EbullMate
Processor for ebulliometer

USER'S GUIDE

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CONTENTS:

1. General information

1.1. Applications

The main application of the processor for ebulliometer **EbullMate** is to automate and increase the measurement accuracy of conventional ebulliometers (with spirit lamp or electric) that measure volume content of ethyl alcohol in low alcohol content liquids (wine, beer etc).

To use the processor for ebulliometer **EbullMate** it is enough to replace the thermometer (mercury or electronic) of your conventional ebulliometer with the temperature probe of **EbullMate .**

1.2. Working principle of ebulliometer

The ebulliometer working principle is based on calculation of volume content of ethyl alcohol as a function of difference between distilled water boiling temperature and sample boiling temperature at the one and same atmospheric pressure.

$$A = f(dT), [\%]$$

where:

A - volume content of ethyl alcohol [%]

dT = Tw - Ts

Tw - distilled water boiling temperature.

   The distilled water boiling temperature depends on atmospheric pressure.

Ts - sample boiling temperature.

   The sample boiling temperature depends on the atmospheric pressure at the time of measurement, on the alcohol content and also on the content of the other components included in the sample.

1.3. Working using classic ebulliometer

When working with a classic ebulliometer the laboratory assistant must :

1) To measure distilled water boiling temperature **Tw**
2) To measure sample boiling temperature **Ts**
3) To calculate temperature difference **dT**
4) To determine volume content of ethyl alcohol **A** from the ebulliometric table depending on **dT**.

1.4. Working using processor for ebulliometer EbullMate

When working with **EbullMate** the laboratory assistant must :

1) To prepare the ebulliometer for sample measurement
2) To start the ebulliometer heating
   - in case of using an ebulliometer with a spirit lamp - to light it.
   - in case of using an electric ebulliometer - to turn on the heater.

Note: in case of using an electric ebulliometer with two power levels - to turn on the high power.

All other activities are fully automated as:

- Distilled water boiling temperature **Tw** is calculated from **EbullMate**(no need to be measured) , based on measured atmospheric pressure from the embedded precise atmospheric pressure sensor.
- Sample boiling temperature **Ts** is measured from **EbullMate** using the precise temperature sensor immersed in the boiling sample(in place of the conventional thermometer, in the ebulliometer used) and the built-in boiling temperature determination algorithm.
- Temperature difference **dT** is automatically calculated from **EbullMate.**
- Volume content of ethyl alcohol A is automatically calculated from EbullMate based on calculated dT and the built-in ebulliometry table.

2. Description

2.1. Appearance

Fig. 1

2.2. Front panel

Fig. 2

2.3. Rear panel
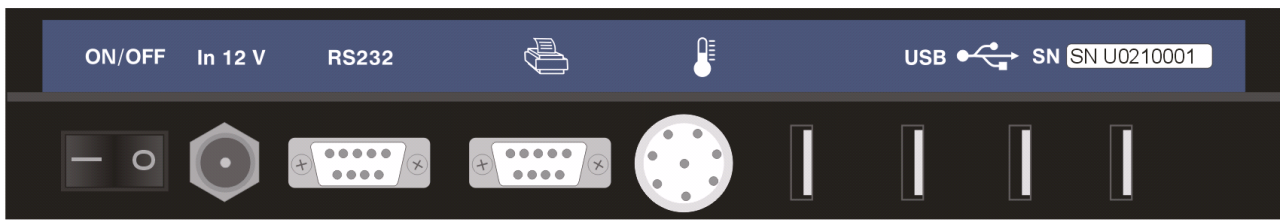
Fig. 3

3. Characteristics

3.1. Measuring characteristics

at alcohol content measurement:

Range (% by volume)	0 -15	15 - 25
Resolution	0,01%	0,01%
Repeatability	±0,05%	±0,1%
Measurement accuracy (absolute)	±0,1%	±0,2%

at boiling temperature measurement:

Range	0 -120 °C
Resolution	0,001 °C
Repeatability	±0,02 °C
Measurement accuracy (absolute)	±0,03 °C

at atmospheric pressure measurement:

Range	700 - 1100 hPa
Resolution	0,1 hPa
Repeatability	±0,2 hPa
Measurement accuracy (absolute)	±0,3 hPa

Time per measurement :
The measurement time depends on the ebulliometer used. Normally the measurement time is within few minutes. The absolute maximum measurement time is restricted up to 25 minutes.

3.2. Operating conditions
Ambient temperature... 15-35 °C
Relative ambient humidity.. 30-80   %
Temperature of sample measured....................................... 10-45   °C

3.3. Power source

Power supply .... 12 V DC (10 .. 15 V) 2A Max.
Input connector .... 2.1 x 5.5 mm positive center
Power consumption .... 24 W Max.
*The device kit contains AC/DC adapter 12VDC / 2A

3.4. Additional characteristics
Overall dimension (H x W x D) .... 90 x 270 x 230 mm
Weight .... 1.1 kg

4. Installing and preparation for work
4.1. Place the processor for ebulliometer **EbullMate** on a smooth and level surface, close to the conventional ebulliometer you are going to use.

 4.2. Connect the temperature sensor (see Fig. 1) to the **EbullMate** connector located on the rear panel of the device.
Note: The connector intended for connecting the temperature sensor is marked with the following sign (see Fig. 3):

4.3. Remove the original thermometer (such as mercury) from the ebulliometer you are going to use and replace it with the temperature sensor from the **EbullMate** ebulliometer processor kit.

4.4. Connect the connector from the power supply adapter cable to the **EbullMate** connector located on the rear panel of the appliance and marked as "In 12V" (see Fig. 3).

4.5. Connect the power supply adapter to the electrical network with a rated voltage according to the nameplate of the mains adapter.

4.6. Turn on the power to the **EbullMate** from the "ON / OFF" switch located on the rear panel of the device (see Fig. 3).

4.7. Select your preferred language (see item 5.5.4.1.).

4.8. Select the ebulliometer type to be used (see item 5.5.4.3).

4.9. Select your preferred temperature scale (temperature unit) (see item 5.5.4.4).

4.10. Prepare the ebulliometer to be used according to its operating instructions.

5. Working with the device

5.1. Starting up

After the connecting the power cable to the electrical network and turning the power on using   <On/OFF> switch (see Fig. 3) the device start its work with a checking procedure and also deleting of obsolete files from the build-in SD card - data collection files, temperature files, error log files and diagnostic files (see items 5.5.5.1, 5.5.5.2 and 5.5.5.3).
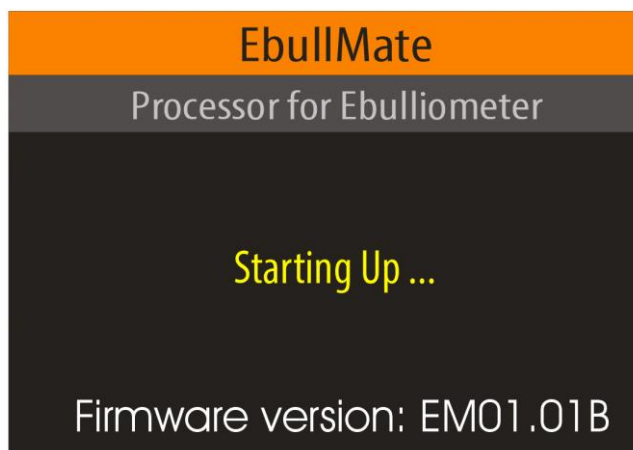
During the components checking procedure is in progress, the current software version is displayed at the bottom of the display (for example "Firmware version: EM01.01B")

In case of a fault is detected in some of the components, the corresponding error message appears on the display, accompanied by an audible signal.

5.2. Home screen

The Home screen appears after the Starting Up procedure complete.
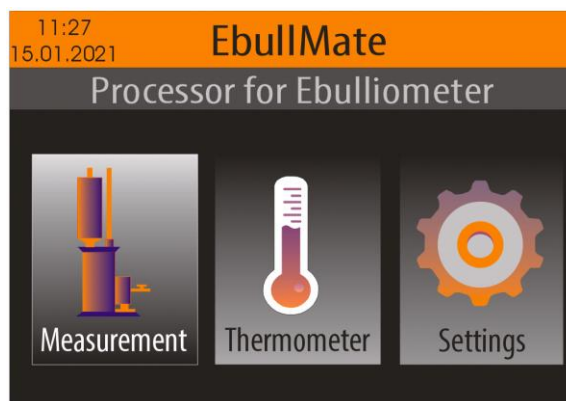
From this screen you may select the icon "Measurement", "Thermometer" or "Settings" using the buttons <Left arrow> / <Right arrow>.

5.3. "Measurement" mode

"Measurement" mode is designed to determine the boiling temperature of the sample(wine) and calculating the volume percentage of ethyl alcohol.
Before to start the "Measurement" mode please prepare the ebulliometer for sample measurement, following the instructions about the flushing the measurement system, sample quantity and cooling system preparing, as it is described in user's manual of your ebulliometer.
Make sure the selected ebulliometer type match of the your ebulliometer type. (see item 5.5.5.3. - Selecting the ebulliometer type).

After the starting of "Measurement" mode (see item 5.2.) the user should select the wine type that will be measured - Dry, semi-dry, semi-sweet, sweet, User type 1, User type 2, ... User type 10.

Note: The following parameters can be entered for each of the above types of wines:
 - Sugar content
 - Alcohol correction
 - Note
For more details about how to edit the parameters of the wine types, see item 5.5.3. - Wine type settings

To select the wine type you will measure, use buttons <Arrow up> / <Arrow down> and then confirm with button <OK>.

IMPORTANT : Once you have started the measurement, start the supply of heat to your ebulliometer:
- In case you use an ebulliometer with a spirit lamp - light the spirit lamp.
- In case you use an electric ebulliometer with fixed power - turn on the heating.
- In case you use an electric ebulliometer with two power levels- turn on High Power.

The correct operation of the device depends on the correct choice of the type of ebulliometer you are using. You can read more details about the choice of ebulliometer type in item 5.5.4.3. - Ebulliometer type.

Below is shown an example of the panel with started measurement process:

Wine type - the selected wine type
Note - note for the selected wine type
Sugar content - sugar content for the selected wine type
Alcohol correction - alcohol correction for the selected wine type
Current temperature - currently measured temperature value of the sample (wine)
Atmospheric pressure - currently measured atmospheric pressure value
Time - the elapsed time since the start of the measurement process
Heater Power - The power(High/Low) that must be applied to the ebulliometer heater.
   Notes:
  1). This message is shown on the display only in case the ebulliometer type is set to :
    "Electric with High/Low power" (see item 5.5.5.3. - Selecting the ebulliometer type).

   2). During the measurement process when the user(laboratory assistant) must switch the power applied to the ebulliometer heater from high to low the device emits a specific sound signal.

If the user wants to break (cancel) the measurement process this can be done using the buttons <MODE> or <HOME>.

Note:
If you cancel the measurement please do not forget to stop supplying heat to your ebulliometer.

5.3.1. Automatic reading of the boiling temperature and the percentage of alcohol
In the device is embedded a boiling temperature determination algorithm based on multiple criteria. After all criteria are met the measurement process is stopped, the volume content of ethyl alcohol is calculated, the device beeps and the results are shown as shown below:
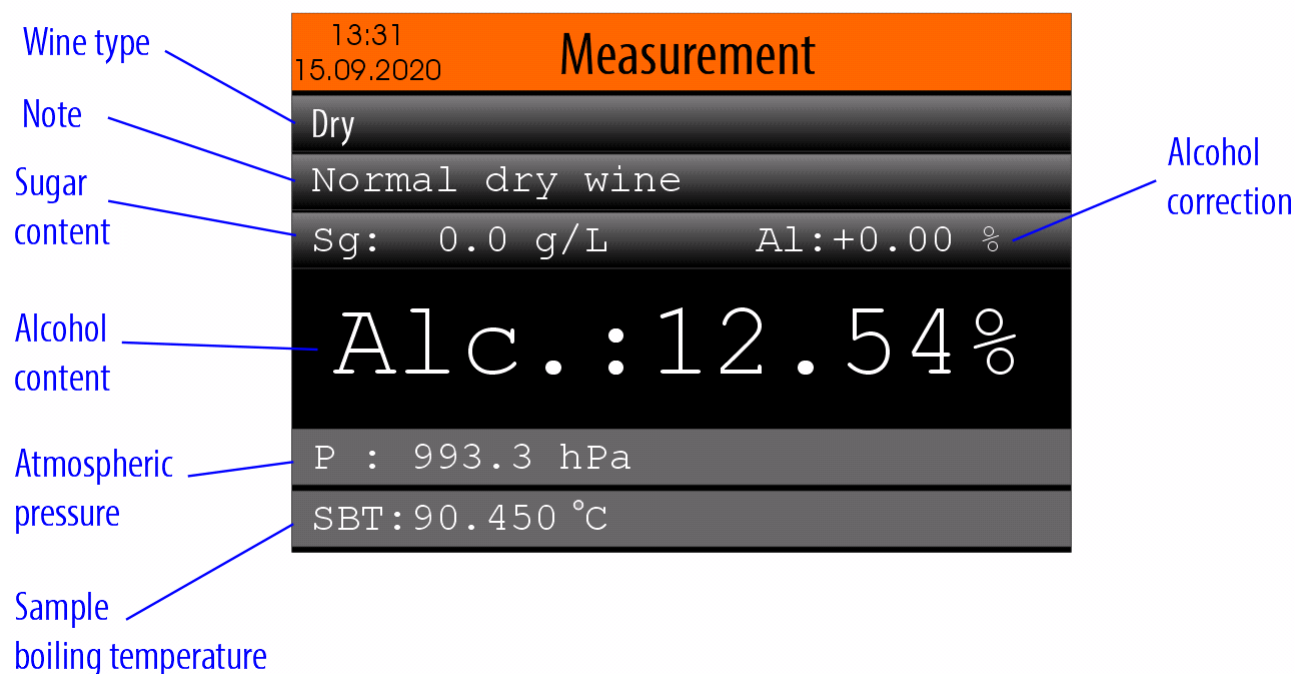
Wine type - the selected wine type
Note - note for the selected wine type
Sugar content - sugar content for the selected wine type
Alcohol correction - alcohol correction for the selected wine type

Alcohol content - Calculated sample (wine) alcohol content
Atmospheric pressure - measured atmospheric pressure
Sample boiling temperature - measured sample (wine) boiling temperature

After the measurement results are displayed, please stop supplying heat to your ebulliometer.

Note:
Depending on the type and amount of additional substances (except ethyl alcohol and water) in the measured wine, the boiling process may be uneven, which leads to cyclical fluctuations in the measured temperature and the inability to automatically read the boiling temperature. In such cases, the user can manually to read the boiling temperature of the wine (see item 5.3.2.).

5.3.2. Manual reading of the boiling temperature and the percentage of alcohol

Once the measurement process reaches a relatively stable sample temperature, an icon appears in the upper right corner of the screen indicating that the user can perform a manual reading by pressing the <OK> button.
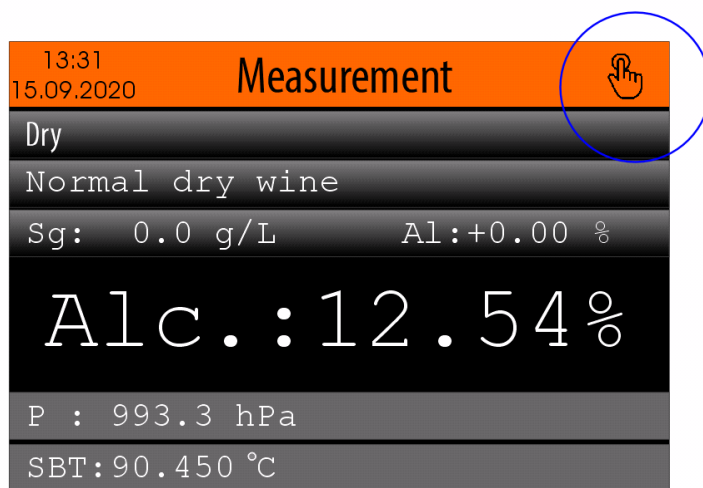
This way, the temperature displayed on the screen at the time of pressing the button <OK> is taken as the boiling point (boiling temperature) of the sample and is used to calculate the percentage of alcohol in the sample.
In this case, the results are displayed as follows :
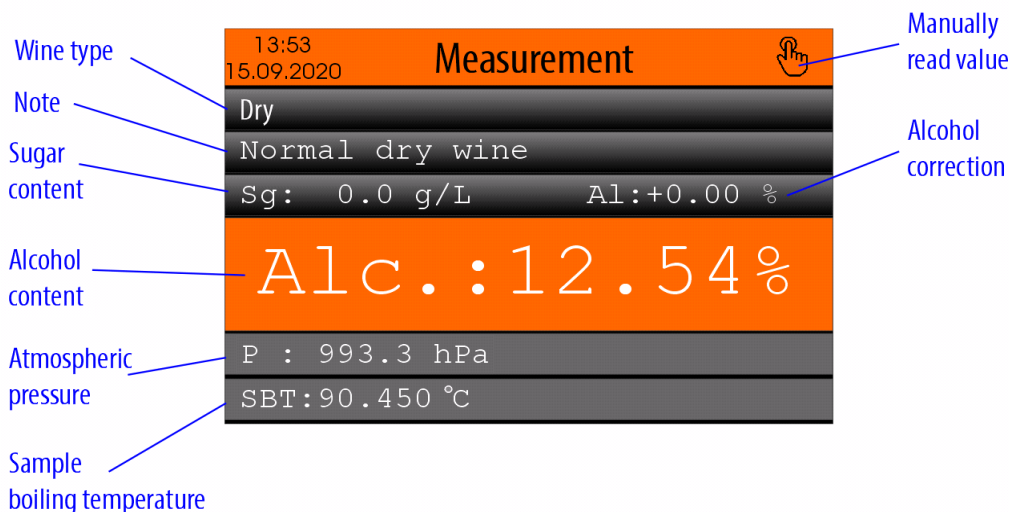
Manually read value - An icon indicating that the calculated result for alcohol content is made on the basis of a manually read sample (wine) boiling temperature.
Wine type - the selected wine type
Note - note for the selected wine type
Sugar content - sugar content for the selected wine type
Alcohol correction - alcohol correction for the selected wine type
Alcohol content - The calculated sample (wine) alcohol content
Atmospheric pressure - measured atmospheric pressure
Sample boiling temperature - measured sample (wine) boiling temperature

After the measurement results are displayed, please stop supplying heat to your ebulliometer.

If you have selected to use the built-in printer or if you have an external printer connected to the device and it is selected (see section 5.5.4.6.), the measurement results will be printed automatically.

Example of printout in case of automatic reading of the boiling temperature:

```
---- MEASUREMENT ----
Date:06/10/2020 Time:14:42:03
Measurement mode: Automatic
Sample Type: Dry wine
Sugar contents : 000.0 g/L
Alcohol correction : 0.00 %
Note: Normal dry wine


Sample alcohol contents: 12.37 %


Sample boiling temp.: 90.516 ^C
Atmospheric Pressure: 992.5 hPa
Water boiling temp. : 99.440 ^C
```

Example of printout in case of manual reading of the boiling temperature:

```
---- MEASUREMENT ----
Date:06/10/2020 Time:14:46:28
Measurement mode: Manual
Sample Type: Dry wine
Sugar contents : 000.0 g/L
Alcohol correction : 0.00 %
Note: Normal dry wine


Sample alcohol contents: 13.01 %


Sample boiling temp.: 90.197 ^C
Atmospheric Pressure: 992.5 hPa
Water boiling temp. : 99.440 ^C
```

If you want to print the results again, press the "Print" button located on the front panel of the device or use the F6 key from the USB keyboard.

Notes:
1. Please ignore the measurement result of the first measurement done after measuring the water boiling temperature determination. Repeat the measurement with a new sample from the same wine.
2. Please be aware the residual sugar in the wine affects the measurement result accuracy. For achieving best results it is recommended the meter to be calibrated with wines with known alcohol content and sugar content, that differs from the sugar content of the tested samples with no more than ±5%. The calibration value can be entered in the processor for ebulliometer EbullMate as a alcohol correction for the corresponding wine type. To enter this value use "Alcohol content correction"(see item 5.5.3.2.).
3. In case the atmospheric pressure sensor is disabled (see item 5.5.4.4.) and you have not performed water measurement in "Water" mode in the previous 24 hours, a warning message will appear on the screen:
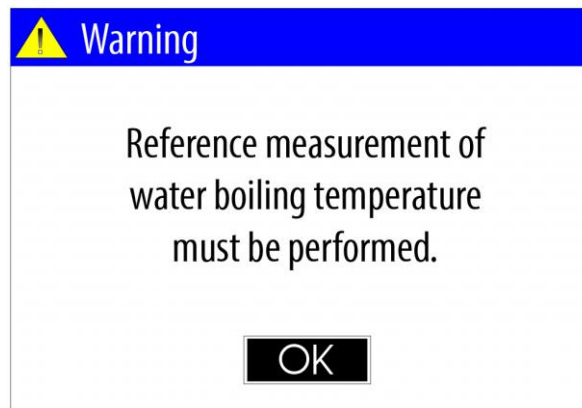
5.4. "Thermometer" mode

Thermometer mode allows you to use **EbullMate** to accurately measure and tracking the temperature and atmospheric pressure of various processes.

Before starting this mode, place the **EbullMate** temperature sensor where you want to measure and track the temperature.

*Note: Since the precision pressure sensor is installed inside the device housing, the measured atmospheric pressure is at the place where the **EbullMate** device housing is placed.*

To start the "Thermometer" mode, from the home screen select "Thermometer" icon, using the buttons <Left arrow> / <Right arrow> and confirm with <OK> button.

After starting t"Thermometer" mode the following panel is shown on the display:
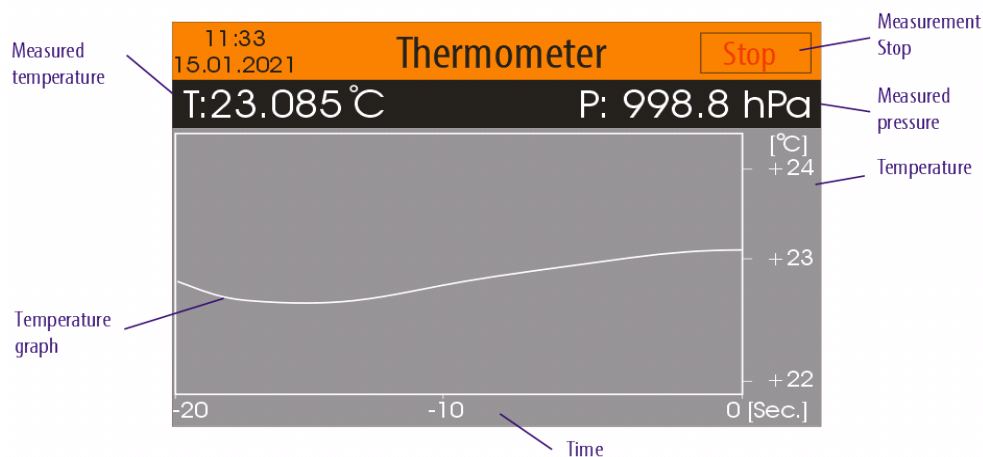
Measured temperature - the last measured temperature value.
Temperature graph - graphical representation of the temperature change as a function of time.
Time - Graphical representation of time. The time range is determined by the user (see item 5.5.4.7. Thermometer options).
Temperature - Graphical representation of the measured temperature. The temperature range is determined automatically, depending on the minimum and maximum value of the graph. The temperature scale depends on the selected one (see item 5.5.4.4. Temperature scale).
Measured pressure - the last measured atmospheric pressure value.
Measurement Stop - Indicates that the measurement process has been started and can be stopped by pressing the <OK> button from the keyboard.

In this mode, after each start of the measurement, the measured values of temperature and atmospheric pressure are saved in a file every second until the process is stopped by pressing the <OK> button.
If the process is stopped, it can be restarted using the <OK> button.

You may read more about temperature files and how to uploading them to a USB flash drive in item 5.5.5.2 - Temperature files upload.

5.5. "Settings" menu

To start the "Settings" menu, from the home screen select "Settings" icon, using the buttons <Left arrow> / <Right arrow> and confirm with <OK> button.
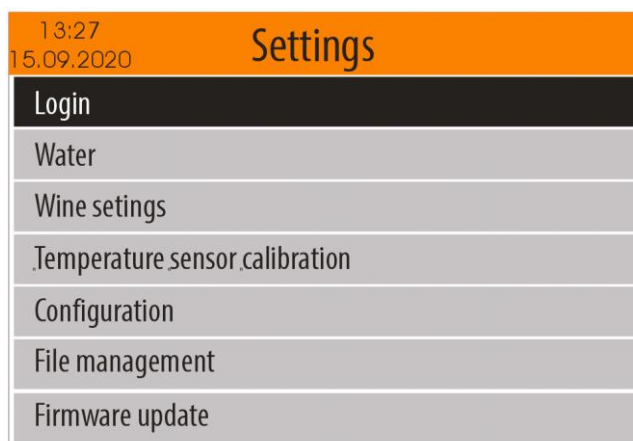
The available options are as follows:
- Login
- Water
- Wine settings
- Temperature sensor calibration
- Configuration
- File management
- Firmware update
- About device
- System

5.5.1. "Login" menu

To enter in "Login" menu, from the "Settings" menu, using the buttons <Up arrow> /<Down arrow> select the "Login" menu item and confirm with <OK> button.

After confirmation with the <OK> button, the selected option is saved in the non-volatile memory of the device and remains valid until the next change.
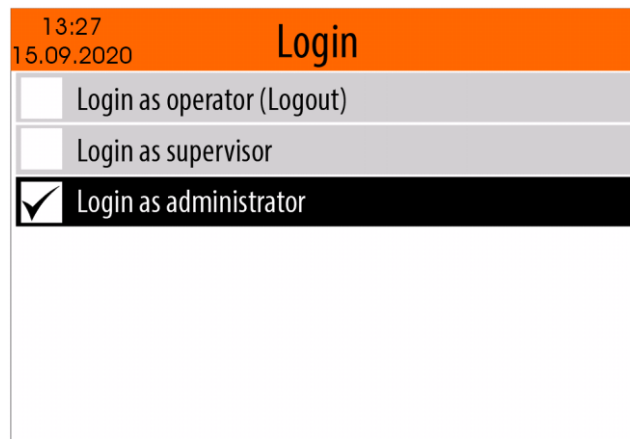
Depending on the selected option, the access to some of the modes from the "Settings" menu is determined.

5.5.2. "Water" mode

Important: The "Water" mode must be used in case the atmospheric pressure sensor is disabled (see item 5.5.4.4.).

The "Water" mode is designed to measure the boiling point (boiling temperature) of distilled water, and the measurement result is recorded in the non-volatile memory of the device.

In case the atmospheric pressure sensor is deactivated (disabled), the recorded value is used in the "Measurement" mode for the next 24 hours to determine the volume content of ethyl alcohol.
In this case if you try to use the "Measurement" mode, but you have not performed a measurement in the "Water" mode in the previous 24 hours, a warning message will appear on the screen:
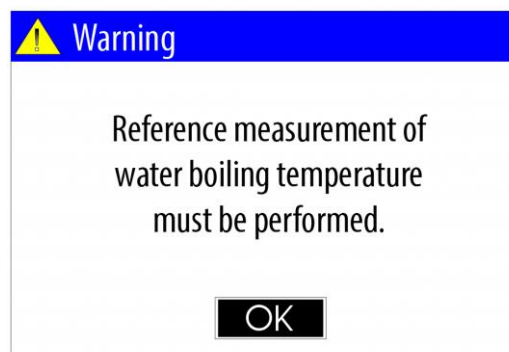
If the atmospheric pressure sensor is activated (enabled), the recorded value of this measurement is not used to determine the alcoholic strength by volume in the "Measurement" mode.

Before starting the "Water" mode, flush the measuring system, following the instructions in the user's manual of your ebulliometer.

To start the "Water" mode form the "Settings" menu select "Water" option, using the buttons <Up arrow> /<Down arrow> and confirm with <OK> button.

IMPORTANT : Once you have started "Water" mode, start the supply of heat to your ebulliometer:
- In case you use an ebulliometer with a spirit lamp - light the spirit lamp.
- In case you use an electric ebulliometer with fixed power - turn on the heating.
- In case you use an electric ebulliometer with two power levels- turn on High Power.

The correct operation of the device depends on the correct choice of the type of ebulliometer you are using. You can read more details about the choice of ebulliometer type in item 5.5.4.3. - Ebulliometer type.

Current temperature - currently measured value of the distilled water temperature
Time - the elapsed time since the start of the measurement process
Heater Power - The power(High/Low) that must be applied to the ebulliometer heater.
Notes:
1). This message is shown on the display only in case the ebulliometer type is set to :
"Electric with High/Low power" (see item 5.5.5.3. - Selecting the ebulliometer type).
2). During the measurement process when the user(laboratory assistant) must switch the power applied to the ebulliometer heater from high to low the device emits a specific sound signal.

If the user wants to break(cancel) the measurement process this can be done using the buttons <MODE> or <HOME>.
Note:
If you cancel the measurement, please do not forget to stop supplying heat to your ebulliometer.

In the device is embedded a boiling temperature determination algorithm based on multiple criteria. After all criteria are met the measurement process is stopped, the measured temperature is saved in the non-volatile memory, the device beeps and the results are displayed as shown below:
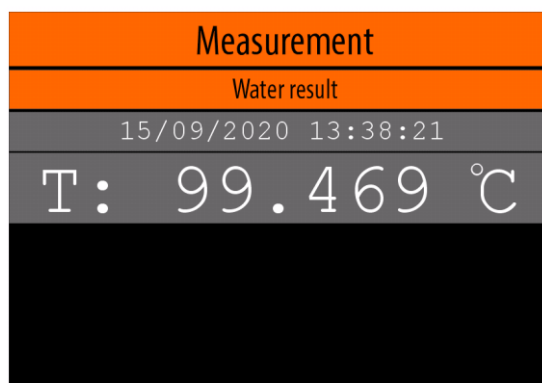
After the measurement results are displayed, please stop supplying heat to your ebulliometer.

If you have selected to use the built-in printer or if you have an external printer connected to the device and it is selected (see item 5.5.4.6.), the measurement results will be printed automatically.

Example of printout:

```
---- MEASUREMENT ----
Date:05/10/2020 Time:16:07:29
Sample Type: WATER
Boiling temperature: 99.493 ^C
```

If you want to print the results again, press the "Print" button located on the front panel of the device or use the F6 key from the USB keyboard.

5.5.3. "Wine settings" menu

From the "Settings" menu, using the buttons <Up arrow> /<Down arrow> select "Wine settings" menu item and confirm with <OK> button.
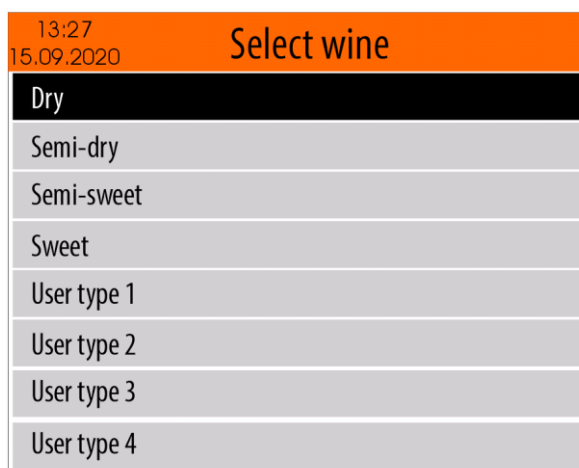
On the screen will appears a menu from which the user should select the type of wine to be edited - Dry, Semi-dry, Semi-sweet, Sweet, User type 1, User type 2, ... User type 10.

Once the type of wine to be edited is selected (for example "Dry"), the user should select one of the following editing parameters:
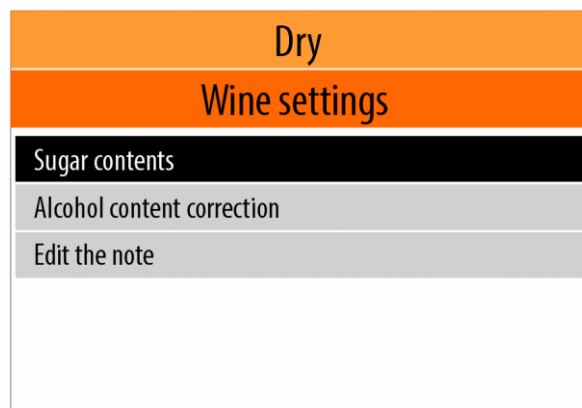
Using the buttons <Up arrow> /<Down arrow> select one of the menu item and confirm with <OK> button.

5.5.3.1. Editing of Sugar content

Once "Sugar contents" menu option is selected (see item 5.3.3.) on the screen will appears the value of sugar content for the selected wine type, saved in the non-volatile memory in the device.
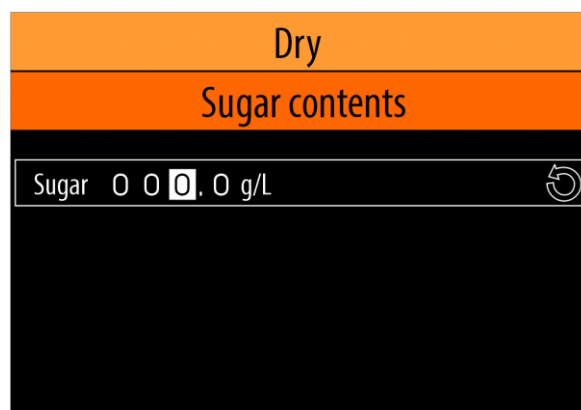
Use the buttons <Left arrow> / <Right arrow> to select which digit of the number to edit, and use the buttons <Down arrow> / <Up arrow> to set the desired value.
If a USB keyboard is connected to the device, you can enter the desired value using the numbers 0 ... 9.

To confirm the selected value press the button <OK>. This way the value will be saved in the non-volatile memory in the device.

If you do not want the changes to be saved, press the <MODE> or <HOME> button.

If you want to enter the default value for sugar content (0.0 g / L), use the <Left arrow> / <Right arrow> buttons to select the default value icon and press the <OK> button.

5.5.3.2. Editing of alcohol content correction

Once "Alcohol content correction" menu option is selected (see item 5.3.3.) on the screen will appear the value of alcohol content correction for the selected wine type, saved in the non-volatile memory in the device.

Use the buttons <Left arrow> / <Right arrow> to select which digit of the number to edit, and use the buttons <Down arrow> / <Up arrow> to set the desired value.
If a USB keyboard is connected to the device, you can enter the desired value using the numbers 0 ... 9,"+" and "-".

To confirm the selected value press the button <OK>. This way the value will be saved in the non-volatile memory in the device.
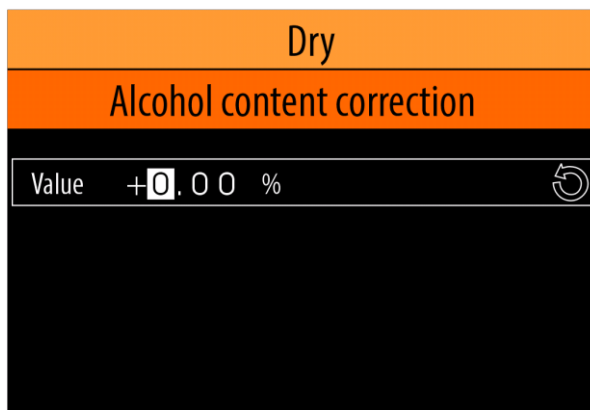
If you do not want the changes to be saved, press the <MODE> or <HOME> button.

If you want to enter the default value for sugar content (0.0 %), use the <Left arrow> / <Right arrow> buttons to select the default value icon and press the <OK> button.

5.5.3.3. Editing the note

Notes:
1). To edit the note for any of the wine types, it is necessary to connect a USB keyboard to one of the four USB connectors mounted on the rear panel of the device (see Fig. 3).
2). The content of the note text can only be entered in Latin letters.

Once "Edit the note" menu option is selected (see item 5.3.3.) on the screen will appear the text for the selected wine type, saved in the non-volatile memory in the device.

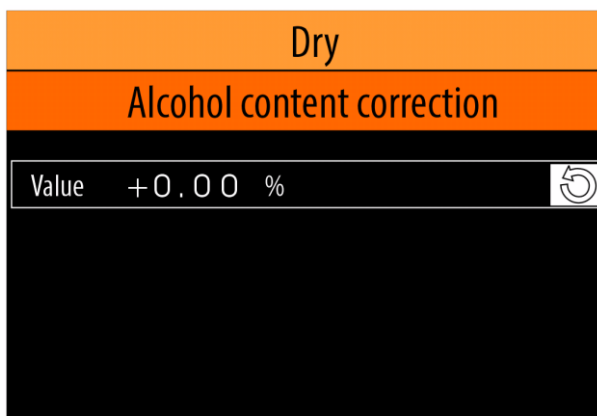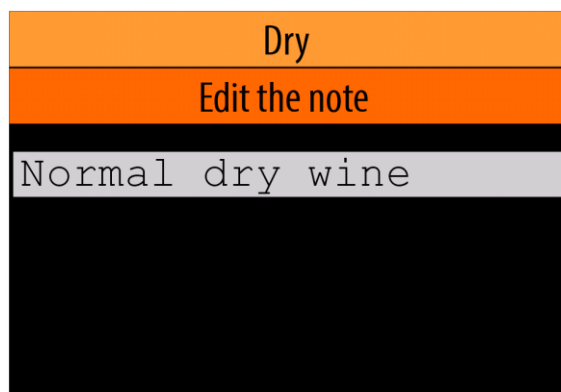The blinking cursor indicates the position at which the next character will be entered. Use the <Left Arrow> / <Right Arrow> buttons to change the cursor position. To fill in the note text, use the symbols "a" ... "z", "A" ... "Z", numbers "0...9" and the punctuation marks as well.

To confirm the entered text press the button <OK>. This way the text will be saved in the non-volatile memory in the device.

If you do not want the changes to be saved, press the <MODE> or <HOME> button.

5.5.4. "Calibration" menu

To select the "Calibration" menu, from the "Settings" menu (see item 5.5.), Select the "Calibration" option using <Down arrow> / <Up arrow> buttons and then confirm with the <OK> button.

To return to the "Settings" Menu, press the <MODE> button. To return to the Home screen, press the <HOME> button.
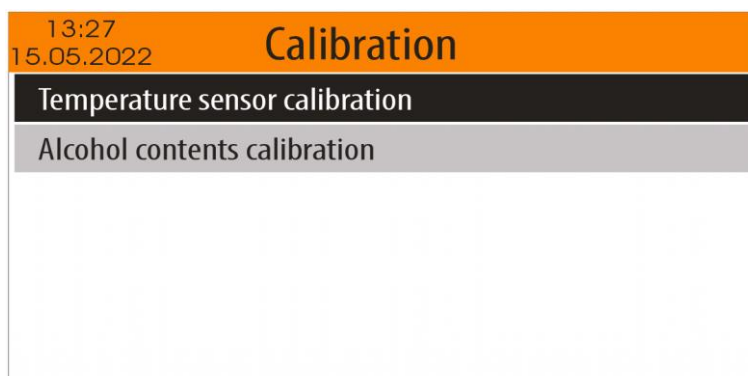
5.5.4.1. Temperature sensor calibration

Periodic calibration of the temperature sensor in combination of your ebulliometer ensures the correct operation of the processor for ebulliometer EbullMate and accurate measurement results.

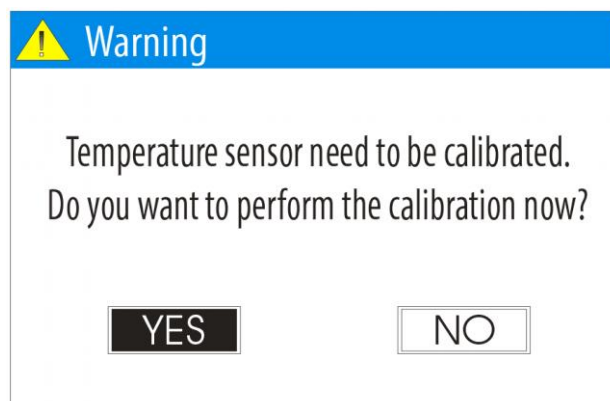The temperature sensor calibration procedure includes several (2) preliminary distilled water measurements and several (3) distilled water measurements, from which the new temperature sensor calibration value is calculated.

Temperature sensor calibration must be performed in the following cases:
  - At initial installation
  - Periodically (30 days or often , at the discretion of the laboratory assistant)

- When changing the used ebulliometer

Note: After initial installation or if the temperature sensor has not been calibrated in the previous 30 days, the following warning message will appear on the display when you start "Measurement", "Water" or "Thermometer" mode:


If you select "YES" with the <Left arrow>/ <Right arrow> buttons and confirm with the <OK > button, the temperature sensor calibration procedure will start.

In case you select "NO" with the <Left arrow>/ <Right arrow> buttons and confirm with the <OK > button you will be able to proceed to the selected mode and this message will not appear until the next turning the power on.

Before starting the "Temperature sensor calibration" mode, carefully clean the measuring system of your ebulliometer with distilled water.

To select the temperature sensor calibration mode from the "Settings" menu (see item 5.5.) select the "Temperature sensor calibration" option using <Down arrow> / <Up arrow> buttons and then confirm with the <OK> button.

The following message will appear on the display:
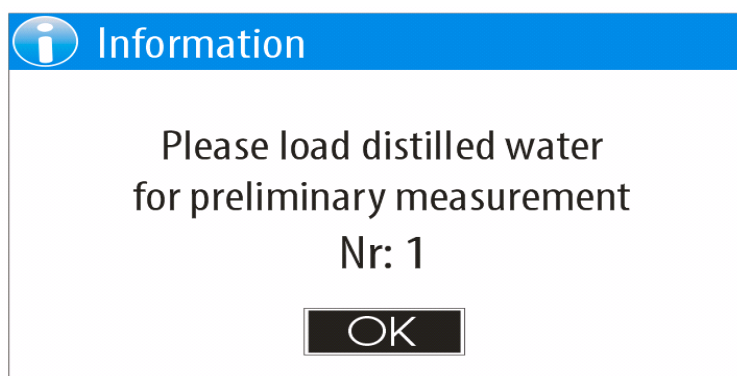
IMPORTANT : Once you have started the measurement, start the supply of heat to your ebulliometer:
- In case you use an ebulliometer with a spirit lamp - light the spirit lamp.
- In case you use an electric ebulliometer with fixed power - turn on the heating.
- In case you use an electric ebulliometer with two power levels- turn on High Power.

The correct operation of the device depends on the correct choice of the type of ebulliometer you are using. You can read more details about the choice of ebulliometer type in item 5.5.4.3. - Ebulliometer type.

Below is shown an example of started measurement process as part of the temperature sensor calibration procedure.
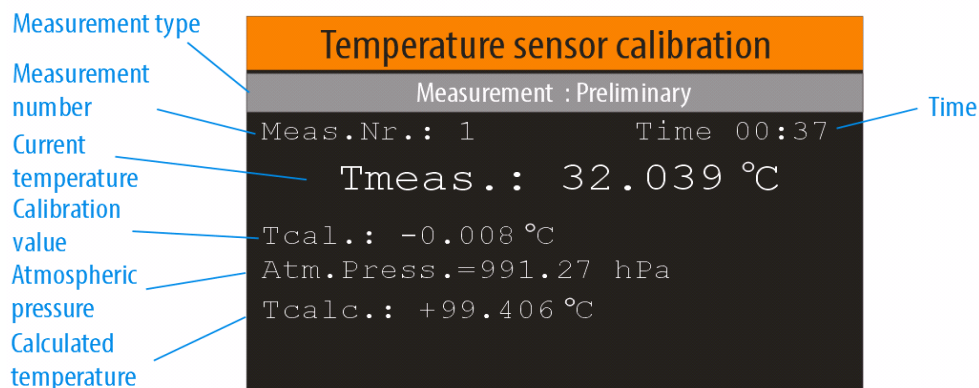
Measurement type - Preliminary or Calibration
Measurement number - The number or the current measurement
Current temperature - Currently measured temperature
Calibration value - Current calibration value (from the previous calibration)
Atmospheric pressure - Currently measured atmospheric pressure
Calculated temperature - Calculated distilled water boiling temperature based on the measured atmospheric pressure
Time - the elapsed time since the start of the current measurement process

Heater Power - The power(High/Low) that must be applied to the ebulliometer heater.
  Notes:
  1). This message is shown on the display only in case the ebulliometer type is set to :
      "Electric with High/Low power" (see item 5.5.5.3. - Selecting the ebulliometer type).

  2). During the measurement process when the user(laboratory assistant) must switch the power applied to
      the ebulliometer heater from high to low the device emits a specific sound signal.

After the current measurement complete, please stop supplying heat to your ebulliometer.

After the completion of the first measurement, a series of similar messages will follow with instructions for the laboratory assistant (user) until the complete completion of the calibration procedure, which will be announced by the following message:
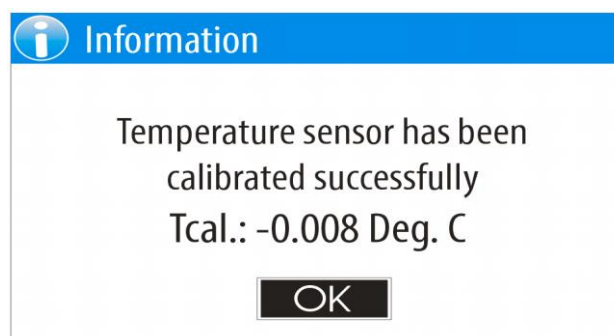
If you have chosen to work with the built-in front panel printer or if you have an external printer connected to the device and it is selected (see item 5.5.5.6), the measurement results will be printed automatically.

Printout example:

```
- Temperature sensor calibration --
Date:28/01/2022 Time:10:15:05

Measurement results:
Nr:1 Tmeas.= 99.555 ^C Tcalc.=99.549 ^C
Nr:2 Tmeas.= 99.550 ^C Tcalc.=99.547 ^C
Nr:3 Tmeas.= 99.553 ^C Tcalc.=99.547 ^C

New calibration value Tcal.= -0.008 ^C
```

5.5.4.2. Alcohol contents calibration

This procedure must be performed in the following cases:
 - After initial commissioning
 - After changing the ebulliometer you are using

The calibration of the alcohol content performs the calibration of the measurement system (reactor, cooler and heater) of the Ebulliometer you are using to accurately measure the absolute value of the alcohol content.

Important :
To carry out this procedure, it is necessary to provide one, two or three water-alcohol solutions with a previously known alcohol content in it. The number of required water-alcohol solutions depends on the calibration method you choose - one, two or three points. The minimum required amount of each water-alcohol solution depends on the amount required for 4 flushings and measurements of the ebulliometer you are using. The deviation from the nominal value of water-alcohol solutions should not be greater than +/- 0.02%.

This procedure must be performed precisely, as it determines the absolute accuracy of the measured alcohol content of all subsequent measurements until the next calibration.

Notes:
1). On initial commissioning, a warning message "The device is not calibrated" will appear on the home screen:
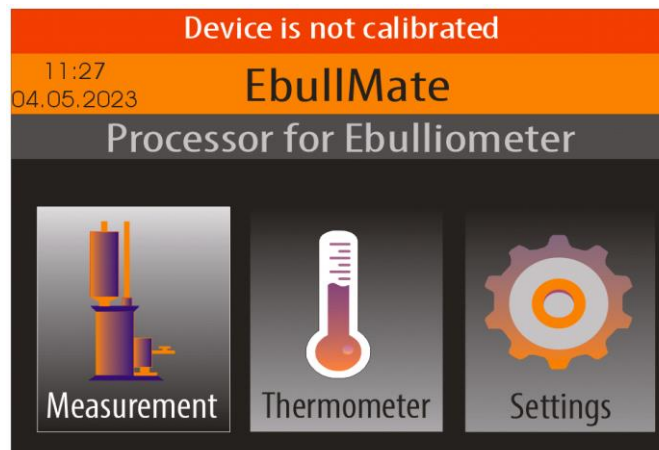
After successful completion of the calibration procedure, this message will not appear any more.

2). In case the pressure sensor is disabled, the procedure for calibrating the alcohol content includes (starting with) several measurements of the boiling temperature of distilled water. The minimum required amount of distilled water depends on the amount required for 5 measurements of your ebulliometer.

To select the alcohol content calibration mode from the "Calibration" Menu (see item 5.5.4), use <Arrow Down> / <Arrow Up> to select the option "Alcohol contents calibration" and then confirm with the <OK button >.

A menu will appear on the display that allows you to select the number of points (the calibration method) :
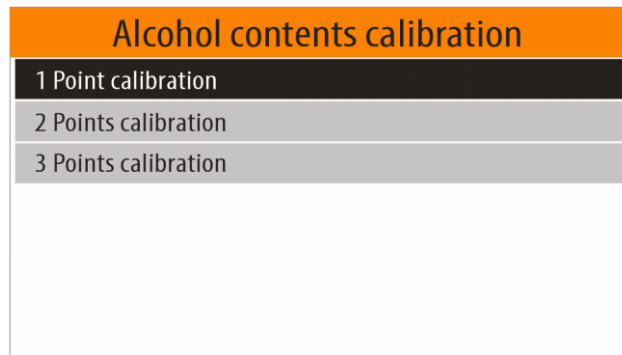
Important:
The selection of the number of calibration points (1, 2 or 3) determines the working width of the alcohol content range in which you will make measurements. The accuracy of the measurement results of samples outside this range is not guaranteed.

In case you select the "1 Point calibration" option, the range width is about 3%.
For example: If you choose a nominal value of the calibration solution 11.5%, the measured samples (wine) should be in the range of 10% to 13%.
This method performs offset calibration and is suitable for a narrow range of measured samples.

In case you select the "2 Points calibration" option, the width of the range is determined by the entered nominal values of the calibration solutions.
For example: If you select nominal values of the calibration solutions 9% and 14%, the guaranteed accuracy is in the range of 9% to 14%.
This method performs a linear calibration and is suitable for a wider range of measured samples.

In case you select the "3 Points calibration" option, the range width is determined by the entered nominal values of the second and third calibration solutions.
For example: If you choose the nominal values of the calibration solutions 10%, 15% and 5% then the guaranteed accuracy is in the range of 5% to 15%.
This method performs non-linear calibration and is suitable for a wide range of measured samples.

Depending on the calibration method you choose, 4, 8 or 12 measurements are performed, as is described in chapters 5.5.4.2.1, 5.5.4.2.2 and 5.5.4.2.3.

After completion of all measurements included in the calibration method, the measured values are checked for repeatability and absolute accuracy.
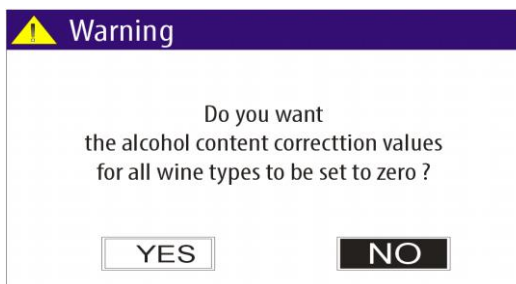
If the results of all checks are within the acceptable limits, the calibration parameters are saved in

the non-volatile memory of the device and the following message is displayed:

> **ⓘ Information**
>
> Alcohol content has been
> calibrated successfully.
>
> **OK**

After successfully completion of the calibration procedure the following warning message will appear on the display:

> **⚠ Warning**
>
> Do you want
> the alcohol content correcttion values
> for all wine types to be set to zero ?
>
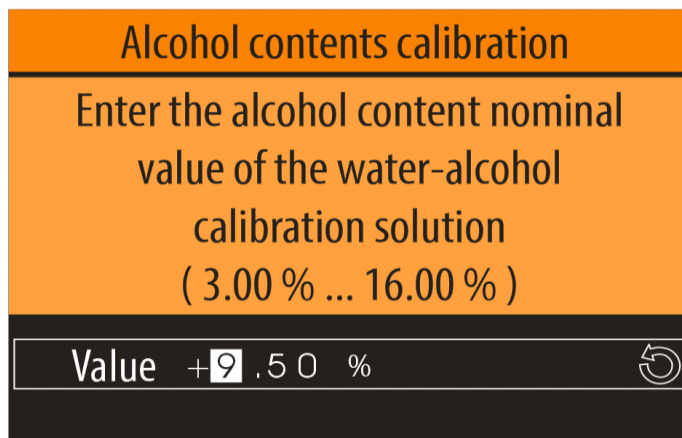> **YES**   **NO**

If you select "YES" using the <Left arrow> / <Right arrow> buttons and confirm with the <OK> button, all alcohol content correction values for all wine types will be set to zero.

If you select "NO" using the <Left arrow> / <Right arrow> buttons and confirm with the <OK> button you will return to the "Calibration" menu.

5.5.4.2.1. 1-Point alcohol content calibration.

After selecting 1 point calibration method, a panel will appear on the display in which you must enter the nominal value of the water-alcohol solution with which you will calibrate:

> **Alcohol contents calibration**
>
> Enter the alcohol content nominal
> value of the water-alcohol
> calibration solution
> (3.00 % ... 16.00 %)
>
> Value +**9** .5 0   %   ↺

All measurements included in the calibration method (including the preliminary one) must be performed strictly following the instructions described in item 5.3. "Measurement" mode, using the calibration water-alcohol solution as a sample.

Important :
 - Make sure the cooling water circulation is switched on.
 - Flushing should be done with a sufficient amount of water-alcohol calibration solution
 - The level of the sample should be according to the description of your ebulliometer

The first measurement included in the calibration procedure is preliminary and aims to prepare the measuring system for calibration.
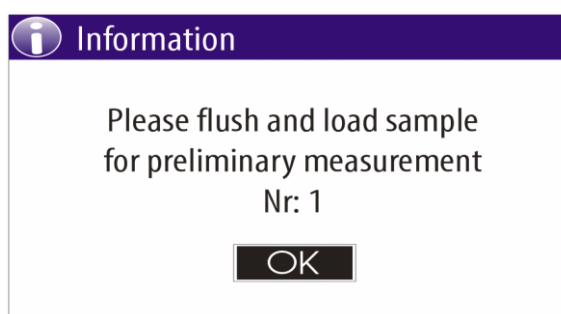

After flushing with a sufficient amount of water-alcohol solution, empty the measuring system, pour water-alcohol solution to the required level and confirm with the <OK> button to start the measurement.

After the completion of the preliminary measurement, three similar measurements will be performed, from which the calibration parameters will be calculated. Each subsequent measurement will start with an information message like this:
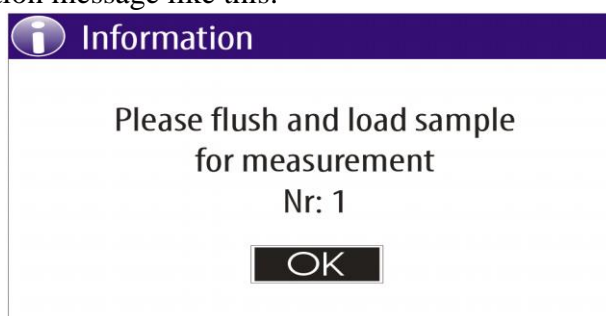
5.5.4.2.2. 2-Points alcohol content calibration.

The 2-point calibration procedure involves performing the 1-point calibration procedure (described in 5.5.4.2.1) twice.

The allowable range for the nominal value of the first point (PN1) is from 9.00% to 16.00%.
The allowable range for the nominal value of the second point is from 3.00% to PN1 - 3.00%.

5.5.4.2.3. 3-Points alcohol content calibration.

The 3-point calibration procedure involves performing the 1-point calibration procedure (described in 5.5.4.2.1) three times.

The allowable range for the nominal value of the first point (PN1) is from 9.00% to 13.00%.
The allowable range for the nominal value of the second point is from PN1 + 3.00% to 20.00%.
The allowable range for the nominal value of the third point is 3.00% to PN1 - 3.00%.

5.5.5. "Configuration" menu

To enter in "Configuration" menu form the "Settings" menu (see item 5.3.) select "Configuration" option, using the buttons <Up arrow> /<Down arrow> and confirm with <OK> button.
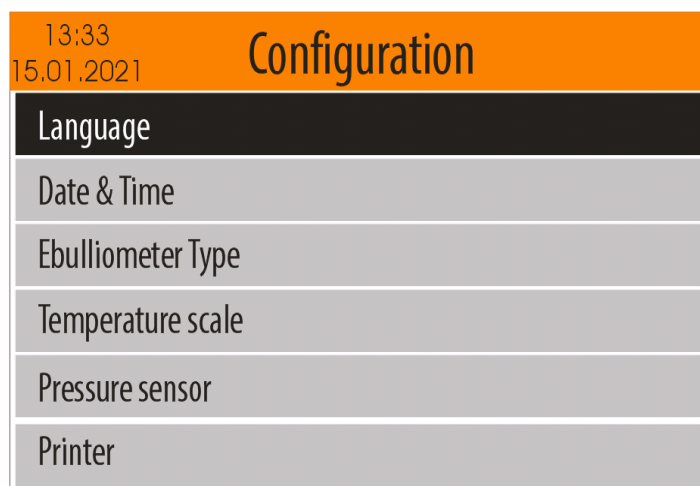
The available options are as follows:
 - Language
 - Date & Time
 - Ebulliometer type
 - Temperature scale
 - Pressure sensor
 - Printer
 - Thermometer options
 - Measurements counter
To return to the "Settings" Menu, press the <MODE> button. To return to the "Home screen", press the <HOME> button.

5.5.5.1. Language select

To select the "Language" menu, from the "Configuration" menu (see item 5.5.4.), select the "Language" option using <Down arrow> / <Up arrow> buttons and then confirm with the <OK> button.

A menu with supported languages will appear on the display and the currently selected language will be marked.
Use <Down Arrow> / <Up Arrow> to select your prefered language and then confirm with the <OK> button. Your selection will be stored in the non-volatile memory of the device and will remain valid until the next change.
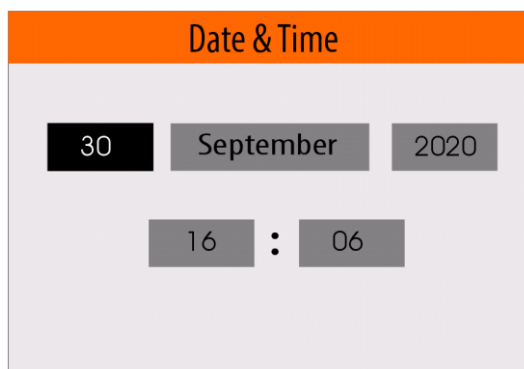
If you do not want the changes to be saved, press the <MODE> or <HOME> button.

5.5.5.2. Date & Time

To enter in "Date & Time" setting mode, from the "Configuration" menu (see item 5.5.4.), select the " Date

& Time " option using <Down arrow> / <Up arrow> buttons and then confirm with the <OK> button.

On the screen will appear current date and time.

From this screen, using the <Left arrow> / <Right arrow> buttons select the date, month, year, hour or minute field.
Once you have selected the field you want to change, use the <Down Arrow> / <Up Arrow> buttons to change the value.
After you are ready with the changes, press the <OK> button to confirm them.

If you do not want the changes to be saved, press the <MODE> or <HOME> button.
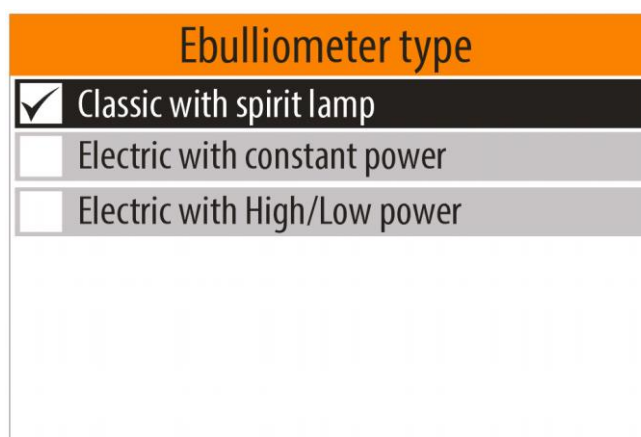
5.5.5.3. Ebulliometer type
This menu allows you to select the ebulliometer type you will use (your ebulliometer).

Important: The correct operation of the device depends on the correct choice of the type of ebulliometer you are using.

To select the "Ebulliometer type" menu, from the "Configuration" menu (see item 5.5.4.), select the "Ebulliometer type" option using <Down arrow> / <Up arrow> buttons and then confirm with the <OK> button.

A menu with supported ebulliometer types will appear on the display and the currently selected is marked.

"Classic with spirit lamp" - Select this option in case your ebulliometer is classic with spirit lamp (for example Dujardin-Salleron, Alla-France etc.).
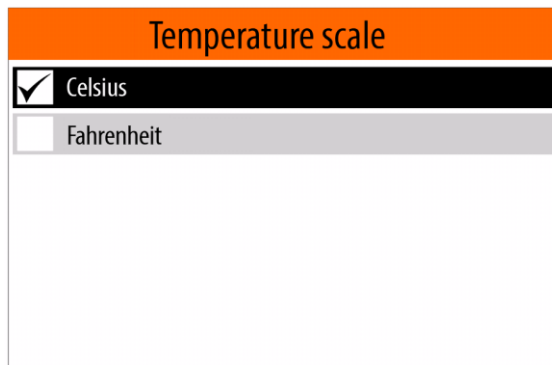
"Electric with constant power" - Select this option in case your ebulliometer is electric without the possibility to switch the power supplied to the heater.

"Electric with High / Low Power" - Select this option in case your ebulliometer is electrical with switchable power supplied to the heater (High / Low) .During the measurement process, the required power you need to apply to the heater will be shown on the display, and the moment when you need to switch from High to Low power will be announced with a specific sound signal.

Use <Down Arrow> / <Up Arrow> to select your ebulliometer type and then confirm with the <OK> button. Your selection will be stored in the non-volatile memory of the device and will remain valid until the next change.

5.5.5.4. Temperature scale

To enter in "Temperature scale" menu, from the "Configuration" menu (see item 5.5.4.), select the " Temperature scale" option using <Down arrow> / <Up arrow> buttons and then confirm with the <OK> button.

A menu with supported temperature scales will appear on the display and the currently selected scale will be marked.

Use <Down Arrow> / <Up Arrow> to select your preferred scale and then confirm with the <OK> button. Your selection will be stored in the non-volatile memory of the device and will remain valid until the next change.

If you do not want the changes to be saved, press the <MODE> or <HOME> button.

5.5.5.5. Pressure sensor

The device has a built-in precision atmospheric pressure sensor. The measured values from this sensor are used in the "Measurement" mode to calculate the distilled water boiling temperature , which is needed to calculate the percentage of alcohol in the sample (see item 1.4.)

This menu allows you to enable or disable the use of the pressure sensor.

To enter in "Pressure sensor" menu, from the "Configuration" menu (see item 5.5.4.), select the " Pressure sensor" option using <Down arrow> / <Up arrow> buttons and then confirm with the <OK> button.

A menu with two options - "Enabled" and "Disabled" will appear on the display and the currently selected state be marked.
Use <Down Arrow> / <Up Arrow> to select your preferred state and then confirm with the <OK> button. Your selection will be stored in the non-volatile memory of the device and will remain valid until the next change.
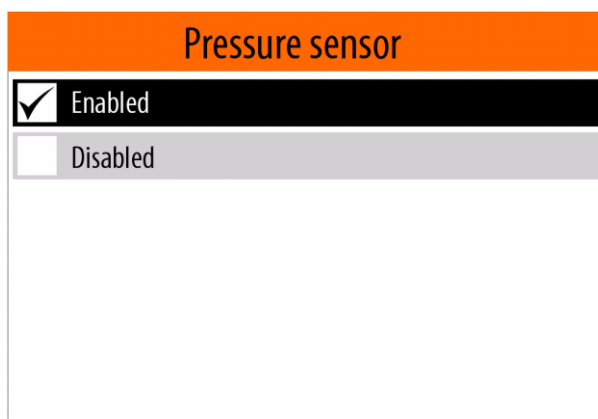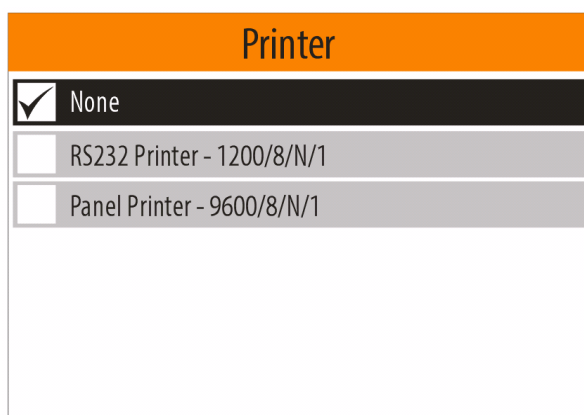If you do not want the changes to be saved, press the <MODE> or <HOME> button.

Important: If you select the "Disabled" option when using the "Measurement" mode, the distilled water boiling temperature measured in the "Water" mode will be used to calculate the alcohol percentage in the sample (see 5.5.2.)

5.5.5.6. Printer
This menu allows you to select the printer type, to which the measurement results will be printed automatically.

To enter in "Printer" menu, from the "Configuration" menu (see item 5.5.4.), select the "Printer" menu option using <Down arrow> / <Up arrow> buttons and then confirm with the <OK> button.

Printer
✓ None
☐ RS232 Printer - 1200/8/N/1
☐ Panel Printer - 9600/8/N/1

A menu with supported printers and option "None" will appear on the display. The currently selected printer is marked.

Notes:
1). The "None" option means that no printer is connected or you do not want the results to be printed on a paper.
2). The "Panel Printer - 9600/8/N/1" option is provided to select the panel printer built into the device.

Use <Down Arrow> / <Up Arrow> to select your preferred option and then confirm with the <OK> button. Your selection will be stored in the non-volatile memory of the device and will remain valid until the next change.
If you do not want the changes to be saved, press the <MODE> or <HOME> button.

5.5.5.7.Thermometer options
This menu allows you to select the time range shown on the graph in "Thermometer" mode (see item 5.5.)

To enter in "Thermometer options" menu, from the "Configuration" menu (see item 5.5.4.), select the "Thermometer options" menu option using <Down arrow> / <Up arrow> buttons and then confirm with the <OK> button.

A menu with options for the time range for the graphic will appear on the display.

Use <Down Arrow> / <Up Arrow> to select your preferred option and then confirm with the <OK> button. Your selection will be stored in the non-volatile memory of the device and will remain valid until the next change.

5.5.5.8. Measurements counter

This mode allows you to see the value and to reset the measurements counter.

To enter in "Measurements counter" mode, from the "Configuration" menu (see item 5.5.5.), select the "Measurements counter" menu option using <Down arrow> / <Up arrow> buttons and then confirm with the <OK> button.

Use the <Left arrow> / <Right arrow> buttons to focus "OK" or "Reset" and confirm with the <OK> button.
In case you confirm "Reset" the measurement counter will be set to zero.

5.5.6. "File management" menu

To enter in " File management " menu, from the "Configuration" menu (see item 5.5.4.), select the " File management " menu option using <Down arrow> / <Up arrow> buttons and then confirm with the <OK> button.

The available options are as follows:
 - Data collection upload
 - Temperature files upload
 - Error log upload
 - Diagnostic files upload
 - Upload all files
 - Pressure calibration restore
 - Serial number restore

To return to the "Settings" Menu, press the <MODE> button. To return to the "Home screen", press the <HOME> button.

5.5.6.1. Data collection upload

After each measurement, the results are automatically saved (added) to the current daily file of the SD card built into the device. The current daily file is created at the beginning of each day after the first measurement. If the procedure "Data collection upload" is executed, which includes the current day, then a new current daily file is created and the next measurements are saved (added) in it. The aim is not to duplicate measurement data in more than one file, in case the procedure "Data collection upload" is executed more than once a day. In this case, the measurements for one day will be saved in several files. Therefore, if you want to collect all the measurements for one day in one file, you need to open and collect the data from all the files with **names corresponding to the respective day**.

The names of the data collection files are as follows:
YYMMDDHM.CSV
where :
YY - The year of the last measurement contained in the file.
MM - The month of the last measurement contained in the file.
DD - The date of the last measurement contained in the file.
H - The hour (encoded) of the last measurement contained in the file.
M - The minute divided by two (encoded) of the last measurement contained in the file.

Table describing the **Hour** encoding in the names of the data collection files:

H	Hour
0	0
1	1
2	2

3	3
4	4
5	5
6	6
7	7
8	8
9	9
A	10
B	11
C	12
D	13
E	14
F	15
J	16
H	17
I	18
J	19
K	20
L	21
M	22
N	23

Table describing the **Minute** encoding in the names of the data collection files:

M	Minute
0	0
1	2
2	4
3	6
4	8
5	10
6	12
7	14
8	16
9	18
A	20
B	22
C	24
D	26
E	28
F	30
J	32
H	34
I	36

J	38
K	40
L	42
M	44
N	46
O	48
P	50
Q	52
R	54
S	56
T	58

Example of data collection file name:
210705AS.CSV
where
21 -Year
07 - Month
05- Date
A - Hour (encoded) - in this case 10
S - Minute(encoded) - in this case 56

Notes:
1).The creation time of the data collection files on the external USB flash drive corresponds to the time of their uploading (copying) .
2). Data collection files stored in the SD card built into the device are kept up to 90 days.
3). Obsolete data collection files (older than 90 days) saved in the built-in SD card are deleted from the Startup procedure (see item 5.1.)

This mode allows the data collection files to be uploaded (copied) to the external USB flash-pen drive, which must be plugged into one of the USB connectors located on the back panel of the device.

To select the "Data collection upload" mode from the "File management" menu (see item 5.5.5.), select the "Data collection upload" menu option using the <Down arrow> / <Up arrow> buttons and then confirm with the < OK>.

A panel will appear on the display in which the user have enter the period of time (start and end date, month and year) for which he wants to upload the corresponding files.

In this panel, use the <Left arrow> / <Right arrow> buttons to select the field for the start or end date, month and year.

Once you have selected the field you want to change, use the <Down Arrow> / <Up Arrow> buttons to change the value.
After making all the changes, press the <OK> button to start the uploading (copying) files process.

The files will be copied to the USB flash pen drive in the DATFILES folder.
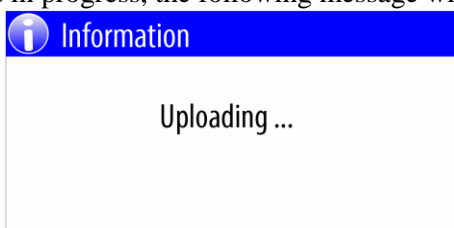
Example:
K:\EBULLPRC\EP00001\DATFILES
where :
 K - Device label (USB flash pen drive)
 EBULLPRC - The Processor for Ebulliometer **EbullMate** folder
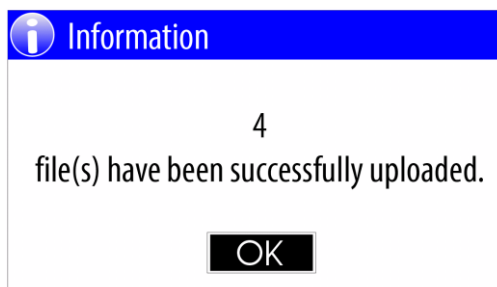 **EP00001** - **EbullMate** serial number (see item 5.5.7.)
 DATFILES - Data collection files folder

During the copy(upload) process is in progress, the following message will be shown:

When the copying (uploading) is complete, a message will appear on the screen about the number of files copied.
Example:

The data collection files are in CSV format and can be open with any text editor or specialized program (application).

Description of the contents of the data collection files:
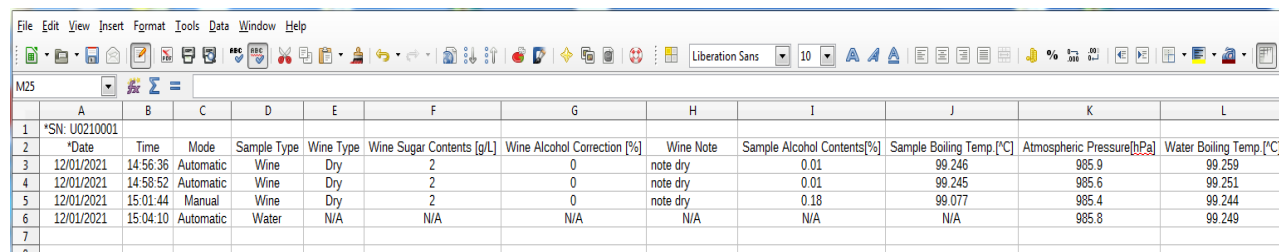The rows that start with asterisk are header rows.
- *SN:U0210001 FWV:EM01.04B - Device serial number and Firmware version
- *Date,Time,Mode,Sample Type ... header row for corresponding columns as follows:
-- Date - The date when the measurement is done
-- Time - The time when the measurement is done
-- Mode - Measurement mode - Automatic/ Manual
-- Sample Type - Wine or Water
-- Wine Type - Dry/Semi-dry/Semi-sweet ...
-- Wine Sugar Content [g/L] - Sugar content for this wine type
-- Wine Alcohol Correction [%] - Alcohol correction for this wine type
-- Wine Note - Note for this wine type
-- Sample Alcohol Content[%] - The calculated alcohol content of the sample
-- Sample Boiling Temp.[^C] - The measured boiling temperature of the sample
-- Atmospheric Pressure[hPa] - The measured atmospheric pressure
-- Water Boiling Temp.[^C] - The calculated distilled water boiling temperature
-- Temp. Sensor Calibration value[^C] - Temperature sensor calibration value

Example of opened file using text editor:

*SN: U0210001 FWV:EM01.04B
*Date,Time,Mode,Sample Type,Wine Type,Wine Sugar Contents [g/L],Wine Alcohol Correction [%],Wine
Note,Sample Alcohol Contents[%],Sample Boiling Temp.[^C],Atmospheric Pressure[hPa],Water Boiling Temp.[^C]
12/01/2021,14:56:36,Automatic,Wine,Dry,002.0,0.00,note dry   ,00.01, 99.246, 985.9, 99.259
12/01/2021,14:58:52,Automatic,Wine,Dry,002.0,0.00,note dry   ,00.01, 99.245, 985.6, 99.251
12/01/2021,15:01:44,Manual,Wine,Dry,002.0,0.00,note dry   ,00.18, 99.077, 985.4, 99.244
12/01/2021,15:04:10,Automatic,Water,N/A,N/A,N/A,N/A,N/A,N/A, 985.8, 99.249

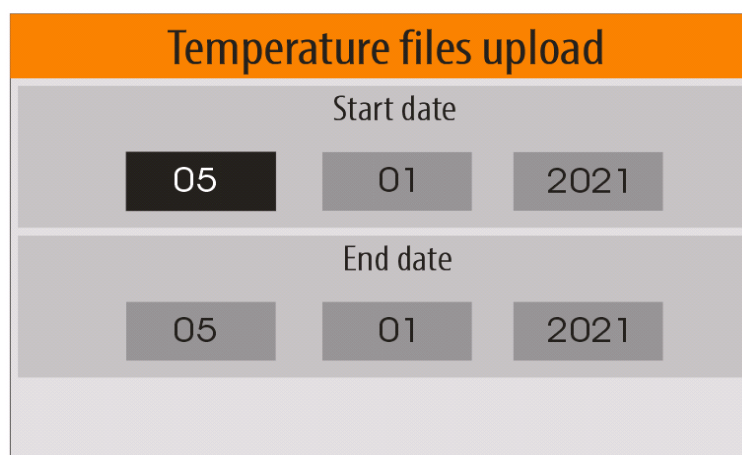Example of opened file using LibreOffice Calc:

5.5.6.2. Temperature files upload

Each started measurement in "Thermometer" mode records the measured temperature and atmospheric pressure every second in a file (temperature file) on the SD card built into the device. Each file contains one measurement and is stored for no more than 90 days.
Note: The obsolete files are deleted during Starting up procedure (see item. 5.1.).

This mode allows the temperature files to be uploaded (copied) to the external USB flash-pen drive, which must be plugged into one of the USB connectors located on the back panel of the device.

To enter in the "Temperature files upload" mode from the "File management" menu (see item 5.5.5.), select the "Temperature files upload" menu option using the <Down arrow> / <Up arrow> buttons and then confirm with the < OK>.

A panel will appear on the display in which the user have enter the period of time (start and end date, month and year) for which he wants to upload the corresponding files.

In this panel use the <Left arrow> / <Right arrow> buttons to select the field for the start or end date, month and year.
Once you have selected the field you want to change, use the <Down Arrow> / <Up Arrow> buttons to change the value.
After making all the changes, press the <OK> button to start the uploading (copying) files process.

The files will be copied to the USB flash pen drive in the TMPAPLOG folder.

Example:
K:\EBULMATE\U0210001\TMPAPLOG
where :
 K - Device label (USB flash pen drive)
 EBULMATE - The Processor for Ebulliometer **EbullMate** folder
 U0210001 - **EbullMate** serial number (see item 5.5.7.)
TMPAPLOG - Temperature files folder

During the copy(upload) process is in progress, the following message will be shown:
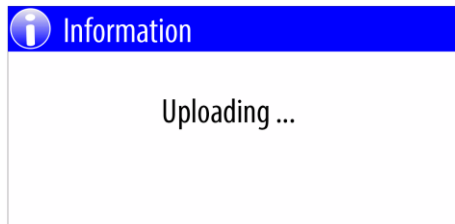
When the copying (uploading) is complete, a message will appear on the screen about the number of files copied.
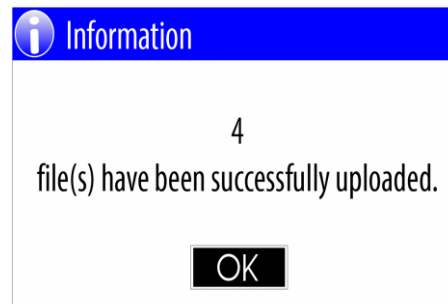
Example:

Example of file name:
2101059K.CSV
21 - year
01 - month
05 - date
9 - hour (encoded)
K - minute (encoded, in this example 40)

The rows that start with asterisk are header rows.
*Temperature and Atmospheric Pressure Measurement - File description
*Start Date/Time 05/01/2021 09:41:35 - Measurement start time
*Time[Sec.],T[^C],AP[hPa] - Column titles
 -- Time[Sec.] - Time in seconds after measurement start time
 -- T[^C] - Measured temperature
 -- AP[hPa] - Measured atmospheric pressure

Example of opened temperature file in text editor:
*Temperature and Atmospheric Pressure Measurement
*Start Date/Time 05/01/2021 09:41:35
*Time[Sec.],T[^C],AP[hPa]
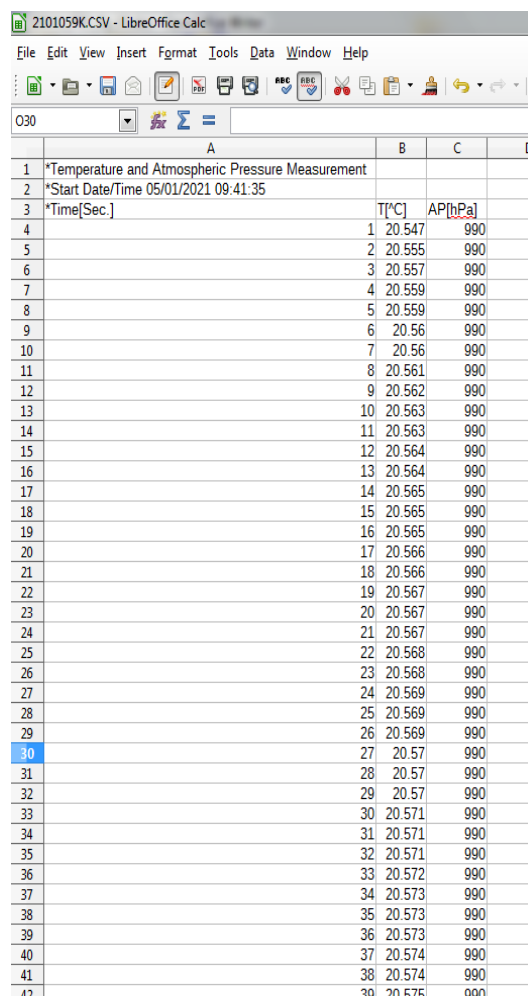
```
1,20.547,990.0
2,20.555,990.0
3,20.557,990.0
4,20.559,990.0
5,20.559,990.0
6,20.560,990.0
7,20.560,990.0
8,20.561,990.0
9,20.562,990.0
10,20.563,990.0
11,20.563,990.0
12,20.564,990.0
13,20.564,990.0
14,20.565,990.0
15,20.565,990.0
```
Example of opened temperature file in LibreOffice Calc:

Example of opened temperature file in LibreOffice Calc and created a chart:
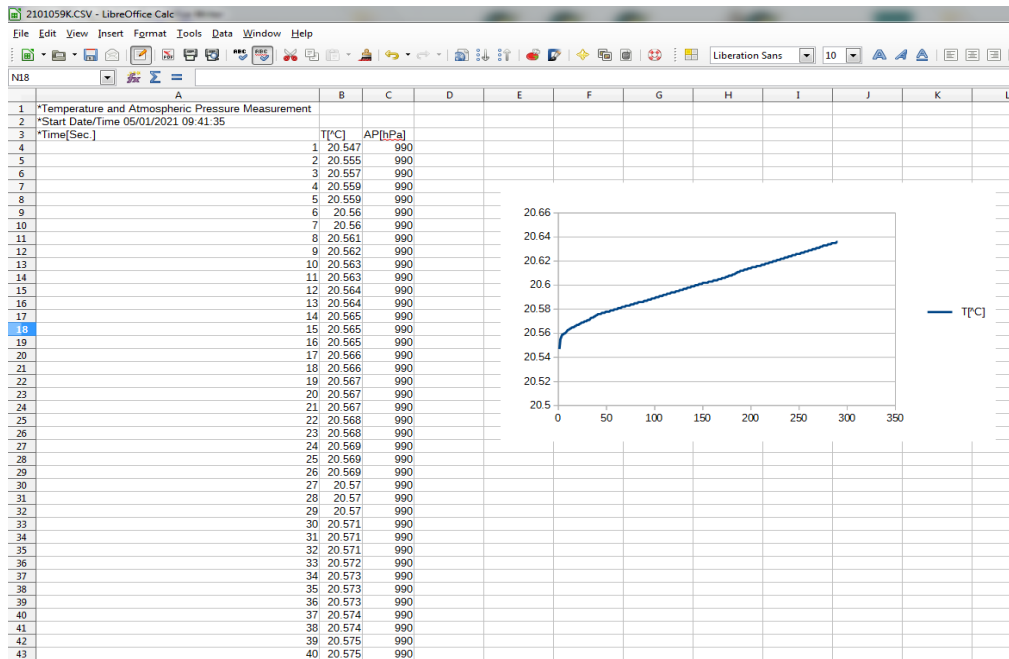
5.5.6.3. Error log upload

Any errors that occur during the device operation are automatically saved (added) to a file (Error Log File) on the built-in SD card in the device. Each file contains the registered errors from one day and is kept up to 90 days.

Note: The obsolete files are deleted during Starting up procedure (see item. 5.1.).

This mode allows the Error log files to be uploaded (copied) to the external USB flash-pen drive, which must be plugged into one of the USB connectors located on the back panel of the device.

Important: Once the files have been uploaded to the USB flash-pen drive they can be send to the distributor or the manufacturer for analysis.

To enter in the "Error log upload" mode from the "File management" menu (see item 5.5.5.), select the " Error log upload " menu option using the <Down arrow> / <Up arrow> buttons and then confirm with the < OK>.

A panel will appear on the display in which the user have enter the period of time (start and end date, month and year) for which he wants to upload the corresponding files.

In this panel use the <Left arrow> / <Right arrow> buttons to select the field for the start or end date, month and year.
Once you have selected the field you want to change, use the <Down Arrow> / <Up Arrow> buttons to

change the value.
After making all the changes, press the <OK> button to start the uploading (copying) files process.
The files will be copied to the USB flash pen drive in the ERRLOG folder.

Example:
K:\EBULMATE\U0210001\ ERRLOG
where :
 K´ - Device label (USB flash pen drive)
 EBULMATE - The Processor for Ebulliometer **EbullMate** folder
 U0210001 - **EbullMate** serial number (see item 5.5.7.)
 ERRLOG - Error log files folder

During the copy (upload) process is in progress, the following message will be shown:

When the copying (uploading) is complete, a message will appear on the screen about the number of files copied.
Example:
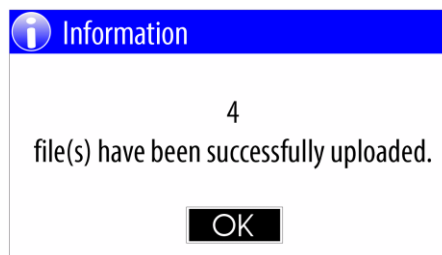
Error log files have LOG file extension and can be opened with each text editor.

Example of file name:
20210105.LOG
where:
2021 - year
01 - month
05 - date

The rows that start with asterisk are header rows.
- *Error Log SN:EP00001 FWV:EM01.04B - device serial number and Firmware version
- *Date,Time,Err Group, Err Code - header row for corresponding columns as follows:
-- Date - The date when the error is registered
-- Time - The time when the error is registered
-- Err Group - Error group
-- Err Code - Error code

Example of opened file using text editor:
*Error Log SN: U0210001 FWV:EM01.04B
*Date,Time,Err Group, Err Code
05/01/2021,09:25:38, 9, 26

More details about errors see item 6.

5.5.6.4. Diagnostic files upload

When you start "Measurement" or "Water" mode and when the process become
When you start the "Measurement" or "Water" mode and after the process reaches a certain stage, the device starts recording the process. Once the recording process has started, no matter how it is completed (manually or automatically), the unit automatically creates a diagnostic file on the built-in SD card.
The diagnostic files
Diagnostic files are kept up to 90 days.
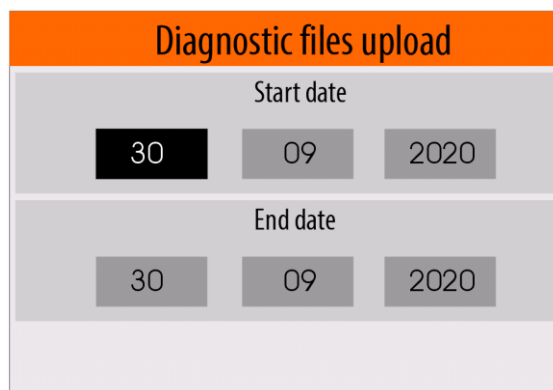
Note: The obsolete files are deleted during Starting up procedure (see item. 5.1.).

This mode allows the diagnostic files to be uploaded (copied) to the external USB flash-pen drive, which must be plugged into one of the USB connectors located on the back panel of the device.

Important: Once the files have been uploaded to the USB flash-pen drive they can be send to the distributor or the manufacturer for analysis.

To enter in the "Diagnostic files upload" mode from the "File management" menu (see item 5.5.5.), select the " Diagnostic files upload " menu option using the <Down arrow> / <Up arrow> buttons and then confirm with the < OK>.

A panel will appear on the display in which the user have enter the period of time (start and end date, month and year) for which he wants to upload the corresponding files.

In this panel use the <Left arrow> / <Right arrow> buttons to select the field for the start or end date, month and year. Once you have selected the field you want to change, use the <Down Arrow> / <Up Arrow> buttons to change the value.
After making all the changes, press the <OK> button to start the uploading (copying) files process.
The files will be copied to the USB flash pen drive in the DIAG folder.
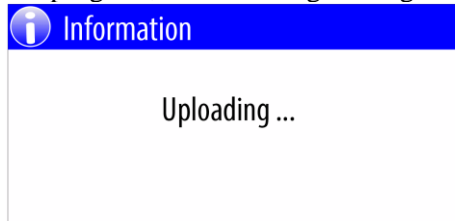
Example:
K:\EBULMATE\U0210001\ DIAG
where :
 K - Device label (USB flash pen drive)
 EBULMATE- The Processor for ebulliometer **EbullMate** folder
 **U0210001** - **EbullMate** serial number (see item 5.5.7.)
 DIAG - diagnostic files folder

During the copy (upload) process is in progress, the following message will be shown:
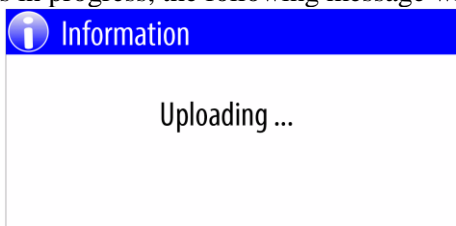
When the copying (uploading) is complete, a message will appear on the screen about the number of files copied.
Example:
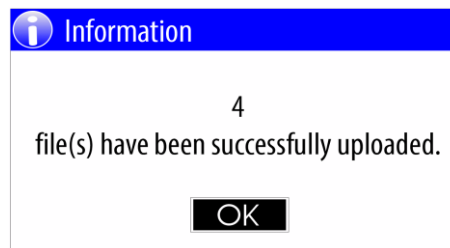
The diagnostic files have "PDG" file extension. They can not be open and they are intended to be used for analysis from the producer.

Example of file name:
210105A6.PDG
where:
21 - year
01 - month
05 - date
A - hour (encoded, in this example - 10)
6 - minute (encoded, in this example 12)

5.5.6.5. Upload all files
This menu option allows you to upload(copy) all existing on SD card files to the external USB flash-pen drive.

The files that will be upload are as follows:
 - Data collection files
 - Temperature files
 - Error log files
 - Diagnostic files
Note: Considering the device keeps on SD card all these file types from the last 90 days, so this operation may take time.

5.5.6.6. Pressure calibration restore
During the producing of each device the producer performs calibration of the build-in atmospheric pressure

sensor, using a high-precision barometer, keeping an archive copy of the calibration values in the factory database.

In case of damage of the calibration values stored in the device by some reason, the user may request the manufacturer to obtain a data file to restore the pressure calibration.

After receiving the file, the user must copy this file to a USB flash-pen drive in the CALDATA folder.

Example:
K:\EBULMATE\ CALDATA\U0210001.PPC
where :
 К - Device label (USB flash pen drive)
 **EBULMATE -** The Processor for ebulliometer **EbullMate** folder
 CALDATA - Folder containing calibration files
U0210001.PPC - Pressure calibration recovery file for **EbullMate** serial number **U0210001**

Note: The EBULLPRC and CALDATA folders on the USB flash-pen drive must be created by the user.

Before starting the "Pressure calibration restore" procedure, the user must plug in the USB flash-drive drive of one of the four USB connectors located on the back panel of the device.

To start the " Pressure calibration restore" procedure, from the "File management" menu (see item 5.5.5.), select the " Pressure calibration restore" menu option using the <Down arrow> / <Up arrow> buttons and then confirm with the < OK>.

Upon successful completion of the recovery procedure, a message will appear :
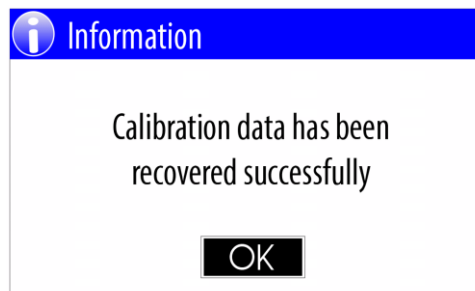
5.5.6.7. Serial number restore

During the producing the producer store serial unique number in the non-volatile memory of the device, as well as in the factory database. The same serial number is printed on a label on the back panel of the device.

In case of damage of the serial number stored in the device by some reason, the user may request the manufacturer to obtain a data file to restore the serial number.

After receiving the file, the user must copy this file to a USB flash-pen drive in the CALDATA folder.

Example:
K:\EBULMATE\CALDATA\U0210001. PSN
where :
 К - Device label (USB flash pen drive)
 EBULMATE - The Processor for ebulliometer **EbullMate** folder
 **CALDATA** - Folder containing calibration files

U0210001.PSN - Serial number recovery file for **EbullMate** serial number **U0210001** (printed on a label on the back panel).

Note: If the EBULLPRC or CALDATA folder does not exist on the USB flash-pen drive, they must be created by the user.

Before starting the "Serial number restore" procedure, the user must connect the USB flash-pen drive and USB keyboard to the USB connectors located on the back panel of the device.

To start the " Serial number restore " procedure, from the "File management" menu (see item 5.5.5.), select the " Serial number restore " menu option using the <Down arrow> / <Up arrow> buttons and then confirm with the < OK>.

A panel will appear on the display in which the user must enter the serial number printed on the back panel of the device:
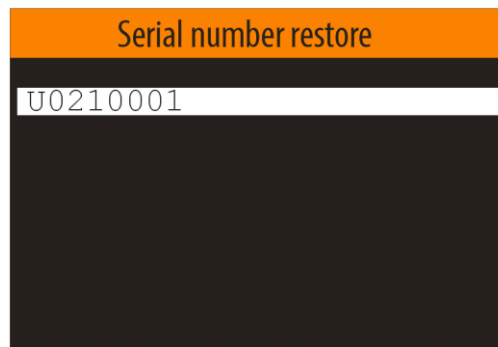
After the user enters the serial number and confirm with <OK> button the recovery process starts.

Upon successful completion of the serial number recovery procedure, a message will appear:
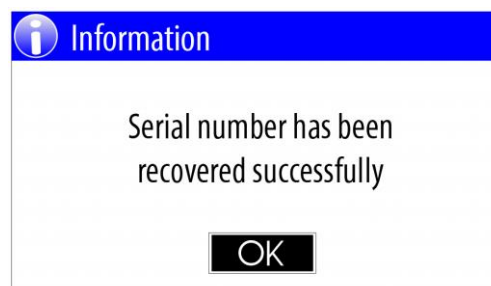
5.5.7. Firmware update

The manufacturer constantly improves the Ebulliometer software by improving the built-in algorithms and adding new features. The firmware update function allows all users of already purchased devices to update the firmware to the latest published version. The latest files with published firmware versions can be obtained from the distributors or manufacturer.

After receiving the firmware update file, the user must copy this file to a USB flash-pen drive in the FWUPDATE folder.

Example:
K:\EBULMATE\FWUPDATE\EM0101B.SUF
where :
 К - Device label (USB flash pen drive)
 EBULMATE - The Processor for ebulliometer **EbullMate** folder

FWUPDATE- Firmware update files folder
EM0101B.SUF - Firmware update file

Note: If the EBULLPRC or FWUPDATE folder does not exist on the USB flash-pen drive, it must be created by the user.

Before to start the "Firmware update" procedure, the user must plug in the USB flash-drive drive of one of the four USB connectors located on the back panel of the device.

To start the " Firmware update" procedure, from the "Settings" menu (see item 5.5.), select the " Firmware update " menu option using the <Down arrow> / <Up arrow> buttons and then confirm with the < OK>.
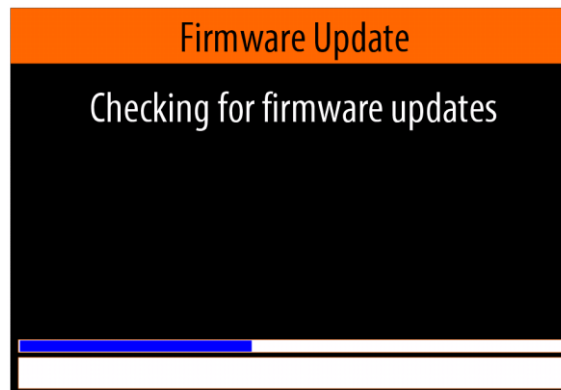
After the device finds suitable firmware update files located on the USB flash-pen drive, displays a menu for selecting the desired update file.
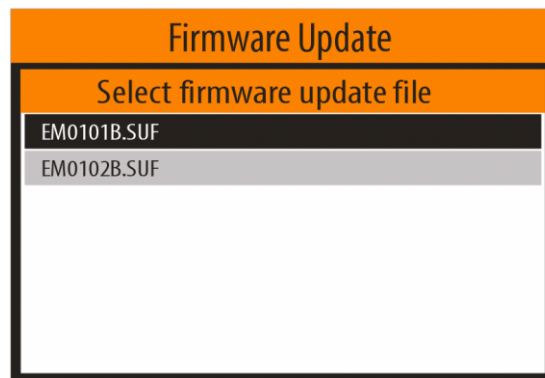
Using the <Down arrow> / <Up arrow> buttons select the desired file and then confirm with the < OK>.
A panel with warning message will appear on the screen:
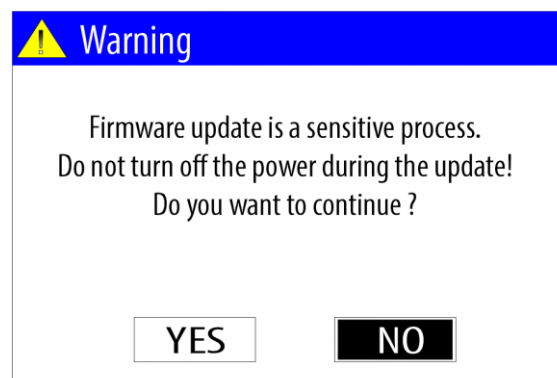
From this panel, using <Left arrow> / <Right arrow> select <YES> and confirm with <OK> button.

A series of messages will appear on the screen, showing the sequence of actions that the device performs to

update the software.

Upon successful completion of the firmware update process, the device will restart and message will appear on the screen.
Example:
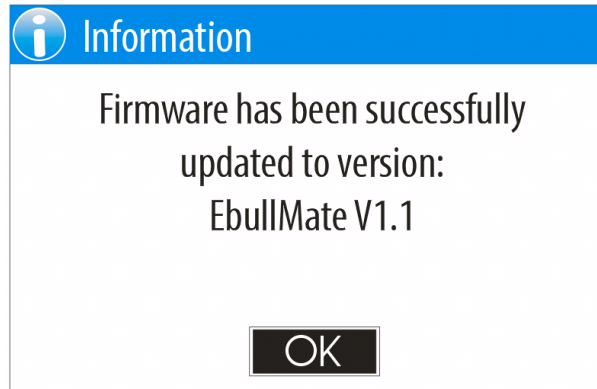
5.5.8. About device

To enter in the "About device" mode from the "Settings" menu (see item 5.5.), select the " About device" menu option using the <Down arrow> / <Up arrow> buttons and then confirm with the < OK>.

Example of "About device" panel:

where:
EbullMate - device type
Serial Number - Device serial number
Firmware version - Current firmware version
Total measurements done - The total number of measurements the device has performed so far.

Bulteh-2000 Ltd - device manufacturer
www.bulteh.com - manufacturer's website

5.5.9. System
This mode is intended to be used from the manufacturer only and it is not available for the users.

6. Errors description

When an error occurs, the device displays a error message.
Example:

where :
Error group - The error group code
code - The error code in the group

6.1. Error group table:

Group	Description
1	File system errors
2	Disk errors - SD card or USB flash memory
3	User settings related errors
4	File management related errors
5	Real-time clock related errors
6	Reserved group
7	EEPROM related errors
8	System timers related errors
9	Atmospheric pressure sensor related errors
10	Temperature sensor related errors
11	Reserved group
12	Boiling temperature determination algorithm related errors
13	Printer errors

6.2. Description of error group 1: File system errors

Code	Description
1	A hard error occurred in the low level disk I/O layer
2	Assertion failed
3	The physical drive (SD card/USB flash memory) cannot work
4	Could not find the file
5	Could not find the path
6	The path name format is invalid
7	Access denied due to prohibited access or directory full
8	Access denied due to prohibited access
9	The file/directory object is invalid
10	The physical drive (SD card/USB flash memory) is write protected
11	The logical drive number is invalid
12	The volume has no work area
13	There is no valid FAT volume
14	The function that create file system aborted due to any parameter error
15	Could not get a grant to access the volume within defined period
16	The operation is rejected according to the file sharing policy
17	LFN working buffer could not be allocated
18	Too many opened files

Code	Description
19	Given parameter is invalid

6.3. Description of error group 2: Disk errors - SD card or USB flash memory

Code	Description
1	Read/Write error
2	The disk (SD card/USB flash memory) is write protected
3	The disk (SD card/USB flash memory) in not ready
4	Invalid Parameter
5	Disk Volume error

6.4. Description of error group 3: User settings related errors

Code	Description
1	Wrong serial number
2	Serial number encoding error
3	Unknown wine type
4	Serial number need restoring
5	Atmospheric pressure sensor calibration need restoring
6	Temperature sensor calibration need restoring
7	Wrong defined time period
8	Damaged measurement counter data
9	Measurement counter check-sum error
10	Alcohol content calibration - Calibration values checksum error
11	Alcohol content calibration - Wrong serial number
12	Alcohol content calibration - Damaged calibration values

6.5. Description of error group 4: File management related errors

Code	Description
1	The operation is aborted
2	File check-sum error
3	Firmware update file version error
4	Incompatible device type stored in firmware update file (SUF file)
5	Incompatible firmware type stored in firmware update file (SUF file)
6	Incompatible encoding in firmware update file (SUF file)
7	Section check-sum error in firmware update file (SUF file)
8	Incompatible file
9	No suitable firmware update file found (SUF file)
10	Go to back
11	Go to home
12	Incomplete file
13	No enough data
14	No USB flash memory connected
15	Header-part file check-sum error
16	Data-part file check-sum error
17	The data in the file are obsolete
18	Too deep recursion during the folder copy
19	Incompatible (unknown) file version
20	Wrong data

6.6. Description of error group 5: Real time clock related errors

Code	Description
1	I2C protocol - No start
2	I2C protocol - No acknowledge

3	Wrong date
4	Real Time Clock not working

6.7. Description of error group 6: Reserved

6.8. Description of error group 7 : EEPROM related errors

Code	Description
1	EEPROM initialization error

6.9. Description of error group 8: System timers related errors

Code	Description
1	Wrong event handler
2	Timer ID is out of range

6.10. Description of error group 9: Atmospheric pressure sensor related errors

Code	Description
1	Wrong ID
2	Wrong structure
3	Device not found
4	Invalid length
5	Communication error
6	Invalid mode
7	Bond wire error
8	Implausible temperature
9	Implausible pressure
10	Calibration parameter is out of range
11	Uncompensated temperature is out of range
12	Uncompensated pressure is out of range
13	Uncompensated temperature and pressure are out of range
14	Uncompensated data cannot be calculated
15	Error in the 32-bit temperature representation
16	Error in the 32-bit pressure representation
17	Error in the 64-bit pressure representation
18	Temperature representation error in double-precision format
19	Pressure representation error in double-precision format
20	Conversion time is out of the limit
21	Pressure value is under minimum value
22	Pressure value is over maximum value
23	Temperature value is under minimum value
24	Temperature value is over maximum value
25	The pressure change value is over the maximum value
26	The temperature change value is over the maximum value
27	Calibration value check-sum error
28	Calibration value is out of range

6.11. Description of error group 10: Temperature sensor related errors

Code	Description
1	I2C protocol - No start
2	I2C protocol - No acknowledge
3	The readiness time of the result is out of the time limit
4	The EEPROM write time is out of the time limit
5	EEPROM write error
6	EEPROM data size error
7	Wrong EEPROM data
8	EEPROM data need to be restored
9	Calibration data check-sum error
10	Calibration value is out of range
11	Offset value error
12	Temperature sensor calibration - Input sample temperature is too high (over 70 deg. C)
13	Temperature sensor calibration - Unstable measurement results

6.12. Description of error group 11: Reserved

6.13. Description of error group 12: Boiling temperature determination algorithm related errors

Code	Description
1	Unstable temperature
2	Distilled water boiling temperature deviation is out of range
3	Distilled water boiling temperature is under the minimum value
4	Distilled water boiling temperature is over the maximum value
5	High power time limit
6	Alcohol content calibration - Entered alcohol calibration Nominal value is out of range
7	Alcohol content calibration - Maximal difference between measurements > 0.1 %
8	Alcohol content calibration - Deviation between measured average value and Nominal value > 1.0 %

6.14. Description of error group 13: Printer errors

Code	Description
1	Printer timeout
2	Start bit error
3	Stop bit error
4	Paper out
5	Overheat
6	Unknown error
7	Cover is open
8	No heat
9	Voltage error
10	Printer is not available

7. WARRANTY CARD

This processor for ebulliometer (**EbullMate**) is warranted from the date of purchase. This warranty covers all expenses incurred in connection with defects in materials and workmanship in this product, excluding broken glass and water leakage defect. This warranty does not cover expenses incurred in connection with defects resulting from improper operation, maintenance or abuse.
This Warranty Card has to be filled in at the time of purchase of the meter. No claims will be accepted without the genuine Warranty Card or other evidence of purchase.
This warranty will be avoided in the case of modification or repair by unauthorized personnel or lack of a serial number.

Serial No:

Date: