User Manual
Pulsator tester PT-VI

ATV Agri

Congratulations

You have chosen a ATV Agri pulsator tester. Many years of experience, continuous product development and innovation ensure that ATV Agri is a dependable partner for the professional user.

Guarantee provisions

The right to a guarantee will lapse if there is evidence of damage resulting from misuse of the filters and/or of irregular changing of the filters.

Objective of this manual

This manual describes the use of the PT-VI pulsator tester.

Pictograms and abbreviations used in this manual

This pictogram warns of danger to the animals or the user, or damage to the product. Carefully follow the recommended procedures in this manual to avoid damage and injury.

PT / PT-VI	Pulsator tester
AFM	Airflow Meter

Requirements of the user

Users of the PT-VI must be fully aware of the operation of milking installations. It is also assumed that the user is familiar with the methods of testing and measurement of similar installations in accordance with current standards.

CONTENTS

1 INTRODUCTION

For dairy farmers, the faultless functioning of the milking equipment is of the greatest importance. The accurate operation of the installation does not only influence the quantity but also the quality of milk production.

The new PT-VI from ATV Agri has been specially developed to accurately and quickly measure as many milking machine functions as possible. In addition to an easy-to-read screen for all functions and measurement results, the PT-VI also has a printer connection. This means that measurement results can be read or printed out at any time.

The Heteren-based company, ATV Agri, was the first manufacturer in Europe to recognise the importance of pulsator testers in dairy farming. The company is fully equipped to develop this type of device. The exceptionally favourable starting position for this development is owed partly to the know-how that ATV Agri has acquired in the area of applied electronics and high-quality measuring and control equipment since the early 1970s. ATV Agri is in a better position than any other party to offer amendments to the service package in order to meet the exact needs of the customer. The company maintains close ongoing consultations with organisations and institutes in the area of milk production, in the search for the best application solutions and further perfection.

1.1 Purpose and conditions

The PT-VI has been specially designed to measure and analyse the vacuum level, the vacuum pulsator system and the air usage in milking installations used in dairy farming. The PT-VI has been specially designed for use during the testing of a milking installation (in the milking stall). Testing can be carried out prior to, during or after milking. Various measurements can be carried out via various apps.

1.2 Safety

⚠ The PT-VI is intended to be used in the milking stall. When testing during milking, the unpredictable behaviour of the cows must always be taken into account.

⚠ During the measuring process, sharp needles may be used for the connections between the PT-VI to the milking installation. Take care that these needles are not stuck into animals or people.

⚠ Always ask the dairy farmer about the behaviour of the cows and the milking method used.

2 DESCRIPTION OF THE PT-VI

On the top of the PT-VI connections for a battery charger/car battery adapter, connection for an airflow meter, connections for the internal and external (optional) sensors, and two USB connectors can be found.

Front view of PT-VI

The sensor colours on the PT-VI screen and this manual as follows:

- Internal sensor 1
- Internal sensor 2
- External sensor 1
- External sensor 2

Top view of PT-VI

2.1 PT-VI Features

- 7-Inch Capacitive Touchscreen for displaying measurement results and a graphical display of the measured data.
- Easy menu-controlled interface for step-by-step guidance through the measurement routines in accordance with the ISO standard or for carrying out individual measurements.
- Flexible, user-guided measurement protocols for easy measurement according to ISO/NMC standards, selectable by country.
- Automatic airflow measurement using the ATV Agri airflow meter, which is controlled by the PT-VI.
- Possibility to use airflow meter of other makes to execute measurements manually.
- A choice of several operating languages.
- 8GB internal memory for storage of measurements. This memory capacity is sufficient for the storage of thousands of measurements.
- Optional external printer can be connected to the PT-VI so measurement results can be printed in the stall.
- Waterproof and dust-proof casing in accordance with IP33.
- Ease of use thanks to the touchscreen.
- Simultaneous measurement of between one and four variables (depending on the number of sensors connected). The PT-VI is equipped with two internal vacuum sensors as standard. Further (external) sensors can be supplied as an option.
- Warning when the battery voltage is low, with automatic switch-off if this warning is generated.
- Rechargeable Li-ion battery
- Battery charging is controlled by software in the PT-VI.
- An optimisation program ensures optimum battery life.
- 8 hours usage with a fully charged battery.
- The PT-VI can be used normally while the battery is being charged.
- Software-controlled calibration.
- The software can be updated when the PT-VI is connected to the Internet, which means the PT-VI will also meet future requirements and additional capabilities can be offered.

2.2 PT-VI capabilities

The PT-VI provides the following measurement and display functions.

- Recording of pressure levels up to +10 kPa.
- Adjustable pressure unit. (kPa or IHg)
- Adjustable timing unit. (ms or %)
- Selectable user language.
- Measurement and analysis of the pulsation curve.
- Cyclic vacuum variations and level of the milk vacuum associated with the pulsation curve.
- Measurement of rest ratios (option).
- Cyclic slow and irregular vacuum variations (option).
- Position measurement for the measurement of a declining vacuum level (option).
- If external sensors are present, simultaneous measuring and analysis over four channels is possible. Ideal with wet measurements.
- Manual measurement of the airflow.
- Automatic menu-driven measurement of milking stalls including the determination of the air usage.
- Printout of measurement results.
- Opening measurement data via a PC.
- Editable names for farm and tester.
- Measurements can be given an identification label (name) so they can be easily found in the memory. Notes can also be added to measurements.
- Store and show measurement data for unique farm/tester combinations.
- Automatic correction of airflow measurements depending on the altitude.

2.3 Transport and storage

2.3.1 Transport

There are no special requirements for the transportation of the PT-VI. It is recommended that the PT-VI be transported in the special PT-case (available as an option).

2.3.2 Protective bag and protective cover

For protection of the PT-VI during use, a nylon protective bag and rubber protective cover are available. The bag and cover have eyelets for a neck strap.

2.3.3 Storage conditions

The best place to store a PT-VI is in the special PT-case (available as an option). The room in which the PT-VI is to be stored must meet the following conditions.

- Temperature: -20°C to +60°C
- Maximum relative air humidity: 90% at 23°C.

2.4 Batteries

The remaining battery capacity is displayed on the upper right of the PT-VI screen. When the capacity or battery voltage falls below 20%, a message to plug the PT-VI into a charger will be displayed. The PT-VI will continue to work until a residual battery capacity of 10% and will then automatically turn itself off. In the mean time, measurements must be stored in order for them not to be lost.

A green battery indicates sufficient battery power to continue with the measurements.

A red battery indicates the PT-VI should be connected to the charger. The lightning sign indicates the charger is properly connected and the battery is charging.

2.4.1 Charging the batteries

There are two possibilities for charging the battery:

- With a car battery adapter that can be connected to a car cigarette lighter (12V).
- With a battery charger that can be connected to a normal wall socket (110-230V).

The battery starts charging automatically when the battery charger is connected. During charging, the PT-VI may become warm. This is normal because some of the energy will be converted into heat.

2.4.2 Life expectancy of batteries

If the PT-VI has not been used for a long period, the battery can become lazy. This means the maximum capacity of the battery can only be achieved after several charge-discharge cycles.

During longer periods of storage, the battery capacity will decrease through self-discharge. Because of this, it is possible that the actual capacity of the battery is not accurately displayed on the PT-VI screen.

2.5 Waste management

2.5.1 Battery charger

The battery charger can not be repaired. If it is defective the battery charger must be disposed of in an environmentally friendly manner

2.5.2 Batteries

The pulsator tester is fitted with a rechargeable Li-ion battery. When this is scrapped or replaced, it must be disposed of in an environmentally friendly manner.

2.5.3 Re-use

The PT-VI case can be reused. All other parts should be disposed of in an environmentally friendly manner.

3 USING THE PT-VI

3.1 Product & accessories

The PT-VI is supplied in a box that also contains the accessories. The PT may also be delivered in the optionally-available case. This case offers extra space for accessories under the PT-VI.
The standard unit consists of the following components:

- User guide;
- USB-A to USB-B cable
- PT-VI (Pulsator tester);
- AC power battery charger and car battery charger for car cigarette lighter;
- Bag containing 20 filters.

Available separately: protective case, nylon protective bag and rubber protective cover.

1. AC power charger and 12V car charger
2. Airflow meter
3. Airflow meter adapter
4. Airflow meter adapter
5. Bypass 2000l/min
6. Bypass 2000l/min
7. PT-VI
8. Documentation holder

3.2 Instructions for use

The PT-VI works with an icon menu on a touchscreen. For an overview of the PT-VI menu structure, refer to Chapter 6.

When the PT-VI is delivered, the battery might be empty. Always connect the battery charger before using the PT-VI for the first time. The battery only functions at full capacity after it has been discharged and re-charged several times.

- Always carry the PT-VI at chest level while taking measurements in the milking stall. This makes connecting the hoses easier.
- In wet conditions, use external moisture-insensitive sensors or moisture catchers with needles (option)
- Empty the fluid traps regularly (only for wet measurements).
- When emptying the fluid traps, always disconnect the hoses from the PT-VI first.
- Only insert needles in rubber hoses. Never insert needles in nylon or silicone hoses.
- Check the needles every time they are removed for blockages. Preferably, use the needles available from ATV Agri.
- Clean the materials that have been used after the measurements have been completed.

3.3 Switching on/off

Switching on

Press the button on the top of the PT-VI. After a moment, a beep will be heard, which indicates that the PT-VI is starting up. A green LED indicates that the device is switched on. The start-up procedure can be followed on the screen. This takes about one minute. When the welcome screen is displayed, press on the green check mark to go to the main menu.

Switching off

Press the Home button to return to the Main Menu.

Click the Off button and choose Power off to switch off. Choose Display Off to enter power-saving mode.

3.4 Preparing the PT-VI for use

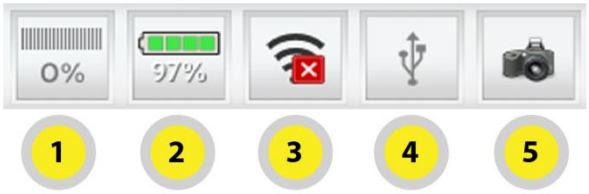
Before the PT-VI is used for the first time, a number of settings must be checked. The settings are stored in the PT-VI, even when it is switched off.
You only need to look at most of the settings once, but it is possible that other settings may be required for use with other installations. For example, the height setting for the Airflow meter will need to be set if heights greater than 300 metres above sea level are

measured. The zero-point must also be checked. For an overview of the PT-VI menu structure, refer to Chapter 6.

3.5 Main menu

The PT-VI is switched on with the power button on the top. After the PT-VI has started up, the Welcome screen appears, from which the main menu can be accessed.

On the top left, you will find the home button and the power off button. Next to the title "Main Menu", there is a pictogram displaying how many screens the appropriate menu contains and in what part you are currently in. In this example, the main menu consists of two screens. Browsing is via the black navigation arrows on the left and/or right of the screen. On the top right, the icons display the status of the PT-VI.

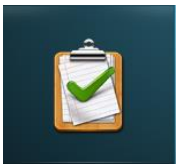


1. Used memory
2. Remaining battery capacity
3. WiFi indicator
4. USB indicator
5. Screenshots can be taken with the camera an they will be stored on the PT-VI hard disk.

3.5.1 Icons in the main menu

Settings

Measurements



Measurements via protocol (option)

Saved files (file manager)

Service menu (only accessible for authorised persons)

3.6 Software updates via WiFi

ATV Agri is continuously working to improve the PT-VI software. As soon as an update is available, it can be downloaded if there is a WiFi connection. Link to WiFi via the icon on the upper right in the bar, or via the WiFi icon on the second page of the settings menu.

1. Choose a network from the list of available networks.
2. Turn WiFi on or off.
3. Refresh the list of networks.
4. Remove the selected network.
5. Browse the list of networks.
6. Connect to the selected network.

Once you are connected to a WiFi network, a message will appear when an update is available. The user will then have the choice to install the update immediately, or to wait

until later. The next time the PT-VI connects to a WiFi network, the message will appear again. Usually, it takes no more than a few minutes to install an update. In the event of an update notification, the instructions on the screen must be followed. If there are no updates available, a message will not appear. We encourage users to connect the PT-VI to the internet via WiFi at least once per week. It is recommended that you always use WiFi to connect to private networks. You may not be able to connect to the internet with public WiFi networks, for example in hotels. This is because of the login portal in the public network. The PT-VI cannot log on using a login portal.

3.7 Farms and users

Measurements are saved in the PT-VI by farm name. For this to work, the farm names must always be created first. Without farm names, the measurements cannot be carried out. An infinite number of farms can be created in the PT-VI. Furthermore, each measurement is linked to the user who carried out the measurement.

Measurement data can then be identified by a combination of farm name and tester name. For every measurement, it is important to first verify that the correct farm and tester have been selected so the data can always be retrieved.

Manage farms

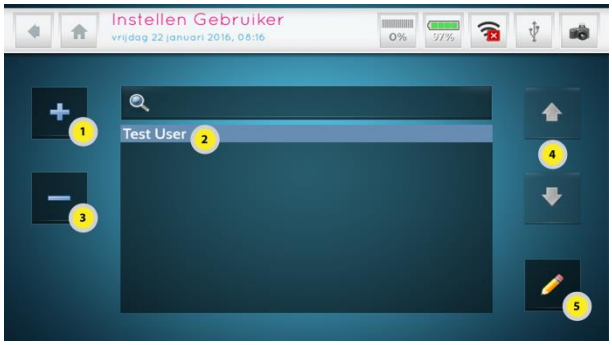
From the main menu, go to settings and click on the farm icon. The following screen will appear.

1. Add a farm.
2. Select an existing farm to make changes.
3. Remove a farm. Farms cannot be removed if there are still measurements associated with that farm in the memory. You can remove these via the file manager.
4. Use the arrows or search function to browse or search the list of farms. The search is a "contents"-type search.
5. Edit the selected existing farm.

1. Click on the input field to edit.
2. Save the data.

Manage users

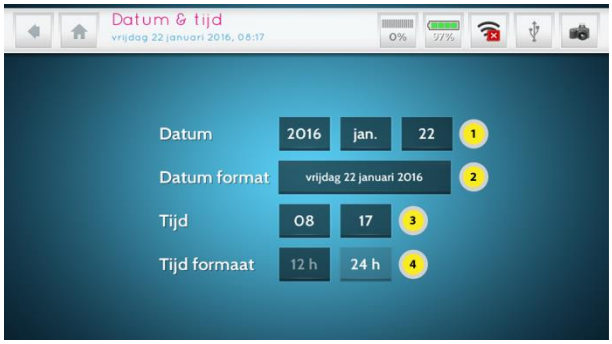
From the main menu, go to settings and click on the user icon.



1. Add a user.
2. Select a user.
3. Remove a user.
4. Use the arrows to browse.
5. Edit the selected user.

3.8 Date and time

From the main menu, go to Settings and click on the date and time icon.



1. Edit year, month and date
2. Edit date display
3. Edit time in hours and minutes
4. Edit time display

3.9 Units and language

The PT-VI menu contains mostly icons, yet text is also used. The available languages are increasing and will be added via software updates. The PT-VI can make use of both metric and imperial units.

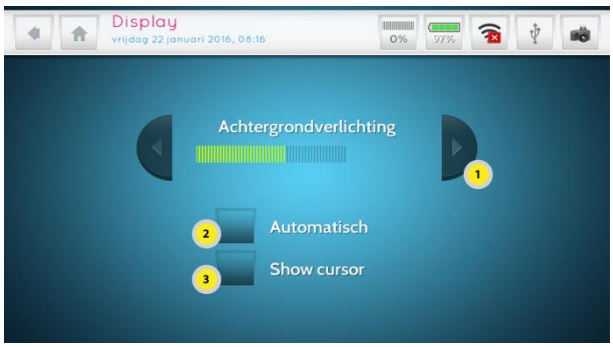
To set the language and units, choose settings in the main menu and then click the icon for language and units.

1. Choose metric units (kPa and L/min).
2. Choose imperial units (inches Hg and CFM).
3. Click on the choice menu for your desired language and select it.

3.10 Display screen

3.10.1 Brightness

Click Settings in the main menu and then on the icon for display settings.



1. The display brightness is adjusted using the arrow keys.
2. By selecting this option, the brightness is automatically adjusted for the light intensity in the environment in which the PT is currently being used.
3. Specify whether or not the cursor should be seen on the screen. The cursor indicates where the user last pressed the screen. The cursor helps the user with the sensitivity of the screen.

3.10.2 Switch-off time/standby time

From the main menu, go to Settings and click on the Power Management icon.

1. Set the number of minutes before the display dims.
2. Set the number of minutes before the display turns off.
3. Set the time period after which the PT-VI turns off.

3.11 Set up external sensors

To set up the external sensors, go to the icon for external sensors in the settings menu.

1. Activate the external vacuum sensor
2. Activate the voltage-measuring probe
3. Edit the description of the sensors. This description appears in all tables.

Note: At the time of writing this manual, only external vacuum and voltage sensors are available. More sensors will be added in the future.

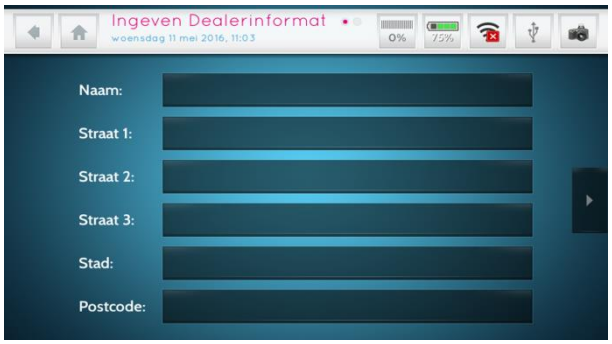
3.12 Airflow meter working level

If you are working with the airflow meter at an altitude of more than 300 metres above sea level, the working height must be adjusted in the PT-VI. To do this, go to the airflow meter icon in the settings menu.

1. Click in this field for a selection list. Select the correct height.
2. Go back to the settings menu.

3.13 Note down dealer information

Go to the settings menu and click on the dealer information icon to view the dealer details.



By clicking on a line of text, a keyboard will be displayed for you to fill in the details.
Note: This option has two pages. The dealer information is shown when a set of measurements is reported.

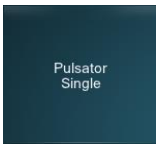
3.14 Activate new apps

When ordering new measuring apps, you will receive a code to activate the app. To do this, go to the app activation icon in the settings menu and enter the code.

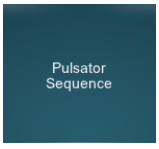
4 MEASUREMENTS

Measurements are carried out with the PT-VI via measurement apps. In the basic configuration, the PT-VI is always delivered with four standard measurement apps. These are the most common measurements for maintenance measurements.

Pulsator Single



Pulsator Sequence



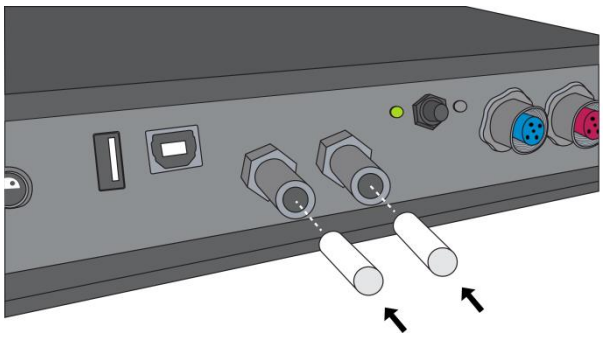
Constant Vacuum

Pressure gauge

As an option, several other measurement apps can be purchased which are often used for taking measurements during milking. The website, www.atv-agri.com, contains more information about other apps that are available. This manual only describes the four standard apps. Measurement apps that are purchased separately have their own, dedicated manual. ATV Agri will be continuously developing new measurement apps for the PT. If you have a requirement for a specific measurement, please contact ATV Agri. Below is a description about how to prepare the PT-VI to carry out a series of measurements.

4.1 Filters

In order to prevent the internal vacuum system from becoming blocked, the included filters must be used. The filters must be placed in the internal sensor connections (see figure). Failure to use a filter can adversely influence the PT measurement and result in very high repair costs. It is advised that the filters are replaced regularly, especially when they appear dirty.

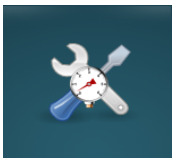


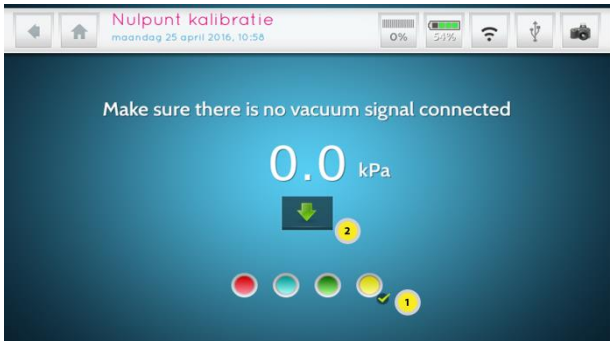
The internal vacuum sensors are not capable of measuring if there is moisture or milk in the pipes. In this case, special external sensors (optional) must be used. Damage to the internal vacuum sensors can lead to very high repair costs.

4.2 Zero-point calibration before use

We recommend carrying out a zero-point measurement of the sensors and, if necessary, to calibrate the sensors. It is possible that various conditions, such as atmospheric air pressure and temperature, have forced one of the sensors to not read 0.0 when there is no vacuum connected.

From the main menu, go to Settings and click on the zero-point calibration icon.





1. Select the correct sensor. The check mark indicates which sensor is selected.
2. Click on the arrow to calibrate the selected sensor.

Repeat these steps for each connectedsensor until all sensors read 0.0.

During calibration, there must be no vacuum connected to the sensors.

4.3 Select farm and user

Before carrying out the measurement, choose the farm for which the measuring is being carried out, as well the name of the tester. This is done in the main menu. This step must be carried out, otherwise it will not be possible to carry out measurements.

1. Select a farm/user
2. Go from Select farm to Select user or vice versa.
3. Use the arrows to browse.
4. If a user and farm are selected, the check mark will turn green. Click to confirm the choices.

4.4 Entering the working vacuum level

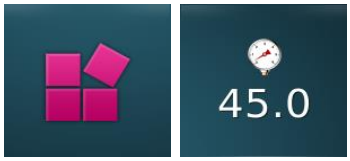
In order to carry out measurements on the milking installation, the workvacuum level must be known. The working vacuum can be measured with the PT-VI. It is also possible to enter the workvacuum level manually when it is known.

It is recommended that the level of the working vacuum be measured before carrying out the first measurements. For all subsequent measurements, the working vacuum level entered previously remains in use for as long as the PT-VI has not been switched off or shut down automatically.

4.4.1 Measuring the working vacuum level

Set the installation in the milking condition. The PT-VI must be connected to the main vacuum system or milking pipeline. Ensure that the hoses have no kinks in them. The measurements can now be performed.

From the main menu, go to Measurements and press the 45.0 icon.



1. Choose the sensor you wish to use to measure the working vacuum.
2. Press the arrow to copy the measured value into the box below it.
3. Press the check mark to save the measured value and return to the measurements menu.

4.4.2 Entering working vacuum

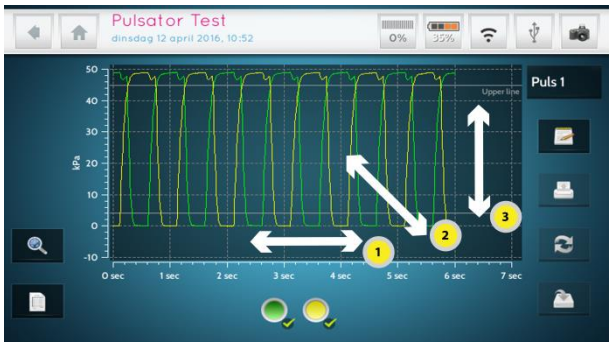
The working vacuum can also be entered into the PT-VI manually. This can be done in the same screen as the measurement of the working vacuum.

1. A keyboard appears, allowing you to manually enter a value.
2. Press the green check mark to save the working vacuum and return to the measurements menu.

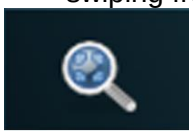
4.5 Save and preview measurements

For all measurements, the same options and icons apply to view, print and save the results.

In the graphical representation of the measurements, the PT-VI image can be zoomed in and out. Below is an explanation of the zoom function, then a description of all the used icons.



1. Zooming in on the horizontal axis can be achieved by swiping right
2. The original aspect ratio of the chart can be seen by swiping from bottom right to top left.
3. Zooming on the vertical axis can be achieved by swiping down The original aspect ratio of the chart can be seen by swiping from bottom right to top left.



If the magnifying glass is displayed, you can zoom in and out on the graph. The scroll function is active when this magnifying glass is pressed.

The green arrows indicate that you can scroll (up, down and sideways) in the chart.

The measurement can be stored in the file manager using this icon. The data can be loaded onto the PC with the USB cable.

You can make notes associated with each measurement using the notebook. These are automatically stored with the measurement.

With this icon, the current measurement will be cleared and a new measurement started. Unsaved data will be deleted.

All measurement results can be printed using the ZEBRA printer.

By clicking on the table icon, the measurement results will be displayed in tabular form.

By clicking on the chart icon again, measurement results will be presented in a graph again.

Next to the measurement is a box containing the file name of a measurement. The file name can be entered by pressing here. If you do not fill anything in, no file name will be displayed in the file manager, only the date and time of the measurement.

4.6 Carrying out measurements

The four standard measurements described earlier are available from the main menu and measurements menu. The measurement menu is only
active when a farm name and user name is selected.

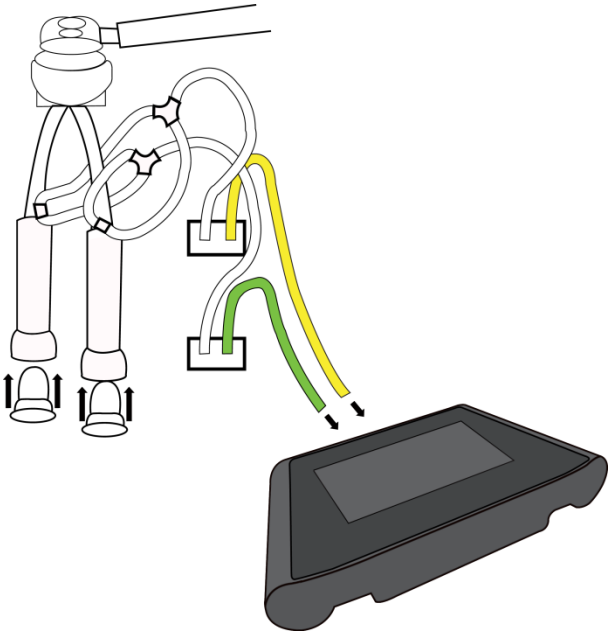
4.6.1 Pulsator Single App

With the Pulsator Single App, the course of the pulsation curve is measured for individual pulsators in a random order.

Bring the milking installation into the milking condition with plugged liners. Connect the PT using a T-piece in the short pulsation hose for the rearmost liners.

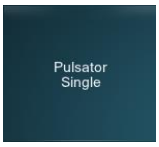
Note:
At the start of the analysis, the PT sees the vacuum signal as a curve, as soon as the vacuum level exceeds the lower 4 kPa limit.

The measurement of the standard curve includes the number of pulsations per minute, the limping with alternative systems, the average top vacuum level of the pulsation curve, the milk phase (A+B), the rest phase (C+D) and the A, B, C, and D phases.



Note:
the top vacuum is determined in accordance with ISO 3918.
Follow the steps below to use the Pulsator Single App.

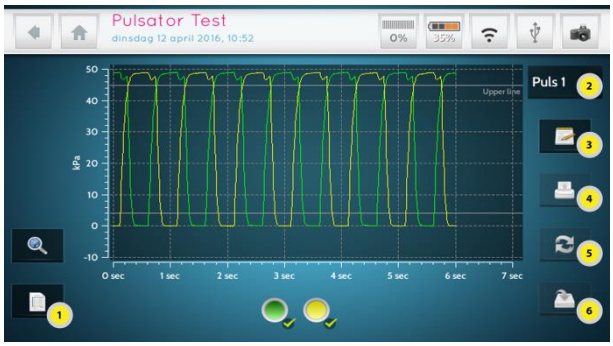
- Check that the correct farm name and tester name have been selected.
- Go to the measurements menu and make sure the displayed working vacuum level is correct. If necessary, enter the correct value. See also Chapter 4.4.
- Press the Pulsator Single icon. The curve measurement will now be performed on the basis of the 4 kPa cut-off line in accordance with ISO 3918.



- If the curve does not comply with the 4 kPa reference line according to ISO 3918, the PT-VI will display a message stating that a valid signal has not been detected and the measurement should be carried out again if necessary. This can be done by refreshing the icon.

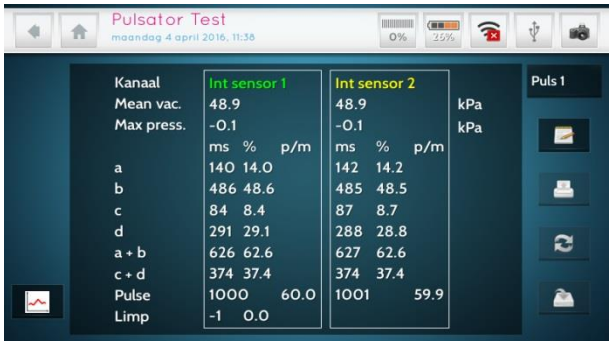
- If the measurement does comply, the PT-VI will continue with the measurement and automatically stop the measurement after the required cycles.
- Explanation of the result:

In the readout of the chart, you can use the default graph functions as described above in Chapter 4.4 and save the measurement (see Chapter 4.6).



1. Toggle between table and graph.
2. Add or change the measurement name.
3. Add or edit notes
4. Print the measurement results
5. Restart the measurement.
6. Save the measurement.

The table readout will include the following data:



- Vacuum level. Displayed as "Mean vac".
- Pressure. Displayed as "Max press".
- A phase. Displayed as "a".
- B phase. Displayed as "b".
- C phase. Displayed as "c".
- D phase. Displayed as "d".
- Milk phase (A+B). Displayed as "a+b".
- Rest phase (C+D). Displayed as "c+d".
- Number of pulsations per minute. Displayed as "Pulse".
- Limping. Displayed as "Limp".

The limping is (A + B) sensor 1 minus (A + B) sensor 2.

Note:
If the above values are displayed as "empty", this means that the PT-VI was unable to analyse and calculate the curves. Any error messages described in Chapter 4.7 will also be displayed in the table. By making the included curve visible you can look to see what went wrong.

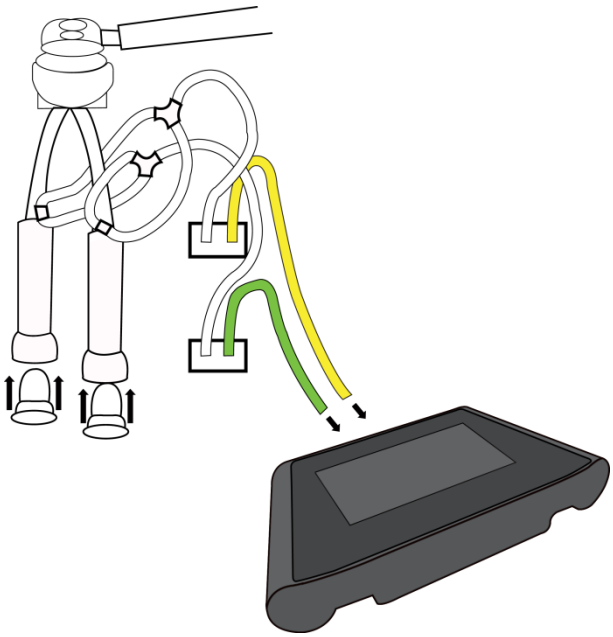
4.6.2 Pulsator Sequence App

With the Pulsator Sequence App, the course of the pulsation curve is measured for individual pulsators in a sequence. For this, a pre-identification label can be applied that increments by one after each measurement so that a series of pulsators can be measured without the need to enter identification label again and again.

Bring the milking installation into the milking condition with plugged liners. Connect the PT-VI using a T-piece in the short pulsation hose for the rearmost liners.

General comment:
At the start of the analysis, the PT-VI sees the vacuum signal as a curve, as soon as the vacuum level exceeds the lower 4 kPa limit.

The measurement of the standard curve includes the number of pulsations per minute, the limping with alternative systems, the average top vacuum level of the pulsation curve, the milk phase (A+B), the rest phase (C+D) and the A, B, C, and D phases.



Note:
the top vacuum is determined in accordance with ISO 3918.

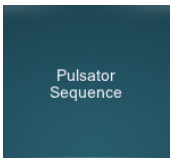
Follow the steps below to use the Pulsator Single App.

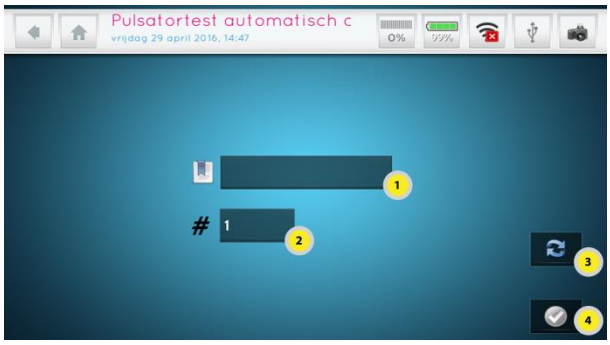
- Check that the correct farm name and tester name have

been selected. (See also Chapter 3.7)

- Go to the measurements menu and make sure the displayed working vacuum level is correct. If necessary, enter the correct value. See also Chapter 4.4.

- Choose the Pulsator Sequence icon in the measurements menu.
- The following screen will appear.



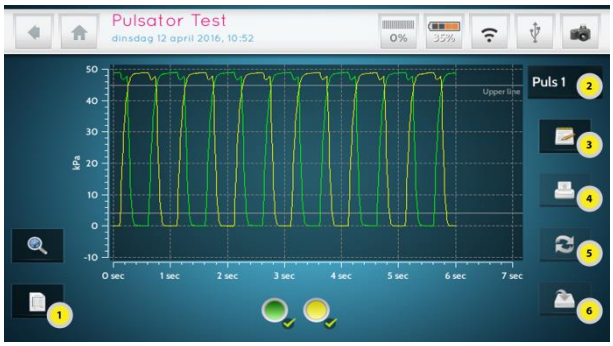


1. An identification label can be entered here.
2. The starting number can be entered here (usually 1).
3. Press this to clear the data.
4. Start the measurement here if the identification label and the starting number have been entered. You will see that the identification label field has already been filled in with the entered value plus the added number. The curve measurement will now be performed on the basis of the 4 kPa cut-off line in accordance with ISO 3918.

- If the curve does not comply with the 4 kPa reference line according to ISO 3918, the PT-VI will display a message stating that a valid signal has not been detected and the measurement should be carried out again if necessary.

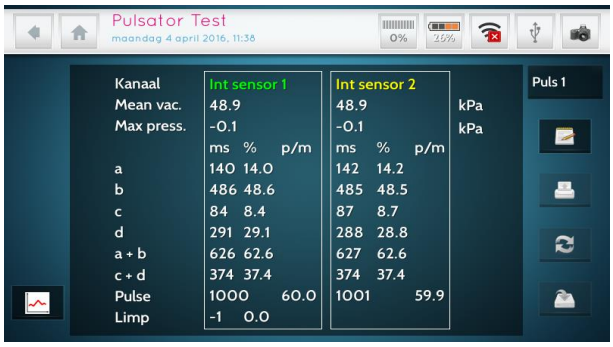
- If the measurement does comply, the PT will continue with the measurement and automatically stop the measurement after the required cycles.
- Explanation of the result:

In the readout of the chart, you can use the default graph functions as described above in Chapter 4.4 and save the measurement (see Chapter 4.6).



1. Toggle between table and graph.
2. Change the measurement name.
3. Add notes.
4. Print the measurement results
5. Restart the measurement.
6. Save the measurement.

The table readout will include the following data:



* Vacuum level. Displayed as "Mean vac".
* Pressure. Displayed as "Max press".
* A phase. Displayed as "a".
* B phase. Displayed as "b".
* C phase. Displayed as "c".
* D phase. Displayed as "d".
* Milk phase (A+B). Displayed as "a+b".
* Rest phase (C+D). Displayed as "c+d".
* Number of pulsations per minute. Displayed as "Pulse".
* Limping. Displayed as "Limp".

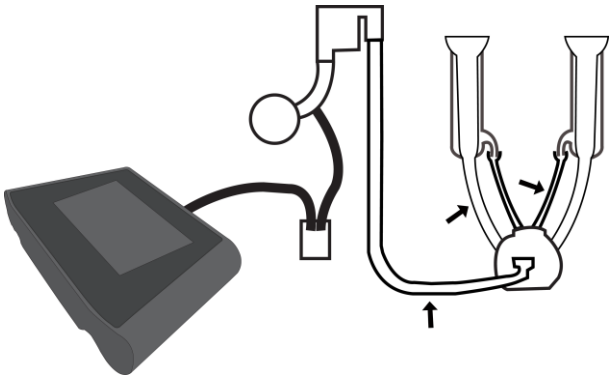
The limping is (A + B) sensor 1 minus (A + B) sensor 2.

Note:
If the above values are displayed as "empty", this means that the PT-VI was unable to analyse and calculate the curves. Any error messages described in in Chapter 4.7 will also be displayed in the table. By making the

included curve visible you can look to see what went wrong.

4.6.3 Constant vacuum measurement

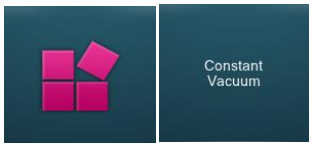
During a constant vacuum measurement, slow variations in vacuum level within a chosen time are displayed.
The minimum, maximum and average value of the measurement are calculated over a period of time, which is chosen by the user.



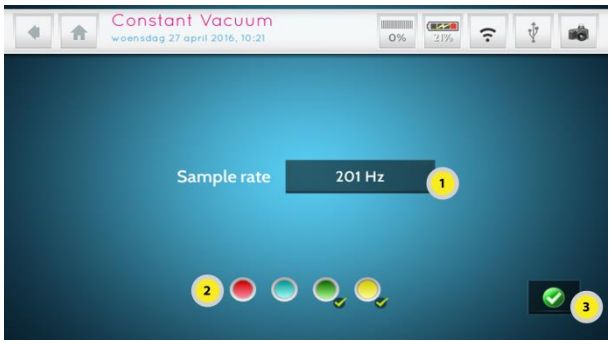
The measurement can be performed using one or both internal sensors. If external sensors are present, these can also be used for the measurement. This means measurements can be made in up to four places at the same time. These external sensors are connected to the milking installation using a needle and moisture trap (in the event of there being any fluid (milk) present in the tubing).

The constant vacuum measurement is carried out for an indefinite period of time. The measurement is stopped at the end of a time period determined by the user. In other words, the PT-VI logs the measurement values until the user stops the measurement. The graph display scales automatically so that it remains visible throughout the entire measurement.

The measuring frequency (the time between the measuring points) can be set in advance. The higher the measuring frequency, the greater the measurement files. The PT-VI can measure at frequencies up to 8,000 measuring points per second. Usually, in the milking stall, 201 data points per second for this type of measurement is sufficient, given that the vacuum sequence is slow. However, the user can decide what this app is used for.



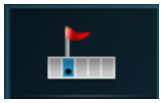
Connect the sensors to the milking installation and verify that the correct farm and user have been selected.
Choose "measurements" and click on "constant vacuum".



1. Enter the desired measuring frequency (sampling rate)
2. Choose the sensor you want to use to carry out the measurement.
3. The measurement will now be started.

When the measurement is being carried out, which can be followed live, a marker can be placed when desired. The measurement can be stopped at any time.

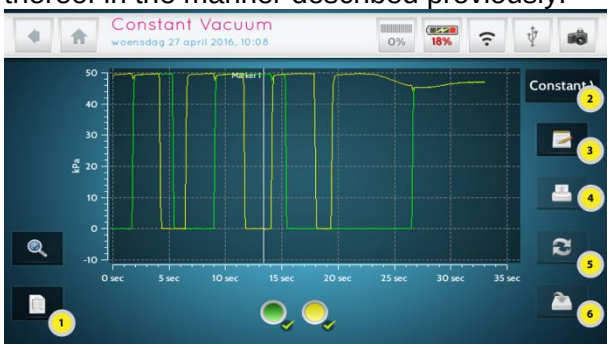
The measurement can be stopped with this icon. The measurement can now be saved or carried out again.

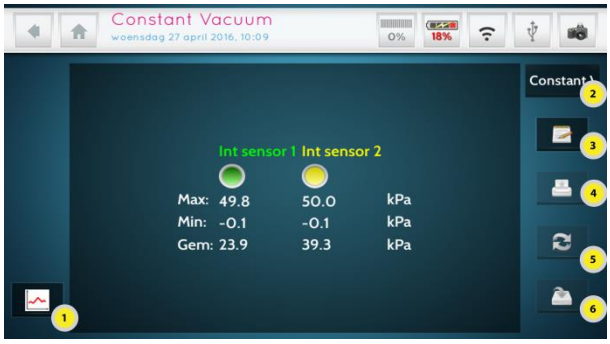


By clicking on this icon during a measurement, a point in time of the measurement is highlighted. You can provide a description of the marker in the note.

Each time the measurement is stopped, the following rule applies for the calculation of the minimum, maximum and average value. This value will always be displayed in the table for the period that the user is currently looking at in the screen. When the picture is zoomed in or out, the PT-VI calculates these values for the zoomed area. Each part, whether zoomed in or out, can be saved separately with the corresponding values that have been calculated on the visible part of the screen. After saving, the PT-VI always asks whether the measurement should be deleted or whether a part should be saved separately. This procedure can be repeated indefinitely. It is also possible to load previously saved

measurements from memory and save parts thereof in the manner described previously.

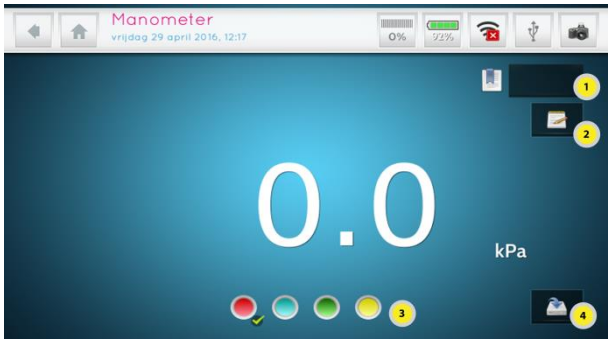




1. Use this icon to toggle between table and graph.
2. Enter a name for the measurement, so it is easy to find.
3. Add notes, for example, about the markers used.
4. Print the data.
5. Repeat the measurement.
6. Save the measurement results.

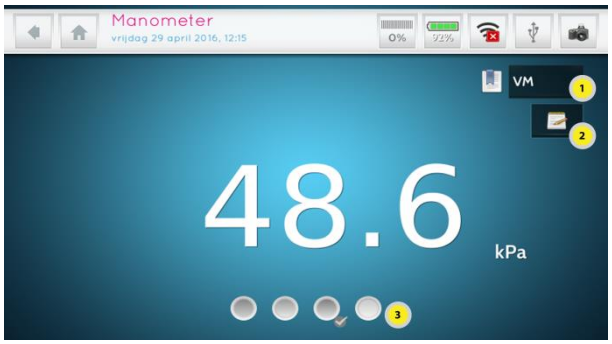
4.6.4 Pressure gauge

Go to the measurements menu and select the pressure gauge icon.



1. Give measurements a file name
2. Add notes to the measurement.
3. Select the sensor to be used.
4. Save the measurement.

The saved measurements can be found in the file manager as follows.



1. The selected file name.
2. Notes added to the measurement by the user.
3. The check mark shows which sensor was used.

The measured value is displayed in the middle of the screen.

4.7 Saving and representing of measurement data

All the measurements that have been saved in PT-VI memory can be:

* displayed on the screen;

The list is now sorted by date, with the last measurement at the top.

The list is now in alphabetical order.

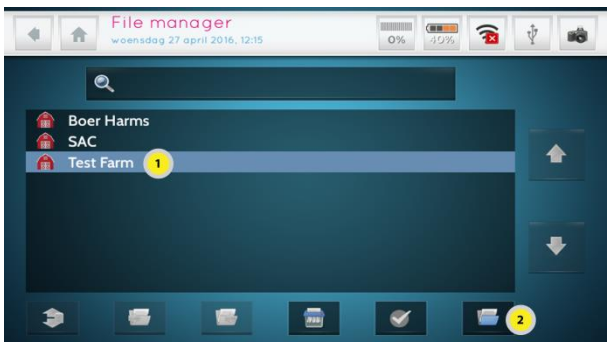
* printed to a connected printer;
* copied from a connected PC or MAC;
* exported to a USB stick or hard drive;
* imported from a connected USB stick or hard drive;
* removed from the file manager.

Measurements can be displayed, printed out, send to a PC or deleted from memory, for one, multiple or all farms.

4.7.1 Saving and supplementing measurement data

The PT-VI uses a unique method of saving measurements. This is true for all measuring apps. Each measurement can be saved with an identification label, which is visible in the file manager. It can also be added to the notes of each measurement. This is an option that allows additional information about the measurement to be entered via a keyboard on the screen. Both identification label and notes can be changed from the file manager. The PT-VI automatically adds the date and time to the measurement when the measurement is carried out.

All measurements can be retrieved by going to the file manager in the main menu. A list of all farms where measurements have been carried out will appear.



1. Select the farm for which you want to see the measurements.
2. Open the file folder for the selected farm.

You then enter the farm file folder in which all measurements are saved. As standard, measurements are saved in order of date and time of the measurement, with the last measurement at the top. You can also sort the list alphabetically using the icons below.

1. Select the measurement.
2. Sort the measurements by date/alphabetical order.
3. Import measurements from a USB stick.
4. Export measurements to a USB stick.
5. Delete the selected measurement.
6. Select multiple measurements, all measurements are selected when pressing this button again.
7. Scroll through the list of measurements using the arrows. This can also be done manually by moving the finger around the measurements.
8. Open the selected measurement.

4.7.2 Export measurement data

It is possible to import measurements from a PC or MAC using special software (Report Generator), which is available through the ATV Agri website. This Report Generator displays your chosen readings per farm name with tables, graphs, file name, and notifications. Using the Report Generator, the chosen measurement can be amended and selected for display in a report. More information about using the Report Generator can be found in the Report Generator manual.

The Report Generator can only be downloaded from the internet or by contacting us, in which case, ATV Agri will make a download link available.

By connecting the PT-VI to a PC using a USB cable, all files (measurements, notes and screenshots) will be copied or moved to the PC. The PT-VI behaves like an external hard drive.

Measurements can also be exported to a USB stick. This is achieved in the PT-VI file manager (see Chapter 4.6.2). This can be useful, for example, if measurements have to be exchanged between multiple PT-VI.

4.8 Error messages

The vacuum curve is assessed on a number of points. Errors are displayed with an error message.

If a drop in vacuum level in the B phase of more than 4 kPa with a duration exceeding 15 ms is observed, message "v" is displayed on the screen. See also the table below.

If a drop in vacuum level in the B phase of more than 2 kPa with a duration exceeding 15 ms is observed, message "~" is displayed on the screen. See also the table below.

If fluctuations in pressure greater than 2 kPa and with a duration greater than 15 ms are measured in the D phase, error message "~" will be displayed on the screen. Fluctuations are measured in relation to local atmospheric pressure.

If a difference exceeding 2 kPa is measured between the top vacuum levels in channel 1 and channel 2, error message "^" will be displayed on the screen.

The following table gives a brief summary of the error messages.

Phase	Assessment of	Error	Error message
B	Vacuum reduction	>4 kPa and >15 ms	v
B	Vacuum reduction	>2 kPa and >15 ms	~
D	Vacuum fluctuation	>2 kPa and >15 ms	~
Top vacuum	Difference in top vacuum between channels 1 and 2	>2 kPa	^

5 TECHNICAL SPECIFICATIONS

Range of PT-VI:

Curve measurement	+10 - 90 kPa.
Constant vacuum measurement	+10 - 90 kPa.
Airflow meter	+10 - 90 kPa.
Volt meter	0 - 40 Vdc

Measuring range of airflow meter:

General	30 - 3000 l/min.
With bypass	+ 2000 l/min

Sample frequency:

Curve measurement	201 Hz
Constant vacuum measurement	adjustable between 201 Hz and 8 kHz
Course measurement	201 Hz
Collapse measurement	201 Hz
Slugs measurement	201 Hz
Voltage measurement	adjustable between 201 Hz and 8 kHz

Accuracy:

Vacuum measurement	0.1 kPa
Airflow meter	max +/- 5% (in accordance with ISO 6690 4.4)

Measurement units

Vacuum	kPa or In.Hg (selectable by user)
Time	mSec, Sec / p/min and % (selectable by user)
Airflow	l/min or cufeet/min (CFM) (selectable by user)

Display screen

Mode	Capacitive touchscreen
Resolution	800 x 480 pixels
Observable size	Diagonal 177.8 mm (7 Inch)

Environmental specifications

Temperature	0ºC - +45ºC
Storage temperature	-20ºC - +60ºC
Protection rating	IP33
Relative humidity	max 90% non-condensating
Height above sea level	max 3,600 m

Mechanical specifications

Dimension (L x W x H)	250 mm x 185 mm x 50 mm
Weight	0.9 kg

Electrical specifications

AC power adaptor	100 – 230 V / 50-60 Hz – 5 Vdc – 2.5 A, standard USB
Car adapter	12 V – 5 Vdc – 2.5 A, standard USB cigarette lighter
Mains plug	EUR, UK, AUS and US
Batteries	Li-ion
Battery voltage	3.7 Volt
Battery capacity	7800 mAh
Working time	8 hours with 25% backlight and full batteries
Maintenance	Built-in battery optimiser

Standards:

EMC	EN 61326-1:2006, EN61326-2-2:2006
LVD	EN 61010-1:2010
R&TTE	EN 301 489-17v2.1.1:2009, EN 300 328v1.7.1:2006
Safety	CE directive
EMI/EMC	CE directive
Accuracy and Stability	ISO/DIN 3918, 5707 and 6690

Interface:

USB-A, master	Version 2.0
USB-B, slave	Version 2.0
Analogue inputs	0 – 10 V (industrial standard), 12 bits ADC
WIFI	IEE 802.11 b/g/n, 2,4 GHz (ISM-band
Bluetooth (optional)	Version 4.0
CAN (optional)	110 kbit/sec
Airflow meter	ATV Electronic Airflow meter

Platform:

Operating system	Linux

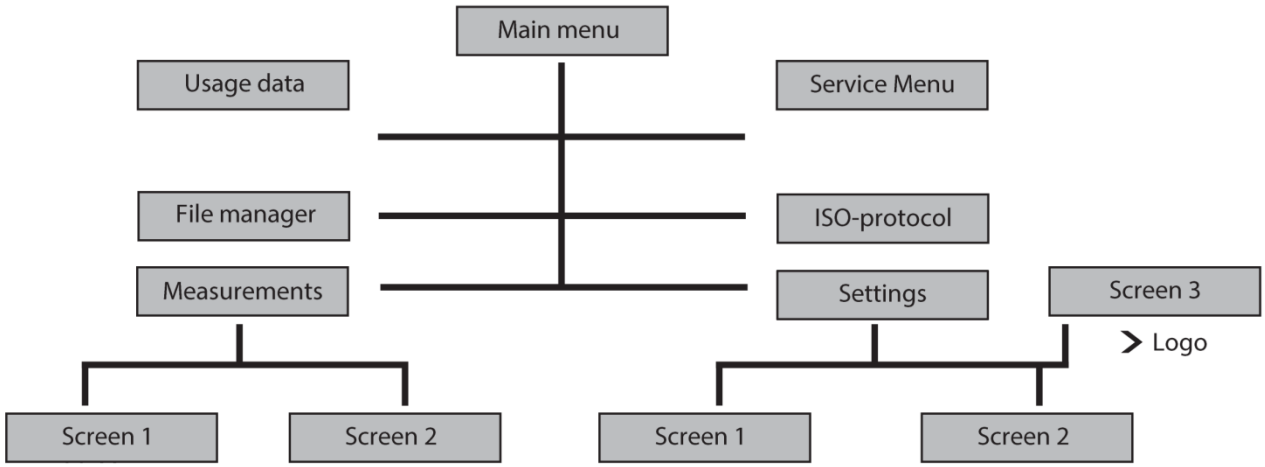
Memory/storage:

Model	8 GB, sufficient for more than 5,000 measurements

Printer:

Thermal printer (optional)	ZEBRA iMZ320 3 inch

MENU STRUCTURE



* Available as an option and will be provided with separate instructions.

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