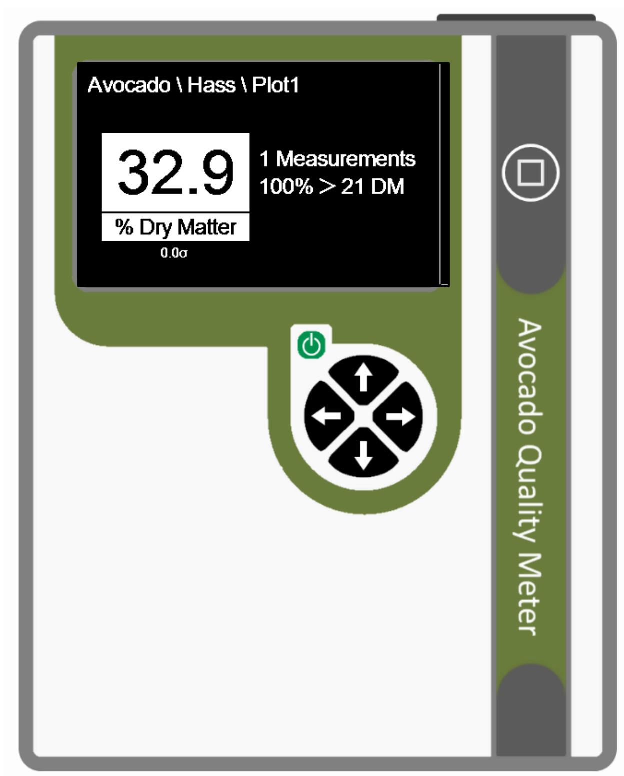
F-751 Avocado Quality Meter
AvoAI Application User Manual

Revision 2 [March 2026]



DECLARATION OF CONFORMITY

Manufacturer:

CID Bio Science, Inc.
Felix Instruments – Applied Food Science
1554 NE 3rd Ave
Camas, WA 98607

Declares that the CE-marked Product:

Product Model(s):

Model F-75x

FCC Compliance Statement:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Complies With:

89/336/EEC Electromagnetic Compatibility Directive
73/23/EEC Low Voltage Directive

Compliance Standards:

EN 55027 RF Emissions Information Technology Equipment
EN 50082-1 EMC Immunity Standard
EN 60950 Safety of Information Technology Equipment
Including Electrical Business Equipment

December 31, 2018

Leonard Felix
President

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Introduction

1.1 Purpose of This Manual

This manual provides instructions and technical guidance for operating the **AvoAI application** on the **F-751 Avocado Quality Meter**. It explains how the system measures avocado dry matter, how measurements should be performed, and how users can access and interpret collected data.

The goal of this manual is to help users obtain reliable, repeatable measurements of avocado dry matter and integrate those measurements into harvest and quality management workflows.

1.2 Intended Users

This manual is intended for professionals involved in avocado production, quality management, and research, including:

- Growers and orchard managers
- Harvest coordinators
- Packing house operators
- Quality assurance personnel
- Agricultural researchers and consultants

Users are expected to have a general understanding of avocado maturity assessment and basic data collection procedures. No prior experience with spectroscopy or chemometric modeling is required.

1.3 System Overview

The **F-751 Avocado Quality Meter** is a portable instrument designed to measure avocado dry matter non-destructively. The device uses **near-infrared (NIR) interactance spectroscopy** to estimate the dry matter content of the fruit, at the location where the measurement is taken.

Dry matter is widely used as a maturity indicator for avocados because it correlates strongly with **mesocarp oil content**, which determines eating quality and market readiness.

The **AvoAI application** expands the functionality of the F-751 by integrating advanced machine-learning models and structured data collection workflows. The system enables users to:

- rapidly measure large numbers of fruit in the field or packing house
- organize measurements into structured datasets
- calculate summary statistics for maturity assessment
- archive and export measurement data for further analysis
- integrate measurements with external data systems

By combining portable NIR spectroscopy with artificial intelligence–based chemometric models, the AvoAI system allows users to obtain rapid maturity insights that previously required destructive laboratory testing.

Principles of Avocado Dry Matter Measurement

2.1 Dry Matter and Oil Content

Dry matter (DM) represents the portion of an avocado that remains after all water has been removed. It includes oils, carbohydrates, proteins, and structural components of the fruit.

In avocados, dry matter is strongly correlated with mesocarp oil content, which is the primary factor influencing flavor, texture, and overall eating quality. As avocados mature on the tree, oil accumulates in the flesh and dry matter increases.

Because of this relationship, dry matter is widely used throughout the avocado industry as a maturity index to determine harvest timing and market readiness.

Traditional dry matter measurement methods require destructive sampling. These methods typically involve removing a portion of the fruit, drying it in an oven or microwave, and calculating the proportion of dry mass relative to fresh mass.

The F-751 allows dry matter to be estimated non-destructively, enabling users to evaluate large numbers of fruit without cutting them open.

2.2 NIR Interactance Measurement

The F-751 measures avocado dry matter using near-infrared interactance spectroscopy.

During a measurement:

1. Near-infrared light is emitted into the fruit.
2. The light penetrates the avocado peel and travels through a region of the mesocarp.
3. Some of the light is absorbed by chemical components within the fruit, while the remaining light is scattered back toward the detector.

The detected light contains spectral information related to the composition of the fruit tissue. Variations in water, oil, and other components influence how light is absorbed and scattered in the NIR wavelength range.

The F-751 measures the returning spectral signal and uses this information to estimate the dry matter content of the fruit.

Because the measurement represents a localized sampling volume of mesocarp tissue beneath the measurement lens, the predicted value reflects the composition of the tissue at the measurement site rather than the entire fruit. When a highly accurate estimate of a single fruit is required, scans can be taken at multiple locations on the fruit and averaged to better represent the overall dry matter.

In most field and postharvest applications, however, the primary goal is to evaluate the maturity of a population of fruit. In these cases, measuring a larger number of fruit typically provides more reliable insights than performing multiple scans on each individual fruit.

2.3 Deep Neural Network (ANN) Chemometrics

The spectral data collected by the F-751 are interpreted using chemometric models developed from large calibration datasets of avocados with known dry matter values.

The AvoAI application uses a deep neural network (DNN) model to translate NIR spectral measurements into predicted dry matter values. A deep neural network is a machine learning model composed of multiple computational layers that learn complex relationships between spectral patterns and reference measurements.

During model development, the DNN is trained using large datasets that pair NIR spectra with dry matter values determined through laboratory reference methods. Through this training process, the model learns to recognize subtle spectral features that correspond to changes in fruit composition.

Compared with earlier modeling approaches, deep neural networks are capable of modeling more complex nonlinear relationships within spectral data. This allows the AvoAI system to achieve improved prediction performance across a broader range of dry matter values.

In particular, the DNN approach helps improve prediction accuracy in the low dry matter and high dry matter ranges, where traditional chemometric models can exhibit increased prediction error due to nonlinear spectral behavior.

Once trained, the DNN model is deployed within the AvoAI application. When a measurement is taken, the spectral data collected by the instrument are processed by the model in real time to generate a dry matter prediction.

2.4 Measurement Location and Sampling Best Practices

Because dry matter is not uniformly distributed throughout the fruit, the location of the measurement can influence the predicted value.

The F-751 measures a small, conical region of mesocarp beneath the lens. As a result, a single measurement represents only a localized portion of the fruit.

When estimating the average dry matter of a single fruit, measurements taken at multiple locations around the equator - such as the dorsal and ventral sides - can help reduce the influence of localized variation.

However, in most operational workflows the objective is to evaluate the maturity of a group of fruit rather than to precisely characterize an individual fruit. For this reason, users are generally encouraged to prioritize measuring a larger number of fruit while maintaining consistent measurement technique (for example, scanning the same general side or region of each fruit).

Taking additional scans per fruit can reduce measurement noise and improve repeatability when higher precision is required for individual fruit analysis.

Understanding Measurement Variance

3.1 Biological Variation Within Fruit

Dry matter is not evenly distributed throughout the mesocarp of an avocado. Different regions of the fruit can exhibit substantial differences in dry matter content.

Variations of up to 15% dry matter between sampling locations have been observed, depending on where tissue is collected within the fruit. Because of this natural variability, a measurement taken from a single location represents only the composition of the tissue directly beneath the measurement lens rather than the entire fruit.

When the objective is to estimate the dry matter of a single fruit as accurately as possible, taking multiple measurements around the equator of the fruit can help reduce the influence of localized variation.

However, in most field and postharvest workflows the goal is to evaluate the maturity of a population of fruit rather than to precisely characterize individual fruit. In these situations, measuring a larger number of fruit typically provides more meaningful results than performing multiple scans on each fruit. Users are therefore encouraged to prioritize sampling more fruit while maintaining consistent measurement technique, such as scanning the same general side or region of each fruit.

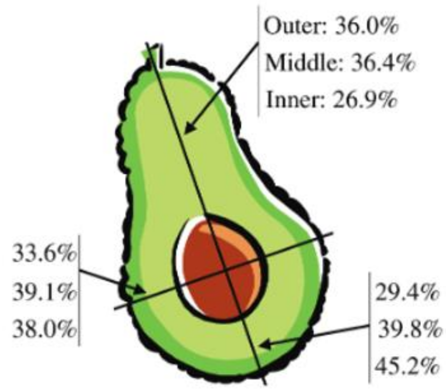


Figure 1: (Phetsomphou, 2000)

3.2 Sampling and Analytical Variance

All analytical methods introduce some level of measurement uncertainty.

In destructive dry matter testing methods such as oven drying or microwave drying, variance can arise from:

- unrepresentative tissue sampling
- differences in sample preparation
- weighing inaccuracies
- temperature control issues during drying

The F-751 most closely mimics the **coring sampling approach**, where a small region of tissue is analyzed from a specific location on the fruit.

When comparing F-751 measurements to destructive reference methods, the closest agreement is typically achieved when the destructive sample is taken from the **same location on the fruit that was scanned by the instrument.**

If a destructive sampling method that integrates tissue from multiple regions of the fruit is used, additional scans across different fruit locations may be required to obtain comparable averages.

3.3 Instrument Variance

The F-751 is designed to provide highly repeatable measurements across instruments.

The AvoAI application uses neural-network-based chemometric models that help minimize differences between individual instruments and improve overall prediction stability.

However, small levels of measurement noise are unavoidable in any spectroscopic system. Environmental conditions, fruit orientation, and surface characteristics can also contribute minor sources of variation.

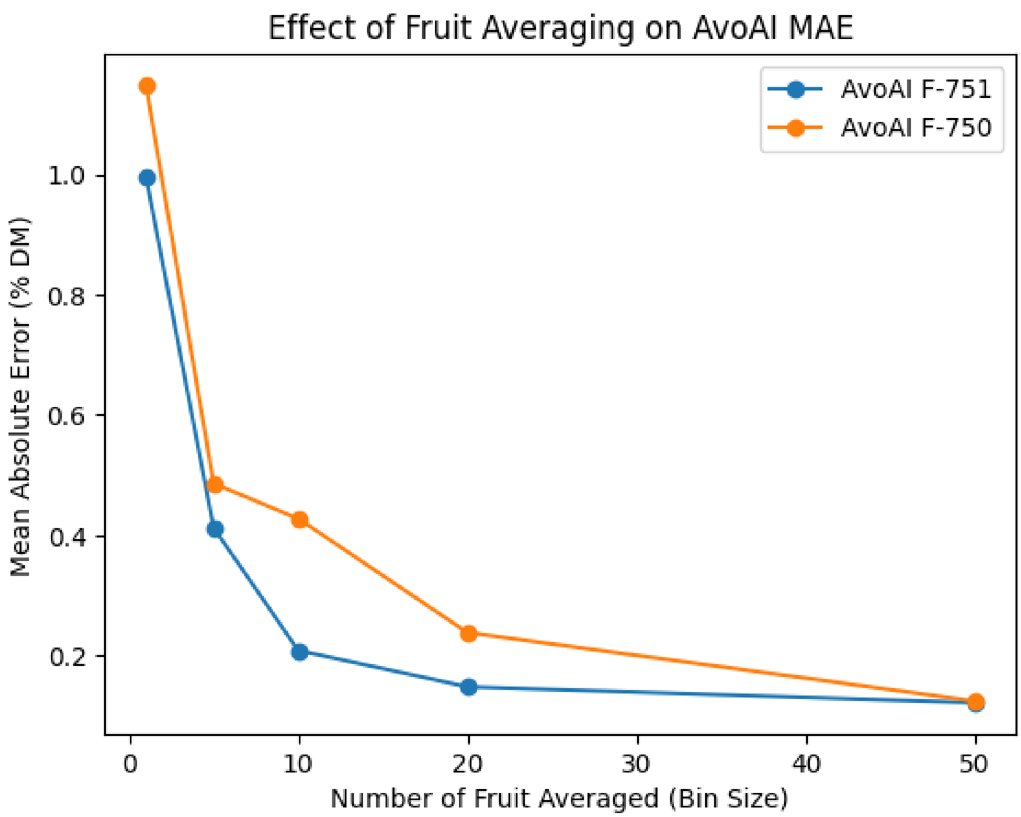
3.4 Improving Accuracy Through Sample Size

Increasing the number of fruit measured is one of the most effective ways to reduce measurement uncertainty.

Larger sample sizes help average out biological variation between fruit and reduce the impact of individual measurement outliers.

For example, calculating the average dry matter from **ten fruit instead of five fruit** can improve prediction reliability by approximately **50%**.

Because the F-751 allows rapid measurements, users are encouraged to measure larger sample sets whenever possible to achieve the most reliable maturity assessments.



Part I – System Architecture

AvoAI System Overview

4.1 Instrument Hardware

The **F-751 Avocado Quality Meter** is a portable near-infrared (NIR) spectroscopic instrument designed to measure avocado dry matter non-destructively.

The instrument includes:

- an NIR light source and optical measurement system
- a spectrometer used to capture the returned spectral signal
- a built-in processor for running chemometric prediction models
- a display and navigation interface for user interaction
- an SD card for application storage and data logging
- wireless connectivity for network communication and cloud integration

During a measurement, the instrument collects NIR spectral data from the avocado tissue beneath the measurement lens. The spectral data are processed internally by the AvoAI application using a trained machine learning model to generate a dry matter prediction.

The result is displayed immediately on the device and stored as part of the measurement record.

4.2 AvoAI Application

The AvoAI application is the software environment that operates on the F-751 instrument and manages the measurement workflow.

The application performs several key functions:

- controls measurement acquisition
- applies the deep neural network (DNN) chemometric model to generate dry matter predictions
- organizes measurements into structured datasets
- calculates summary statistics for measured fruit groups
- manages measurement records and metadata
- prepares measurement data for export or upload

AvoAI also introduces **structured workflow modes** designed to match common avocado industry use cases, such as field sampling and post-harvest quality assessment. These workflows help standardize measurement procedures and simplify data organization.

Workflow modes are described in detail in **Section 5**.

4.3 SD Card Structure

All AvoAI applications, configuration files, and measurement data are stored on the **SD card installed in the F-751 instrument.**

The SD card serves several important functions within the system architecture:

- storing the AvoAI application and model files
- maintaining configuration settings and workflow definitions
- logging measurement records and metadata
- organizing archived datasets

Because the application and data structure are stored on removable media, the SD card also enables users to:

- transfer measurement data to a computer
- back up measurement records
- update application files when new versions are released

A detailed explanation of the SD card directory structure is provided later in **Section 6 – SD Card Structure and File Management**.

4.4 Data Storage and Archiving

Each measurement performed with the AvoAI application is recorded as part of a structured dataset stored on the SD card.

Measurement records typically include:

- Measurement Timestamp
- Unique measurement identifier
- Dataset or workflow identifiers
- GPS coordinates (if enabled)
- Dry matter value

Datasets remain active on the device during measurement collection. Once a dataset is complete, it can be archived, which moves the data into a structured archive directory on the SD card.

Archiving helps maintain device organization and prepares measurement datasets for export or upload to external data systems.

4.5 Data Server and Cloud Integration

The AvoAI system can optionally integrate with external data platforms through wireless connectivity.

When network connectivity is enabled, archived measurement datasets can be automatically transmitted to:

- a **Data Server** used for centralized data storage and integration with external software systems
- **FruitMaps**, a web-based platform developed by Felix Instruments, Agricultural Robotics, and Central Queensland University for visualizing and analyzing avocado maturity data

These integrations allow users to manage large datasets, monitor maturity trends across orchards or lots, and share measurement data across teams.

FruitMaps provides tools for visualizing measurement data, organizing orchard sampling results, and supporting harvest decision-making workflows. An example of the FruitMaps interface is shown in Figure 2.

Figure 2. Example FruitMaps interface displaying avocado maturity data. The FruitMaps platform is actively developed and updated, so the appearance and features of the interface may change over time.

Configuration of network connectivity and data upload settings is described later in Part V – Data Access and Integration.

Workflow Overview (Modes)

The AvoAI application organizes measurements using **workflow modes**. Each mode corresponds to a specific measurement structure and is defined by a configuration file stored on the SD card.

These configuration files determine how measurement data are grouped and labeled within the application. The hierarchy defined in the configuration file becomes the navigation structure that users interact with when recording measurements.

Each workflow mode therefore represents a different **organizational hierarchy for measurements**, tailored to common avocado industry workflows.

The AvoAI system currently includes three primary workflow modes:

- InField Mode
- PostHarvest Mode
- DataCollection Mode

Although the measurement process remains the same in all modes, the **data hierarchy and metadata structure** differ between workflows.

5.1 InField Mode

InField Mode is designed for **orchard sampling workflows**.

Measurements are organized according to orchard sampling locations so that maturity can be evaluated across multiple areas of a field.

A typical hierarchy used in InField Mode is:

```
Orchard
 └── Cultivar
      └── Plot
```

An example configuration hierarchy may include entries such as:

Avocado\Hass\Plot1
Avocado\Hass\Plot2
Avocado\Shepard\Plot1
Avocado\MalumaHass\Plot1

This structure allows users to record measurements within specific orchard locations and cultivars. The system can then calculate summary statistics for each plot or cultivar.

InField Mode is typically used for:

- orchard maturity surveys
- harvest readiness assessment
- research field trials

5.2 PostHarvest Mode

PostHarvest Mode is designed for **packing house or intake workflows** where fruit are measured after harvest.

In this mode, measurements are grouped by bins containing harvested fruit. The hierarchy used in this workflow is defined by the **Bins.txt** configuration file.

The hierarchy structure is:

```
Bin
└── Fruit
```

Example entries may include:

Bin1\Fruit1
Bin1\Fruit2
Bin1\Fruit3
Bin2\Fruit1
Bin2\Fruit2

Each bin represents a container of harvested fruit, and individual fruit measurements are recorded within that bin. The system calculates summary statistics for each bin as measurements are collected.

PostHarvest Mode is commonly used for:

- packing house intake testing
- maturity verification of harvested fruit
- lot segregation or quality checks
- storage and shipment assessments

5.3 DataCollection Mode

DataCollection Mode is designed for **general measurement collection without a fixed agricultural hierarchy**.

This mode commonly uses a simpler structure focused on bins and fruit identifiers.

A typical hierarchy used in this mode is:

```
Batch
  └── Fruit
        └── Measurement Side
```

Example structure:

Batch1\Fruit1\Side1
Batch1\Fruit1\Side2
Batch1\Fruit2\Side1
Batch1\Fruit2\Side2

This simplified workflow is useful when collecting datasets for:

- research trials
- calibration dataset development

- instrument validation experiments

Because the hierarchy is minimal, measurements can be collected quickly without defining additional metadata.

5.4 Comparing Workflows

Each workflow mode uses a different hierarchy to organize measurements.

Workflow Mode	Configuration File	Data Hierarchy
InField	Plots.txt	Commodity → Cultivar → Plot
PostHarvest	Bins.txt	Bin → Fruit
DataCollection	Batches.txt	Batch → Fruit → Side

Although these workflows differ in structure, all modes ultimately store measurement data in the same logging format on the SD card.

5.5 Selecting the Appropriate Mode

Users should select the workflow mode that best matches their operational environment.

General guidelines include:

Use **InField Mode** when measuring fruit directly in orchards to evaluate harvest readiness across cultivars and plots.

Use **PostHarvest Mode** when evaluating harvested fruit in bins during packing house intake or storage.

Use **DataCollection Mode** when collecting structured datasets that require tracking individual fruit and multiple scan locations.

Selecting the appropriate workflow mode ensures that measurement data are organized in a way that supports accurate analysis and reporting.

Part II – SD Card & Configuration

SD Card Structure and File Management

The AvoAI application operates from the SD card installed in the F-751 instrument. The SD card contains the software required to run the application, the trained deep neural network (DNN) model used to generate dry matter predictions, configuration files that define workflow structure, and measurement data generated during operation.

When the AvoAI system is first installed, the SD card contains a small set of core system files located in the root directory. These files are required for normal operation and should not be removed.

Additional files and folders are automatically created by the device as measurements are collected.

*****IMPORTANT SD CARD HANDLING REQUIREMENTS*****

The AvoAI SD card **must only be accessed using a Windows PC.**

Inserting the SD card into a macOS computer can automatically create hidden system files (for example .DS_Store, ._ files, and Spotlight indexing files). These hidden files may interfere with the AvoAI application and can cause workflow configuration errors or prevent the software from operating correctly.

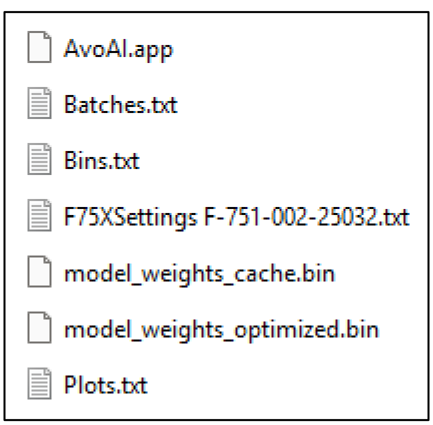
For this reason:

- Only insert the AvoAI SD card into a Windows PC
- Do not open or edit the SD card using a Mac computer
- Always safely eject the SD card before removing it from the computer

If a Mac has been used to access the SD card and hidden files are created, the card may need to be cleaned or restored before the instrument will operate correctly.

6.1 Required System Files

Before the device has been used, the SD card contains the following required files in the root directory:



Removing required system files will prevent the AvoAI application from launching or may cause measurement functions to fail.

If the SD card becomes corrupted or files are accidentally deleted, the application may need to be reinstalled using a replacement SD card image provided by Felix Instruments.

6.2 Application File & Model Weight Files

AvoAI.app is the executable application used by the F-751 to run the AvoAI measurement software.

This file contains the user interface, workflow logic, and measurement processing routines used by the instrument.

If this file is missing or corrupted, the AvoAI application will not launch.

This file should not be edited or renamed.

The files:

- model_weights_cache.bin
- model_weights_optimized.bin

contain the **trained deep neural network (DNN) weights** used to convert spectral measurements into predicted dry matter values.

When a spectrum is collected by the instrument, the spectral data are processed through the neural network stored in these files to generate the final prediction.

These files are not user-editable and should not be modified or removed.

6.3 Spectrometer Settings File

The file:

F75XSettings F-751-002-XXXXX.txt

contains the **spectrometer calibration coefficients for the device**.

These coefficients define how the raw detector signal from the spectrometer is converted into a calibrated spectrum. The file typically includes parameters such as wavelength calibration coefficients and other instrument-specific settings required for spectral processing.

This file is **device-specific and extremely important**. Without the correct settings file:

- the spectrometer cannot properly interpret detector data
- the calculated spectra will be incorrect
- dry matter predictions will not be valid

For this reason, the settings file should **never be deleted or edited manually**.

6.4 Mode Configuration Files

The files:

- Plots.txt

- Bins.txt
- Batches.txt

define the **measurement hierarchy used by the AvoAI workflow modes**.

Unlike the application and model files, these .txt files **can and should be edited** so the hierarchy used by the device matches the user's existing organizational structure.

Users commonly customize these files to reflect:

- orchard names
- cultivars
- plot identifiers
- bin identifiers
- batch structures

However, the files themselves must remain present on the SD card.

Formatting rules for editing these files are described in **Section 7 – Customizing Workflow Configuration Files**.

6.5 Files Generated During Use

After the device is used to collect measurements, additional files and folders will appear on the SD card.

These include:

- AppLog files for each workflow mode
- the Apps folder containing measurement data
- cached files generated by the application

These files store measurement records and the raw spectral data collected during operation.

The structure and purpose of these files are described in the following sections.

Customizing Workflow Structure (.txt Configuration Files)

The files Plots.txt, Bins.txt, and Batches.txt define the measurement hierarchies used by the AvoAI workflow modes. These files are stored in the **root directory of the SD card** and can be edited so the workflow structure matches the user’s existing organizational system.

Unlike other files on the SD card, these configuration files are intended to be customized. Editing them allows users to define the orchard, bin, batch, or sampling structures that will appear in the AvoAI application interface.

Although these files are editable, they must follow specific formatting rules so the application can interpret the hierarchy correctly.

7.1 Editing Configuration Files

Configuration files can be edited using any basic text editor, such as:

- Notepad (Windows)
- TextEdit (macOS, plain text mode)
- any standard plain-text editor

To edit a configuration file:

1. Remove the SD card from the instrument.
2. Insert the SD card into a computer.
3. Open the desired .txt file.
4. Modify the hierarchy entries as needed.
5. Save the file.
6. Safely eject the SD card before reinserting it into the instrument.

Only plain text should be used. Do not save the file in a formatted document format such as .docx.

7.2 Hierarchy Syntax

Each line in the configuration file represents a **measurement path** within the workflow hierarchy.

Hierarchy levels are separated using a **backslash (\)**.

General structure:

Level1\Level2\Level3

Each level becomes a selectable level in the AvoAI measurement workflow.

For example:

Avocado\Hass\Plot1
Avocado\Hass\Plot2
Avocado\Shepard\Plot1

This structure creates the following hierarchy in the InField workflow:

Commodity → Cultivar → Plot

7.3 Examples by Workflow Mode

InField Mode (Plots.txt)

```
Avocado\Hass\Plot1
Avocado\Hass\Plot2
Avocado\Shepard\Plot1
Avocado\Shepard\Plot2
Avocado\MalumaHass\Plot1
Avocado\MalumaHass\Plot2
```

Hierarchy created:

Commodity → Cultivar → Plot

PostHarvest Mode (Bins.txt)

```
Bin1\Fruit1
Bin1\Fruit2
Bin1\Fruit3
Bin1\Fruit4
Bin1\Fruit5
Bin2\Fruit1
Bin2\Fruit2
Bin2\Fruit3
Bin2\Fruit4
Bin2\Fruit5
Bin3\Fruit1
Bin3\Fruit2
Bin3\Fruit3
Bin3\Fruit4
Bin3\Fruit5
```

Hierarchy created:

Bin → Fruit

DataCollection Mode (Batches.txt)

```
Batch1\Fruit1\Side1
Batch1\Fruit1\Side2
Batch1\Fruit2\Side1
Batch1\Fruit2\Side2
Batch1\Fruit3\Side1
Batch1\Fruit3\Side2
Batch1\Fruit4\Side1
Batch1\Fruit4\Side2
Batch1\Fruit5\Side1
Batch1\Fruit5\Side2
Batch2\Fruit1\Side1
Batch2\Fruit1\Side2
Batch2\Fruit2\Side1
Batch2\Fruit2\Side2
Batch2\Fruit3\Side1
Batch2\Fruit3\Side2
Batch2\Fruit4\Side1
Batch2\Fruit4\Side2
Batch2\Fruit5\Side1
Batch2\Fruit5\Side2
```

Hierarchy created:

Batch → Fruit → Side

7.4 Formatting Rules

To ensure the application reads the configuration files correctly, follow these rules:

- Each hierarchy entry must appear on its own line
- Use the **backslash (\)** to separate hierarchy levels
- Do not add extra spaces before or after hierarchy names
- Do not leave blank lines in the file
- Do not add tabs or special characters

Incorrect formatting may prevent the application from loading the workflow hierarchy correctly.

7.5 Recommended Best Practices

Before modifying configuration files:

- create a backup copy of the SD card
- test changes with a small number of entries
- keep naming conventions simple and consistent

If formatting errors occur, restoring the original configuration file will usually resolve the issue.

Part III – Operating the AvoAI Application

Getting Started

8.1 Powering the Instrument

Turning the Instrument On:

1. Press the **Power On/Off** button. The instrument will turn on.

This process takes a few moments, and the display will show the splash screen when the instrument is ready to be used.

8.2 Navigation and Controls

Instrument Interface:

1. **Power On/Off** button
2. **Measure** button

3. **Navigation** buttons (referred to as **Up/Down/Left/Right**)

Navigating Menus:

The instrument's interface is composed primarily of menus that are operated using the navigation buttons.

 **Up/Down** navigates between menu items.

 **Left** navigates back to the previous menu.

 **Right** navigates into the selected menu item.

8.3 Entering Text and Numeric Values

When prompted, text/numbers can be entered on the device by using the navigation buttons.

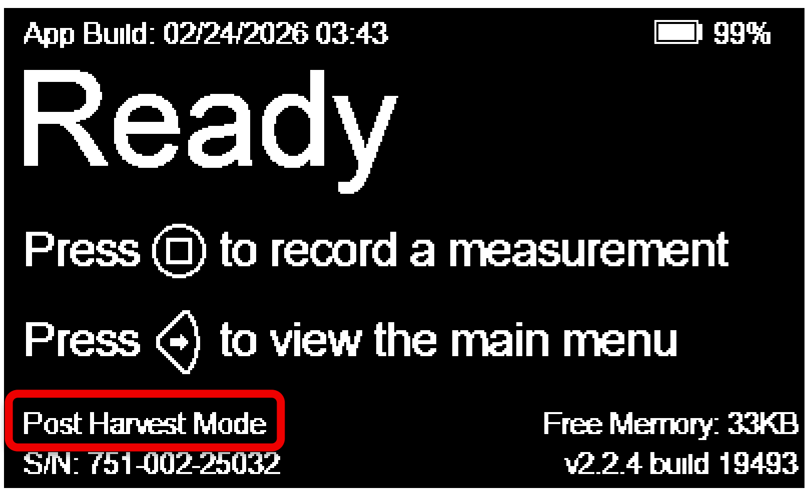
Up/Down navigates between letters/numbers for the current cursor position.

Left navigates the cursor to text that has already been entered. Navigating past the beginning of the text aborts and returns to the previous menu.

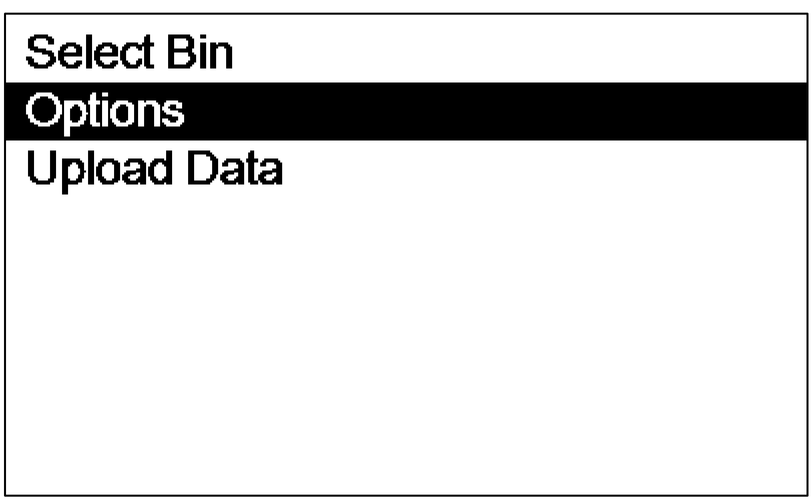
Right navigates the cursor to text that has already been entered. Navigating past the end of the text saves your entry and continues.

8.4 Selecting a Workflow Mode

When the device is powered on, the splash screen that is displayed will indicate which mode the device is currently in:



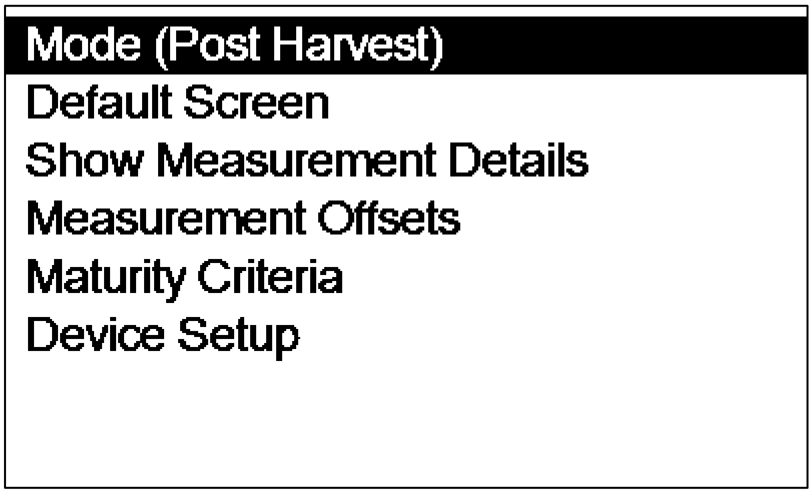
Pressing **Right** from the splash screen will take you to the **Root Menu**:



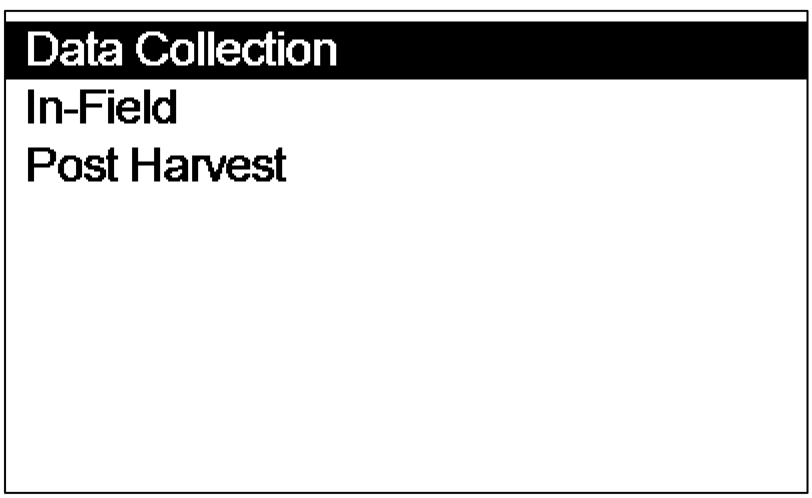
From the **Root Menu**, there are three options:

1. Select Bin (Post Harvest Mode) / Select Plot (In Field Mode) / Select Batch (Data Collection Mode)
2. Options
3. Upload Data

To change the workflow mode, highlight **Options** using the **Down** arrow as shown above and press **Right.**



The first selection in the **Options** menu is the workflow mode. Ensure it is highlighted, then press **Right.**



This will bring up the list of the three available workflow modes. Highlight the one you wish to use, then press **Right.** The device will load the new workflow mode and take you back to the **Ready** splash screen.

8.5 Default Screen Options

The **Default Screen** setting determines which level of the workflow hierarchy the device returns to after each measurement.

For the **InField** and **PostHarvest** modes, users can choose to return to any level of the hierarchy defined by the workflow configuration files. For example, the device can return to:

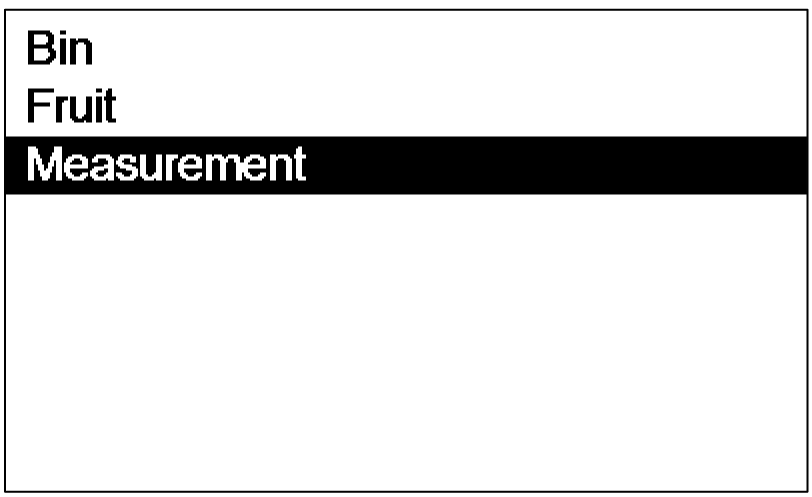
- the plot or measurement level (InField Mode)
- the bin, fruit, or measurement level (PostHarvest Mode)

Selecting the appropriate default screen can significantly improve measurement efficiency by reducing the number of navigation steps required between scans.

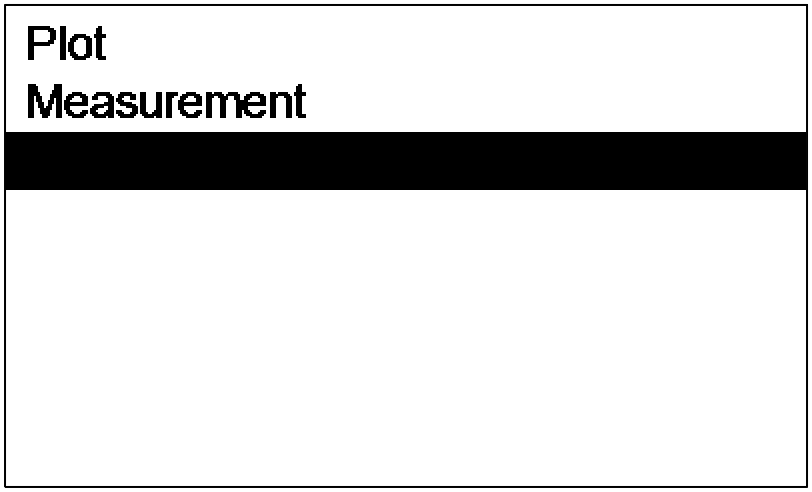
To change the **Default Screen** after each measurement is taken, highlight **Options** from the **Root Menu**, press **Right**, then highlight **Default Screen**, and press **Right.**

Highlight the hierarchy level you wish to view after each measurement is taken, then press **Right.**

The **Default Screen** options for the **PostHarvest** mode are below:



The **Default Screen** options for the **InField** mode are below:



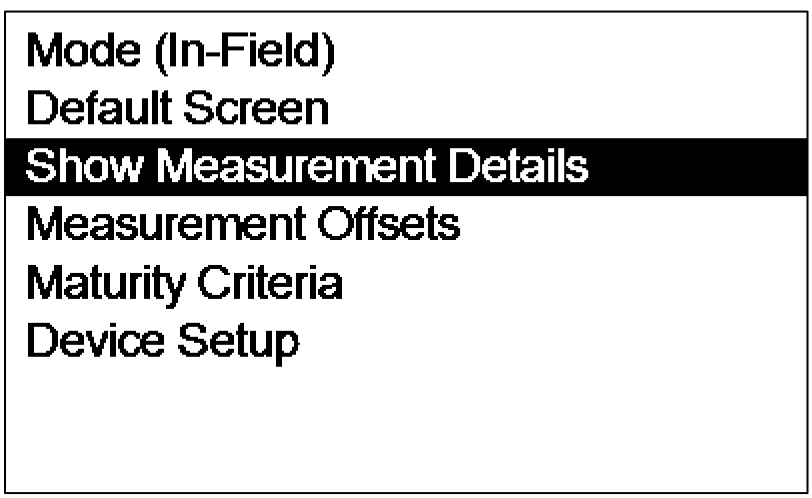
8.6 Show Measurement Details Option

The **Measurement Details** setting controls what information is shown on the **Measurement** level screen. This applies whether the user has set **Measurement** as their **Default Screen** or not.

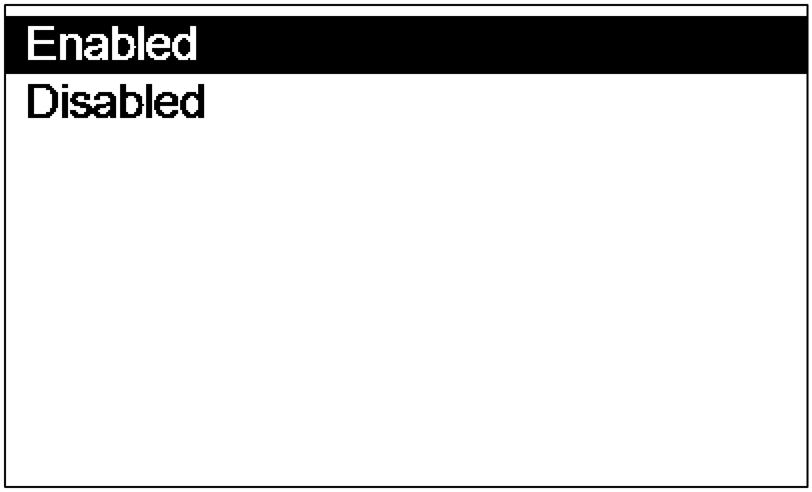
When enabled, the device displays the **predicted dry matter value** for each measurement taken.

When disabled, the instrument only displays a **confirmation checkmark** indicating that the scan was successfully completed.

To adjust whether **Measurement Details** are displayed, navigate into the **Options** menu from the **Root Menu**, then highlight **Show Measurement Details** and press **Right.**



You can then choose to **Enable** or **Disable** this feature by highlighting the option you want and pressing **Right.**



InField Mode

InField Mode Operation

InField Mode is designed for collecting avocado dry matter measurements directly in orchards prior to harvest. Measurements are organized using the hierarchy defined in the Plots.txt configuration file. This hierarchy typically follows the structure:

Commodity → Cultivar → Plot

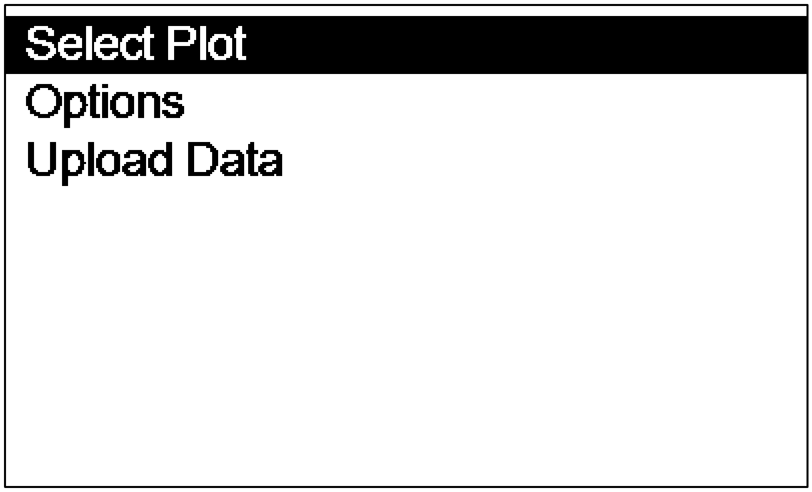
Each measurement is associated with the selected plot location, allowing users to collect maturity data across different orchard areas and cultivars.

The workflow in InField Mode generally follows these steps:

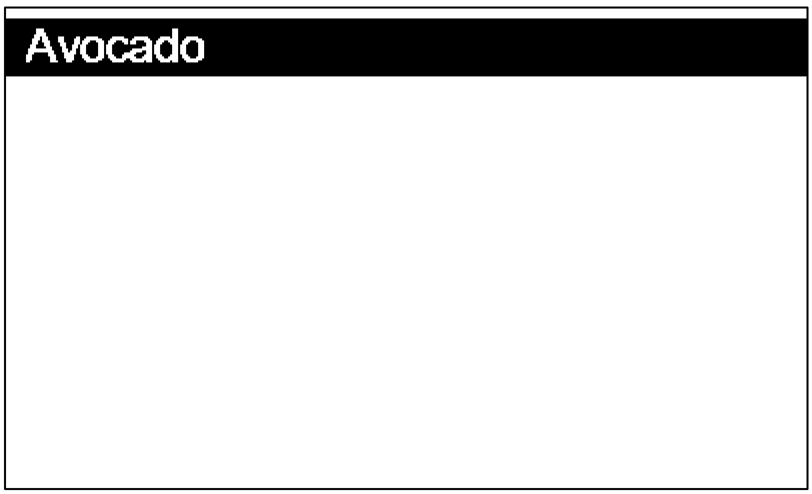
1. Navigate the organizational hierarchy
2. Measure fruit
3. Review or edit measurements
4. View summary statistics
5. Archive completed datasets

9.1 Navigating Organizational Hierarchy [InField Mode]

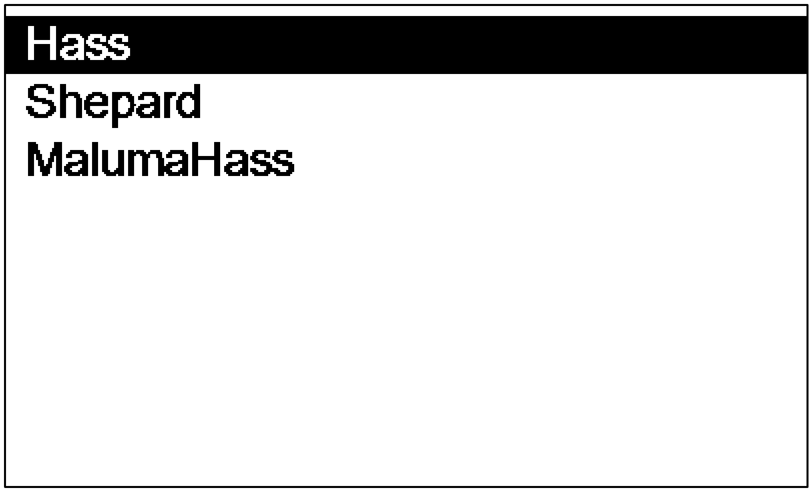
From the **Ready** splash screen, press **Right** to navigate to the Infield **Root Menu:**



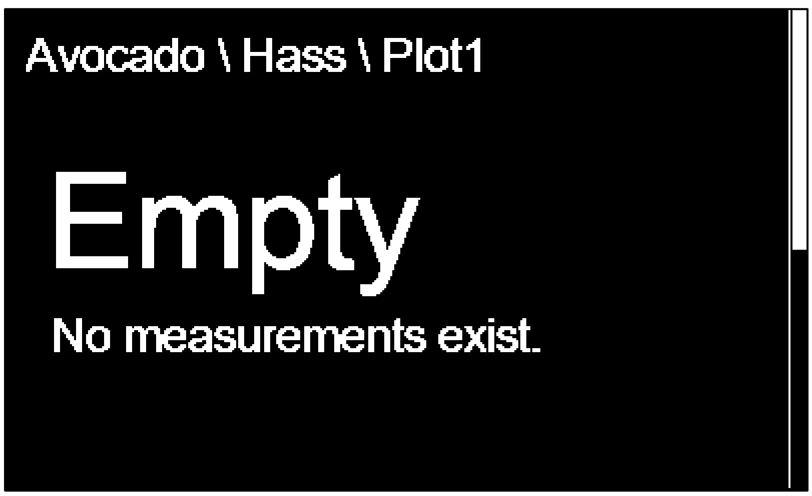
Ensure **Select Plot** is highlighted, then press **Right.**



By default, this menu will only show **Avocado**, as **Commodity** is the first level of the organizational hierarchy in the default **Plots.txt** file. Press **Right** to continue to the next level of the hierarchy.



This menu will display the options for the second level of the organizational hierarchy, **Cultivar**. The default **Plots.txt** file includes three cultivars – Hass, Shepard, and Maluma Hass. Highlight the cultivar that you intend to measure, then press **Right.**



You are now in the final level of the hierarchy, which is the **Plot** level view. You can navigate between different plots by using the **Up** and **Down** arrows.

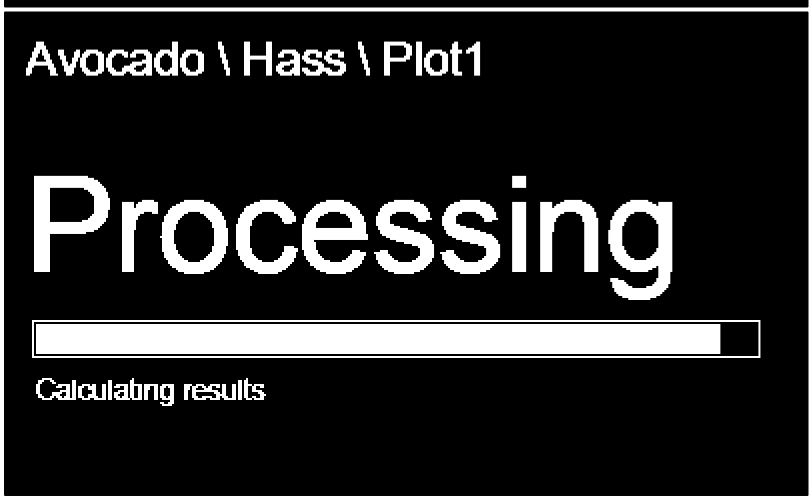
9.2 Measuring Fruit [InField Mode]

When you are ready to begin taking measurements, first ensure the top of the **Plot** level screen contains the name or number of the plot you intend to collect data for.

Position the instrument so that the surface of the avocado is pressed firmly against the measurement lens of the F-751.

Press the **Measure** button.

The instrument will begin the process of recording the spectral measurement of the avocado. The display will show what step of the measurement process is underway:



When the device screen transitions from **Recording** to **Processing**, it is safe to remove the avocado from the F-751 measurement lens.

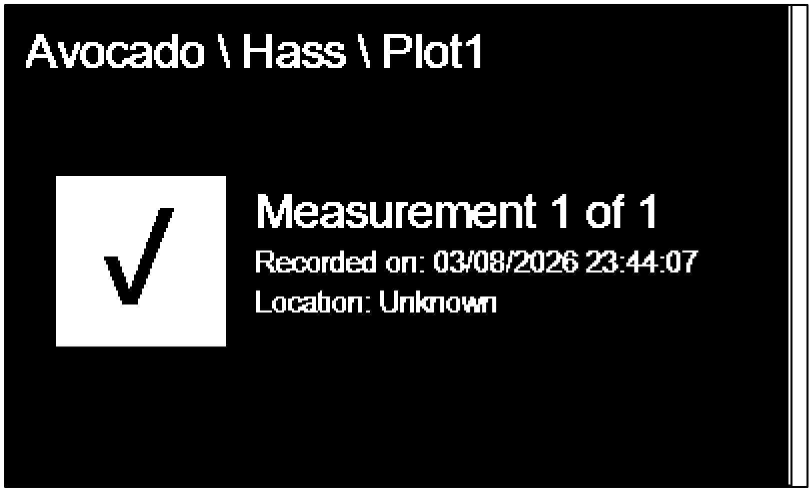
After the measurement is completed:

- the measurement is recorded in the **InField_AppLog.txt** file
- the spectral data are saved as a .dat file within the Apps/InField/Data directory

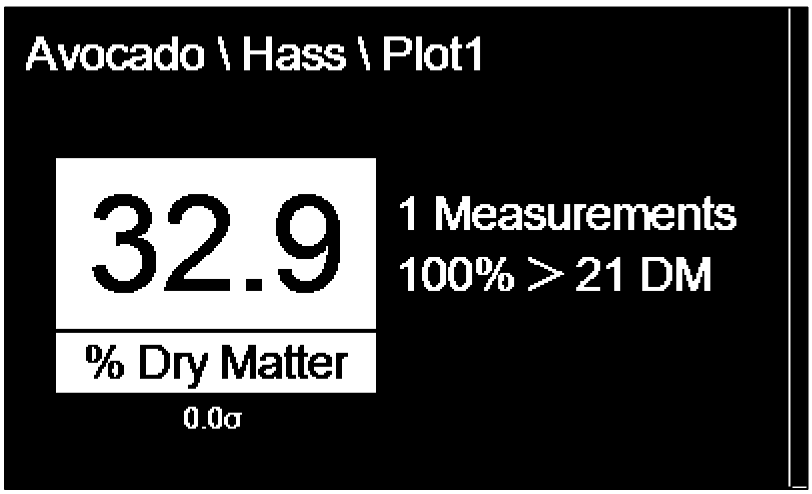
The display behavior depends on the **Show Measurement Details** setting described in **Section 8**. When measurement details are enabled, the predicted dry matter value is displayed after each scan. When disabled, the device displays a confirmation checkmark indicating the measurement was successfully recorded.

After the scan is completed, the instrument returns to the hierarchy level specified by the **Default Screen setting**.

Below is an example of the **Measurement** view with the **Show Measurement Details** option **Disabled**:



Below is an example of the **Plot** level view:



9.3 Reviewing and Editing Measurements [InField Mode]

Users can review measurements collected within a plot or plot summaries at any time during the sampling session. To navigate between individual measurements or plots, use the **Up/Down** navigational keys within either the **Measurement** view or the **Plot** view.

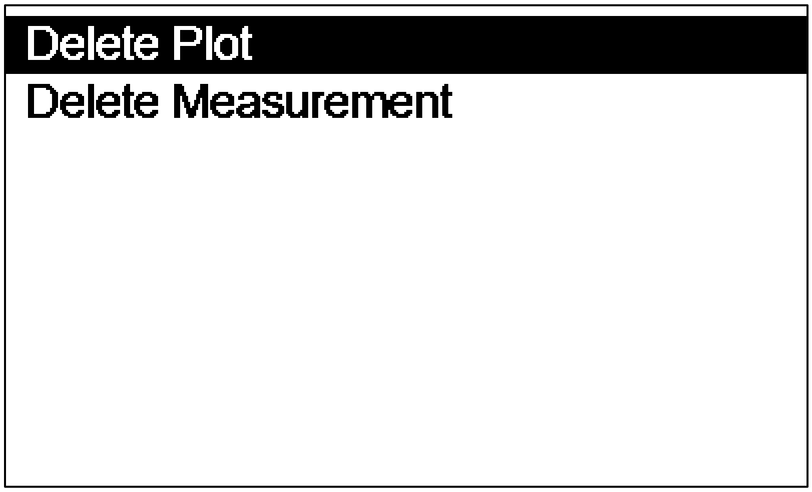
If a measurement was taken incorrectly, or if an entire plot needs to be removed, it can be deleted from the dataset.

Deleting a measurement removes both:

- the AppLog entry
- the associated spectral .dat file

Deleted measurements cannot be recovered unless the spectral files were previously backed up.

To delete a plot or measurement, press **Right** from the **Measurement** view, then highlight the option you wish to proceed with and press **Right**.



9.4 Viewing Summary Statistics [InField Mode]

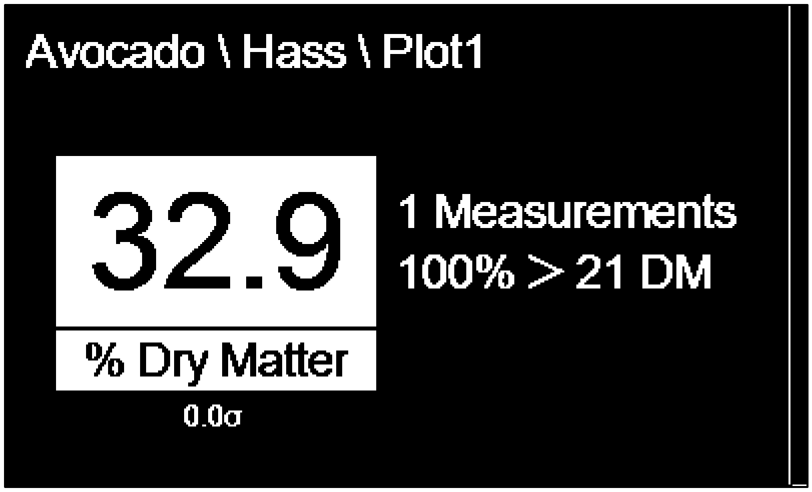
InField Mode provides summary statistics for measurements collected within the selected plot or sampling location.

These statistics include:

- average dry matter percentage
- standard deviation of all measurements within the selected plot
- number of measurements taken
- percentage of fruit above the maturity threshold

These statistics allow users to quickly evaluate maturity levels within the sampled orchard location and determine whether fruit meet harvest criteria.

You can view all Plot level statistics at any time by navigating to the **Plot** view and using the **Up/Down** navigation buttons.



9.5 Archiving Data [InField Mode]

When the dataset is complete, the measurements should be archived.

Archiving moves the measurement records and spectral files from the active data directory to an archive folder on the SD card. This helps keep the active dataset organized and preserves completed datasets for later analysis.

Detailed instructions for archiving datasets are provided in **Section 15 – Archiving Data**.

PostHarvest Mode

PostHarvest Mode Operation

PostHarvest Mode is used to measure avocados after harvest, typically during packing house intake or quality control inspection. Measurements collected in this mode are organized using the hierarchy defined in the Bins.txt configuration file.

The typical structure for this workflow is:

Bin → Fruit

This organization allows users to measure fruit from specific bins, pallets, or lots and evaluate maturity variation across harvested fruit containers.

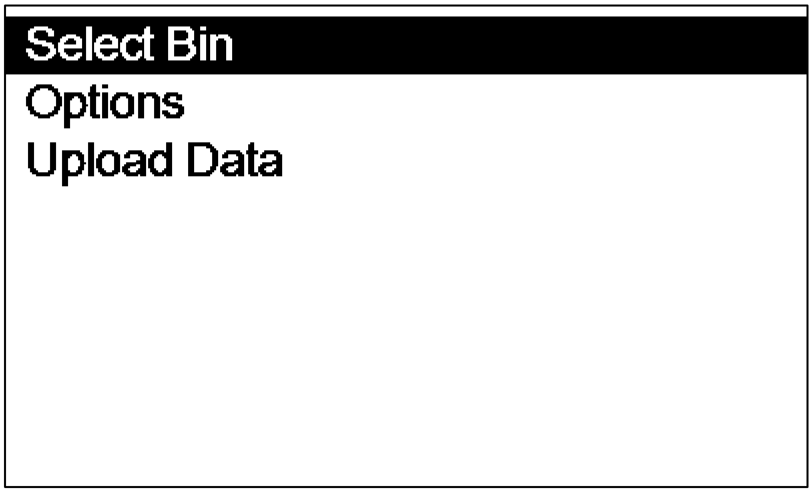
The typical workflow in PostHarvest Mode includes:

1. Organizing bins or pallets
2. Measuring fruit

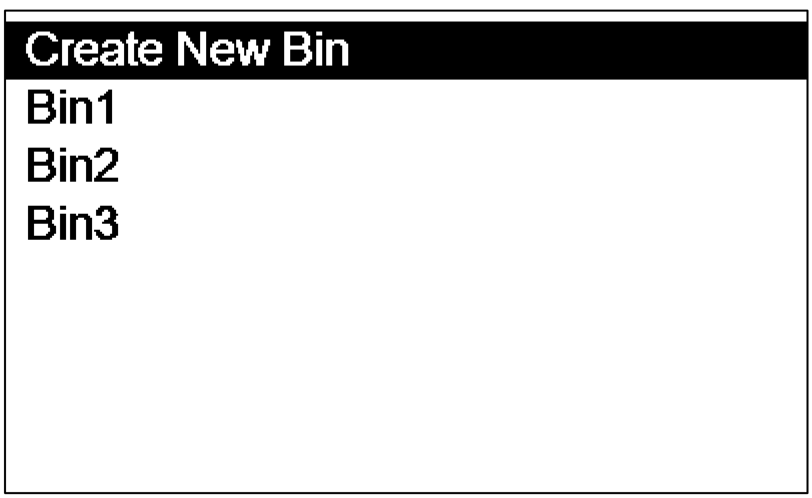
3. Reviewing measurements
4. Viewing maturity statistics
5. Archiving the dataset

10.1 Organizing Bins or Pallets [PostHarvest Mode]

From the **Ready** splash screen, press **Right** to navigate to the PostHarvest **Root Menu:**



Select a Bin you wish to populate with measurements, or create a new one, then press **Right.**



By default, this menu will show **Bin1, Bin2,** and **Bin3**. Users are encouraged to customize this list by editing the **Bins.txt** file to match existing packing house or intake labeling systems.

Once you have selected your bin or created a new one, you will be taken to the **Bin** level view. You can navigate between different bins by using the **Up** and **Down** arrows.

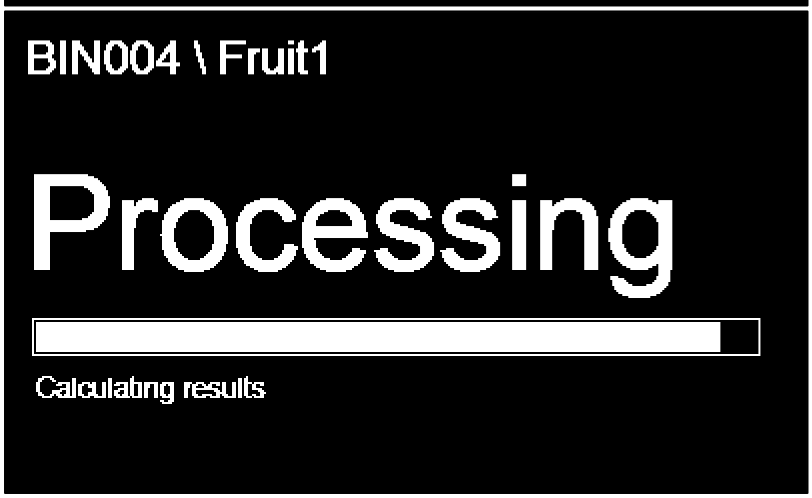
10.2 Measuring Fruit [PostHarvest Mode]

When you are ready to begin taking measurements, first ensure the top of the **Bin** level screen contains the name or number of the bin you intend to collect data for.

Position the avocado so that the surface is pressed firmly against the measurement lens of the F-751.

Press the **Measure** button.

The instrument will begin the process of recording the spectral measurement of the avocado. The display will show what step of the measurement process is underway:



When the device screen transitions from **Recording** to **Processing**, it is safe to remove the avocado from the F-751 measurement lens.

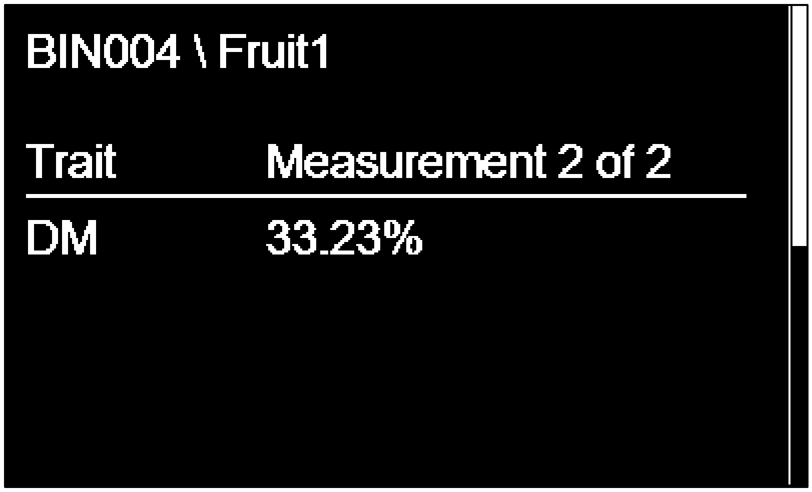
After the measurement is completed:

- the measurement is recorded in the **PostHarvest_AppLog.txt** file
- the spectral data are saved as a .dat file within the Apps/PostHarvest/Data directory

The display behavior depends on the **Show Measurement Details** setting described in **Section 8**. When measurement details are enabled, the predicted dry matter value is displayed after each scan. When disabled, the device displays a confirmation checkmark indicating the measurement was successfully recorded.

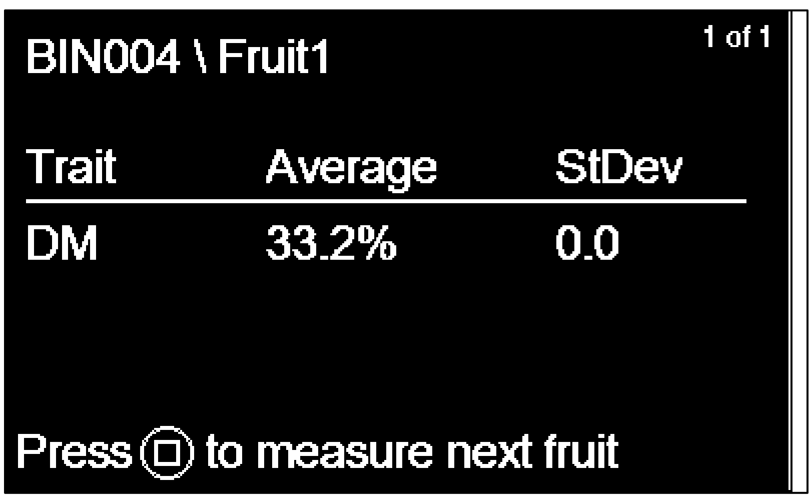
After the scan is completed, the instrument returns to the hierarchy level specified by the **Default Screen setting**.

Below is an example of the **Measurement** view with the **Show Measurement Details** option **Enabled**:



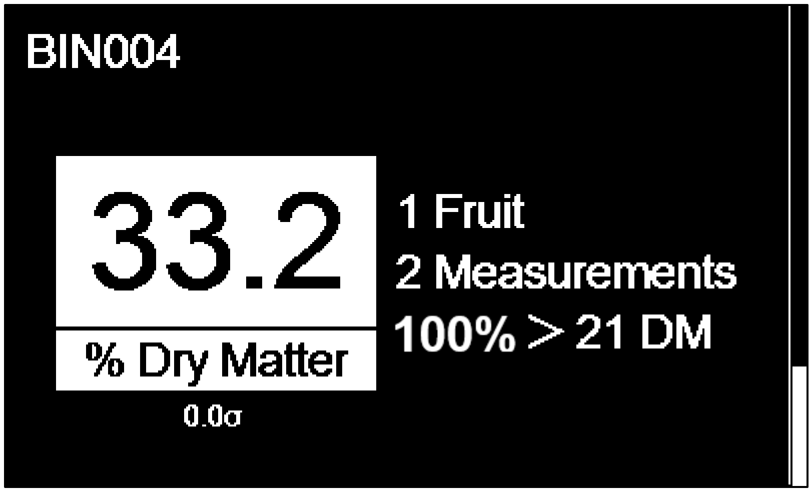
Taking a new measurement from the **Measurement** view shown above will result in an additional measurement being logged for the same fruit. This is useful for situations where single avocado dry matter results need to be as accurate as possible. Please see **Section 12 – Proper Measurement Technique** for more information.

Below is an example of the **Fruit** level view:



Taking a new measurement from the **Fruit** view shown above will result in a new measurement for the next fruit number in the bin.

Below is an example of the **Bin Summary** level view:



Taking a new measurement from the **Bin Summary** view shown above will also result in a new measurement for the next fruit number in the bin.

10.3 Reviewing and Editing Measurements [PostHarvest Mode]

Users can review data from individual measurements, fruits, or bins at any time during the sampling session. To navigate between individual measurements, fruit, or bins, use the **Up/Down** navigational keys within either the **Measurement** view, **Fruit** view, or the **Bin** view.

If a measurement was taken incorrectly, or if an entire fruit or bin needs to be removed, it can be deleted from the dataset.

Deleting a measurement removes both:

- the AppLog entry
- the associated spectral .dat file

Deleted measurements cannot be recovered unless the spectral files were previously backed up.

To delete a plot or measurement, press **Right** from the **Measurement** view, then highlight the option you wish to proceed with and press **Right**.

10.4 Viewing Summary Statistics [PostHarvest Mode]

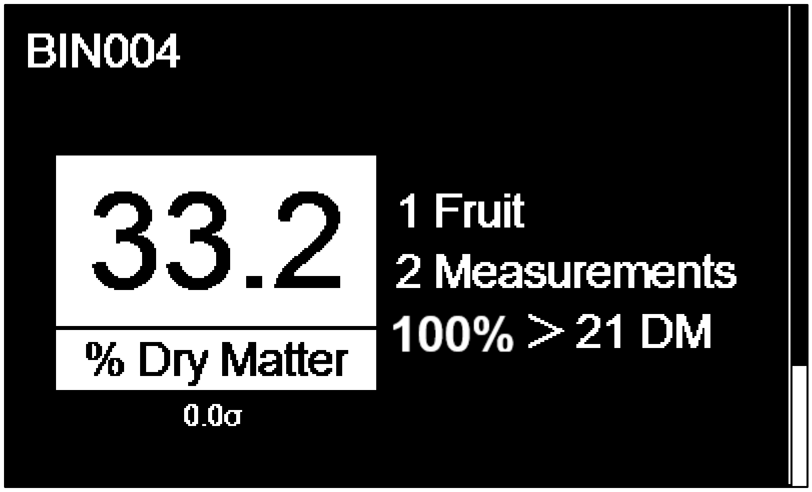
PostHarvest Mode provides summary statistics for measurements collected within a bin or lot.

These statistics include:

• average dry matter percentage
• standard deviation of all measurements within a bin
• number of fruit measured
• percentage of fruit above the maturity threshold

These statistics allow users to quickly evaluate the maturity distribution of fruit within a bin or intake lot and determine whether the fruit meets quality or maturity requirements.

Summary statistics are found in the **Bin** view:



10.5 Archiving Data [PostHarvest Mode]

When measurements for an intake session are complete, the dataset should be archived.

Archiving moves the measurement records and spectral files from the active data directory to an archive folder on the SD card. This helps keep the active dataset organized and preserves completed datasets for later analysis.

Detailed instructions for archiving datasets are provided in **Section 15 – Archiving Data**.

DataCollection Mode

DataCollection Mode Operation

DataCollection Mode is designed for structured dataset collection, such as research studies, calibration dataset development, or validation measurements. In this mode, measurements are organized using the hierarchy defined in the Batches.txt configuration file.

The typical structure for this workflow is:

Batch → Fruit → Side

This hierarchy allows users to group measurements into batches, track individual fruit within those batches, and record multiple measurement locations for each fruit.

The typical workflow in DataCollection Mode includes:

1. Navigating the batch hierarchy

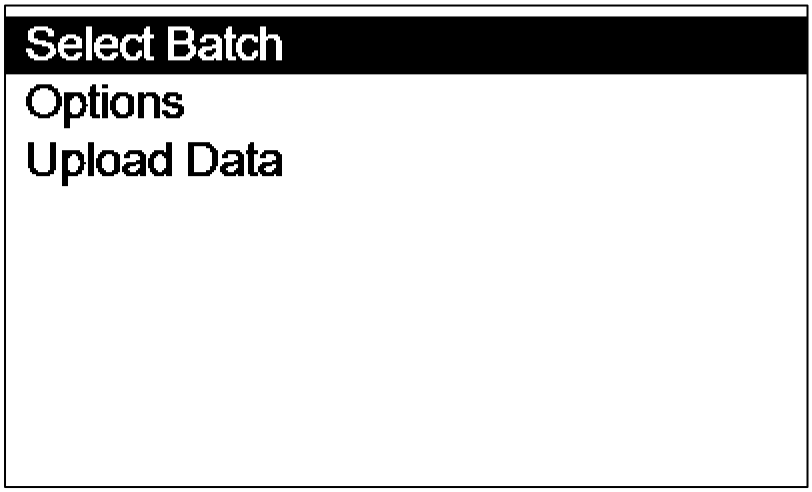
2. Measuring fruit

3. Reviewing and editing measurements

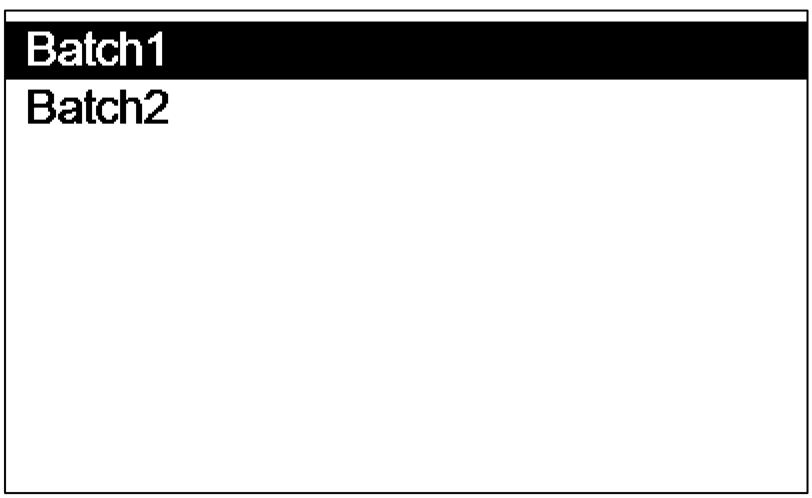
4. Archiving the dataset

11.1 Navigating the Batch Hierarchy [DataCollection Mode]

From the **Ready** splash screen, press **Right** to navigate to the DataCollection **Root Menu:**



Highlight a batch you wish to populate with measurements, then press **Right.**

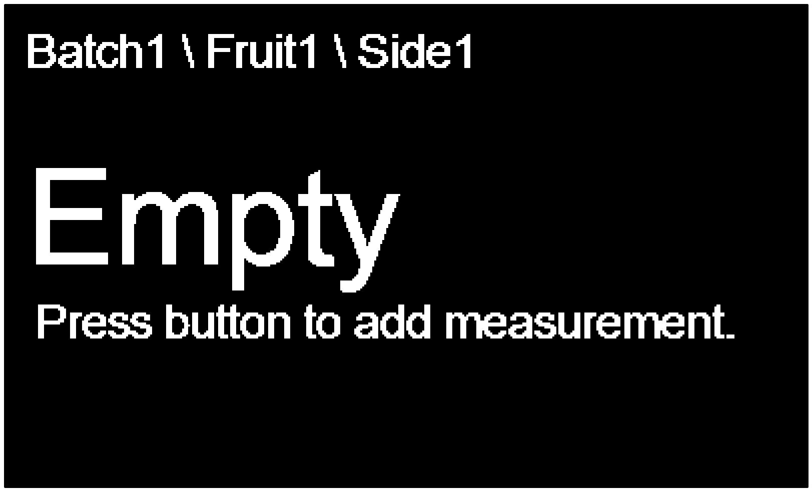


By default, this menu will show **Batch1** and **Batch2**. Users are encouraged to customize this list by editing the **Batches.txt** file to match existing organizational systems or naming schemes.

Once you have selected your batch, you will be taken to the **Fruit** level view. You can navigate between different fruit by using the **Up** and **Down** arrows.

Select the fruit number you wish to take measurements for and press **Right.**

You will now see options within the last level of the hierarchy, which is **Side**. Select which side of the fruit you wish to populate with measurements and press **Right**.



Once you have selected the side, you will be taken to the **Side** level view, from which you can begin to take measurements.

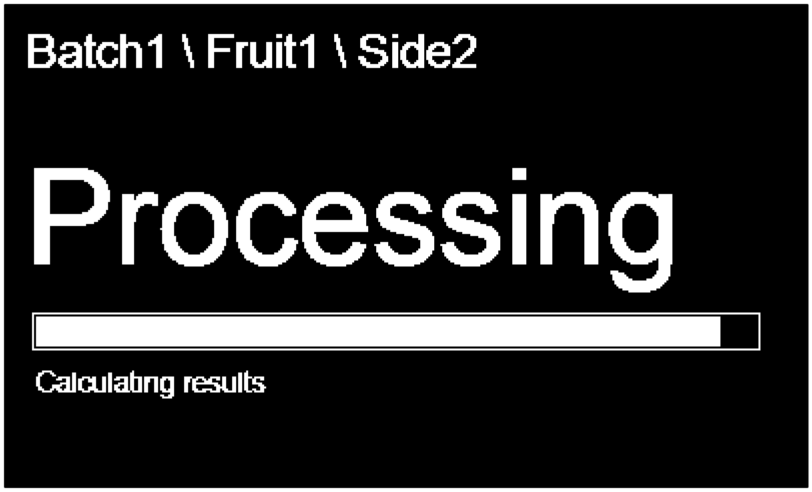
11.2 Recording Measurements [DataCollection Mode]

When you are ready to begin taking measurements, first ensure the top of the **Side** level screen aligns with the batch, fruit, and side you intend to collect data for.

Position the avocado so that the surface is pressed firmly against the measurement lens of the F-751.

Press the **Measure** button.

The instrument will begin the process of recording the spectral measurement of the avocado. The display will show what step of the measurement process is underway:



When the device screen transitions from **Recording** to **Processing**, it is safe to remove the avocado from the F-751 measurement lens.

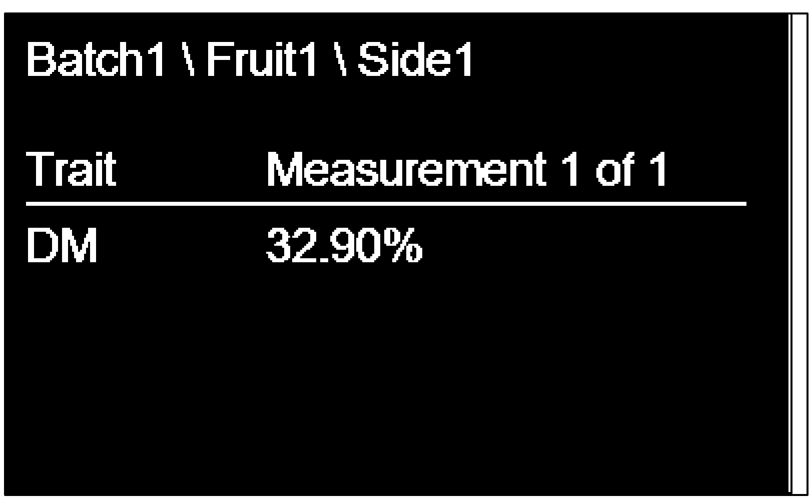
After the measurement is completed:

- the measurement is recorded in the **DataCollection_AppLog.txt** file
- the spectral data are saved as a .dat file within the Apps/DataCollection/Data directory

The display behavior depends on the **Show Measurement Details** setting described in **Section 8**. When measurement details are enabled, the predicted dry matter value is displayed after each scan. When disabled, the device displays a confirmation checkmark indicating the measurement was successfully recorded.

After the scan is completed, the instrument returns to the hierarchy level specified by the **Default Screen setting**.

Below is an example of the **Side** view with the **Show Measurement Details** option **Enabled**:



11.3 Reviewing and Editing Measurements [DataCollection Mode]

Measurements collected within a batch can be reviewed at any time during the data collection session.

If a measurement was taken incorrectly, it can be deleted from the dataset.

Deleting a measurement removes both:

- the entry in the DataCollection AppLog file
- the associated .dat spectral file stored on the SD card

Deleted measurements cannot be recovered unless the spectral files have been backed up elsewhere.

11.4 Archiving Records [DataCollection Mode]

When the dataset is complete, the measurements should be archived.

Archiving moves the measurement records and spectral files from the active data directory to an archive folder on the SD card. This helps keep the active dataset organized and preserves completed datasets for later analysis.

Detailed instructions for archiving datasets are provided in **Section 15 – Archiving Data**.

Part IV – Measurement Best Practices

Proper Measurement Technique

Accurate dry matter measurements depend on consistent and correct measurement technique. The AvoAI system measures avocado dry matter using near-infrared interactance spectroscopy. In this measurement method, near-infrared light enters the fruit tissue, interacts with the internal structure of the fruit, and a portion of the light is detected after passing through the fruit.

Because the measurement relies on detecting light that has traveled through the fruit tissue, proper positioning of the instrument and consistent measurement technique are important for obtaining reliable results.

Following the recommended measurement procedure helps ensure that the spectral data collected by the instrument accurately represent the internal composition of the fruit and that the AvoAI model generates consistent predictions.

12.1 Fruit Selection

When collecting measurements, select fruit that are representative of the population being evaluated. The goal of sampling is to capture the natural variation in maturity within the orchard block, bin, or batch being measured.

Avoid measuring fruit that are:

- severely damaged
- heavily bruised
- excessively dirty or wet
- unusually misshapen

If the fruit surface is dirty or wet, gently clean and dry the area before taking a measurement. Surface debris or moisture can interfere with consistent contact between the instrument and the fruit.

Selecting representative fruit improves the reliability of maturity estimates and summary statistics generated by the device.

12.2 Recommended Scan Locations

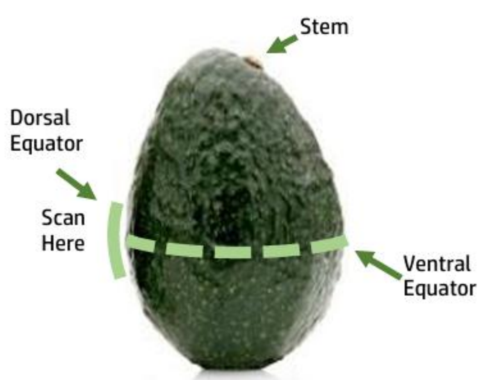
Scans should be taken near the **equatorial region of the avocado**, which is the widest portion of the fruit. This area generally provides the most representative measurement of internal fruit composition and minimizes interference from structural features of the fruit.

Avoid taking measurements near the:

- stem end
- blossom end
- highly curved or irregular areas of the fruit

Scanning near the ends of the fruit can increase variability because those regions often contain different tissue structures and may be closer to the seed.

When multiple scans are collected from a single fruit, measurements should be taken at different positions around the equator rather than repeatedly scanning the same location.



12.3 Number of Scans per Fruit

The number of scans collected per fruit depends on the measurement workflow and the level of accuracy required.

In most operational scenarios, **one scan per fruit** provides sufficient information for evaluating maturity within a population of fruit.

However, collecting **multiple scans per fruit** can help reduce measurement variability and provide a more representative estimate an individual fruit's internal composition. When multiple scans are taken, the fruit should be rotated slightly between scans so that each measurement is taken from a different location around the equator.

Multiple scans per fruit are commonly used when:

- collecting calibration datasets
- conducting research studies
- evaluating measurement repeatability

12.4 Seed Interference

The F-751 measures dry matter using near-infrared interactance spectroscopy, where light enters the fruit and travels through the mesocarp (flesh) before being detected by the instrument. For accurate measurements, the optical path should pass primarily through the mesocarp tissue.

If the avocado is too small, the mesocarp thickness at the equatorial region may not be sufficient to prevent the measurement path from reaching the seed. When the measurement light interacts with the seed, the resulting spectrum may differ from the spectral signature of the mesocarp tissue and can lead to inaccurate dry matter predictions.

For this reason, the AvoAI system should only be used on avocados of **size class 48** and larger.

If unusually small fruit must be measured, scans should be collected at the neck of the avocado towards the stem end of the fruit.

12.5 Surface Defects and Irregularities

Surface defects or irregularities can affect measurement quality by preventing consistent contact between the instrument and the fruit surface.

When the measurement window does not sit flush against the fruit, small gaps may allow external light or environmental factors to influence the measurement or cause the instrument to scan an unrepresentative portion of the fruit.

Avoid taking measurements on areas with:

- deep ridges or indentations
- significant bruising

- large scars or surface defects
- thick dirt or debris

Measurements should be taken on smooth areas of the fruit surface where the instrument window can maintain full contact with the fruit.

If the fruit surface is dirty or contaminated with debris, gently clean the measurement area before taking the scan.

12.6 Firmness Considerations

The AvoAI dry matter model is designed to measure **unripe avocados**. Measurements should therefore be taken when fruit are firm and physiologically unripe.

As avocados ripen, significant changes occur in the internal cellular structure of the fruit. These changes affect how light scatters within the fruit tissue, which can alter the spectral characteristics measured by the instrument.

Because the AvoAI prediction model was developed using spectra collected from unripe fruit, measurements taken on **soft or ripe avocados may produce unreliable predictions**.

For best results:

- measure fruit that are firm and unripe
- avoid measuring fruit that are soft or fully ripened
- ensure fruit have not entered advanced ripening stages

Maintaining this measurement condition ensures that the spectral data collected by the instrument matches the conditions used during model development.

12.7 Environmental Considerations

The F-751 instrument includes a built-in reference shutter that compensates for ambient light conditions. Because of this design, the instrument can be used reliably in a wide range of lighting environments, including indoor facilities, orchards, and direct sunlight.

However, other environmental factors can influence measurement quality and should be considered during operation.

Water exposure

The F-751 instrument is not waterproof and should not be exposed to rain or excessive moisture. Additionally, water on the fruit surface can affect measurements because liquid water scatters near-infrared light differently than fruit tissue.

Avoid taking measurements on fruit that are:

- wet from washing

- covered in condensation
- exposed to rain

If fruit surfaces are wet, dry the measurement area before scanning.

Temperature effects

Temperature can influence spectral measurements because changes in temperature affect both the optical properties of the fruit tissue and the instrument's spectral response.

The AvoAI model is not completely temperature independent. To maintain prediction accuracy, the instrument includes an **offset calibration procedure** that should be performed under the same environmental conditions in which measurements will be taken.

For best results:

- perform offset calibration at the temperature where measurements will occur
- if measuring fruit in cold storage, perform offset calibration in the cold storage environment
- if measuring fruit at ambient conditions, calibrate the instrument at ambient temperature

Matching the calibration conditions to the measurement environment helps ensure that the instrument produces accurate dry matter predictions.

For more on the **offset calibration** see **Section 13.3**.

Maturity Thresholds and Offset Calibration

The AvoAI system allows users to define a **maturity threshold**, which represents the minimum dry matter percentage considered acceptable for harvest or marketing. Measurements collected by the instrument can then be evaluated relative to this threshold.

In addition to maturity evaluation, the instrument includes an **offset calibration function**. This procedure allows users to correct for systematic differences between predicted dry matter values and local reference measurements or environmental conditions.

Offset calibration helps maintain prediction accuracy when measurement conditions differ from those used during model development.

13.1 Understanding Maturity Criteria

Dry matter percentage is a widely accepted indicator of avocado maturity. As the fruit develops on the tree, the dry matter content gradually increases. Many regulatory agencies and industry organizations define minimum dry matter levels that fruit must reach before they can be harvested or marketed.

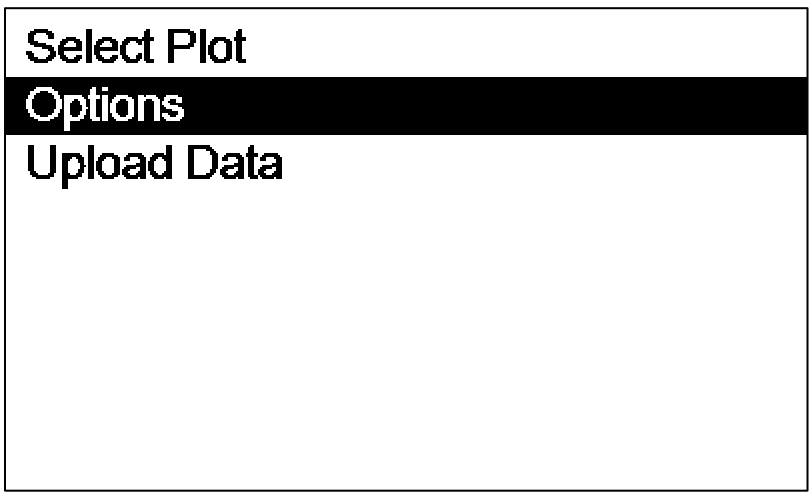
These maturity thresholds vary depending on factors such as:

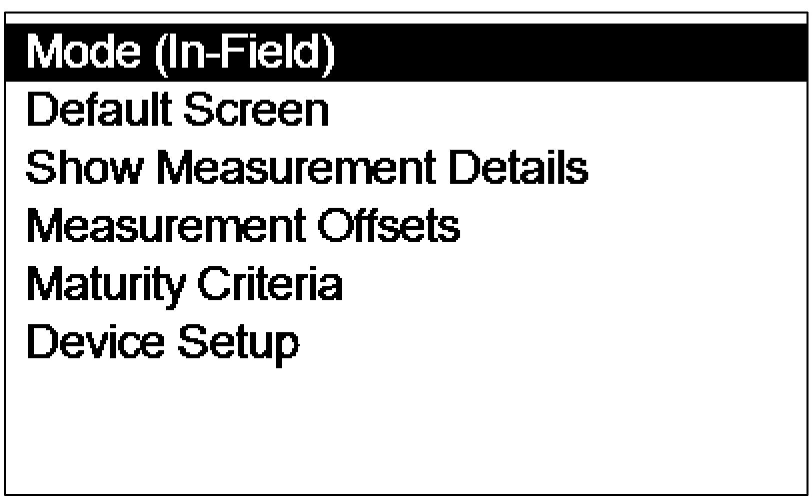
- avocado cultivar
- production region
- local regulations or marketing standards

For example, some avocado industries use dry matter thresholds around **20–23% dry matter** as a general maturity guideline for certain cultivars. However, specific thresholds should always follow the maturity standards established by the local industry or regulatory authority.

The AvoAI system allows users to set a maturity threshold so that measurements collected by the instrument can be evaluated relative to that target value.

This menu can be found in the **Options** menu located in the **Root Menu** of the InField and PostHarvest modes.





Use the **Up/Down** navigation buttons to highlight **Maturity Criteria** and press **Right**. Enter the dry matter value you wish to use, then press **Right** again to confirm.

13.2 Interpreting Percentage Above Threshold

When a maturity threshold is defined, the AvoAI system can calculate the **percentage of measurements that exceed the selected threshold**.

This value is displayed in the **Plot Summary** view in the **InField** mode, and in the **Bin Summary** view in the **PostHarvest** mode. It helps users quickly evaluate whether a group of fruit meets maturity requirements.

For example, if 100 fruit are measured and 78 of them have dry matter values above the selected threshold, the instrument would report **78% > threshold**.

This metric is useful for:

- orchard maturity surveys
- harvest readiness decisions
- evaluating maturity variation within a lot or block

A high percentage above the threshold indicates that most of the sampled fruit meet the defined maturity criterion, while a low percentage suggests that the fruit population may still be immature.

Users should interpret this value in the context of their sampling protocol and the maturity standards relevant to their operation.

13.3 Offset Calibration Overview

Offset calibration is a procedure that adjusts the predicted dry matter values produced by the AvoAI model to account for systematic differences between the instrument predictions and local reference measurements.

These differences can arise from several factors, including:

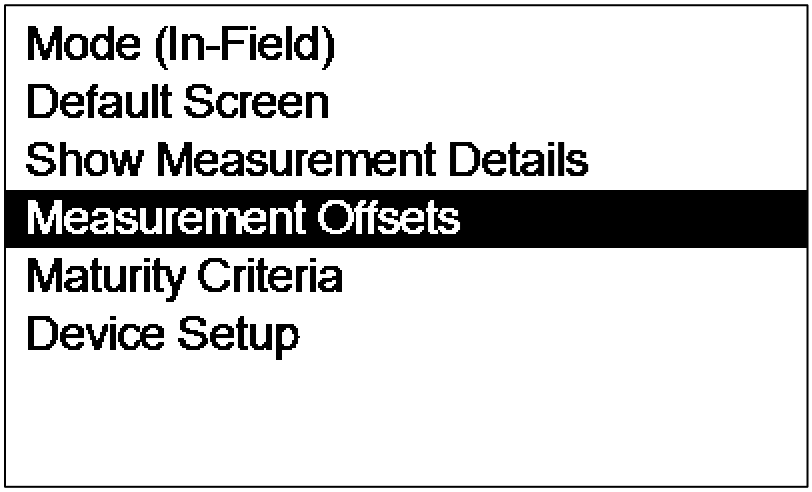
- temperature conditions during measurement
- differences between regional fruit characteristics and model training data
- variation between instruments

The offset calibration procedure applies a small correction to the predicted dry matter values so that they align more closely with reference measurements obtained from destructive dry matter testing.

Offset calibration is particularly important when measurement conditions differ from those used during model development. For example, if measurements are routinely taken on fruit coming directly from cold storage, performing offset calibration at cold storage temperature can improve prediction consistency.

When performing offset calibration, users should collect measurements from a representative sample of fruit and compare the predicted dry matter values with reference dry matter values obtained through laboratory analysis.

The calculated offset value is then entered directly on the device by accessing the **Options** menu from any mode:



Users can access a free step-by-step offset calibration protocol Excel workbook on the Felix Instruments website here: [F-751 Avocado Quality Meter Support Page - Downloads]

13.4 When to Contact Technical Support

In some cases, users may observe prediction results that appear inconsistent with expected dry matter values or historical measurements.

Before attempting to adjust calibration settings, users should verify that proper measurement procedures are being followed and that fruit being measured meet the recommended conditions described in **Section 12**.

Technical support should be contacted if:

- offset calibration does not resolve prediction discrepancies
- the instrument displays errors during measurement or calibration

Felix Instruments technical support can assist with diagnosing measurement issues, verifying instrument configuration, and determining whether additional calibration adjustments or software updates are required.

When contacting technical support, users should expect to provide:

- the instrument serial number
- the device firmware version
- AppLog files and spectral .dat files from the SD card

These files allow support personnel to review measurement conditions and assist in troubleshooting.

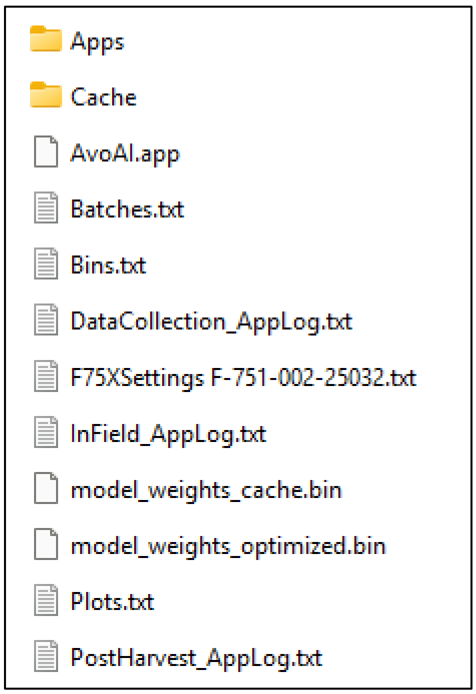
Part V – Data Access and Integration

Accessing Data via SD Card

All measurements collected by the F-751 AvoAI system are stored on the instrument's SD card. These data include both the **measurement summary records** and the **raw spectral data** used to generate dry matter predictions.

The measurement summaries are stored in **AppLog files**, while the raw spectral data are stored as .dat files within the Apps directory structure. These files can be accessed by removing the SD card from the instrument and inserting it into a **Windows PC**.

Users can review measurement results, perform additional analysis, or export datasets for research or modeling applications using these files.



14.1 Locating Measurement Files

Measurement data can be found on the SD card after it has been removed from the instrument and inserted into a Windows computer.

Two main types of files are generated during operation:

AppLog files

These files contain a running log of all measurements performed in each workflow mode. Examples include:

• InField_AppLog.txt

```
Timestamp          Measurement ID  Device ID       Plot     Latitude          Longitude        DM%
03/08/2026 23:44:07      ce09cab5-d91b-6be7-91c1-f2c5692a08cb     751-002-25032    Avocado\Hass\Plot1       0.00000 0.00000 32.88
```

• PostHarvest_AppLog.txt

```
Timestamp          Measurement ID  Device ID       Plot     Latitude          Longitude        DM%
03/08/2026 23:45:37      bd8c4bda-a845-cded-f5f1-638d23fddf1a     751-002-25032    Batch1\Fruit1\Side1\M001        0.00000 0.00000 32.90
03/08/2026 23:46:11      db99c968-e7cf-221c-d202-9697d6bc3b76     751-002-25032    Batch1\Fruit1\Side2\M001        0.00000 0.00000 32.82
```

• DataCollection_AppLog.txt

```
Timestamp          Measurement ID  Device ID       Plot     Latitude          Longitude        DM%
03/08/2026 23:40:36      b9e07ad5-53fd-2e73-c016-53d04fcc451d     751-002-25032    BIN004\Fruit1    0.00000 0.00000 33.22
03/08/2026 23:41:30      656ad466-06b5-9fb6-3530-f980ddcd4c30     751-002-25032    BIN004\Fruit1    0.00000 0.00000 33.23
03/08/2026 23:42:38      45012307-87eb-5a71-346f-b74c06f51129     751-002-25032    BIN005\Fruit1    0.00000 0.00000 33.16
```

Each entry in an AppLog file corresponds to a single measurement and includes columns for both metadata and measured data. The columns are as follows:

- **Timestamp** – the date and time when the measurement was taken
- **Measurement ID** – a unique identifier for the scan
- **Device ID** – the instrument serial number used for the measurement
- **Plot** – organizational hierarchy identifying information
- **Latitude** – measured GPS latitude coordinate. Only recorded if GPS is enabled.
- **Longitude** – measured GPS longitude coordinate. Only recorded if GPS is enabled.
- **DM%** - the dry matter value predicted by the AvoAI model.

For data analysis and post processing, the entire AppLog.txt file can be copied and pasted into a blank Excel workbook – the columns will automatically separate.

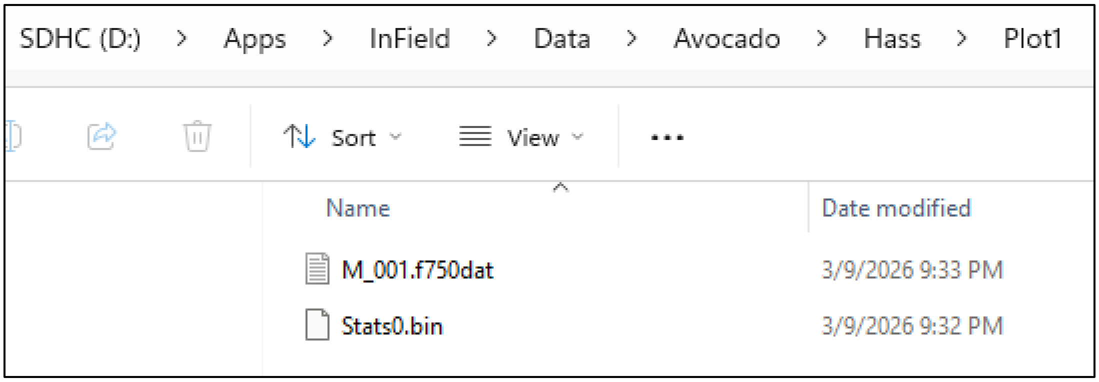
Spectral data files

The raw spectral measurements are stored as .dat files within the Apps directory structure:

```
Apps
 ├── InField
 │    ├── Data
 │    └── Archive
 ├── PostHarvest
 │    ├── Data
 │    └── Archive
 └── DataCollection
      ├── Data
      └── Archive
```

The **Data** folders contain spectra from active measurement sessions, while the **Archive** folders contain spectra that have been archived.

Within the **Data** folders, there will be a series of subfolders aligned with the organizational hierarchy of each workflow mode. Individual measurement .dat files can be located in the folder of the lowest level of the hierarchy and can be identified by the naming convention **M_00X.f750dat**.



Users are not expected to utilize the measurement .dat files unless they are asked to provide them to Felix Instruments for troubleshooting purposes.

Archiving Data

Archiving data organizes completed measurement sessions and moves associated measurement files from the active **Data** directory into a permanent **Archive** directory on the SD card.

During normal operation, measurement files are stored in the **Data** folder of the selected workflow mode. This folder contains the raw spectral .dat files organized according to the workflow hierarchy (for example, Plot → Fruit or Bin → Fruit).

When the user performs an archive operation, the instrument moves the measurement data into a time-stamped archive folder. This helps organize datasets and ensures that completed measurement sessions are preserved for later review, analysis, or export.

Archiving must be **performed manually by the user**. The device does not automatically archive measurement sessions.

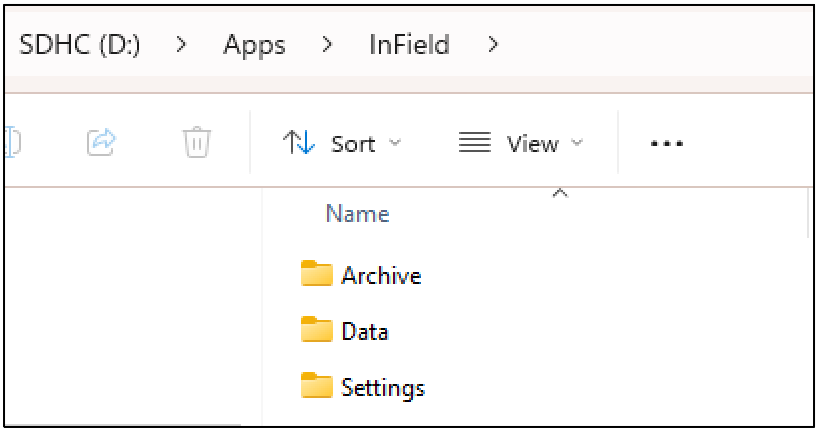
15.1 When to Archive Data

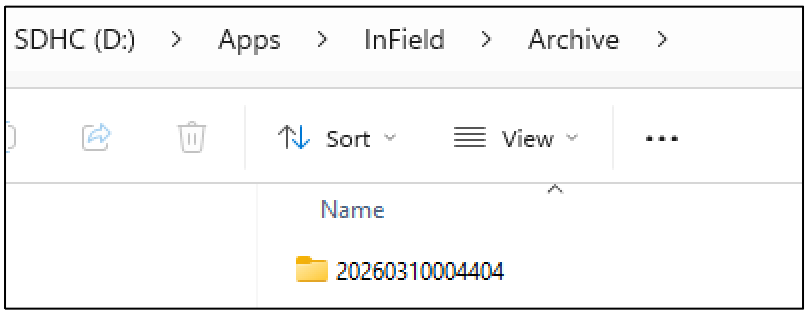
Users should archive data after completing a measurement session, such as:

- completing an orchard sampling survey
- finishing measurements for a packing house intake lot
- completing a research dataset collection

Archiving data after each session helps keep the active Data directory organized and prevents measurement files from accumulating across multiple sessions. It also prevents data from being mistakenly deleted.

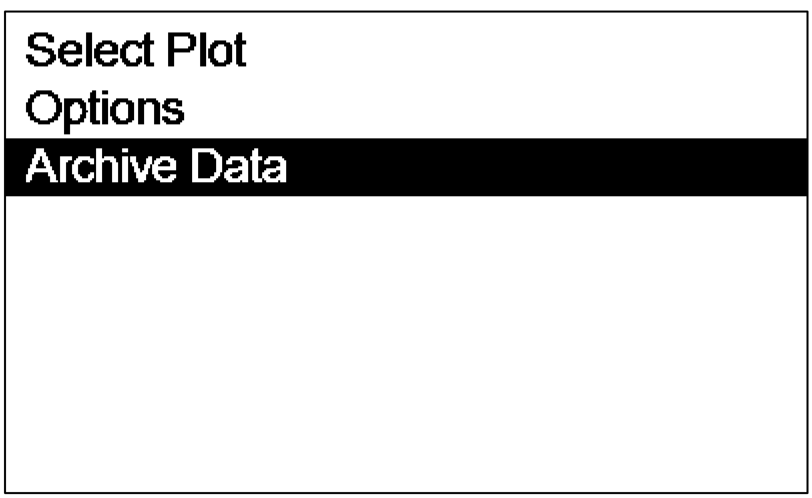
Archived datasets are easier to identify because each archive folder is labeled with the **date and time of the archive operation**.





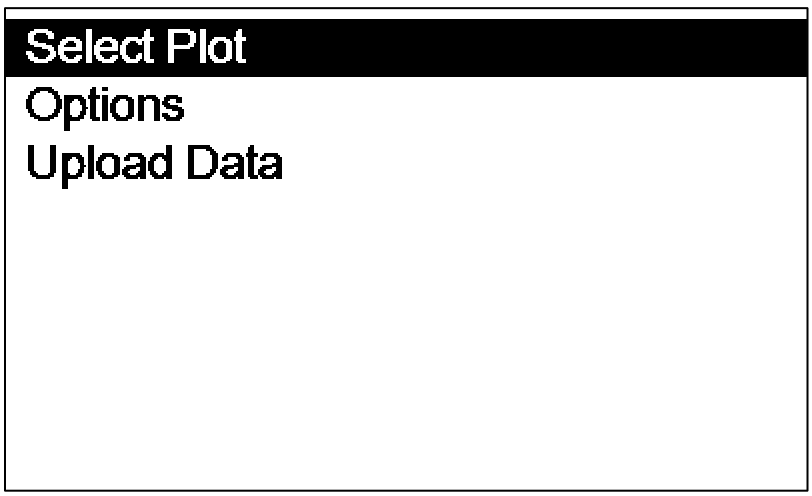
15.2 How to Archive Data

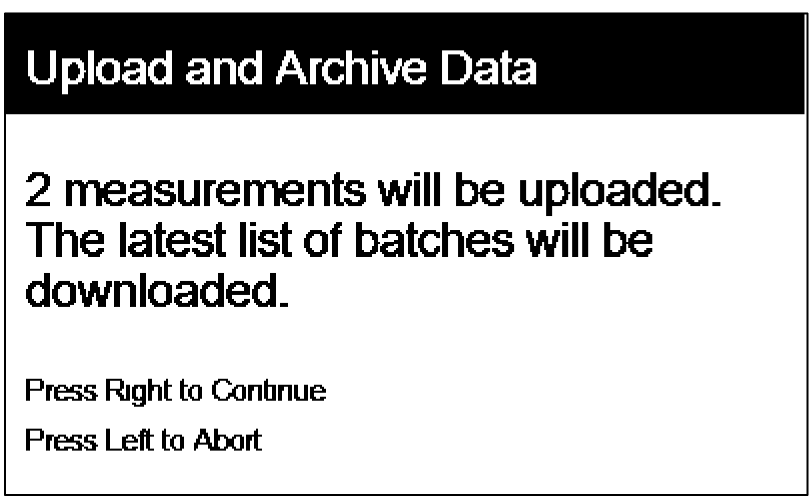
To archive measurement data, navigate to the **Root Menu** of any workflow mode and highlight **Archive Data**, then press **Right.**



The screen will inform the user how many measurements will be archived. This provides an opportunity for a quick quality check to ensure you have collected all of the measurements that you planned to. Pressing **Right** from this screen will execute the archiving function and is irreversible.

****NOTE**:** if either FruitMaps or Data Server options are **Enabled**, the **Root Menu** of all workflow modes will read as **Upload Data** instead of **Archive Data**. This action will execute data upload to Fruitmaps or the designated Data Server, and will simultaneously archive the data on the SD card.





15.3 Archived Data Structure

Archived datasets are stored in the following directory structure on the SD card:

```
Apps
 └── <Mode>
      └── Archive
           └── YYYY-MM-DD_HH-MM-SS
                 └── <hierarchy folders>
                       └── measurement.dat
```

The internal folder hierarchy inside the archive directory matches the structure defined by the workflow configuration files. For example:

```
Apps
 └── InField
      └── Archive
           └── 2026-03-10_14-32-05
                └── Avocado
                     └── Hass
                          └── Plot1
                               ├── M_001.dat
                               └── M_002.dat
```

Preserving the hierarchy allows users to easily identify where each measurement was collected within the workflow structure.

15.4 AppLog Files and Archived Data

The AppLog files used by the AvoAI system are **not moved during the archive process**.

The AppLog files remain in the **root directory of the SD card** and continue to record measurements performed in each workflow mode.

These files contain the measurement summaries and predicted dry matter values for all scans performed in that workflow mode.

The archived spectral .dat files correspond to the measurement records contained in the AppLog files. Together, these files allow users to review measurement results and reconstruct datasets if necessary.

Data Server Integration

The AvoAI system supports optional integration with external data servers. This functionality allows measurement records collected by the instrument to be automatically uploaded to a centralized server when datasets are archived.

Using a data server allows organizations to:

- centralize measurement records from multiple instruments
- automatically back up measurement datasets
- integrate measurement data with external software systems
- enable remote monitoring of avocado maturity data

Data uploads occur through the instrument's **Wi-Fi connection**. Once configured, datasets can be transmitted automatically whenever measurements are archived on the device.

16.1 Overview of Data Server Functionality

The F-751 can transmit archived measurement records to an external server through a wireless network connection.

When this feature is enabled:

1. Measurement data are collected during normal device operation.

2. Data remain stored locally on the SD card while measurements are being taken.

3. When the user uploads a dataset, the instrument automatically archives the records locally on the SD card and then transmits the archived folder to the designated data server.

This process ensures that the device maintains a local backup of all measurement data while simultaneously transferring records to a centralized storage location.

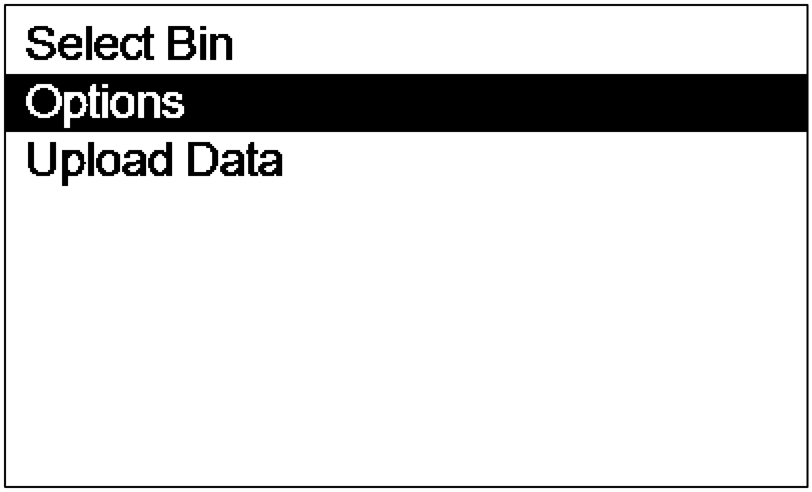
16.2 Connecting to a Wireless Network

Before measurement records can be uploaded to a data server, the instrument must be connected to a wireless network.

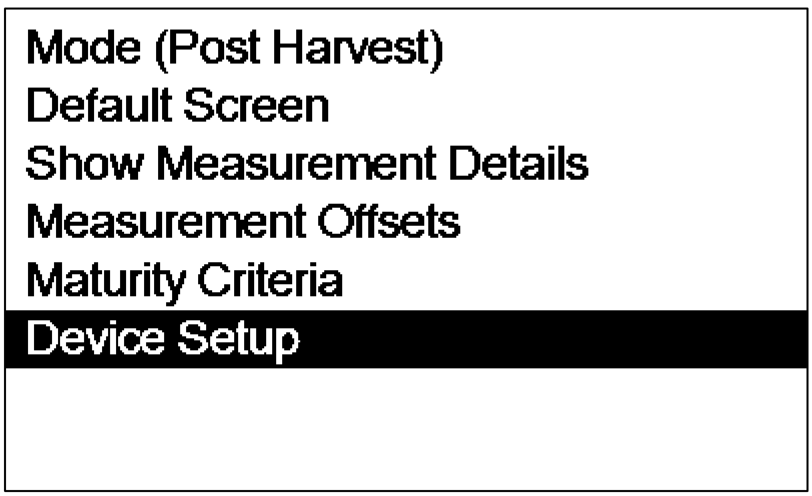
To connect the instrument to Wi-Fi:

1. Navigate to the **Root Menu** of any workflow mode.

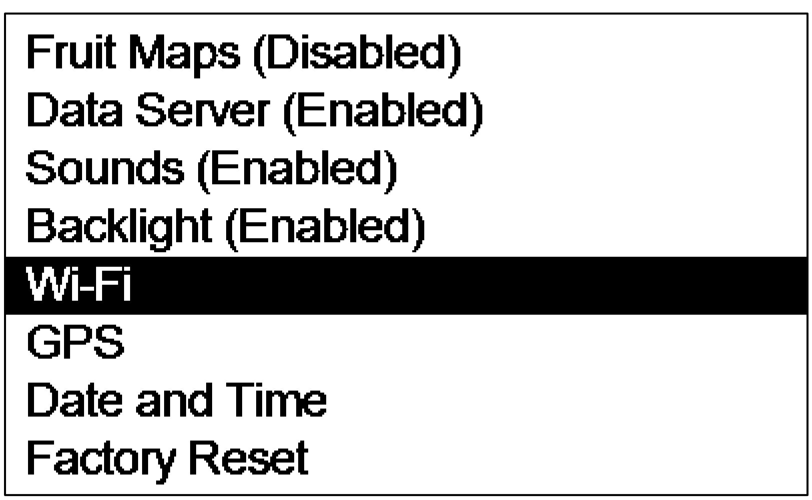
2. Select **Options**.



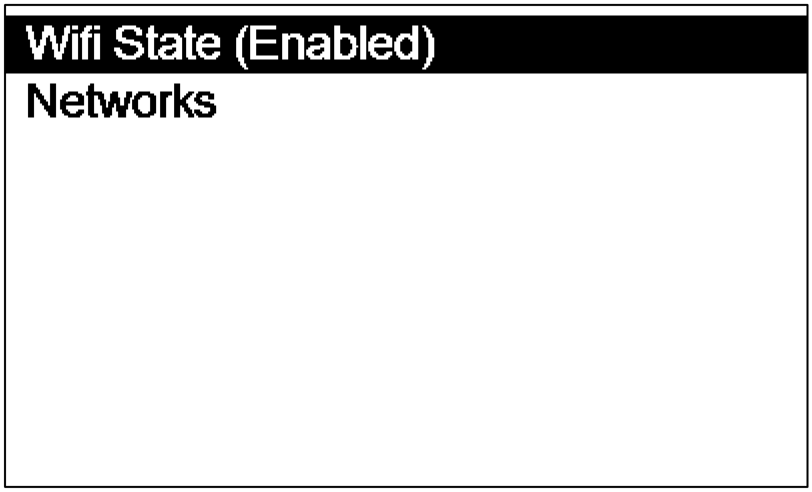
3. Navigate to **Device Setup**



4. Select Wi-Fi



5. Ensure the **Wi-Fi State** is set to **Enabled**.



6. Select **Networks** to view available wireless networks.

7. Choose the desired network.

8. Enter the network password using the device interface.

Once connected, the instrument will maintain the wireless connection while the device is powered on.

16.4 Setting Up the Data Server

Each instrument comes with a unique account specific to its serial number. Please contact Felix Instruments Support at support@felixinstruments.com for step-by-step instructions on how to set up your data server.

16.5 Configuring Data Server Settings

After connecting to a wireless network, the instrument must be configured with the appropriate data server settings.

These settings are accessible through the **Device Setup** menu.

From this menu, users can:

- enable or disable communication with a data server
- specify server connection parameters

Data server configuration is typically performed during device setup or deployment within an organization.

If your organization uses centralized data collection infrastructure, your system administrator will provide the appropriate configuration settings.

FruitMaps Integration

FruitMaps is a free web-based orchard management system developed by Felix Instruments, Agricultural Robotics, and Central Queensland University that allows users to visualize, organize, and analyze avocado dry matter measurements collected with the F-751.

When FruitMaps integration is enabled, measurement datasets archived on the instrument can be automatically uploaded to the FruitMaps platform through a wireless network connection.

Using FruitMaps allows users to:

- centralize measurement records from multiple instruments
- visualize maturity trends across orchards or lots
- share measurement data with team members
- maintain long-term records of sampling activities

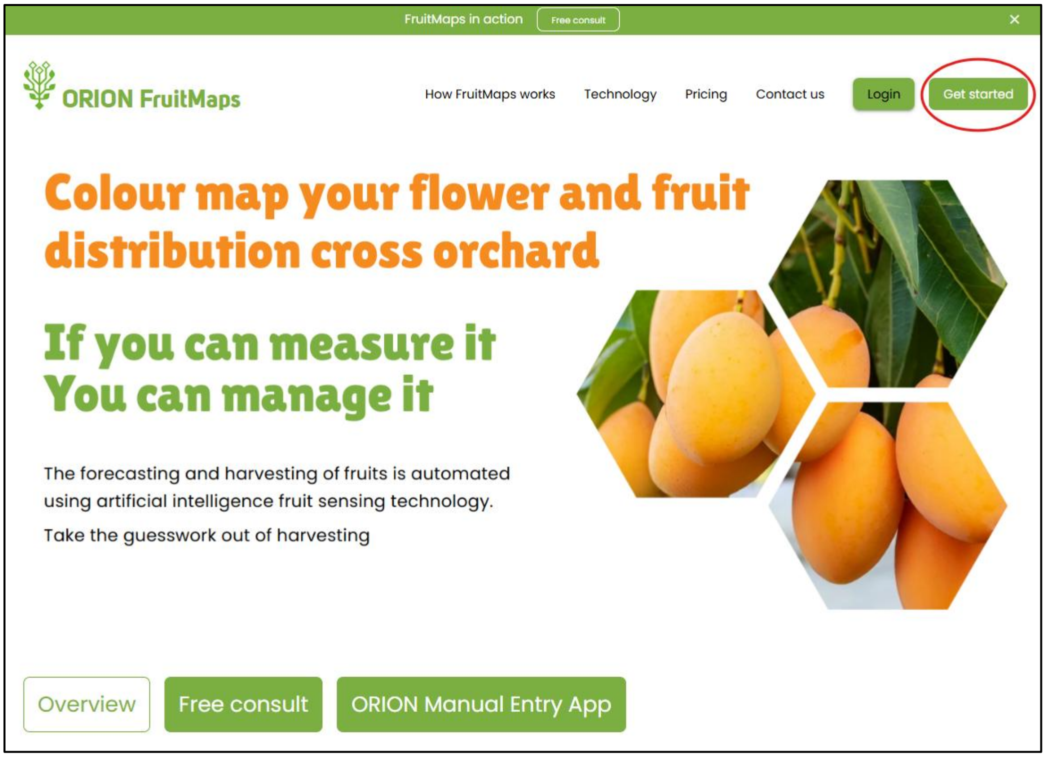
FruitMaps integration requires a valid FruitMaps user account and an active wireless network connection on the instrument.

17.1 Creating a FruitMaps Account

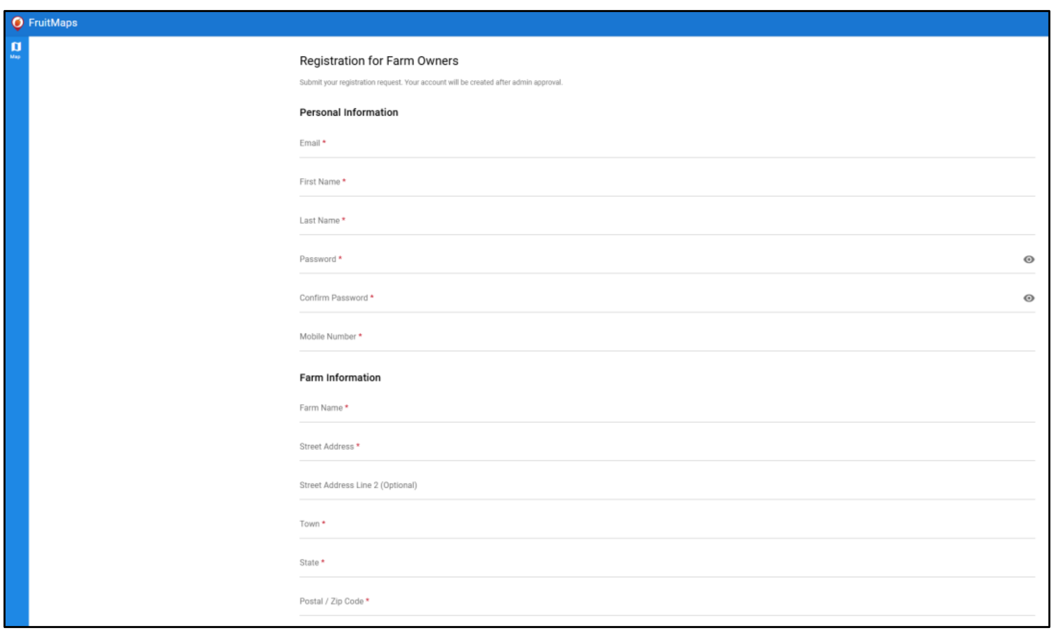
Before uploading measurement data, a FruitMaps account must be created.

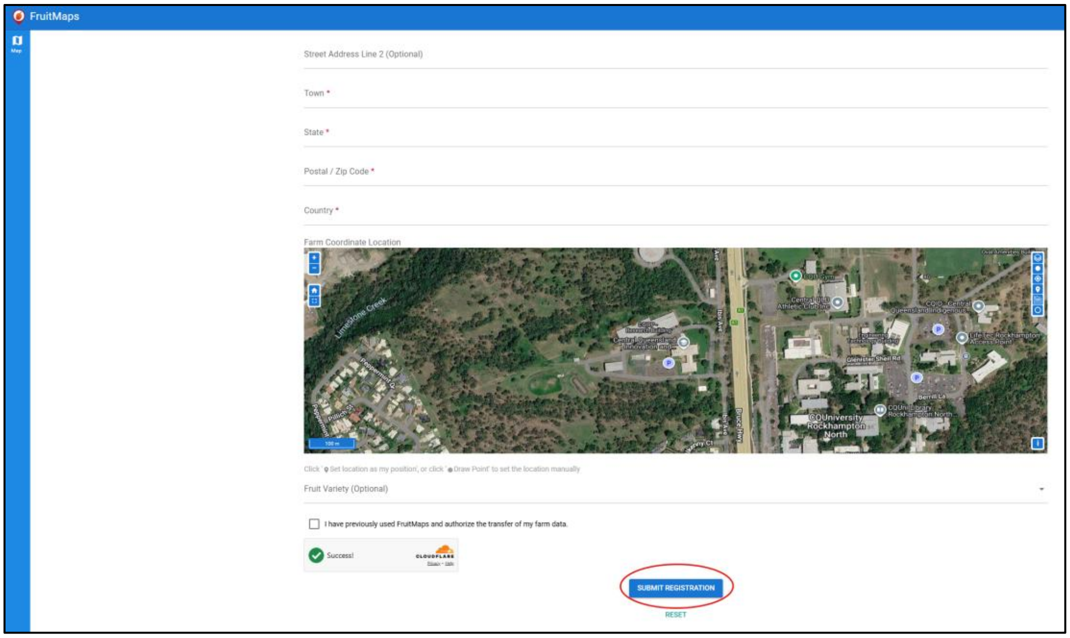
To create an account:

1. Open a web browser and navigate to **www.fruitmaps.com**.
2. Select **Get Started**.



3. Enter the required account information.





4. Confirm the account through the verification email sent to the registered email address.

Once the account has been created, users can log in to the FruitMaps platform and establish farms/orchards, and individual blocks.

It is highly recommended that users that wish to utilize FruitMaps upload capabilities review the FruitMaps user manual, which is available to view directly from the website.

17.3 Enabling Upload to FruitMaps

After creating a FruitMaps account and connecting the instrument to a wireless network, the device can be configured to upload archived datasets automatically.

Enabling FruitMaps upload is similar to enabling Data Server upload:

1. Navigate to the **Root Menu** of any workflow mode and select **Options**
2. Select **Device Setup**.
3. Navigate to **FruitMaps.**
4. Choose **Enable** and press **Right**.

When this setting is enabled, the instrument will automatically upload measurement datasets to FruitMaps whenever a dataset is archived.

17.4 Viewing Data Online

Once measurements have been uploaded, they can be accessed through the FruitMaps web interface.

To view uploaded data:

1. Navigate to **www.fruitmaps.com**.
2. Log in to your FruitMaps account.
3. Open the dashboard to view measurement datasets.

Within FruitMaps, users can:

- review uploaded measurement records
- analyze maturity trends across sampling locations
- visualize data from multiple measurement sessions
- export datasets for additional analysis

Uploaded datasets typically appear in the FruitMaps dashboard shortly after the archive process has been completed.

A comprehensive overview of FruitMaps features can be found on the Felix Instruments YouTube channel here: FruitMaps Feature Walkthrough Video

Part VI – Device Administration

Device Settings

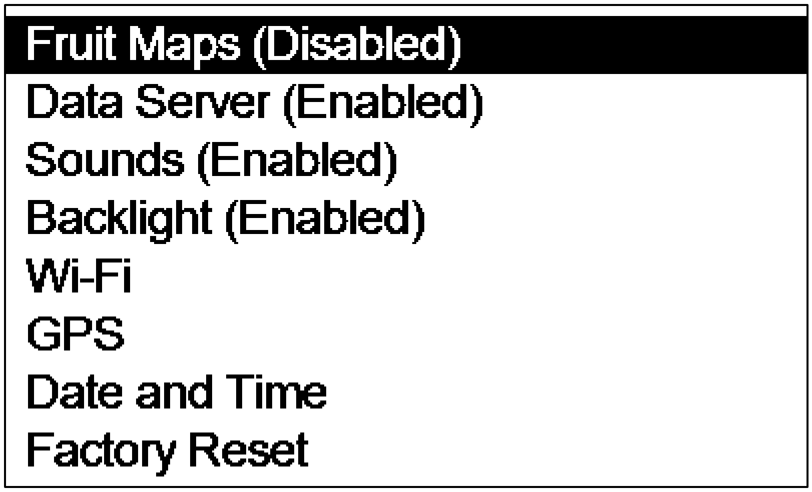
Device settings control general system behavior such as date and time, language, display settings, wireless connectivity, and network configuration.

All device settings are accessed through the **Device Setup** menu.

To access device settings:

1. From the **Root Menu** of any workflow mode, navigate to **Options → Device Setup**.
2. Press **Right** to open the Device Setup menu.
3. Use the navigation buttons to scroll through the available settings.

Most device settings can be adjusted directly from this menu using the device navigation controls.



18.1 Available Device Settings

The Device Options menu includes several configurable settings that control instrument behavior:

- **FruitMaps Settings** – Configures optional automatic data upload to FruitMaps.
- **Data Server Settings** – Configures optional automatic data upload to external servers.
- **Sounds** – Enables or disables audible feedback during device operation.
- **Backlight** – Controls display backlight behavior.
- **Wi-Fi Configuration** – Connects the instrument to a wireless network.
- **GPS Settings** – Enables or disables GPS location recording (if available).
- **Date and Time** – Sets the system clock used for timestamps in measurement records.
- **Factory Reset** – Used in troubleshooting operations with Felix Instruments Support Team.

Most users will only need to adjust these settings during initial device setup.

Maintenance and Care

Proper maintenance and handling of the F-751 AvoAI system will help ensure reliable operation and accurate measurements over the lifetime of the instrument.

The F-751 is designed for field use but contains sensitive optical and electronic components. Users should follow the guidelines in this section to prevent damage and maintain optimal performance.

Routine maintenance for the instrument is minimal and primarily consists of proper storage, cleaning of the optical window, and careful handling during field measurements.

19.1 Cleaning the Optical (Measurement) Window

The optical window located on the measurement head must remain clean to ensure accurate spectral measurements.

If the window becomes dirty due to dust, fruit residue, or debris, gently clean it using a **soft lint-free cloth**.

If necessary, the cloth may be slightly dampened with **water or a mild alcohol solution**.

When cleaning the window:

- do not apply excessive pressure
- avoid abrasive materials or paper towels
- ensure the window is dry before performing measurements

Keeping the optical window clean helps prevent measurement interference caused by surface contamination.

19.2 Handling and Storage

When not in use, the instrument should be stored in its **protective carrying case** to prevent damage.

Users should avoid exposing the instrument to:

- excessive vibration or impact
- extreme temperatures
- prolonged exposure to moisture or rain

The instrument should always be powered off before transporting or storing it.

Proper handling will help prevent damage to internal components and maintain long-term measurement stability.

19.3 Environmental Protection

The F-751 is designed for field use but **is not waterproof**.

Users should avoid operating the device in conditions where it may be exposed to rain or standing water.

In addition, water present on the fruit surface can interfere with spectral measurements by altering light scattering. Fruit surfaces should be **dry before performing measurements**.

If the instrument becomes wet, power it off immediately and allow it to dry completely before using it again.

19.4 Battery Care

The F-751 is powered by **two removable rechargeable lithium-ion batteries**.

Each battery has the following specifications:

- **Type:** 18650 lithium-ion
- **Capacity:** 3500 mAh
- **Nominal Voltage:** 3.6 V
- **Energy:** 12.6 Wh

The instrument is supplied with **two complete sets of batteries** and a **dedicated battery charger**. This allows users to operate the instrument with one set of batteries while the second set is charging.

When the batteries require recharging, remove them from the device and place them in the supplied charger. Charging typically requires several hours depending on the remaining battery capacity.

Additional batteries and chargers may be purchased from **Felix Instruments**. Users may also purchase replacement batteries from other suppliers, provided the batteries match the exact specifications listed above.

When using replacement batteries, ensure that:

- the batteries are **18650 lithium-ion cells**
- the **capacity is approximately 3500 mAh**
- the **nominal voltage is 3.6 V**

Using batteries that do not meet these specifications may result in reduced performance or potential damage to the device.

For best battery performance:

- use only batteries that match the required specifications
- store batteries in a cool, dry location when not in use
- avoid exposing batteries to excessive heat or moisture
- replace batteries that show signs of damage or abnormal performance

If battery performance decreases significantly or if the batteries fail to charge properly, contact Felix Instruments technical support for assistance.

19.5 Firmware Updates

Firmware updates may periodically be released to improve device performance or add new features.

If a firmware update is available, Felix Instruments technical support will provide instructions for installing the update.

Users should not attempt to modify or replace firmware files unless instructed by Felix Instruments support personnel.

Part VII – Troubleshooting and Support

Troubleshooting Guide

This section provides basic troubleshooting steps for resolving common operational issues with the F-751 AvoAI system.

If the instrument behaves unexpectedly or becomes unresponsive, restarting the device will often restore normal operation.

If the issue persists after following the troubleshooting procedures described below, contact Felix Instruments Technical Support for further assistance.

20.1 Device Reset Procedure

If the instrument becomes unresponsive or encounters an unexpected error, perform a manual reset using the following procedure.

1. Press and hold the **Power On/Off button** for approximately **20 seconds**.
2. Release the button and wait **two seconds**.
3. Press the **Power On/Off button again** to restart the instrument.

The device should reboot and return to normal operation.

20.2 Additional Troubleshooting Resources

Additional troubleshooting resources, documentation, and frequently asked questions are available on the Felix Instruments website.

Visit:

https://felixinstruments.com/food-science-instruments/nir-spectroscopy/f-751-avocado-quality-meter/support/

Technical Support

If you require assistance with the F-751 or AvoAI system, Felix Instruments provides technical support through multiple channels.

Email support is available at:

support@felixinstruments.com

Felix Instruments contact information:

Mailing Address

Felix Instruments – Applied Food Science
1554 NE 3rd Ave
Camas, WA 98607
USA

Phone
+1 (360) 833-8835

Fax
360-833-1914

When contacting technical support, please be prepared to provide:

- instrument serial number
- instrument firmware version
- description of the issue
- relevant measurement files (AppLog or spectral .dat files if requested)

Providing this information will help the support team diagnose and resolve issues more efficiently.

Warranty Information

Felix Instruments – Applied Food Science warrants new equipment of its own manufacturing against defective workmanship and materials for a period of **one year from the date of sale**.

This warranty does not cover damage caused by:

- misuse or improper handling
- neglect or improper maintenance
- accidental damage
- corrosion or environmental exposure
- unauthorized repair or modification

Felix Instruments' liability is limited to repair or replacement of defective components at the factory where the instrument was originally manufactured.

Repair or alteration by unauthorized personnel will void the warranty.

All warranty repairs require a **Returned Material Authorization (RMA)** number. Customers must contact Felix Instruments Technical Support to obtain an RMA before returning any instrument for service.

Return address for warranty service:

Felix Instruments – RMA # *XXXX*
1554 NE 3rd Ave
Camas, WA 98607
USA

Customers are responsible for shipping the instrument to Felix Instruments. Felix Instruments will cover return shipping costs for repairs performed under warranty.