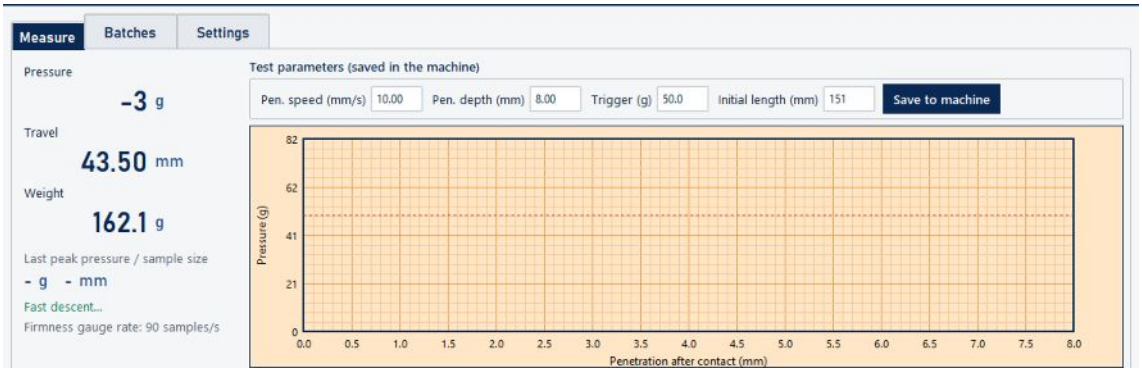


Figure 10 - Phase 2: fast descent (the travel increases)

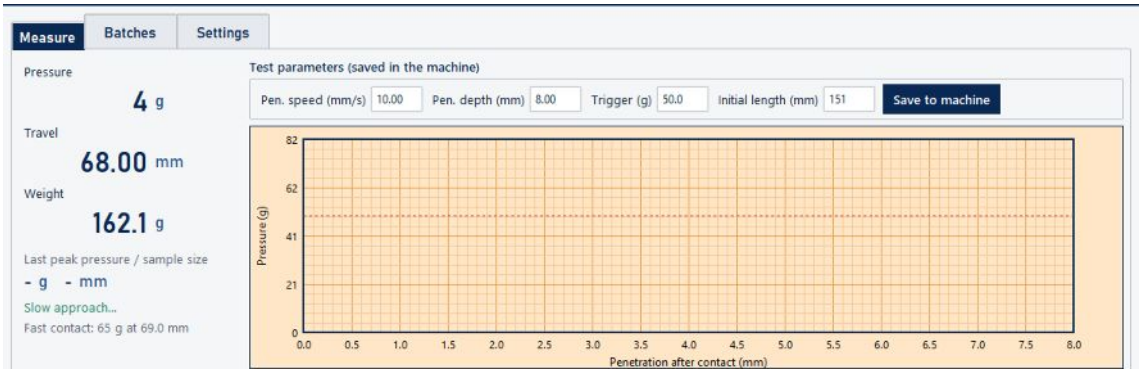


Figure 11 - Phase 3: the trigger has been reached, slow approach to find the exact contact

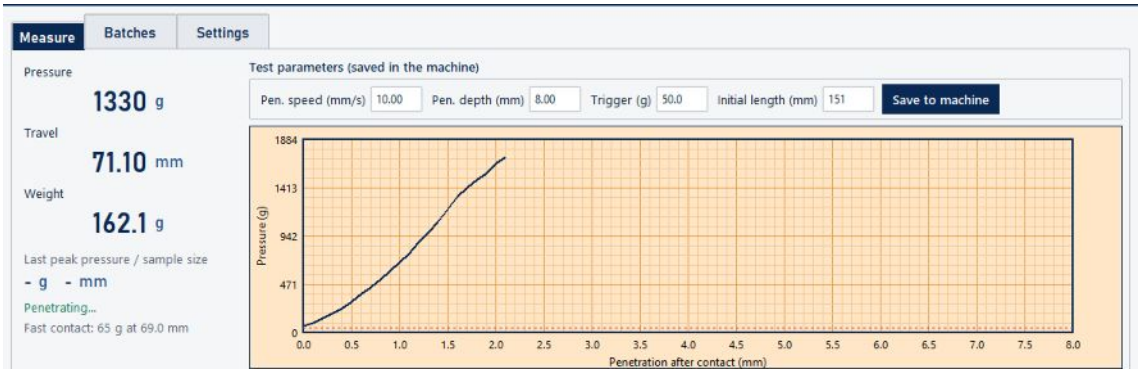


Figure 12 - Phase 4: penetration, the curve is drawn in real time



Figure 13 - Phase 5: test complete, peak pressure and size are written in the table

> The **Stop** button stops the test at any time: the carriage goes back to its starting position and no measurement is recorded.

9.5 Measure the next fruits

Repeat the operations for each fruit. Weight and firmness can be measured **in any order and at any time** (you can weigh the next fruit while a test is running): each new weight or each new test completes the oldest line that is still incomplete, and a new line is created only when all lines are complete.



Figure 14 - A series of fruits: table and statistics (mean, standard deviation, minimum, maximum)

Peak pressure and size are displayed without decimals (newtons with 2 decimals); the weight keeps one decimal and the statistics two decimals. Double click in the **Notes** column to type a comment on a fruit (for example "stem end").

10. Batches: save, open, export

The measurements are **not kept automatically**: save your series before closing the software (the software warns you if a batch has not been saved).

1. Click **Save batch...** and type the name of the batch.
2. The batch is saved in the folder `Documents\FRUITLAB\Batches` (a text file in CSV format that can also be opened with Excel).

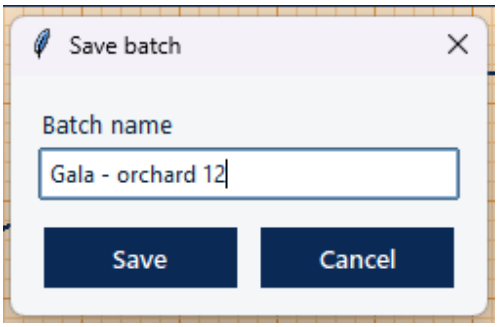


Figure 15 - Naming a batch

- Tab **Batches**: lists the saved batches (name, number of lines, date). Select one or several and click **Open in table** (or double click) to consult them or to continue the series, **Delete selected** to remove them, **Open folder** to open the folder in Windows.
- **Export to Excel...** (Measure tab or Batches tab): the Windows file explorer opens so that you choose the folder and the file name. The Excel file contains the sheet **Measurements** and the sheet **Statistics**.
- **Erase / new batch**: clears the table to start a new series (after confirmation).



Figure 16 - The Batches tab

11. Moving the carriage by hand

The buttons **Up** and **Down** (or the keyboard arrows) move the carriage by **8 mm** at each click, smoothly. **Up** stops by itself at the top limit switch. The position reached becomes the **starting and return position of the next tests**: for example, bring the tip close to a tall fruit to shorten each test. **Home** brings the carriage back to the top position and cancels this position.

> The motor is released when it is not moving, to avoid heating. The size of the fruit is always measured from the top position, whatever the starting position chosen.

12. Settings and calibration (trained users)

The **Settings** tab is protected by a password supplied by Agrosta on request. The settings are stored in the instrument itself: they remain the same if the software is reinstalled or if the instrument is used with another computer.

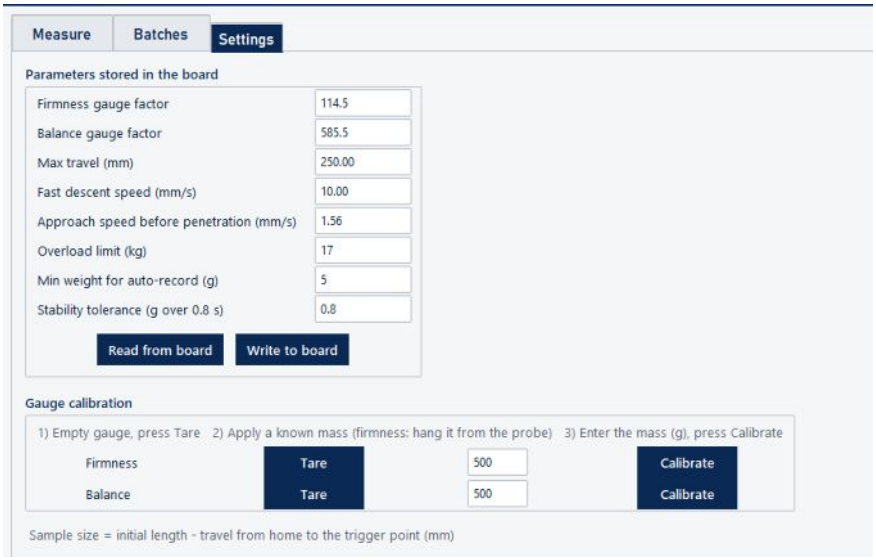


Figure 17 - The Settings tab

Setting	Meaning
Firmness gauge factor	Calibration factor of the force sensor.
Balance gauge factor	Calibration factor of the scale.
Max travel (mm)	Maximum distance the carriage may travel down before the test is given up ("No contact").
Fast descent speed (mm/s)	Speed of the first, fast descent.

Setting	Meaning
Approach speed before penetration (mm/s)	Speed of the slow approach that finds the exact contact point. The slower, the more precise.
Overload limit (kg)	If the force exceeds this value (17 kg by default), the carriage stops and goes back.
Min weight for auto-record (g)	The scale records a weight automatically above this value (5 g by default).
Stability tolerance (g over 0.8 s)	Maximum variation of the weight to consider it as stable (0.8 g by default).

Read from board reads the values stored in the instrument; **Write to board** stores the values typed in the window.

Calibrating the balance (no password needed)

1. With the empty pan, press **Tare balance**.
2. Put a known weight on the pan and type its value in grams in the frame **Calibrate balance** (Measure tab).
3. Click **Calibrate**: the factor is calculated and stored in the instrument.

Calibrating the force sensor (password needed)

1. Remove the fruit and let the tip free. In Settings, click **Tare** on the Firmness line.
2. **Hang a known mass from the tip** (do not rest it on the tip: it would push in the opposite direction to a fruit).
3. Type the mass in grams and click **Calibrate**.

> If the software warns that a gauge factor is **negative**, answer **Yes** to switch to the positive value: with a negative factor the pressure would read negative and the tip would not stop on the fruit.

13. Troubleshooting

Message / symptom	What to do
"Looking for CH340..." never changes to "Connected"	Check the USB cable and the power plug; check in the Windows Device Manager that "USB-SERIAL CH340" appears (otherwise reinstall the driver); try another USB port.
"No contact before max travel"	No fruit under the tip, or the trigger is too high, or the initial length / max travel are wrong. Check the fruit and the parameters.
"Gauge overload"	The force exceeded the overload limit (17 kg by default). The carriage stopped and went back. Reduce the penetration depth or check the tip and the fruit.
"Top limit switch not found"	The carriage could not reach its top position: check the power supply and that nothing blocks the carriage.
The weight is not recorded	The weight must be above 5 g and stable for about one second. Remove the fruit and put it back; press **Tare balance** if the empty pan does not read zero.
The pressure reads negative when pressing	The force sensor factor is negative: see the note at the end of chapter 12.
A series has disappeared after a restart	The measurements are not kept automatically: use **Save batch...** and the tab **Batches**.

14. Maintenance

- After each change of tip, update the **Initial length** and click **Save to machine**.
- Check the calibration from time to time with a known weight (scale) and a known hanging mass (force sensor).
- Keep the weighing pan, the measuring table and the tip clean and dry.
- Keep your software up to date: contact Agrosta for new versions.