MINITA17

Texture Analyzer - User manual

TPA - Firmtech - Penetrometry - Tensile

1. Introduction

The MINITA17 is a compact laboratory texture analyzer designed by Agrosta in France. A motorised carriage, driven by a lead screw, carries a precision force sensor and a probe. It compresses, penetrates or pulls the sample and records the force against the displacement; the software then calculates the texture indicators and keeps the results in batches that can be exported to Excel.

Four measuring modes are available:

- **TPA** (main mode): Texture Profile Analysis with single press, double press or constant force. It gives hardness, fracturability, adhesiveness, resilience, cohesiveness, springiness, gumminess and chewiness.
- **Firmtech**: pressure-driven test, firmness factor between a trigger pressure and a target pressure.
- **Penetrometry**: depth-driven test, peak force over a set penetration depth.
- **Tensile**: the sample is pulled until it breaks (strength, elongation, energy, stiffness).



Figure 1 - The MINITA17 with a sample on the measuring table, under the probe

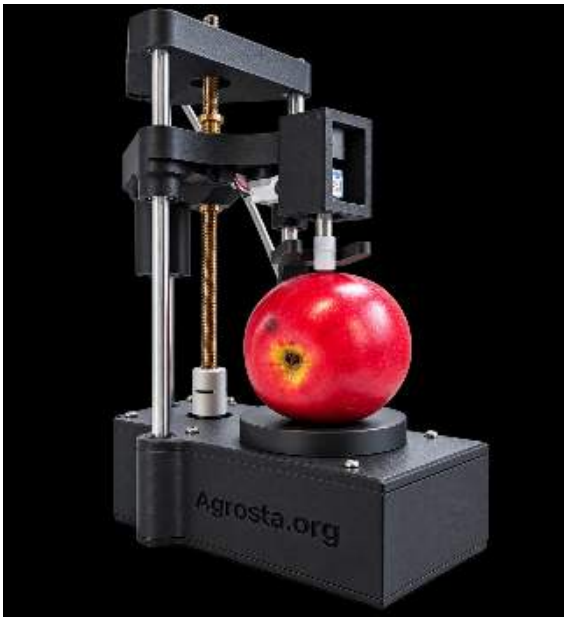


Figure 2 - The same instrument seen from the front, with the force sensor on the carriage

> The MINITA17 measures texture only: it does not give the weight or the size of the sample.

Many thanks for having acquired an Agrosta instrument.

2. Your package

Your package contains:

- The instrument itself, with its **measuring table**
- The three **probes** (see chapter 5)
- A USB stick with the **MINITA17** software for Windows (installer, including the USB driver)
- A USB cable
- A power supply
- A certificate of conformity
- A manual

3. Main characteristics of the machine

- Using Stepper Motor Nema 23 with lead screw (800 steps per mm)
- 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 sensor
- Resolution: 1 gram
- Max pressure: 17 000 grams (capacity 17 kg). The software stops the carriage above this **overload limit** (17 kg)
- Min pressure measurement: 31 grams
- Precision: 0.2 grams
- Four measuring modes: TPA, Firmtech, Penetrometry and Tensile
- Software compatible with Windows 10 and Windows 11 (64 bits), in English, French, Spanish, Portuguese and Italian

4. Know your instrument



Figure 3 - The instrument: base, column with the two guide rods and the lead screw, carriage with the force sensor

- **Base**: it contains the electronics (processor, motor driver and force measurement).
- **Measuring table**: the black disc on the base. The sample is placed here, centred under the probe.
- **Column**: two guide rods and a lead screw move the carriage up and down.
- **Carriage with force sensor and probe**: it moves along the column and measures the force. The probe is interchangeable.
- **Top limit switch**: the carriage stops at the top of the column; this is the "home" position.
- **USB cable and power supply**: both must be connected to use the instrument.

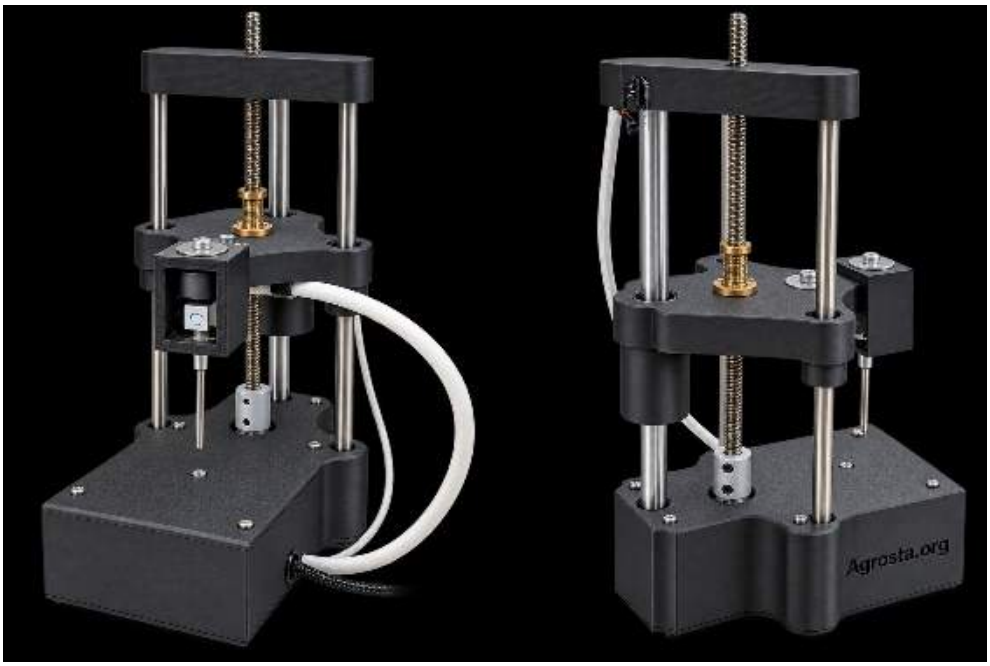


Figure 4 - Two views of the instrument: the carriage with the force sensor on the column, the base with the electronics

5. Probes

The instrument is supplied with **three probes**, which are screwed under the force sensor of the carriage:

- **Flat probe, diameter 40 mm**: dedicated to compression tests (TPA, Firmtech on a whole sample).
- **All-metal probe (stainless steel), diameter 4.4 mm**: for deep texture tests.
- **0.5 cm² probe**: usually dedicated to penetrometry measurements on crunchy fruit.



Figure 5 - The accessories supplied with the instrument

1. Bring the carriage to its top position (**Return to origin**).
2. Screw the probe by hand onto the force sensor, until it is tight. Do not force: the force sensor is a precision part.

3. Check that the probe is straight and that nothing touches it.
4. Press **TARE** (see chapter 12) so that the weight of the probe is not counted.

> Choose the probe according to the test: the 40 mm flat probe for compression (TPA, Firmtech), the 4.4 mm stainless steel probe for deep texture tests, the 0.5 cm² probe for penetrometry of crunchy fruit. For a tensile test the sample must be fixed to the probe and to the measuring table with a clamp or a glue suited to the sample.

6. Installing the software

1. **Do not connect the instrument yet.** Insert the USB stick in your computer and double click on `MINITA17_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, French, Spanish, Portuguese or Italian) and keep the proposed installation folder.
4. Keep the box **Install the USB driver (CH340) for the MINITA17 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 **MINITA17** (icon on the desktop or in the Start menu). A window asks for the measuring mode (chapter 7). The software finds the instrument by itself: "Connected on COMx" is displayed at the bottom left. The carriage goes up to its top position, then the gauge is zeroed.

> Always connect the power supply before starting the software: the carriage needs it to reach its top position. The software language is chosen with the flags at the top right of the window; the screenshots of this manual show the English interface.

7. The software window

7.1 Choosing the measuring mode

At each start, a window asks for the measuring mode. **TPA** is the main mode (first, in green). Click the mode you want. The window then shows this mode only; the button **Change mode** opens the choice again (not during a measurement).

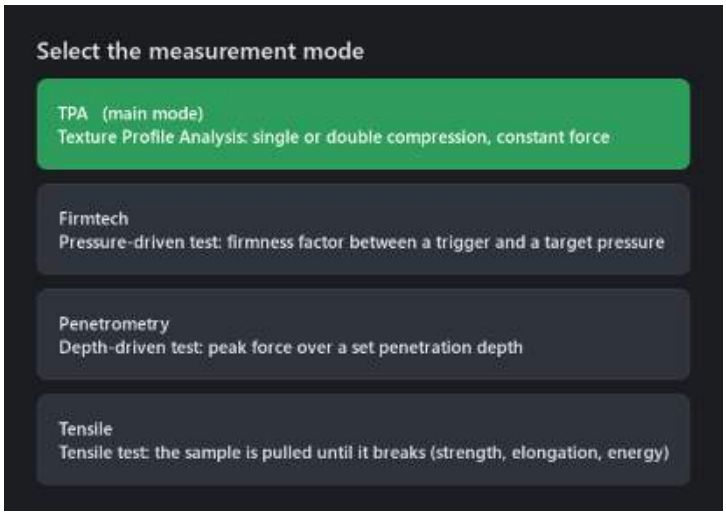


Figure 6 - The measuring mode window

7.2 Overview

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

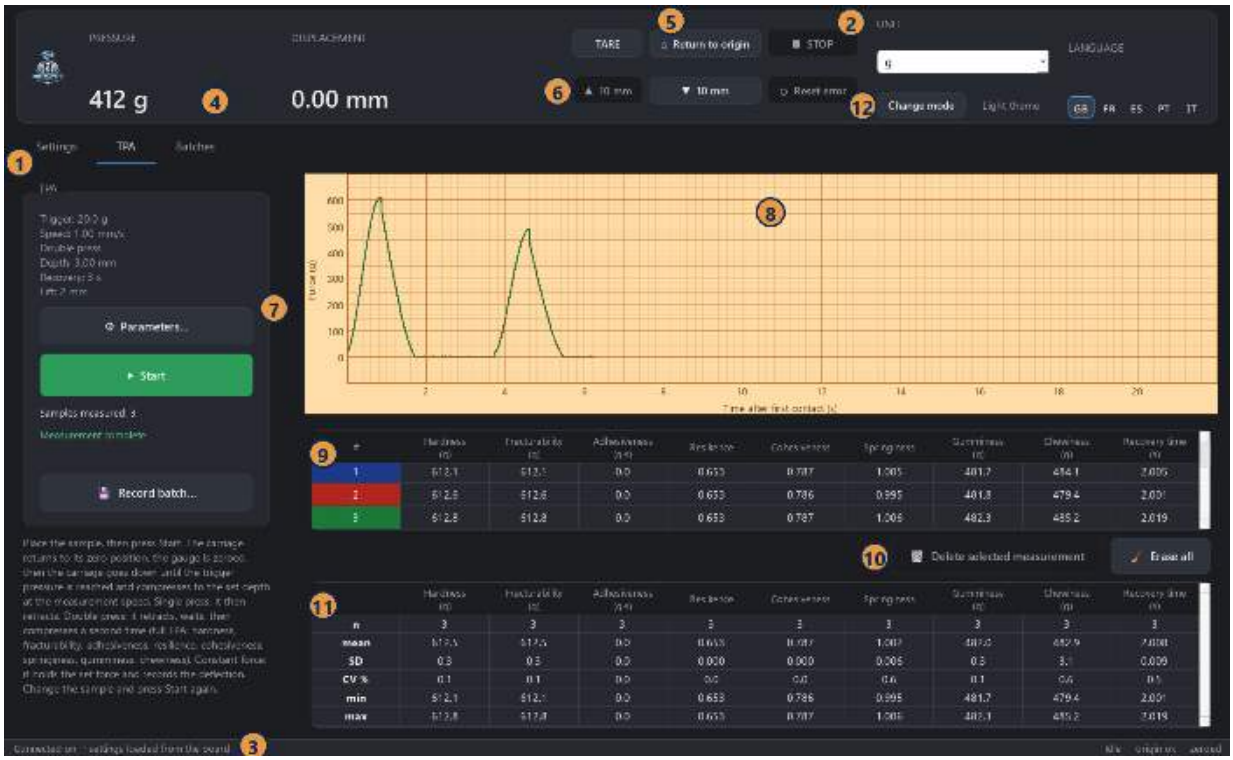


Figure 7 - MINITA17, TPA mode, after three measurements

#	Element	Description
1	Tabs	Settings (protected by a code), the selected mode, and Batches.
2	Pressure unit	g (gram-force), N (newton) or mlbf (milli-pound-force). All displays, tables and exports follow this choice.
3	Connection	Status bar: instrument found on the USB port, state of the carriage, origin known and gauge zeroed. The software reconnects by itself if the cable is unplugged.

#	Element	Description
4	Live readouts	**Pressure** (mean of the last 20 measurements, whole grams; shown as "--" while the gauge is zeroed and during the first 5 mm of a compression) and **Displacement** (position of the probe in mm from the top).
5	Commands	**TARE** (zero the gauge), **Return to origin** (top position), **STOP** (stops at any time) and **Reset error**.
6	Arrows	**▲ / ▼ 10 mm** move the carriage by 10 mm at each click (chapter 11).
7	Test panel	Summary of the test parameters, button **Parameters...** (opens the parameters window), **Start**, number of samples measured and **Record batch...**.
8	Graph	Force against time (TPA) or against displacement (other modes), drawn in real time on millimetre paper, one colour per sample.
9	Results	One line per sample with its indicators (chapter 9). The coloured number is the colour of its curve.
10	Table buttons	**Delete selected measurement** and **Erase all** (both ask for confirmation).
11	Statistics	n, mean, SD (standard deviation), CV % (SD / mean), min and max of each indicator. A column shows "n/a" when nothing could be calculated.
12	Change mode	Reopens the measuring mode window.

8. Measuring a sample, step by step

One press on **Start** measures **one sample**. Change the sample by hand and press **Start** again: the results of the successive samples accumulate in the table until **Erase all** or **Record batch…**.

8.1 Place the sample

Place the sample on the measuring table, centred under the probe. Make sure the carriage is at its origin (status bar: origin ok, zeroed). The **Start** button is available only when the instrument is connected, at rest, with its origin known and the gauge zeroed.

8.2 Set the test parameters

Click **Parameters…** (it also opens when you click the tab of the mode). Every value is stored in the instrument and comes back identical at each start. The trigger pressure cannot be set below **20 g**.

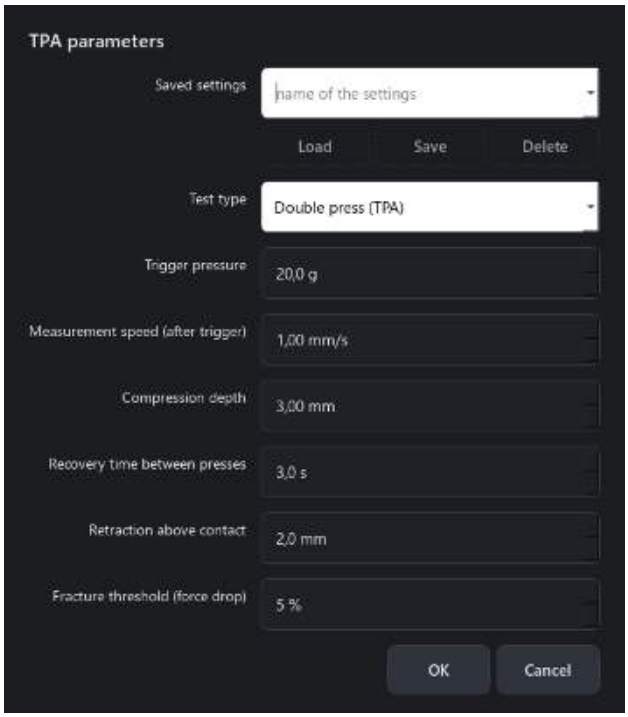


Figure 8 - Parameters window of the TPA mode

Parameter	Meaning
Trigger pressure	Force at which the software considers that the probe touches the sample (minimum 20 g). All modes except tensile.
Measurement speed (after trigger)	Speed of the probe once the trigger is reached (mm/s).
Test type	TPA: single press, double press or constant force (hold).
Compression depth	How far the probe compresses the sample after the contact (mm).
Recovery time between presses	Double press: time between the end of the first decompression and the second contact (s).
Retraction above contact	How far the probe rises above the contact point between two presses (mm).
Hold force / Hold time	Constant force: the force to hold and for how long (s).
Fracture threshold (force drop)	Force drop (% of the peak) from which a fracture is detected; analysis only, see chapter 9.
Target pressure	Firmtech: the pressure at which the measurement stops.
Penetration depth	Penetrometry: distance travelled by the probe after the contact (mm).
Pulling speed / Maximum elongation	Tensile: speed of the carriage going up (mm/s) and maximum elongation (mm).
Break detection (force drop) / Force before break detection	Tensile: the sample is considered broken when the force falls by this percentage below its peak, once the force has exceeded the minimum force.

In **TPA**, the box Saved settings saves a complete protocol under a name (Save), reloads it (Load) or removes it (Delete). In **Firmtech**, the optional Fruit type (optional) proposes published settings and can save yours.

8.3 Start the test

Click **Start**. The test goes through the following phases.

1. **Zeroing.** With the motor released, the gauge is set to zero; the pressure shows "--".

2. **Approach.** The carriage goes down. After 5 mm the board corrects the small offset caused by the running motor (a message under the buttons gives the correction).
3. **Measurement.** From the trigger, the probe moves at the measurement speed according to the mode (TPA: compression, decompression, second compression or hold; Firmtech: up to the target pressure; Penetrometry: over the depth; Tensile: the carriage goes up).
4. **Return.** The carriage goes back to its starting position, the result appears in the table and the gauge is zeroed again one second later.

> The **STOP** button stops the test at any time. If the pressure exceeds **17 kg**, the carriage goes back to the top immediately (overload protection); in a tensile test it stops where it is.

8.4 The four modes

TPA, double press. The graph shows force against time: two compression peaks separated by the recovery time. All the TPA indicators are calculated (chapter 9).

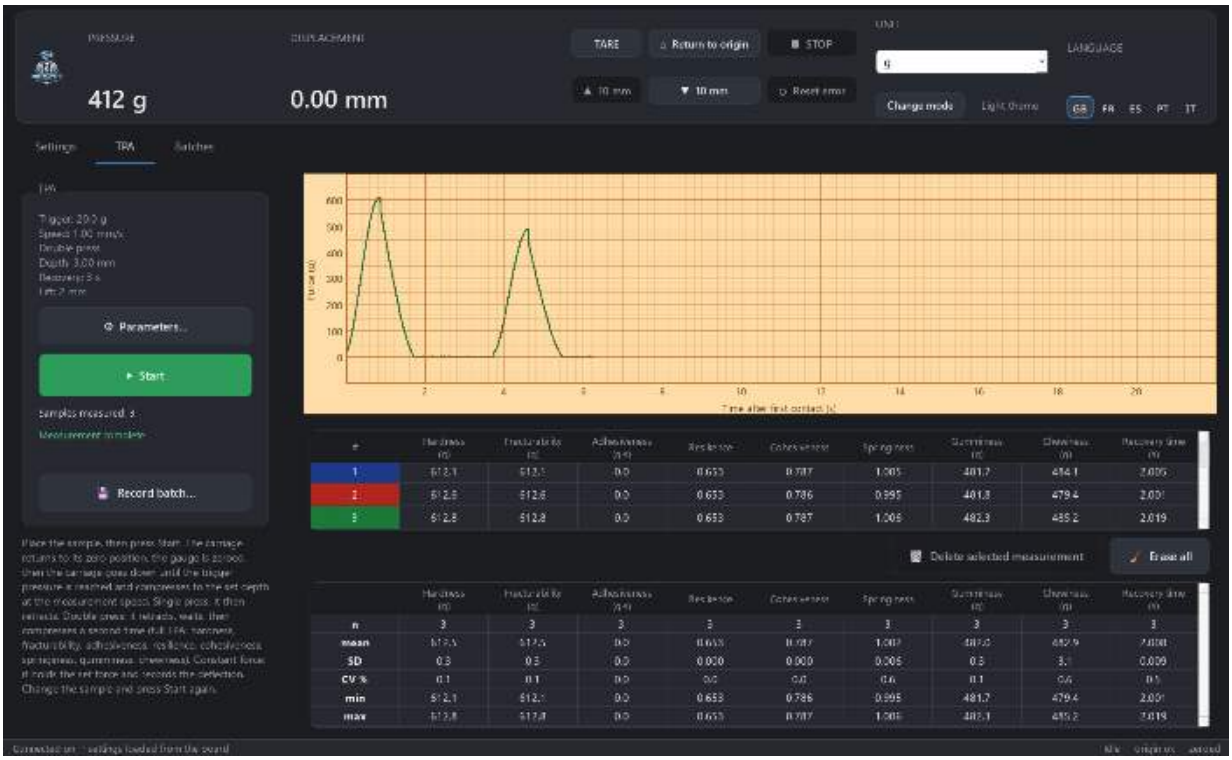


Figure 9 - TPA double press: three samples, graph, indicators and statistics

Firmtech. The Firmtech factor is the pressure difference between the trigger and the target divided by the travel between them (unit/mm): the softer the sample, the longer the travel.

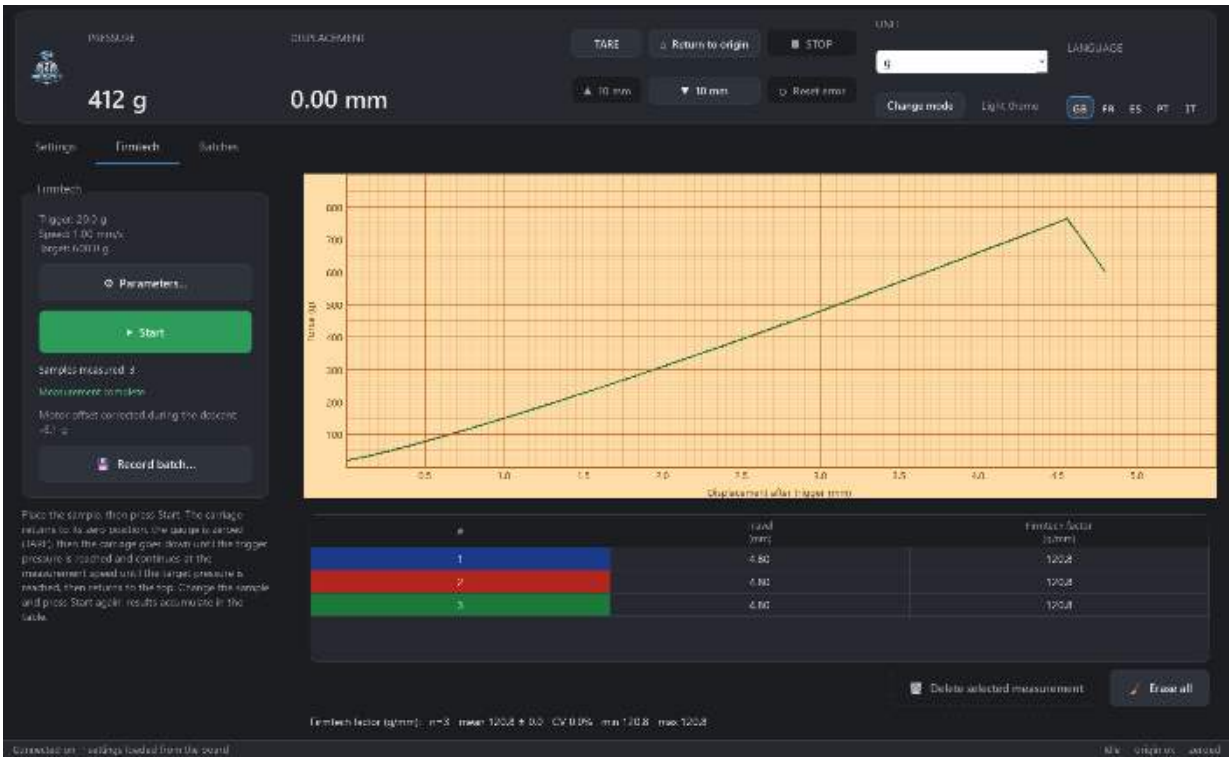


Figure 10 - Firmtech mode

Penetrometry. The result is the peak force over the penetration depth, and the depth at which it occurs.

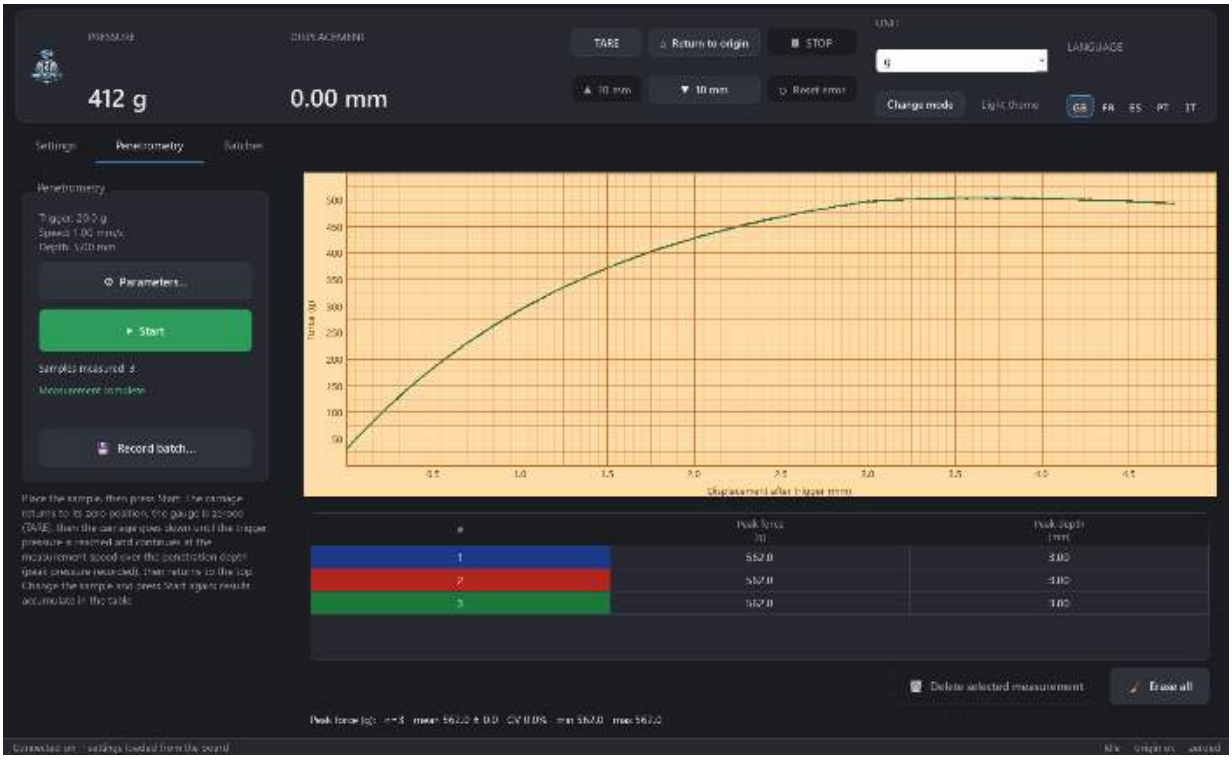


Figure 11 - Penetrometry mode

Tensile. Fix the sample between the probe and the measuring table, bring the carriage to the starting position with the arrows (it must have room to go up), then press **Start**. The carriage goes up until the sample breaks, the maximum elongation is reached or the top limit is met, then returns to the top.

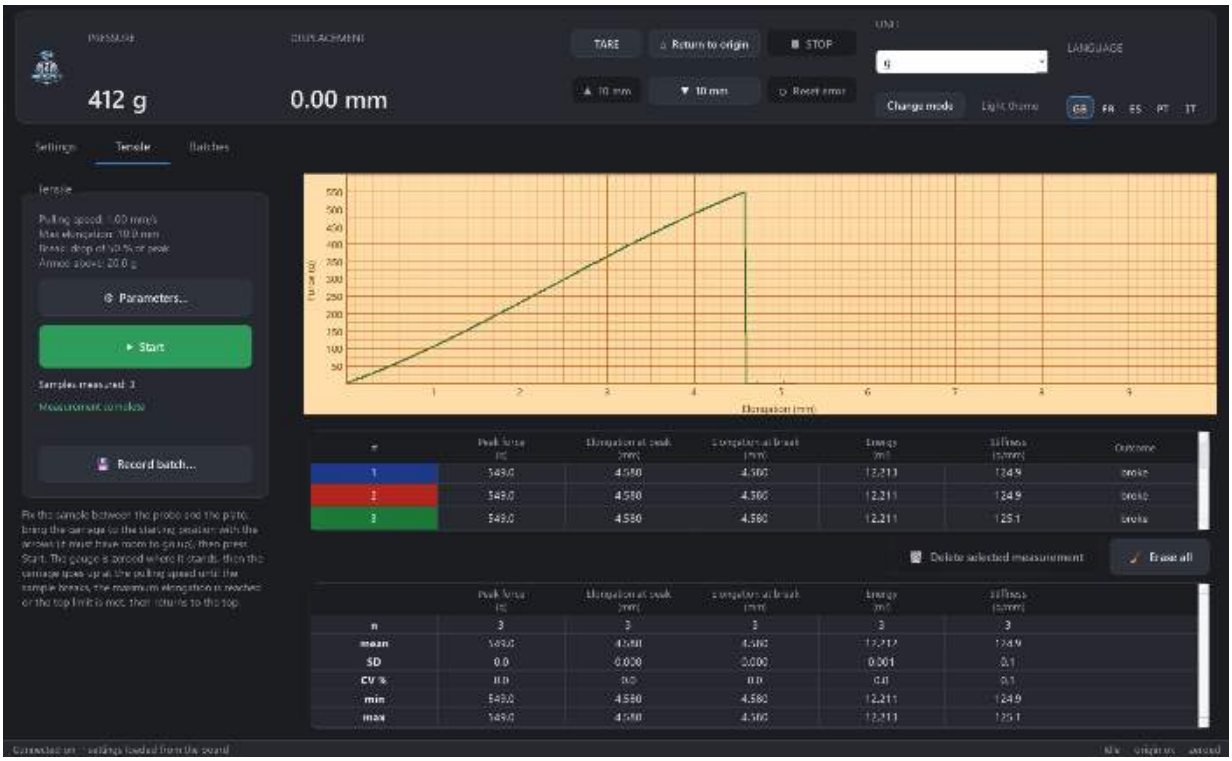


Figure 12 - Tensile mode: force against elongation, break at 4.6 mm

9. The indicators

9.1 TPA (Texture Profile Analysis)

Forces are in the chosen unit and times in seconds from the first contact. Areas are in force x second.

Indicator	Definition
Hardness	Peak force of the first compression.
Fracturability	Force at the first significant peak of the first compression: the first point where the force then drops by more than the fracture threshold (n/a when the curve never breaks).
Adhesiveness	Negative area (force x time) after the first decompression, until the second compression starts (or the end of the test for a single press).
Resilience	Area of the first decompression divided by the area of the first compression.
Cohesiveness	Double press: area of the second compression and decompression divided by the same for the first.
Springiness	Double press: time from contact to peak in the second compression divided by the same in the first.
Gumminess	Hardness x cohesiveness.
Chewiness	Gumminess x springiness.
Recovery time (s)	Double press: real time between the release of the probe after the first compression and the second contact.
Initial deflection (mm) / Final deflection (mm)	Constant force (hold): depth of the probe below the contact point at the start and at the end of the hold.

The **fracture threshold** is a percentage of the peak: the lower it is, the more small irregularities of the curve are counted as fractures. 5 to 10 % suits crunchy products. It changes the analysis only, not the measurement.

9.2 Tensile

Indicator	Definition
Peak force (g)	Maximum tensile force (tensile strength, in force: the section of the sample is not known).
Elongation at peak (mm)	Elongation where the peak force is reached.
Elongation at break (mm)	Elongation just before the force collapsed (n/a when the sample did not break).
Energy (mJ)	Area under the force-elongation curve up to the break (or to the end of the test).
Stiffness (g/mm)	Slope of the curve between 10 % and 50 % of the peak force.
Outcome	"broke", "maximum elongation reached" or "top limit reached".

10. Batches: record, open, export

The measurements are **not kept automatically**: record your series before closing the software.

1. Click **Record batch…**. Type the **lot name** (it can be a barcode); choose the folder with Browse… if needed; the fruit type and postharvest data are optional.
2. The software writes **one Excel file per lot** in the folder `Documents\MINITA17\Batches`. If the lot already exists, the new samples are added to the same file.

- Sheet **Info**: lot name, fruit type, postharvest data, creation and last update.
- **Curves** sheets (one per mode): the raw curve of every sample.
- **Summary** sheets: one line per sample with its indicators, and n, mean, SD, CV %, min and max recalculated over every sample of the lot.

The tab **Batches** lists the batches recorded during the session (date, lot, mode, samples ok / total, file). The protocols saved in TPA and the fruit settings are kept in `%APPDATA%\MINITA17`. Neither folder is removed when the software is uninstalled.

11. Moving the carriage by hand

The buttons ▲ **10 mm** and ▼ **10 mm** move the carriage by 10 mm at each click, with a smooth start and a smooth stop. ▲ stops by itself at the top limit switch.

The position reached becomes the **return position**: the compression tests (TPA, Firmtech, Penetrometry) start from it and come back to it, which shortens each test with a tall sample. The **tensile** test also starts from it but always returns to the top. **Return to origin** brings the carriage to the top with the same smooth movement and cancels the return position. When the arrows have not been used, every cycle ends with a return to the top.

> The motor is released when it is not moving, to avoid heating. The carriage is vertical and is then no longer held: check that it does not drift. Switching the instrument off and on always brings the carriage back to the top.

12. Settings and calibration (trained users)

The **Settings** tab is protected by a code supplied by Agrosta on request: the tab opens as soon as the code is typed, and stays open for 5 minutes. The settings are stored in the instrument itself.

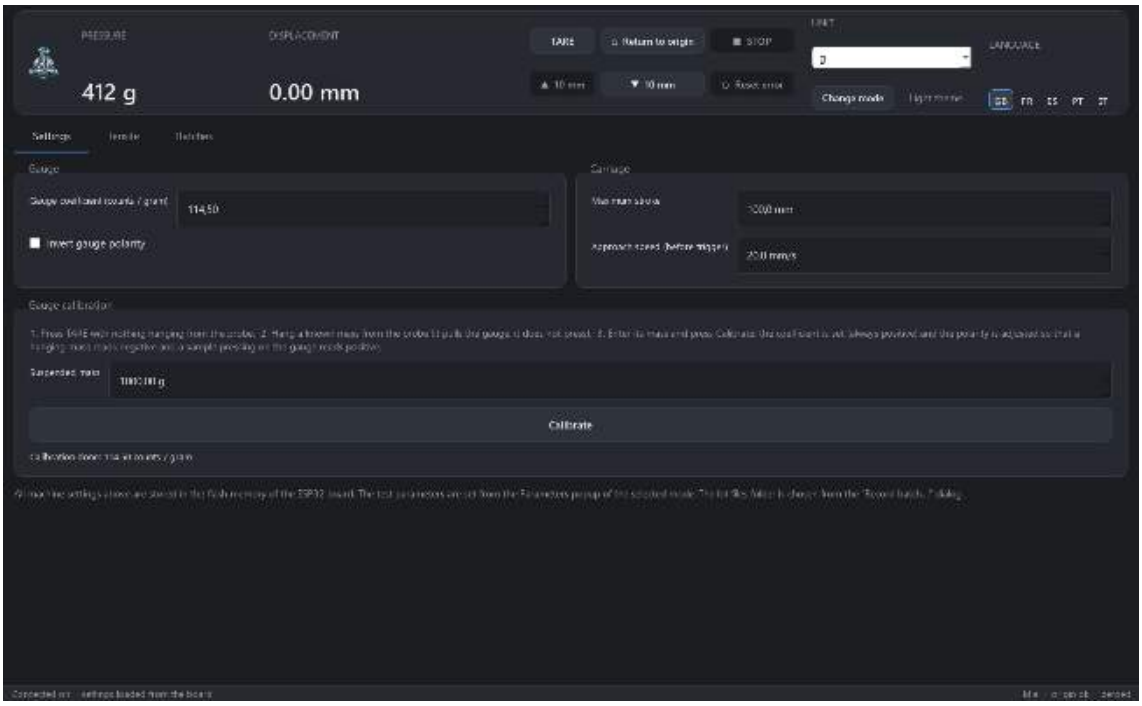


Figure 13 - The Settings tab with the calibration

Setting	Meaning
Gauge coefficient (counts / gram)	Calibration factor of the force sensor (HX711 counts per gram).
Invert gauge polarity	Sign of the force: a sample pressing on the gauge must read positive. Set automatically by the calibration.
Maximum stroke	Maximum distance the carriage may go down from the top (mm).
Approach speed (before trigger)	Speed of the carriage before the trigger (mm/s).

Calibrating the force sensor

1. Remove the sample and leave the probe free, then press **TARE**.
2. **Hang a known mass from the probe** (do not rest it on the probe: it would push in the opposite direction to a sample).
3. In Gauge calibration, type the mass in grams in Suspended mass (a comma or a point is accepted) and click **Calibrate**.
4. The coefficient is calculated, always positive, and the polarity is set so that the hanging mass reads negative. The result is displayed in the frame and stored in the instrument.

> If the calibration answers that no mass was detected, the mass was not hanging, or the gauge was zeroed with the mass already attached: remove it, press TARE, then hang it again.

13. Troubleshooting

Message / symptom	What to do
"Searching for the board…"	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; close any other program using the port.
"Trigger pressure not reached before the end of the stroke"	No sample under the probe, the trigger is too high, or the maximum stroke (Settings) is too short.
"Overload: pressure above 17000 g - the carriage returned to its origin automatically"	The pressure exceeded 17 kg. Reduce the depth or the target, or check the probe and the sample.
"Tensile overload: force above 17000 g - the carriage stopped where it was"	The tensile force exceeded 17 kg and the carriage stopped. Release the sample, then use Return to origin.
"Top end stop not found - check the end stop, press Reset error, then Return to origin"	The carriage could not reach its top position: check the power supply and that nothing blocks the carriage, press Reset error, then Return to origin.
"The carriage is at the top: lower it with the arrows first (the sample is pulled upward)."	A tensile test needs room above the carriage: lower it with the arrows first.
"Unknown or outdated board firmware: flash minita17_arduino.ino on the board"	The program in the instrument is not the latest one: ask Agrosta for the update of the instrument program.
"Calibration: no mass detected - hang the mass from the probe (after TARE)"	See the note at the end of chapter 12.
The pressure reads negative when pressing	Run the calibration again (chapter 12): it sets the polarity.
A series has disappeared after a restart	The measurements are not kept automatically: use Record batch….

14. Maintenance

- After each change of probe, press TARE.
- Check the calibration from time to time with a known hanging mass.
- Keep the measuring table, the probes and the guide rods clean and dry.
- Keep your software up to date: contact Agrosta for new versions.