



SOIL HEALTH MONITORING TOOL  
USER MANUAL v1.2

[support@pestechнологies.com](mailto:support@pestechнологies.com)

Tel: 01480 759812



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## 1. Important Safety Instructions

### READ THIS INSTRUCTION MANUAL CAREFULLY BEFORE USING THE PRODUCT

- The product consists of an Electronic Reader Unit (ERU), a cassette containing a reel of sensors and an App for a mobile device (not provided)
- Always include this instruction manual when passing the product on to a third party
- Do not use an obviously defective product
- Do not use the product where Bluetooth® wireless transmission is not permitted

### SAFETY MESSAGES

The following safety guidelines are intended to prevent unforeseen risks or damage from unsafe or incorrect operation of the product.



This symbol is displayed to indicate matters and operations that can cause risk. Read the part with this symbol carefully and follow instructions to mitigate risk.



#### **WARNING**

This indicates that a failure to follow the instructions can cause serious injury or damage.



#### **CAUTION**

This indicates that a failure to follow the instructions can cause minor injury or damage or effect the performance of the unit.



#### **WARNING**

This product contains Lithium-ion battery cells. Follow the warning information provided below to prevent incidents such as fire, explosions or damage:

- Do not expose the device to excessive physical impact
- Do not pierce the device with sharp objects
- Do not use the product in ambient temperatures greater than 40°C
- Do not store in ambient temperatures greater than 50°C or below -10°C
- Do not expose the device to liquid chemicals
- Do not charge batteries at battery temperatures greater than 45°C
- This product contains magnesium sulphate crystals. Avoid contact with eyes. If this occurs, flush with water
- This product is not intended for use by children



## CAUTION

- Do not remove the cassette drawer while the unit is powered on
- If any part of the casing is cracked, do not use and instead call PES Technologies
- Do not expose the device to water moving with force
- Do not immerse the device in water
- If the device gets wet, dry with a cloth
- If the device requires cleaning, use a damp cloth to wipe it
- Do not operate with the base of the ERU at angles greater than 30°
- Do not open the device. If faulty contact, [support@pestechologies.com](mailto:support@pestechologies.com) for further instructions
- Do not move excessively or shock the ERU during a test. It is permissible to walk with the unit while a test is running
- Do not use the device in close proximity to areas of high emissivity, such as pylons and powerlines, as readings may be affected



## INTENDED USE/LIABILITY

- This product is designed for use with mobile devices (e.g. mobile phones, tablets) that support wireless communications via Bluetooth®. This device is intended to work with Bluetooth® 5.0 and above. Performance cannot be guaranteed on devices running lower than Bluetooth® 5.0. There is no compatibility below Bluetooth® 4.1
- It is considered improper use when this product is used for anything other than its intended purpose

## CARING FOR THE ENVIRONMENT



- This crossed-out wheeled bin symbol indicates that waste electrical and electronic equipment (WEEE) should be disposed of at specialised recycling centres or returned to your supplier for correct disposal. Do not dispose of the product with household waste
- Your old device may contain reusable parts that could be used to repair other products as well as other valuable materials that can be recycled to conserve limited resources

Please report any issues to [support@pestechologies.com](mailto:support@pestechologies.com)

## 2. Performance Criteria

### FUNCTIONAL OPERATION

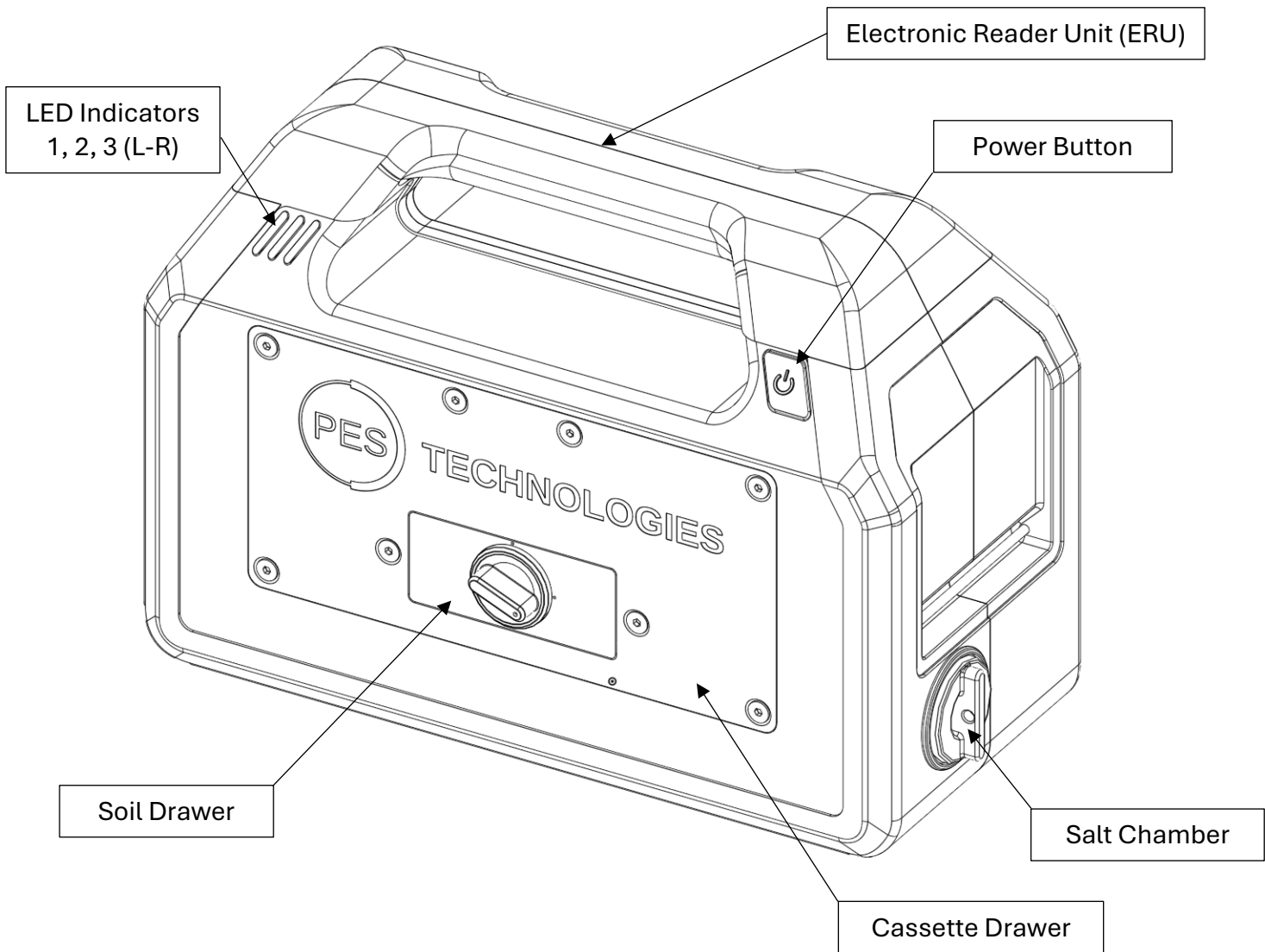
The Soil Health Measurement Tool consists of an Electronic Reader Unit (ERU), a Mobile Application (App) called ScentsCheck, and a Cloud-based database communicating with a Machine Learning Algorithm (MLA) on a controlled Machine Learning Server.

- The ERU receives instructions from the App and executes these instructions to deliver a Sample Results File (SRF) back to the App. The instructions sent by the App and the file format received by the App cannot be changed by the User; these are predetermined formats to ensure that the test is carried out consistently
- The ERU is considered to be functioning normally if it is receiving the instructions, executing these and transferring the SRF back to the App
- It is permissible for the ERU to transmit a file containing noise introduced from external sources. The data processing and MLA provide immunity to the final result
- A sensor check must be passed before the test can commence. A small set of data is taken by the ERU and analysed in the App to ensure the sensor is showing all channels and no short circuits
- The ERU is designed to work with the base horizontal. An angle of 30° (degrees) to the horizontal in either direction is permissible
- The App allows the User to add Meta data to the results file. This data includes attributes such as a Farm Name, Field Name and Test Name
- The App initiates a test, receives the SRF, formats the data and sends this to the cloud database
- The Cloud database logs this data and sends this onto the Machine Learning Server, which in turn processes the data through the MLA. The processed data is returned to the Cloud database as a set of results to log against the original data. The results are then sent back to the App to be viewed by the User
- The Cloud database and the Machine Learning Server are responsible for the quality of the results provided to the user
- The user is responsible for the interpretation of the results and any actions taken in response to the results

### SPECIFICATIONS

- Dimensions: 295mm W x 130mm D x 200mm H
- Weight: 3.2kg
- Operational temperature range: 5°C to 40°C
- Operational humidity range: 20% to 90% non-condensing
- Storage temperature range: -10°C to 50°C
- Storage humidity range: 0% to 90% non-condensing
- Battery: 16.8V lithium-ion
- Low voltage shut-off: 3.5V
- Charging: USB Type-C port with Power Delivery Support
- Charging Time: 8 hours from fully discharged
- Communication to mobile device: Bluetooth® Low Energy (BLE)
- Operational angle: <30° from horizontal on the base

### 3. The Soil Health Measurement Tool

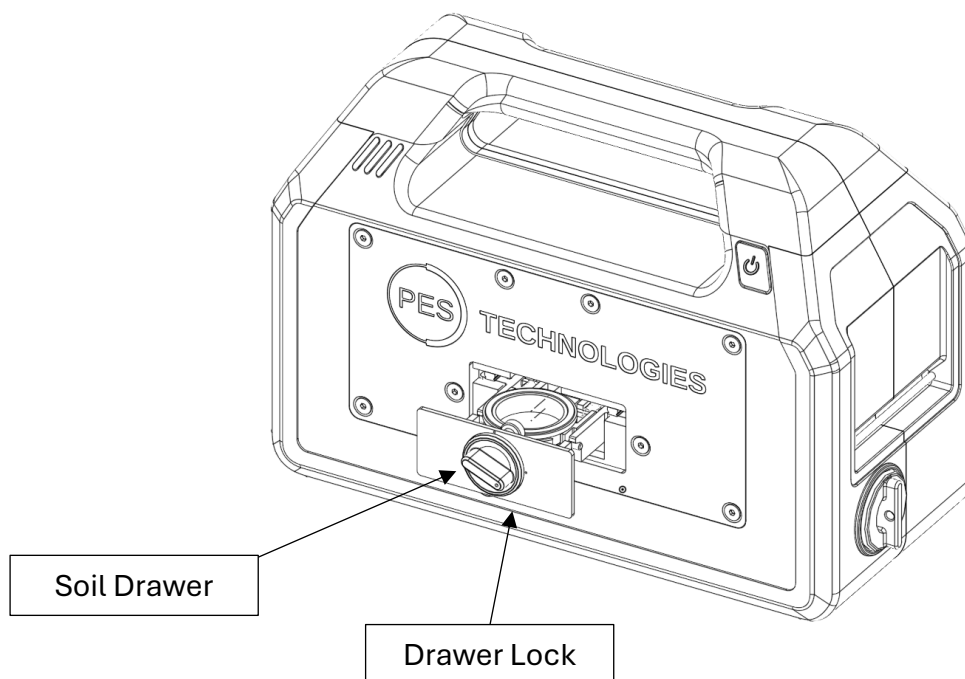


## 4. Preparing a Test

To prepare a soil sample, using a trowel or soil auger, remove the top 5cm of soil and discard. Take a sample from the 5cm to 15cm depth of soil. While it is possible to take just a teaspoon of soil from the ground, PES recommends taking a larger sample (e.g. by taking multiple cores from the same area), putting it in a bucket and mixing. This will enable any localised variations to be averaged in your test sample, providing a more accurate result.

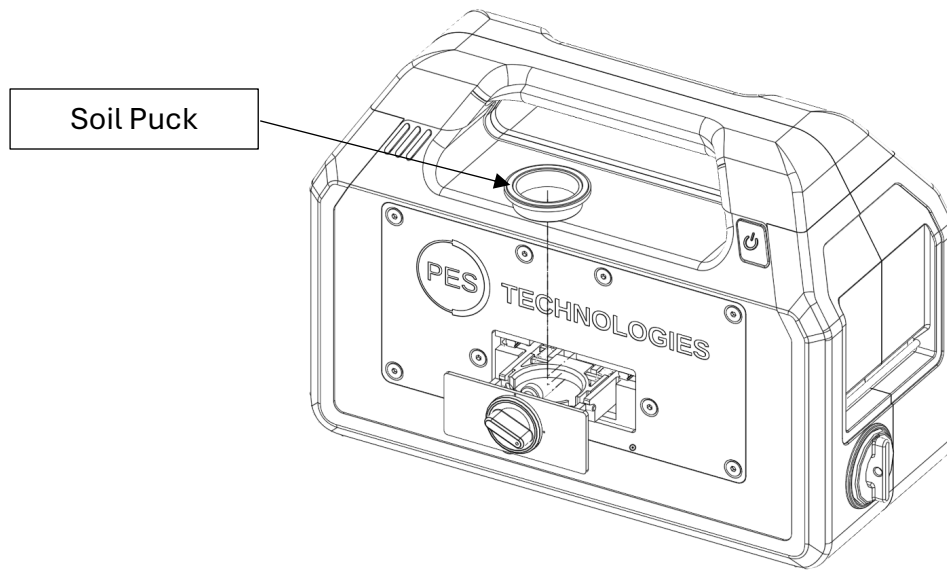
For an instructional video, visit [www.pesttechnologies.com](http://www.pesttechnologies.com).

It should be noted that no two samples of soil are the same, and therefore small discrepancies in the results between two samples taken from the same averaged soil should be expected.



- To open the soil drawer, rotate the drawer lock counter-clockwise and pull
- To close the soil drawer, push the drawer in and then rotate the drawer lock clockwise

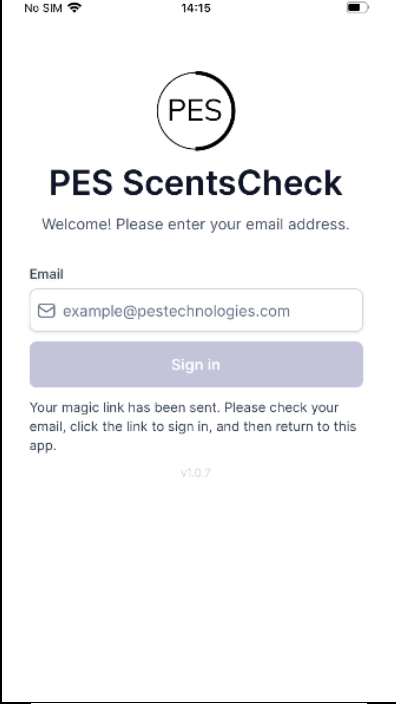
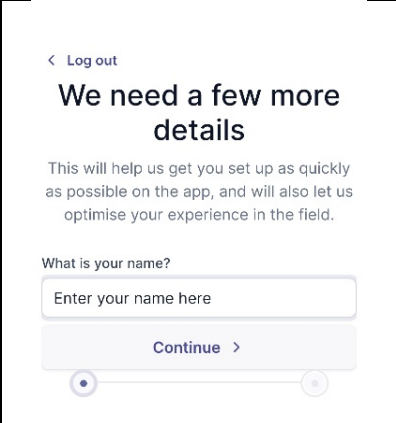


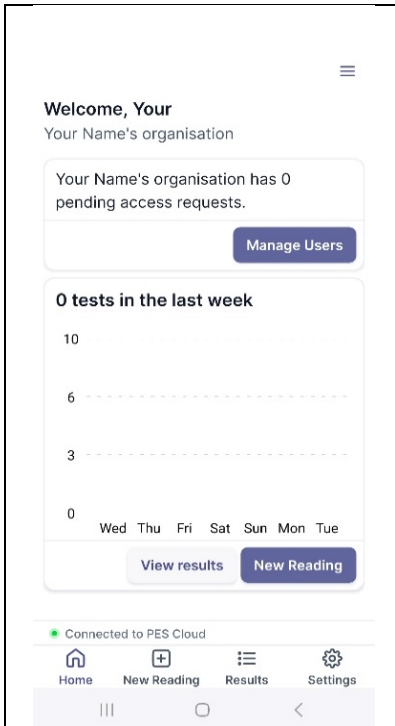



- To load / unload soil, remove the soil puck from the soil drawer
- To load the soil puck with soil, take a teaspoon of soil from between 5cm and 15cm from your chosen location
  - Do not overfill the soil puck; level with the surface is the correct volume
- Place the soil puck back into the drawer and close
- The test may now be started from the App on your mobile device
- After completion of the test, discard the soil sample. Do not retest the same sample twice as it has already released it's volatile organic compounds ("smell") and will not give a correct result

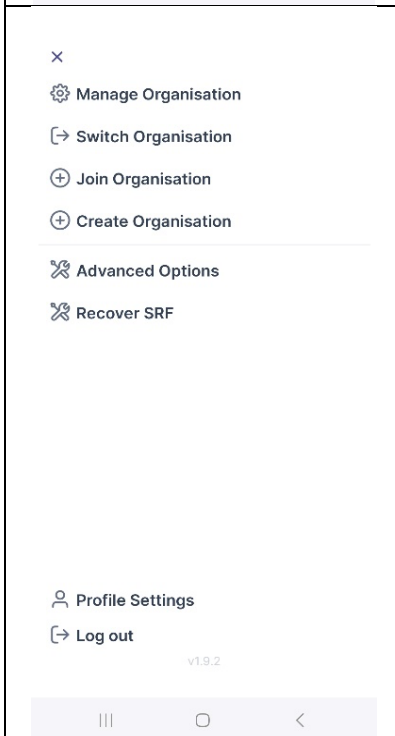
## 5. The App

The Mobile App, PES ScentsCheck, is a required component of the Soil Health Measurement Tool and is available through the Apple App Store or the Google Play store. Please Search for PES ScentsCheck on either store and install the App. To set up the App, an internet connection is required.

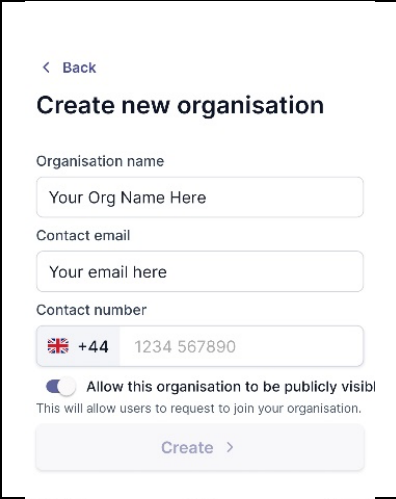
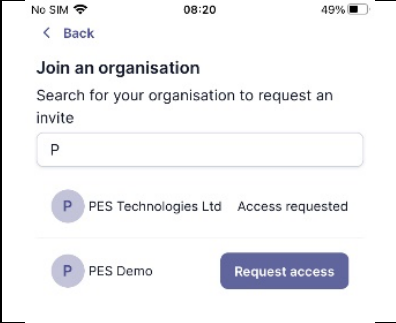
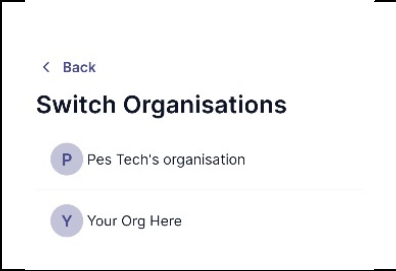
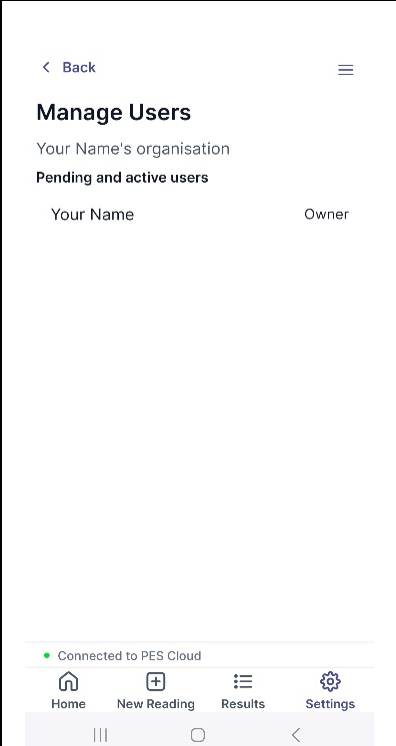
	<ul style="list-style-type: none"> <li>• Once installed, enter an email address             <ul style="list-style-type: none"> <li>○ This is the email address that test results / exports are emailed to as well as being your login name</li> </ul> </li> <li>• The first time you enter your email, or if you have logged out of the app, you will be sent a Magic Link to the email address entered             <ul style="list-style-type: none"> <li>○ It is important that the email address entered is accessible from the device that the App has been installed on</li> <li>○ Click the Magic Link in the email that has been sent to you by PES Technologies, and it will navigate you back to the App and log you in. If you do not receive an email within a couple of minutes, please check your spam box</li> </ul> </li> </ul>
	<ul style="list-style-type: none"> <li>• Upon logging in to the App for the first time, you will be asked for your name</li> </ul>

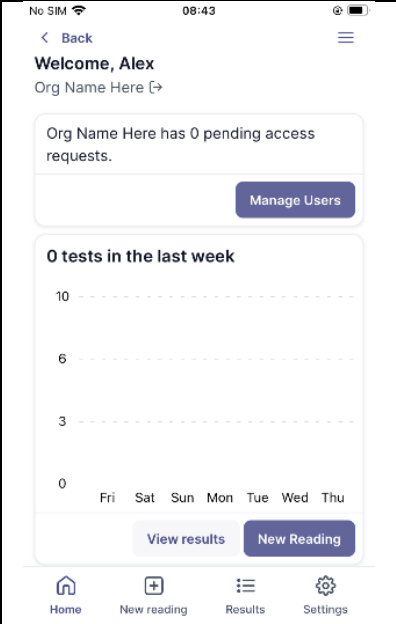
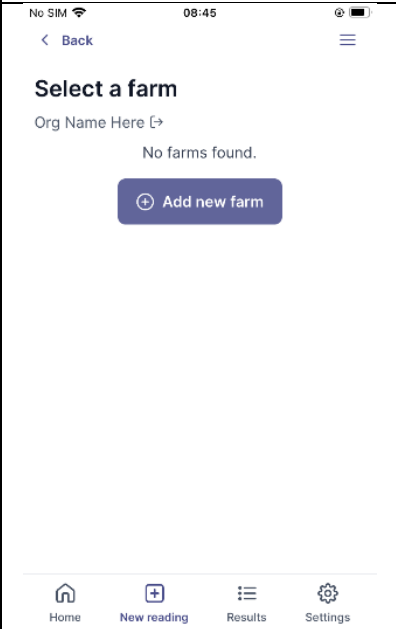
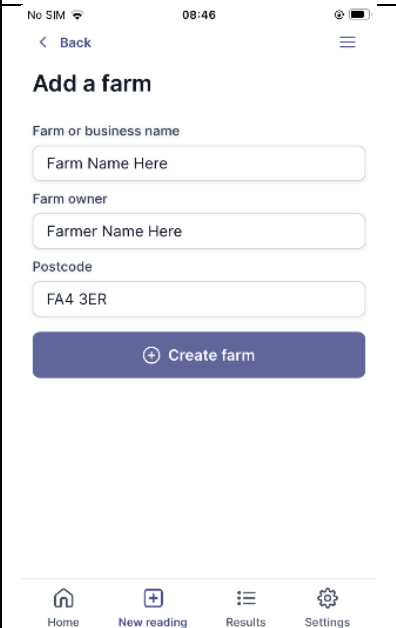


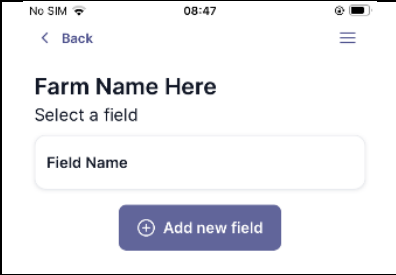
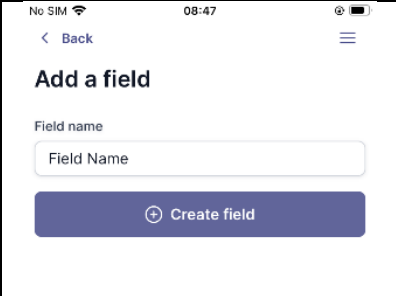
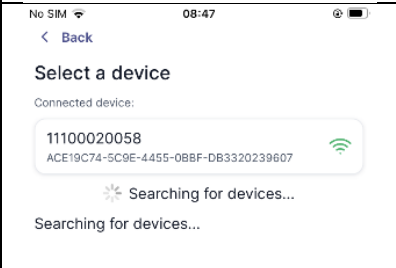
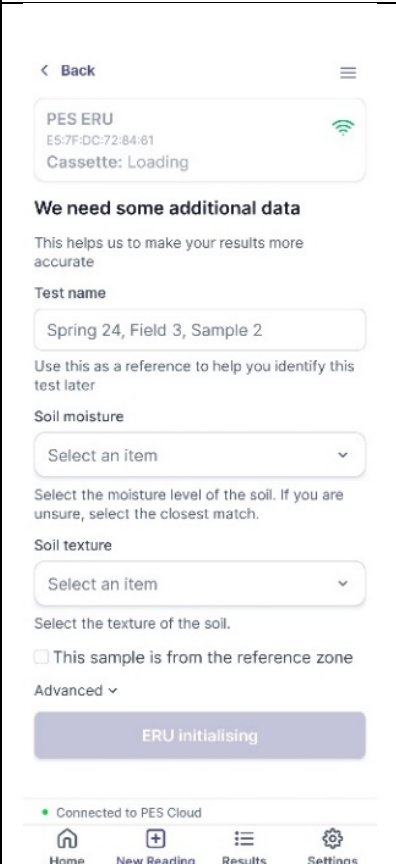
- You will be taken to the Home Page, where you can then either start a new test or access the menu to create a new, or join an existing organisation
- To create or join an existing organisation, click the menu 

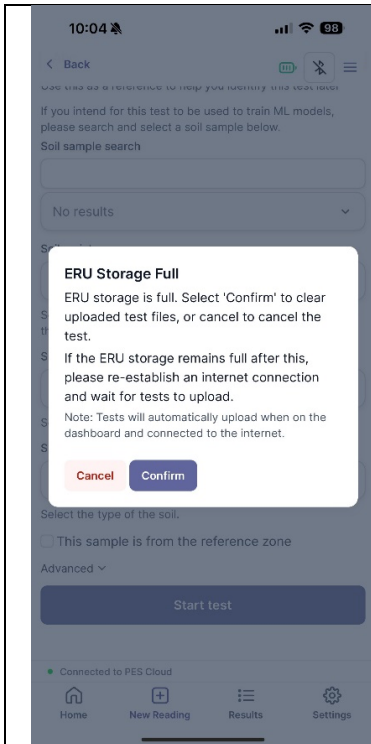


- Select “Create Organisation” to create a new organisation, or “Join Organisation” to search for an organisation to join

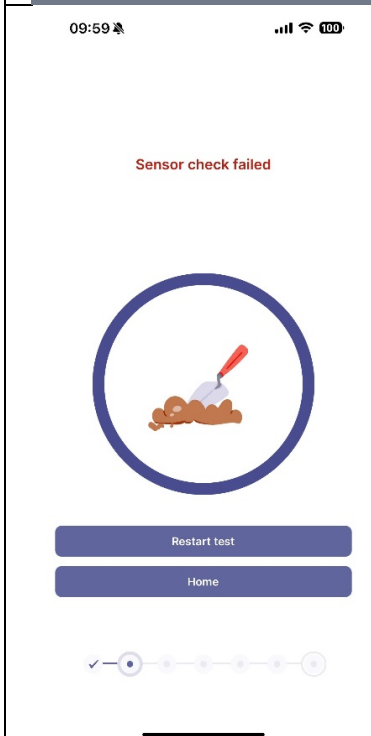
 <p>The screenshot shows the 'Create new organisation' screen. It includes a 'Back' button, a title 'Create new organisation', and three input fields: 'Organisation name' (with placeholder 'Your Org Name Here'), 'Contact email' (with placeholder 'Your email here'), and 'Contact number' (with a flag icon, '+44', and placeholder '1234 567890'). There is a toggle switch for 'Allow this organisation to be publicly visible' and a 'Create &gt;' button at the bottom.</p>	<ul style="list-style-type: none"> <li>• If your organisation is new to the Soil Health Measurement Tool, then you will need to create a new organisation</li> <li>• Enter the requested details and click “Create”</li> </ul>
 <p>The screenshot shows the 'Join an organisation' screen. It includes a 'Back' button, a title 'Join an organisation', and a search bar with the placeholder 'P'. Below the search bar, there are two search results: 'PES Technologies Ltd' with 'Access requested' and 'PES Demo' with a 'Request access' button.</p>	<ul style="list-style-type: none"> <li>• If you are a member of an existing organisation, then you can search for the organisation in the “Join an Organisation” page</li> <li>• If you are not the Owner or Administrator of the organisation, you will need to request access to join an organisation. The Owner or Administrator will provide access to the organisation; please contact them regarding your request</li> </ul>
 <p>The screenshot shows the 'Switch Organisations' screen. It includes a 'Back' button, a title 'Switch Organisations', and two selection options: 'P Pes Tech's organisation' and 'Y Your Org Here'.</p>	<ul style="list-style-type: none"> <li>• If you are a member of more than one organisation, select the organisation whose results you wish to see and to which you would like to record testing to</li> </ul>
 <p>The screenshot shows the 'Manage Users' screen. It includes a 'Back' button, a title 'Manage Users', and a subtitle 'Your Name's organisation'. Below this, there is a section for 'Pending and active users' with a table showing 'Your Name' as the 'Owner'. At the bottom, there is a status bar 'Connected to PES Cloud' and a navigation bar with icons for Home, New Reading, Results, and Settings.</p>	<ul style="list-style-type: none"> <li>• If you are an organisation Administrator or Owner, you can manage access to the organisation by selecting “Manage Organisation” from the menu</li> <li>• Users and pending requests will be visible in a “Manage Users” screen</li> </ul>

	<ul style="list-style-type: none"> <li>• After the first log-in, you will no longer be required to set up or join an organisation, and instead you will be taken to the Home Page directly</li> <li>• Organisation Admins will see a “Manage Users” button through which they can approve or reject requests to join</li> <li>• You can switch organisations from the Home screen by clicking the organisation name (top right of home screen) or by selecting “Switch Organisation” from the menu</li> <li>• To start a test, select “New Reading”</li> </ul>
	<ul style="list-style-type: none"> <li>• If Farms have already been added under your organisation, you can select a Farm here</li> <li>• If no Farms have been added under your organisation, you will need to “Add new farm” <ul style="list-style-type: none"> <li>○ Click the “Add new farm” button</li> </ul> </li> </ul>
	<ul style="list-style-type: none"> <li>• To add a farm, enter the details requested and click “Create farm”</li> <li>• You will now be able to select the farm from the “Select a farm” page</li> </ul>

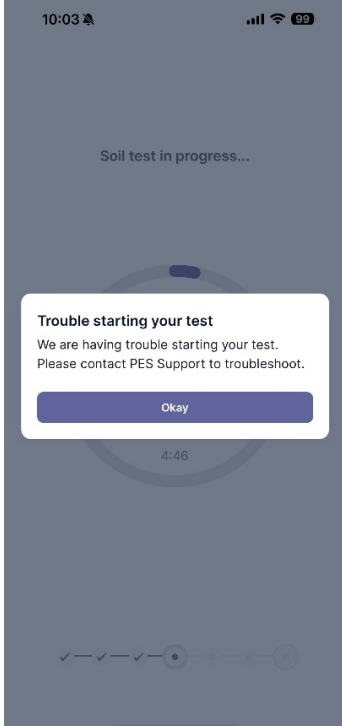
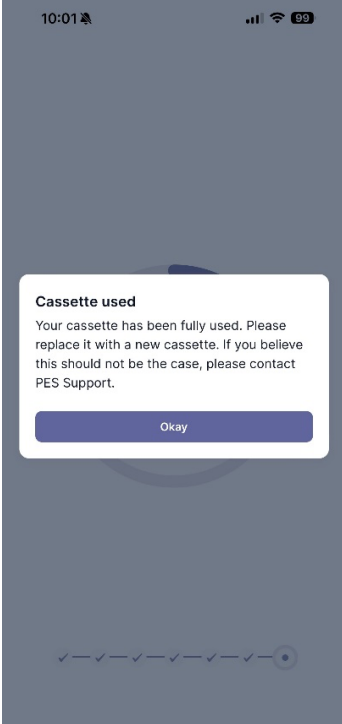
 <p>The screenshot shows a mobile app interface for a farm. At the top, it says 'Farm Name Here' and 'Select a field'. There is a text input field labeled 'Field Name' and a blue button with a plus icon and the text 'Add new field'.</p>	<ul style="list-style-type: none"> <li>• Within the Farm page, you will have the option to select a Field</li> <li>• If Fields have already been added to a Farm, you can select a Field here</li> <li>• If no Fields exist, you will need to “Add new field” <ul style="list-style-type: none"> <li>○ Click the Add new field button</li> </ul> </li> </ul>
 <p>The screenshot shows a mobile app interface for adding a field. It says 'Add a field' and 'Field name'. There is a text input field labeled 'Field Name' and a blue button with a plus icon and the text 'Create field'.</p>	<ul style="list-style-type: none"> <li>• To add a field, enter the field name and click create field</li> <li>• You will now be able to select the field from the “Select a field” page</li> </ul>
 <p>The screenshot shows a mobile app interface for selecting a device. It says 'Select a device' and 'Connected device:'. There is a card showing a device with ID '11100020058' and MAC address 'ACE19C74-5C9E-4455-08BF-DB3320239607'. Below the card, it says 'Searching for devices...'.</p>	<ul style="list-style-type: none"> <li>• Under “Select a device”, select the ERU you are using to perform a test</li> <li>• If multiple ERU devices are present, select the appropriate device by its serial number (shown on the back of the ERU)</li> </ul>
 <p>The screenshot shows a mobile app interface for entering test data. It says 'We need some additional data' and 'This helps us to make your results more accurate'. There are several form fields: 'Test name' (with 'Spring 24, Field 3, Sample 2' entered), 'Soil moisture' (a dropdown menu), and 'Soil texture' (a dropdown menu). There is also a checkbox for 'This sample is from the reference zone' and a blue button labeled 'ERU initialising'.</p>	<ul style="list-style-type: none"> <li>• Enter a name for your sample in the “Test name” box</li> <li>• Select the soil moisture from the drop-down box, “Soil moisture” <ul style="list-style-type: none"> <li>○ Three options are provided – Dry, Moist and Wet. Please choose the option you feel most closely resembles conditions in the field</li> </ul> </li> <li>• Select the soil texture from the drop-down box, “Soil texture” <ul style="list-style-type: none"> <li>○ Three options are provided – Light, Medium and Heavy. Please choose the option you feel most closely resembles conditions in the field</li> </ul> </li> <li>• A test can only begin once all options are completed <ul style="list-style-type: none"> <li>○ Select “Start test” and you will see an “ERU Initialising” message before moving to a sensor check screen</li> </ul> </li> </ul>



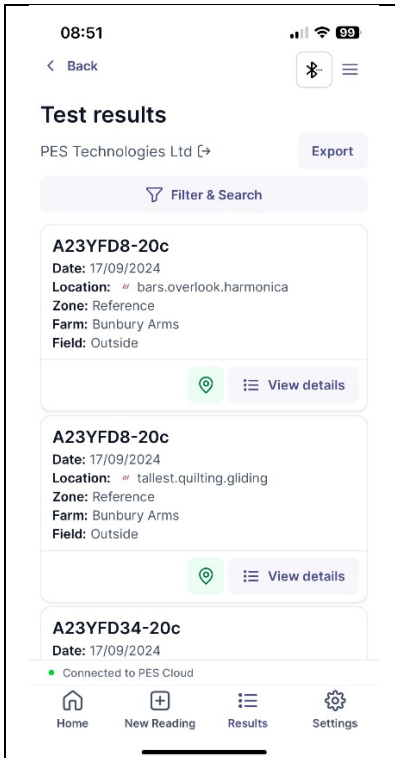
- If the ERU has been operating in Offline Mode (see section 6), it is possible that your ERU’s storage is full
- You will be prevented from starting a test if the ERU storage is full
- You can cancel your test, or you can force a clear down of any tests that have been uploaded successfully to the cloud, but not deleted due to a disconnection of the signal
- If confirming the clear down does not increase storage, then you will be required to find a phone signal or data connection (Wi-Fi) to upload SRFs to the cloud in order to create space



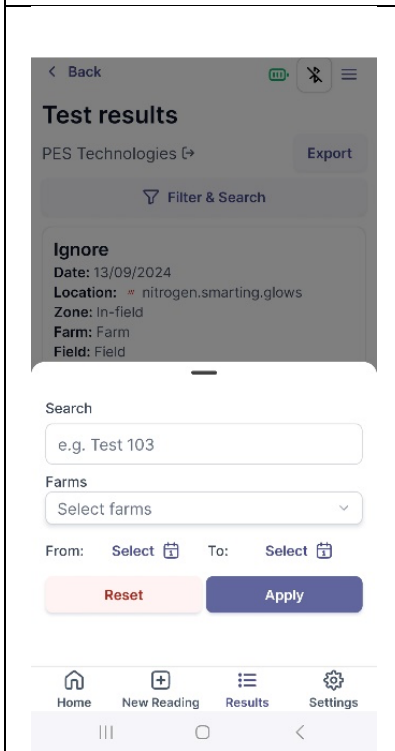
- Once the test is initialised, the ERU will index to a new sensor
- The ERU will then test the sensor to ensure the quality of the sensor prior to commencing a reading
  - If the sensor fails, you will receive a sensor failed message and the test will not start
  - Select “Restart test” to move to the next sensor
  - If the sensor passes, the test will begin automatically
- The screen will keep you informed of the test progress

	<ul style="list-style-type: none"> <li>• If multiple sensor checks fail, it may indicate that there is an issue with your ERU or Cassette of sensors</li> <li>• You will receive a message asking you to contact PES Support who can be reached at <a href="mailto:support@pestechnologies.com">support@pestechnologies.com</a> or 01480 759812</li> </ul>
	<ul style="list-style-type: none"> <li>• If you have used all of your sensors on the cassette, you will receive a message informing you of such</li> <li>• If you have a replacement cassette, please follow instructions in Section 8. Changing a Cassette</li> <li>• If you do not have a replacement cassette, please contact PES Technologies to order one</li> </ul>

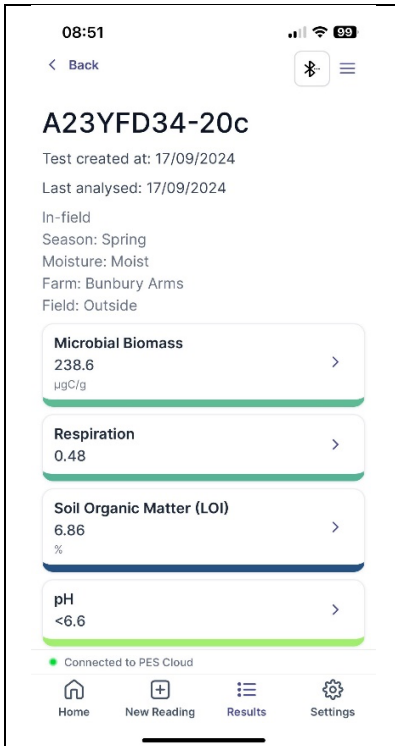




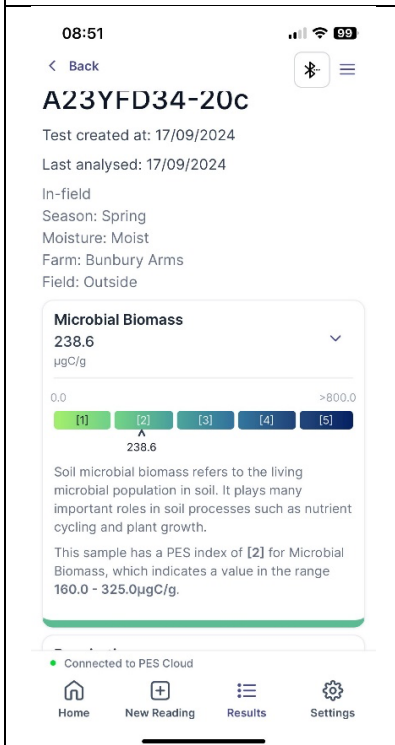
- To view your results, select “View results” from the Home page or “Results” from the toolbar at the bottom of most pages
- The results are listed in date order, but they can also be searched and filtered
  - To see the details of a set of results, select “View details”



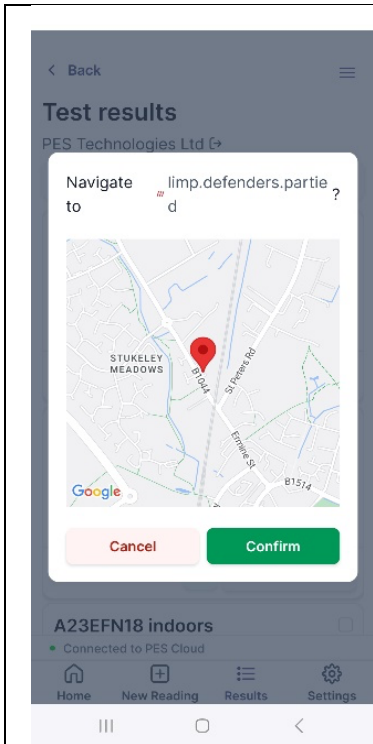
- Results can be searched and filtered by Test name, Farm, Fields and by date
- All selections allow for multiple filters to be selected and applied



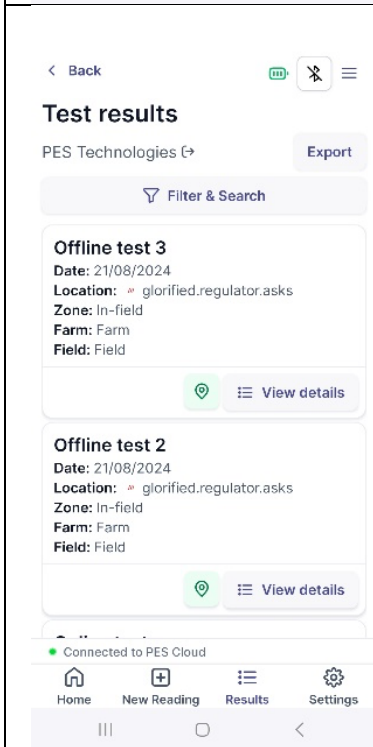
- When viewing the details of a Result, the list of indicators is presented
- For each indicator, a value is given and its units shown beneath
- A colour bar is also used to provide a quick indication as to where the value sits in the range for this indicator. The darker the colour the higher the value
- Results are GPS-located and time-stamped so can be used as part of your soil management plan



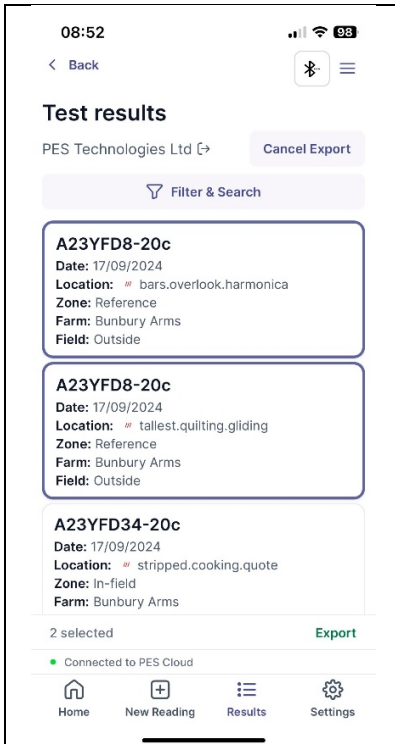
- Clicking the “>” button on an indicator will expand the box and bring up an explanation of the indicator
- It will show where the indicator sits within the range and PES has applied an index related to this position when compared to the full range for ease of comparison
- The index is an arbitrary index, 1 to 5, based on the range of the data unless a standard for the indicator already exists, such as RB209 where this has then been used



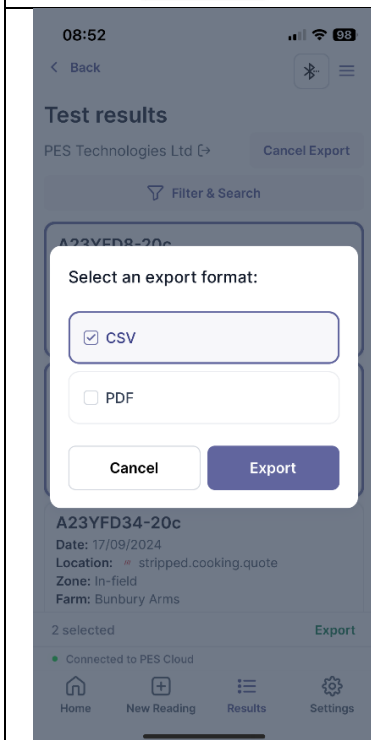
- For auditing purposes or to enable tracking of progress, it is possible to navigate back to the location where a sample was taken, within the accuracy of GPS (3m)
- Click the green location icon and select “Confirm” to be navigated back to this location
- You will have a choice to navigate in Google Maps or What3words



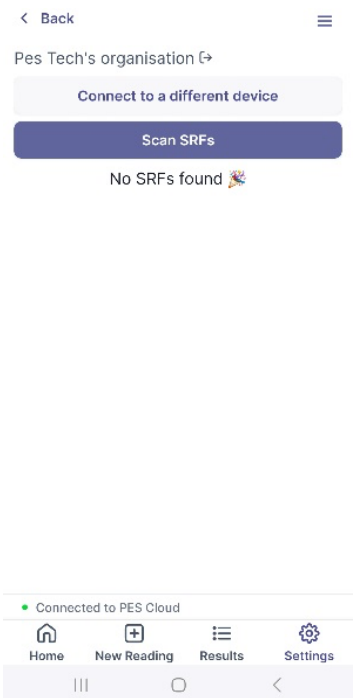

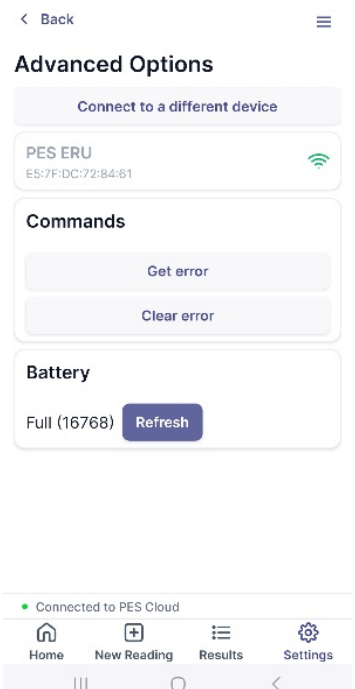
- To export results, click the “Export” button
  - You will be given the option of CSV or PDF formats for export



- It is possible to select multiple files by clicking on them
- Once all the required files are selected, click the Export located bottom right above the toolbar



- You will be given the option to export as a CSV or PDF File format
- The file will be emailed to the email address that you have logged in with

	<ul style="list-style-type: none"> <li>• If an error occurs during data transmission (e.g. a Bluetooth<sup>®</sup> failure, mobile phone runs out of battery, etc.), there will be a need to recover an SRF from the ERU</li> <li>• Select the menu  in the top-right part of the Home page, and on the menu is a function called “Recover SRF”</li> <li>• Select the “Scan SRFs” button</li> <li>• Select the SRFs to upload</li> </ul>
	<ul style="list-style-type: none"> <li>• On the rare event of the ERU going into an error state that will not clear with an ERU reboot (Amber and Red LEDs showing still), select “Advanced Options” from the menu</li> <li>• Select “Clear error” and the LEDs should return to green</li> </ul>

## 6. Offline Mode

In the event that there is no phone signal or no data connection where a test intends to be done, the ERU is capable of running in an “offline” mode. The online / offline status can be seen in the bottom-left corner of the Home page in the App, just above the toolbar. The ERU does require Bluetooth® enabled on your mobile device to operate in offline mode.

If you are offline, there is limited functionality. You can start a new test, but you will not receive the results until your phone has re-established a data connection and the SRF has transferred from your phone to the cloud-based database. This transference is done automatically in the background and should not require further input. However, if for some reason this does not occur automatically, then it is possible to retrieve the SRF files manually using the “Recover SRF” function; this is accessible from the menu in the top-right of the Home Page.

In order to prevent any possibility of data loss, tests remain stored on the ERU until they have been uploaded to the cloud database. The ERU can store approximately 15 tests at any one time. Therefore, if more than this amount of test tests are done while offline, it will be necessary to re-establish a connection. This will enable the SRFs to upload and clear the ERU storage.

When in offline mode, new farms and fields cannot be created. Please ensure you have created these in advance if there is a risk of poor phone and data signal.

## 7. LED Status

	LED 1	LED 2	LED 3
Unit off	Off	Off	Flashing Red 10 sec
Unit on	Off	Solid Green	Solid Green
Unit charging	Off	Solid Green	Flashing Green*
Unit charged	Off	Solid Green	Solid Green
Testing	Flashing Blue	Flashing Green	Solid Green
Low ERU Battery	Off	Solid Green	Flashing Amber
Unit Error	Off	Solid Amber	Solid Red
Unit Error	Off	Flashing Amber	Solid / Flashing Green

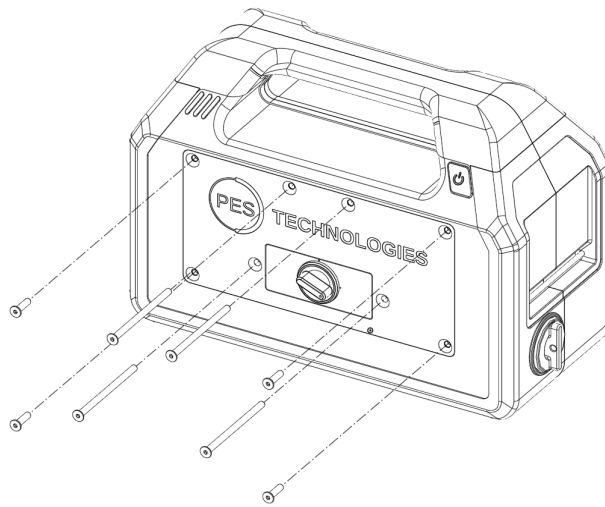
\*The rate of flashing indicates the speed of charging. The faster the flashing, the faster the charging.

## 8. Changing a Cassette

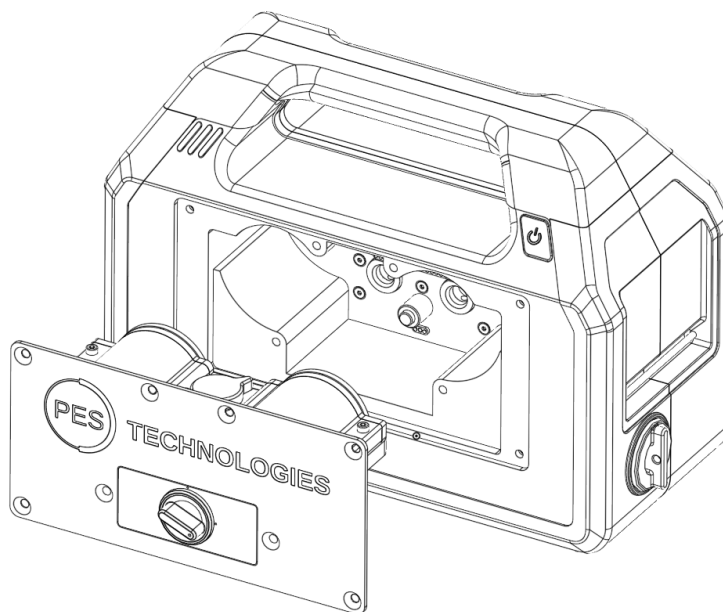
**!** **WARNING** - Ensure the ERU is powered off. Avoid touching the pins at the rear of the drawer cavity – ESD sensitive devices are connected to these.

When you have consumed all of the sensors in a cassette, you will need to change the Cassette in the ERU. Cassettes can be purchased from PES Technologies in 50-sensor or 100-sensor rolls. The cassettes are programmed with the number of sensors purchased but provisioned with an allowance for failures. The system will count the number of good sensors and tests completed and disregard the sensor failures, ensuring you receive all of the tests purchased.

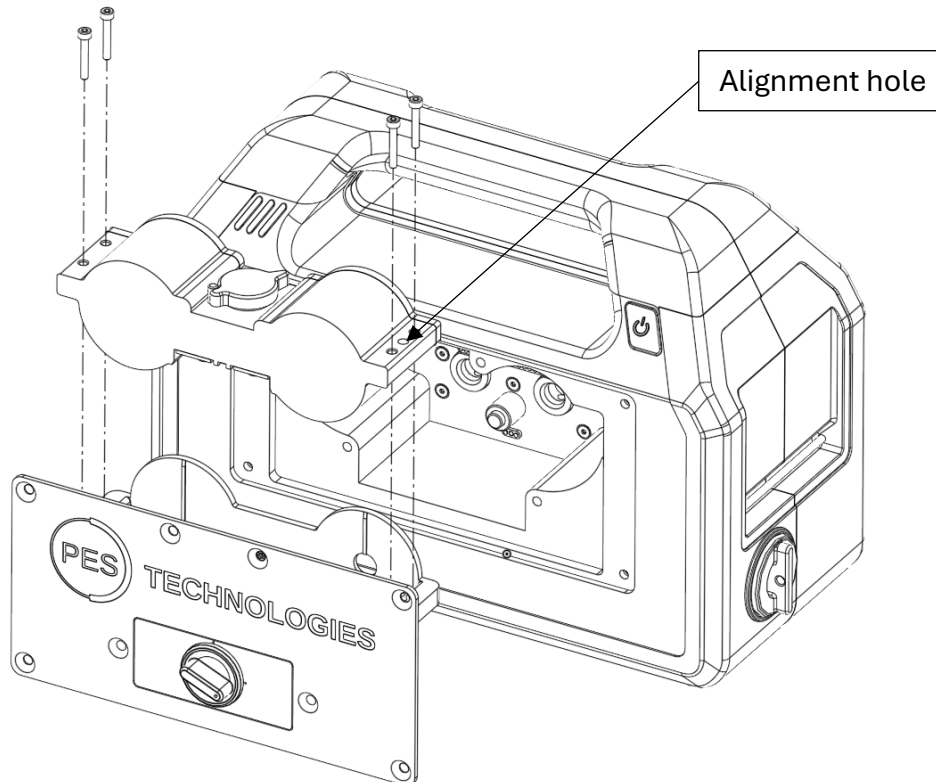
To remove the old cassette and install a new cassette, you will need a 2mm Hex / Allen key (supplied with your replacement cassette).



- Remove the 8 fastening screws using the 2mm Hex / Allen key



- Remove the cassette drawer
  - Tip – Open the soil drawer and gently pull to pop out the cassette drawer



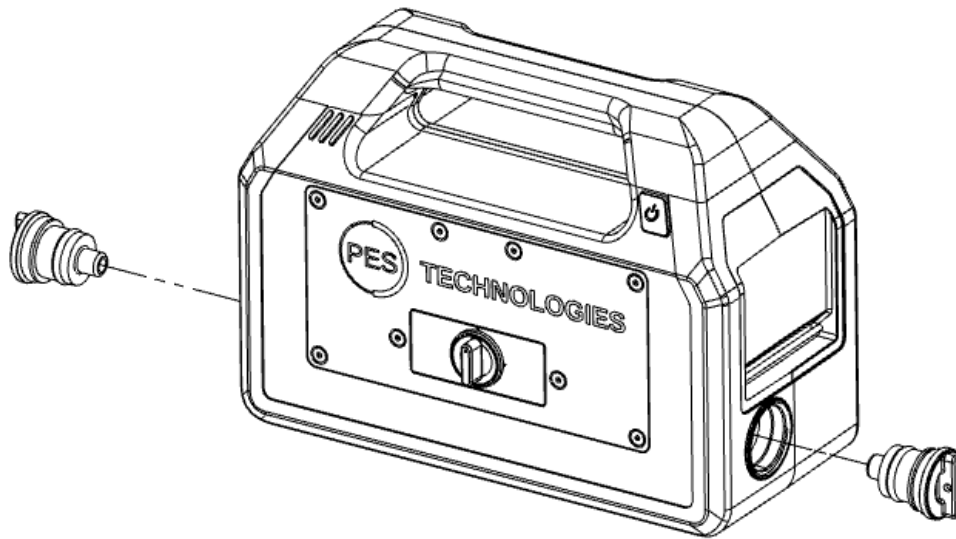
- Remove the four screws affixing the Cassette to the drawer using the 2mm Hex / Allen key (provided with your replacement cassette)
- Lift the cassette out of the drawer
  - Please return this cassette to PES Technologies using the packaging from your replacement cassette and the pre-paid envelope
- To install the cassette, insert the replacement into the drawer, ensuring that the plain face is to the front and the alignment hole is on the right-hand side
- Ensure the 4 screws affixing the cassette to the drawer are re-inserted and tightened to a nip

**⚠ CAUTION - DO NOT OVER TIGHTEN THE SCREWS**

- Replace the cassette drawer into the ERU and press firmly to ensure it is properly located
- Replace the 8 screws in the front face of the cassette drawer, starting with the two long screws on either side of the soil drawer, then the next two long screws and finally the 4 short screws



## 9. Changing Salt



- When a cassette is changed, the salt (Magnesium Sulphate crystals – Epsom salts) is changed as well. Two small packets of Epsom salt will be provided with each cassette that PES Technologies that sends to you
  - Do not use scented salts – just the pure Epsom salts provided to you
  - Magnesium Sulphate does not absorb Volatile Organic Compounds (VOCs), and so does not affect the results of a test. Other salts or desiccants must not be used, as they will affect the results of any test
- To change the salt, remove the salt tube bungs from either end of the unit. The bungs should pull out but the aid of a tool, such as the hex key provided for the cassette change, may be required if they are too stiff to give extra leverage
- Pour the used salt away by tilting and gently shaking the unit
  - You may need to use an implement to break up any crusted salt
  - It is safe to pour the salt into the general waste
- ⚠ **CAUTION** - Take care not to damage the chamber or the filters located in the chamber
- Check the filter is in the chamber and is visually clear from salt crystals
- Fill with new salt
- Replace the bung
  - Ensure the bungs are pushed all the way in

## 10. Troubleshooting

Issue	Possible cause	Actions
Sensor failure	Poor sensor	Press “Retry” button in the App
	Soil drawer not closed	Close drawer and ensure it is locked
	Soil drawer connection poor	Re-open and re-close the drawer and press “Retry” button in the App
		Take cassette drawer out and screw back in the following order: 2 long screws either side of soil drawer 2 long screws top of cassette drawer 4 outer short screws
		Contact the PES Support Team
Poor sensor connection	Remove cassette drawer Remove cassette Ensure plunger is working by twisting black cap Ensure sensor is flat against the cassette board window Re-seat cassette Ensure cassette is screwed down Contact the PES Support Team	
Test won’t start	ERU has low battery	Check ERU battery level in App Charge battery
	Information missing on form in App	Ensure all applicable boxes are filled out in App
App cannot see ERU	ERU has low battery	Charge the battery of the ERU
	Bluetooth® on phone is off	Check phone Bluetooth® is on
	Unit asleep / device not on	Check LEDs are green (see section 7). If not, Press power button for 1 second and release
	Another user connected	Check no-one else in the proximity has connected to the ERU through their App
	Too far away	Ensure you are within 5m of the ERU
Results not returned	No phone signal	Connect to a 4G/5G network or WiFi
		Contact the PES Support Team
Unit LEDs indicate error		Hold power button for 15 seconds to reboot the ERU
		In the App, select Advance Options, and then select Clear Error
Test result invalid message	Test has not completed correctly	Retry with a fresh sample
	ML Algorithm could not find a solution	Retry with a fresh sample
	Sensor or hardware fault	Retry with a fresh sample
		Contact the PES Support Team

## 11. Support Contacts

Email: [support@pestechologies.com](mailto:support@pestechologies.com)

Phone: 01480 759812

