SMART

EBULLIOMETER

USER'S GUIDE

Document revision: 17
04.07.2024

Firmware Version 01.20B

CONTENTS:

1. General information

1.1. Applications

The main application of SMART EBULLIOMETER is for volume content measurement of ethyl alcohol in wine but it is possible to be used for volume content measurement of ethyl alcohol in other low alcohol content liquids - for example beer.

1.2. Working principle

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 SMART EBULLIOMETER

When working with SMART EBULLIOMETER the laboratory assistant must :
1) To start sample measurement.

All other activities are fully automated as:
- Distilled water boiling temperature **Tw** is calculated, based on measured atmospheric pressure from the embedded precise atmospheric pressure sensor.
- Sample boiling temperature **Ts** is measured from the precise temperature sensor immersed in the boiling sample and the built-in boiling temperature determination algorithm.
- Temperature difference **dT** is automatically calculated.
- Volume content of ethyl alcohol **A** is automatically calculated based on calculated **dT** and the built-in ebulliometric table

2. Description

2.1. Appearance
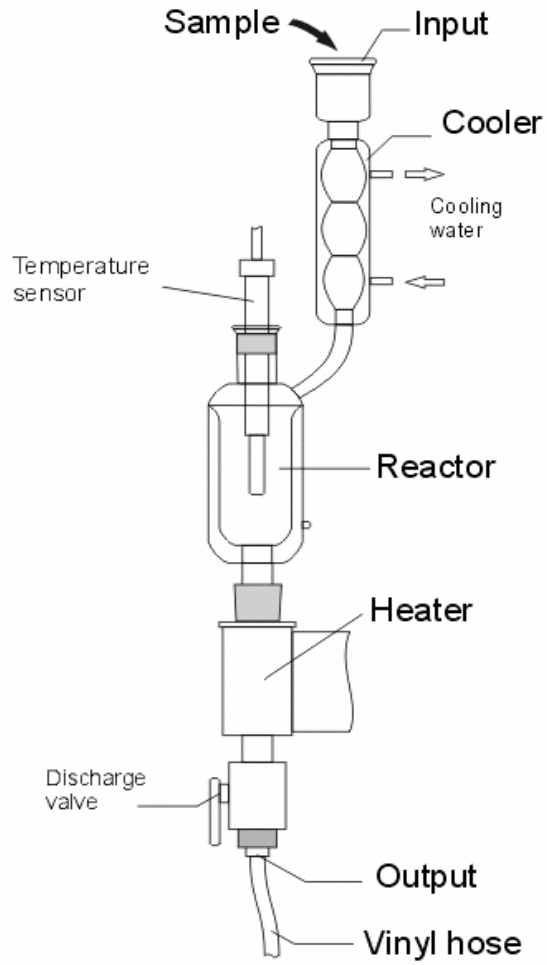
Fig.1

2.2. Measuring system

Fig.2

2.3. Schematic of cooling system connections
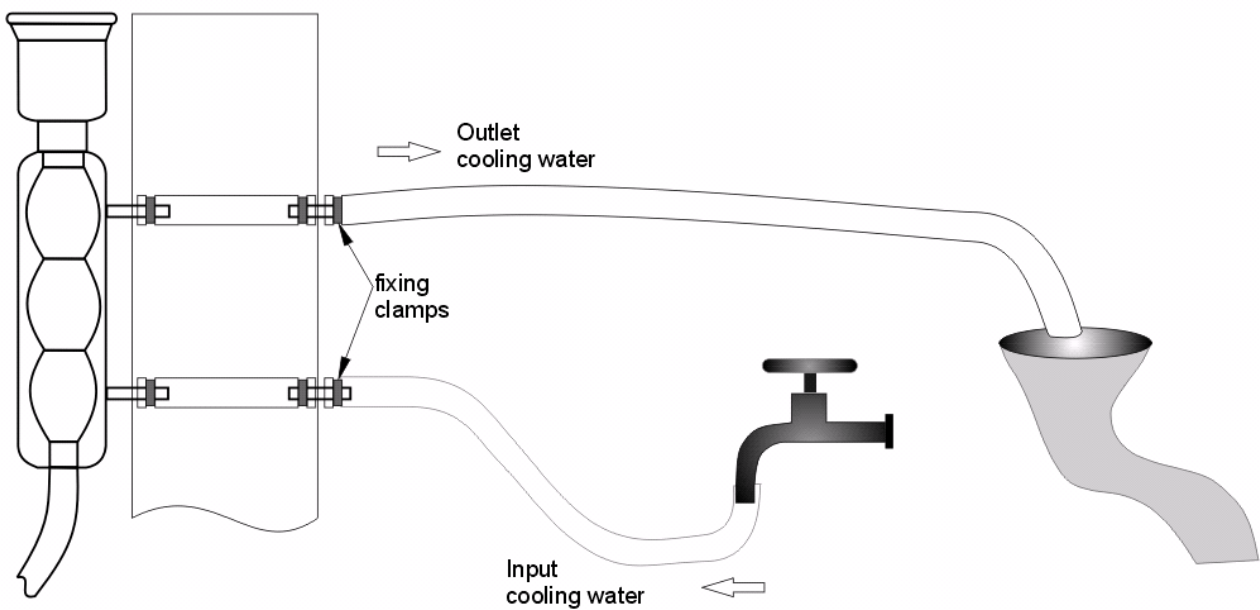
Fig. 3

2.4. Display and keyboard
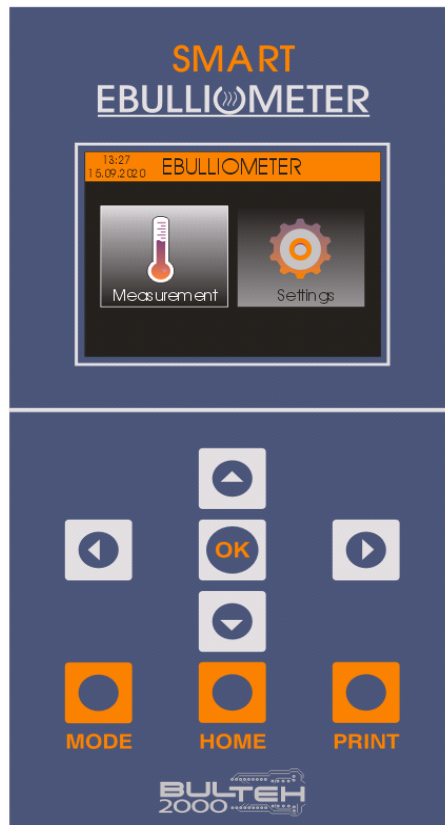
Fig. 4

2.5. Rear panel
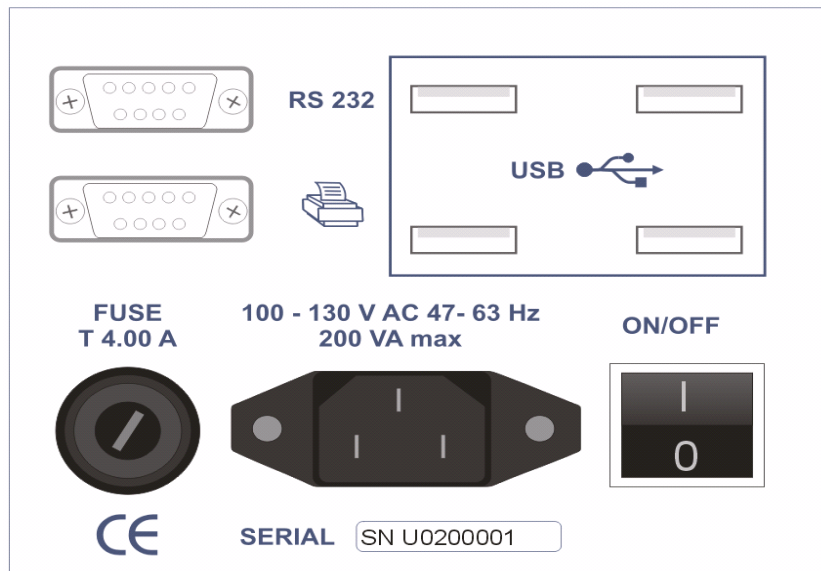
Fig. 5

Notes:
1). SN U0200001 - Device serial number
You may see Main PCB serial number as it is described in item 5.4.9. About device

2). AC power connector type : C14 acc. to IEC 60320-1
3). In the set: Power cable type SCHUKO EUROPE CEE7/7 male plug to IEC320 C13 Female

3. Characteristics

3.1. Measuring characteristics

at alcohol content measurement:

Range (% by volume)	1 -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

Quantity of sample measured (cleaning and analysis)   - about   150 ml
Time per measurement < 6 min.

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

Stationary.. 230/110 V AC   +10/-15%   50/60 Hz
Power consumption .... < 200VA

3.4. Additional characteristics

Overall dimension (H x W x D) .... 485 x 230 x 220 mm
Weight .... 6 kg

4. Installing and preparation for work

Place the meter in vertical position on a smooth and level surface (table, writing desk, etc.).
Connect the cooling water to water supply network or another source of cooling water as shown in
Fig. 3.

The source of cooling water shall meet the following requirements:
 - Temperature -   not higher than 25°C
 - Flow rate   -   from 0.5 to 1.0 L/min.

Put both Vinyl hoses 8mm x 1.5 m and tighten the fixing clamps at the inlet and outlet of the
cooling system.

Connect the cooling system inlet to a water supply network or another source of cooling water as shown in Fig. 3. Consult a technician for supplying of suitable part.

Water at the device cooling system outlet is taken away to the sewerage network by gravity.

Turn on cooling water, adjust the flow rate from 0.5 to 1.0 L/min (using tap) and check for leaks at connection points.

Attention: Make sure the output hose of cooling system is not blocked (folded, pressed, squeezed etc.). The output hose blockage leads to flooding of measuring system and serious damage of the device

Remove the polyethylene bag covering the inlet of the measuring system.
Put the free end of the 3 mm x 1.5 m vinyl hose connected to the discharge valve (Fig. 2) into a suitable vessel for collection of samples measured or directly to the sewerage.
Connect the power cable to the meter.
Connect the power cable to a mains supply source of nominal voltage in accordance with the nameplate at the rear panel of the device.

Attention: Power the device from 3-prong grounded schuko plug only

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. 5) the device start its work with a procedure that checks all critical components (power block, sensors etc.) and also deleting of obsolete files from the build-in SD card - data collection files, error log files and diagnostic files (see items 5.4.7.1, 5.4.7.2 and 5.4.7.3).

During the components checking procedure is in progress, the current software version is displayed at the bottom of the display (for example "Firmware version: ET01.01B")

In case of a fault is detected in some of the components, the corresponding error message appears on the display.

After a checking procedure completes, the device beeps.
Note: Please see chapter 5.4.5.6 about enabling and disabling the buzzer.

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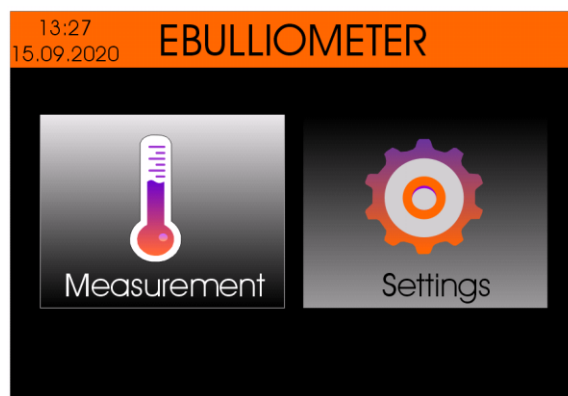
From this screen you may select the icon "Measurement" or "Settings" using the buttons <Left arrow> / <Right arrow>.

5.3. "Measurement" mode

"Measurement" mode is designed to determine the boiling point of the sample(wine) and calculating the volume percentage of ethyl alcohol.

Attention: During this procedure tap water must flow through the cooling system (see point 4).

Important note: Before starting "Measurement" mode the measuring system should be flushed with the wine to be measured .This procedure must be followed even if consecutive samples of the same wine are to be tested in order to obtain correct results.

Close the discharge valve (see Fig. 2), and fill the measuring system to the top with wine to be measured (about 100 ml). Then open the discharge valve to evacuate the measuring system. This way the measuring system will be flushed and prepared for measurement.
Close the discharge valve, measure another 50 mL from the sample and pour it into the inlet of the measuring system.
Adjust the wine volume to the printed mark (see Fig. 6) on the reactor by opening the valve to drain the excess wine. During the volume adjustment, the mark should be at your eye level.
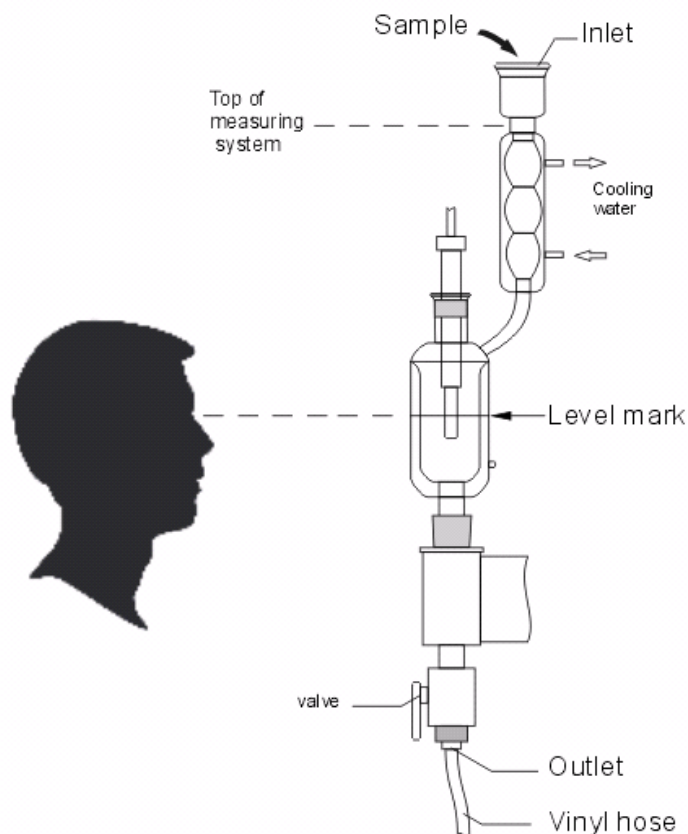
Fig. 6

Attention: The precise wine volume is very important for the accuracy of ebulliometer!

After the starting of "Measurement" mode (see item 5.3.) 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 5.4.2. - Wine type settings

To select the wine type you will measure, use buttons <Arrow up> / <Arrow down> and then confirm with button <OK>.
Below is shown an example of the panel with started measurement process:
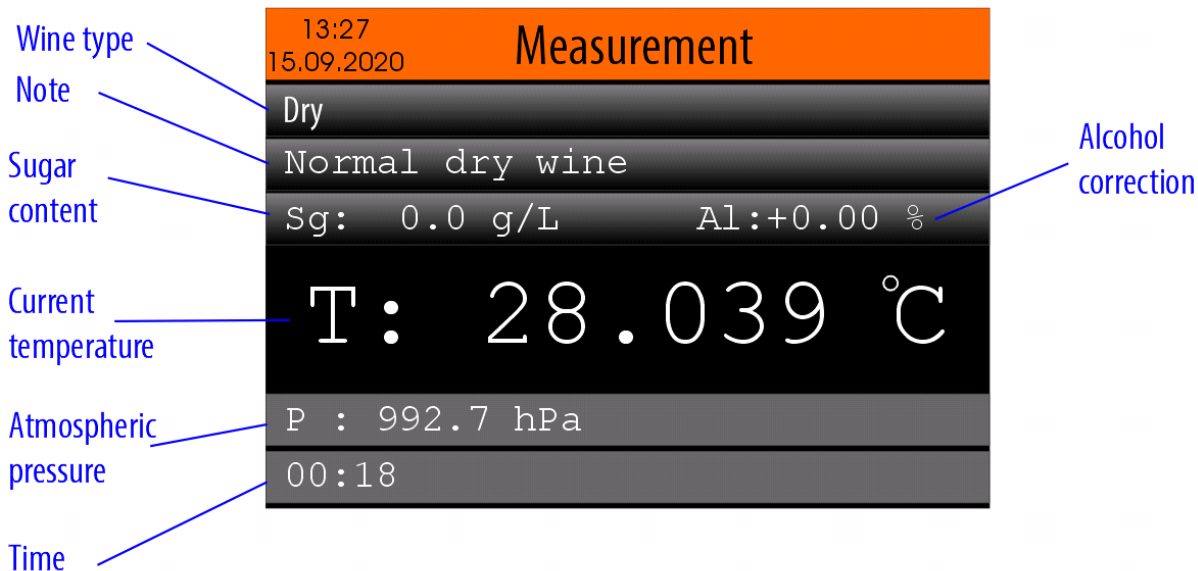
Wine type - the selected wine type
Note - note for the selected wine type
Sugar content - sugar content for the selected wine type
Alcohol correction - alcohol correction for the selected wine type
Current temperature - currently measured temperature value of the sample (wine)
Atmospheric pressure - currently measured atmospheric pressure value
Time - the elapsed time since the start of the measurement process

The measurement process is fully automated and no need any actions from the user.
If the user wants to break the measurement process this can be done using the buttons <MODE> or <HOME>.

5.3.1. Automatic reading of the boiling point 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, volume content of ethyl alcohol is calculated and the results are shown as shown below:
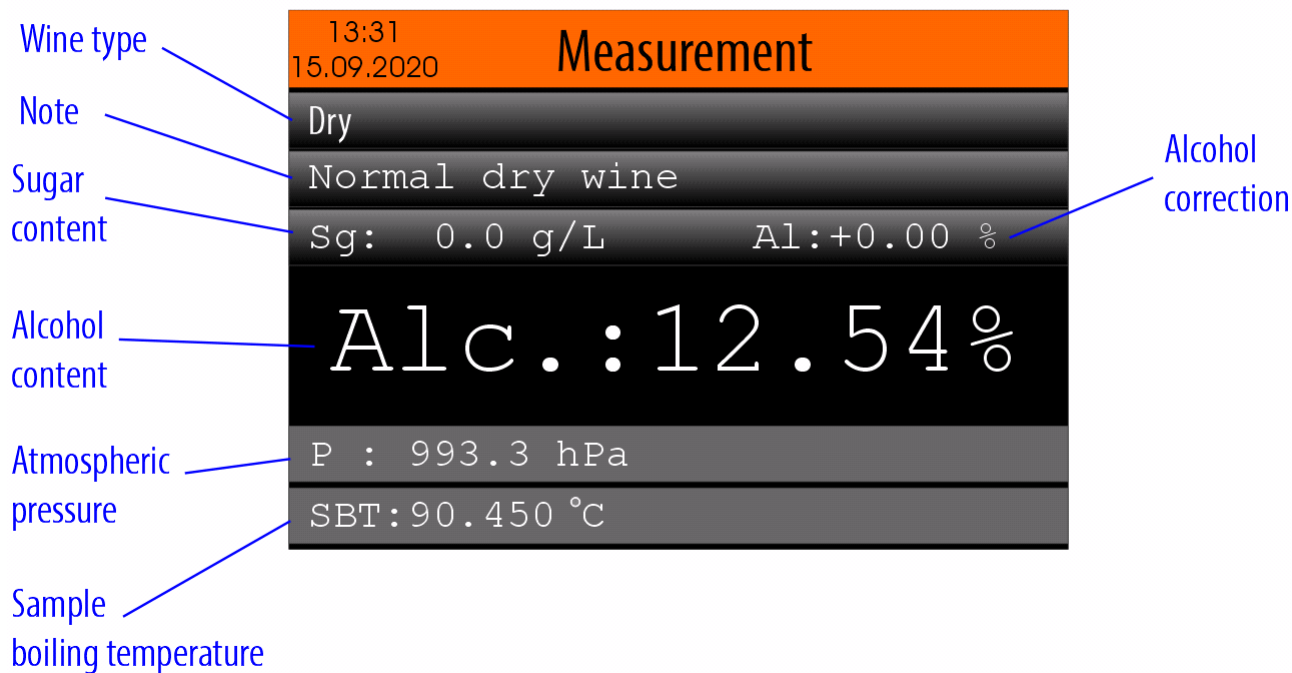
Wine type - the selected wine type
Note - note for the selected wine type
Sugar content - sugar content for the selected wine type
Alcohol correction - alcohol correction for the selected wine type
Alcohol content - Calculated sample (wine) alcohol content
Atmospheric pressure - measured atmospheric pressure
Sample boiling temperature - measured sample (wine) boiling temperature

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 read the boiling temperature of the wine (see item 5.3.2.).

5.3.2. Manual reading of the boiling point 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.
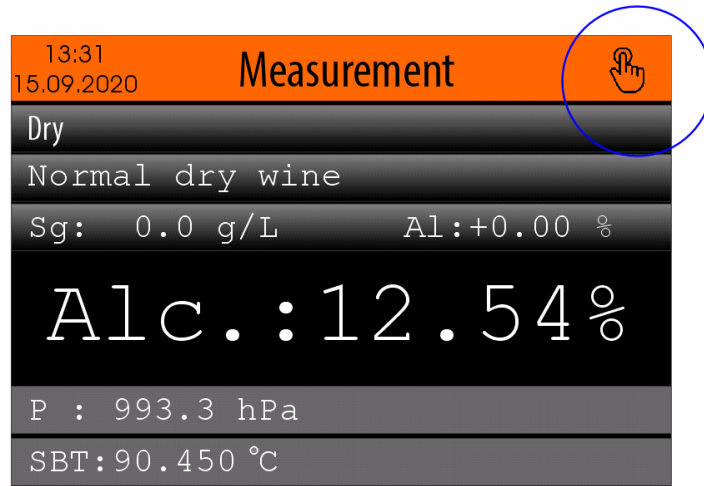
This way, the temperature displayed on the screen at the time of pressing the button <OK> is taken as the boiling temperature of the sample and is used to calculate the percentage of alcohol in the sample.
In this case, the results are displayed as follows :

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
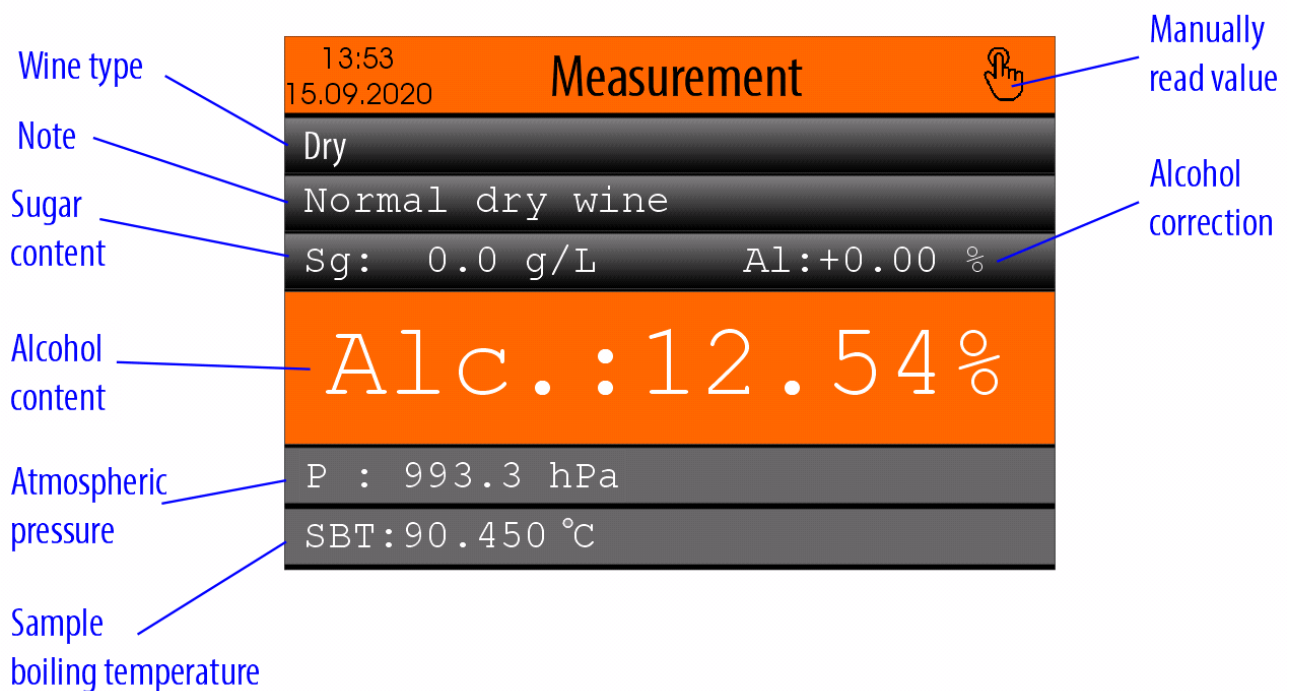Sample boiling temperature - measured sample (wine) boiling temperature

After the measurement completion open the discharge valve to evacuate the measuring system.

In case you have a printer connected to the device and it is selected (see item 5.4.6.5.) the measurement results will be printed out 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 as a acohol correction for the corresponding wine type. To enter this value use "Alcohol content correction"(see item 5.4.2.2.).

3. In case the atmospheric pressure sensor is disabled (see item 5.4.6.4.) and you have not performed water measurement in "Water" mode in the previous 24 hours, a warning message will appear on the screen:
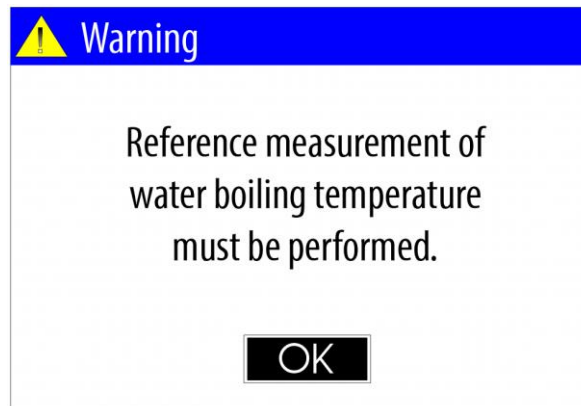
5.4. "Settings" menu

To start the "Settings" menu, from the home screen select "Settings" icon, using the buttons <Left arrow> / <Right arrow> and confirm with <OK> button.
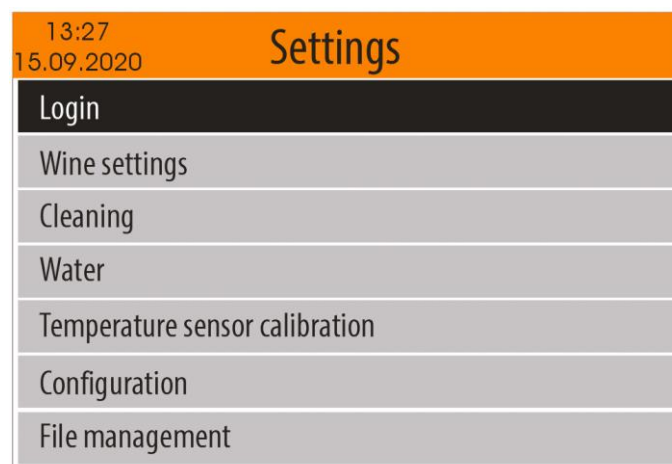
This menu contains options as below:
 - Login
 - Wine settings
 - Cleaning
 - Water
 - Temperature sensor calibration
 - Configuration
 - File management
 - Firmware Update
- About device

5.4.1. "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.
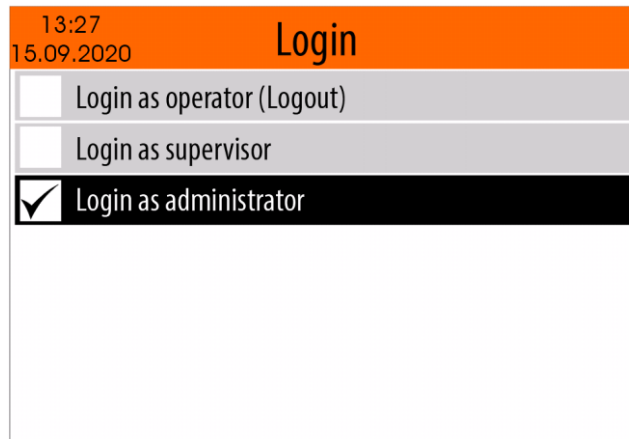
After confirmation with the <OK> button, the selected option is saved in the non-volatile memory of the device and remains valid until the next change.

Depending on the selected option, the access to some of the modes from the "Settings" menu is determined.

5.4.2. "Wine settings" menu

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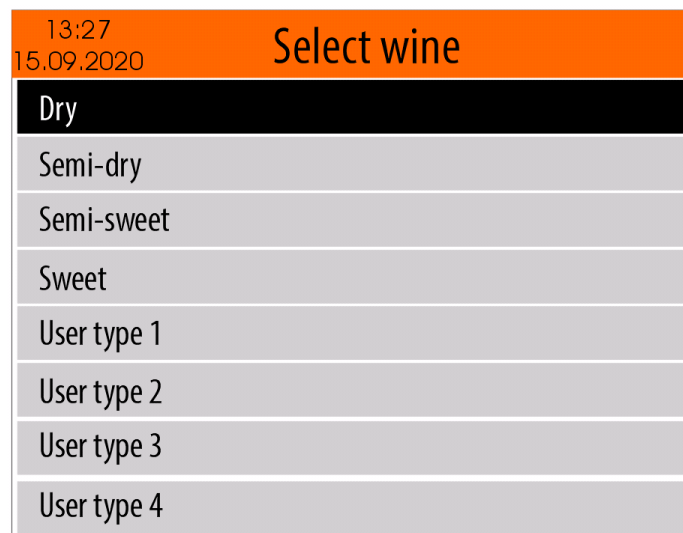
On the screen will appears a menu from which the user should select the type of wine to be edited - Dry, Semi-dry, Semi-sweet, Sweet, User type 1, User type 2, ... User type 10.

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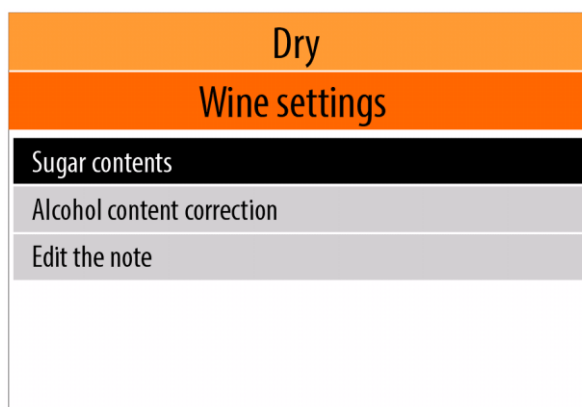
Using the buttons <Up arrow> /<Down arrow> select one of the menu item and confirm with <OK> button.

5.4.2.1. Editing of Sugar content

Once "Sugar contents" menu option is selected (see item 5.4.2.) on the screen will appear the value of sugar content for the selected wine type, saved in the non-volatile memory in the device.
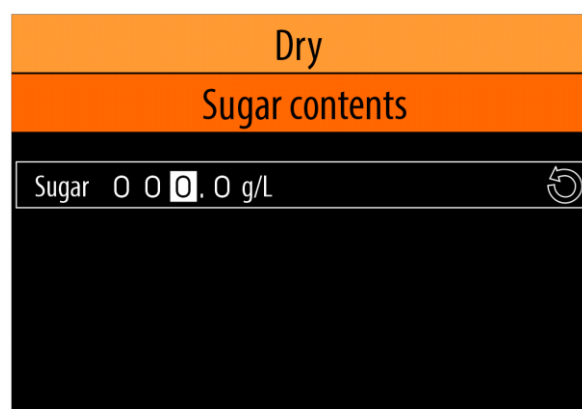
Use the buttons <Left arrow> / <Right arrow> to select which digit of the number to edit, and use the buttons <Down arrow> / <Up arrow> to set the desired value.
If a USB keyboard is connected to the device, you can enter the desired value using the numbers 0 ... 9.

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.

5.4.2.2. Editing of alcohol content correction

Once "Alcohol content correction" menu option is selected (see item 5.4.2.) 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.
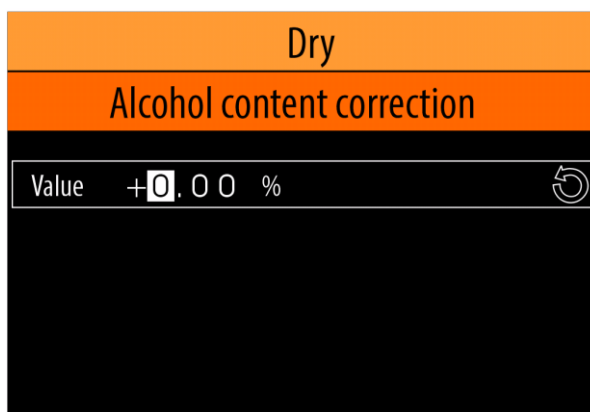
Use the buttons <Left arrow> / <Right arrow> to select which digit of the number to edit, and use the buttons <Down arrow> / <Up arrow> to set the desired value.
If a USB keyboard is connected to the device, you can enter the desired value using the numbers 0 ... 9,"+" and "-".

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.
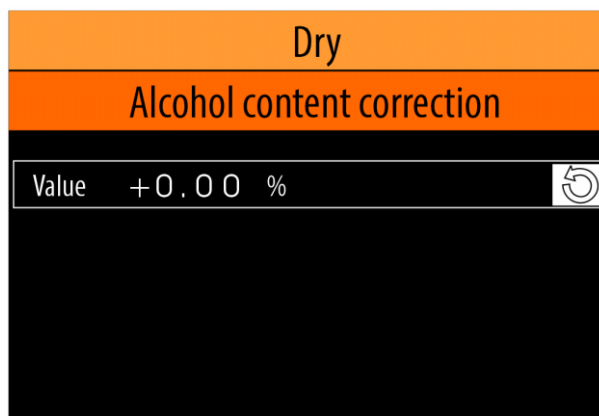
5.4.2.3. Editing the note

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. 5).
2).

Забележки:
1). За да редактирате забележката за някое от типовете вина е необходимо да свържете USB клавиатура към един от четирите USB съединителя, монтирани на задния панел на уреда (виж. Фиг. 5).
2). The content of the note text can only be entered in Latin letters.

Once "Edit the note" menu option is selected (see item 5.4.2.) on the screen will appear the text for the selected wine type, saved in the non-volatile memory in the device.
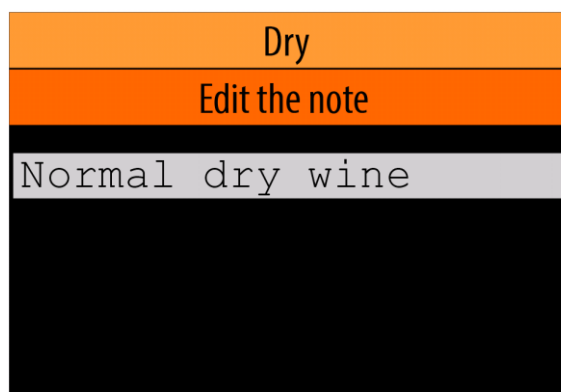
The blinking cursor indicates the position at which the next character will be entered. Use the <Left Arrow> / <Right Arrow> buttons to change the cursor position. To fill in the note text, use the symbols "a" ... "z", "A" ... "Z", нумберс "0...9" and the punctuation marks as well.

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.

5.4.3. "Cleaning" mode

A regular and proper cleaning of the meter measuring system will assure accurate and reliable measurement results. You may apply different cleaning solutions and procedures depending on the samples tested:

 - In case you are measuring dry wines only it is enough if at the end of the working day you run the device few times (2-3) in "Cleaning" mode, using distilled water as a cleaning solution.

 - In case you are measuring sweet wines the cleaning procedure is to be made at the end of the working day by running the device few times (2-3) in "Cleaning" mode, using 5% of NaOH solution as a cleaning solution.
Distilled water should be used then to flush the measuring system in order to remove NaOH remains.

Before starting the "Cleaning" mode, close the drain valve (see Fig. 2), measure out 50 mL of cleaning solution (distilled water or 5% of NaOH solution) and pour it into the input of measuring system. The volume must be up to the level of the printed mark placed on the reactor. Drain excess through the drain valve. During this procedure, the reactor printed mark must be at eye level (see Fig. 6).

To start the "Water" mode form the "Settings" menu select "Cleaning" option, using the buttons <Up arrow> /<Down arrow> and confirm with <OK> button.
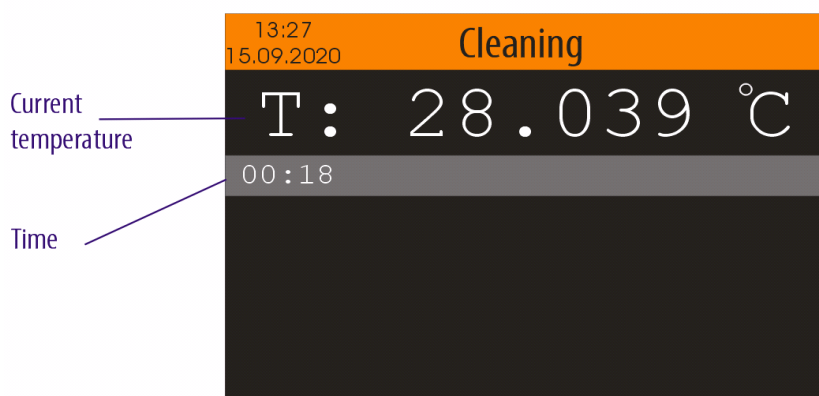
Current temperature - currently measured value of the cleaning solution temperature
Time - the elapsed time since the start of the cleaning mode

After the cleaning procedure finish the device shows the following message:

5.4.4. "Water" mode

Important: The "Water" mode must be used in case the atmospheric pressure sensor is disabled (see item 5.4.6.4.).

The "Water" mode is designed to measure the boiling temperature of distilled water. The measurement result is recorded in the non-volatile memory of the device and is used in the "Measurement" mode for the next 24 hours to determine the volume of alcohol.

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:
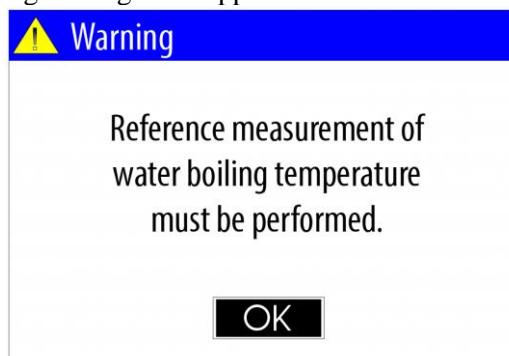
Before starting the "Water" mode, flush the measuring system several times with distilled water, close the drain valve (see Fig. 2), measure out 50 mL of distilled water and pour it into the input of measuring system. The volume of water must be up to the level of the printed mark placed on the reactor. Drain excess through the drain valve. During this procedure, the reactor printed mark must be at eye level (see Fig. 6).

To start the "Water" mode form the "Settings" menu select "Water" option, using the buttons <Up arrow> /<Down arrow> and confirm with <OK> button.
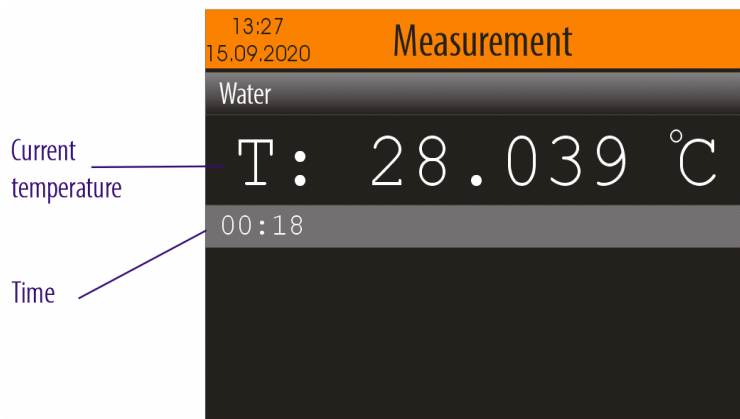
Current temperature - currently measured value of the distilled water temperature
Time - the elapsed time since the start of the measurement process

The measurement process is fully automated and no need any actions from the user.
If the user wants to break the measurement process this can be done using the buttons <MODE> or <HOME>.

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 and the results are displayed as it is shown below:
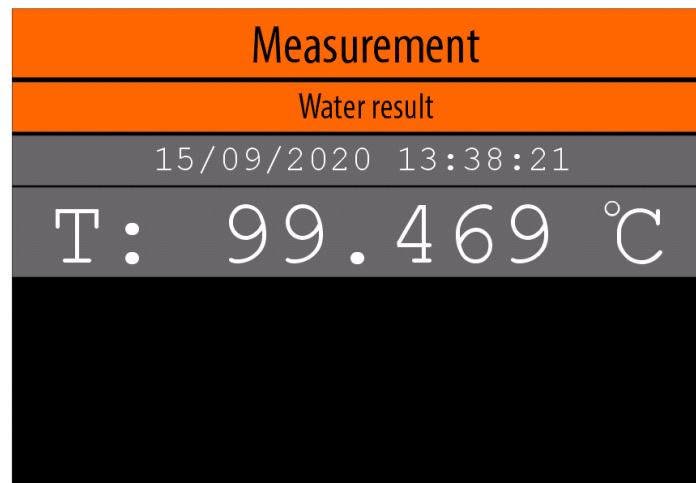
In case you have a printer connected to the device and it is selected (see item 5.4.6.5.) the measurement results will be printed out automatically.

Example of printout:

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.

After the measurement completion open the discharge valve to evacuate the measuring system.

5.4.5. "Calibration" menu

To select the "Calibration" menu, from the "Settings" menu (see item 5.4.), Select the "Calibration" option using <Down arrow> / <Up arrow> buttons and then confirm with the <OK> button.
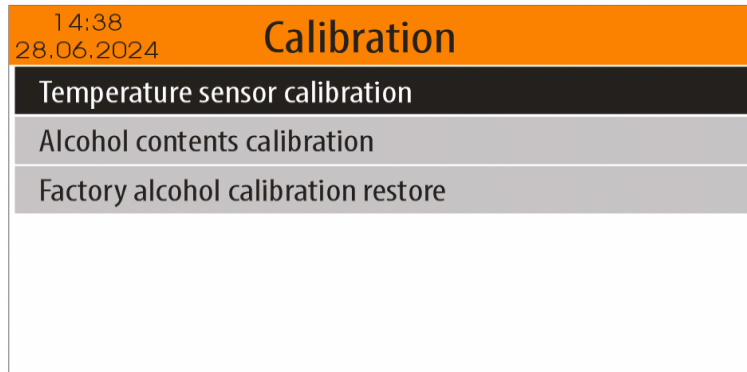
To return to the "Settings" Menu, press the <MODE> button. To return to the Home screen, press the <HOME> button.

5.4.5.1. Temperature sensor calibration

Periodic calibration of the temperature sensor guarantees the correct operation of the SMART EBULIOMETER 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.

The temperature sensor calibration should be performed periodically (90 days or often, at the discretion of the laboratory assistant).

Note: If the temperature sensor has not been calibrated in the previous 90 days, the following reminder message will appear on the display when the "Measurement" or "Water" mode is started:
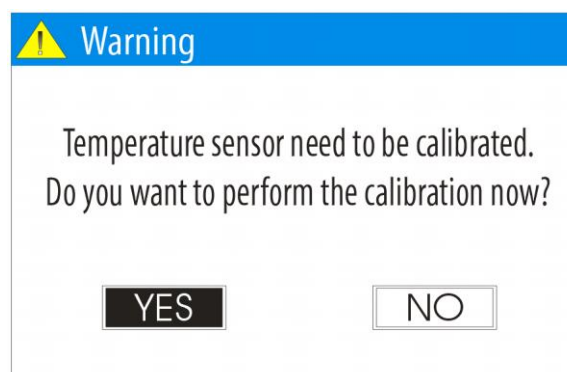
If you select "YES" with the <Left arrow >/ <Right arrow> buttons and confirm with the <OK > button, the temperature sensor calibration procedure will start.

If 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 clean the **SMART EBULLIOMETER** measuring system thoroughly with distilled water.

Close the discharge valve, measure another 50 mL distilled water and pour it into the inlet of the measuring system. Adjust the wine volume to the printed mark (see Fig. 6) on the reactor by opening the valve to drain the excess wine. During the volume adjustment, the mark should be at your eye level.

To select the temperature sensor calibration mode from the "Settings" menu (see item 5.4.), Select the "Temperature sensor calibration" option with <Down arrow> / <Up arrow> and then confirm with the <OK> button.

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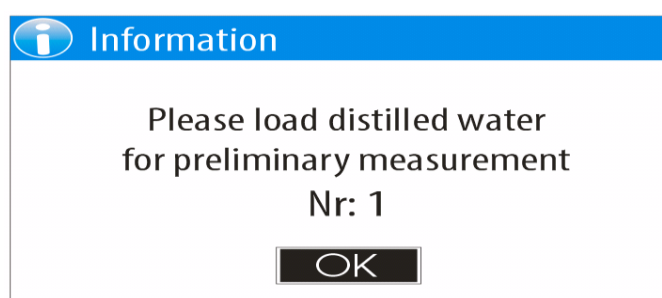
The following is an
example panel of a started measurement process as part of the temperature sensor calibration procedure.
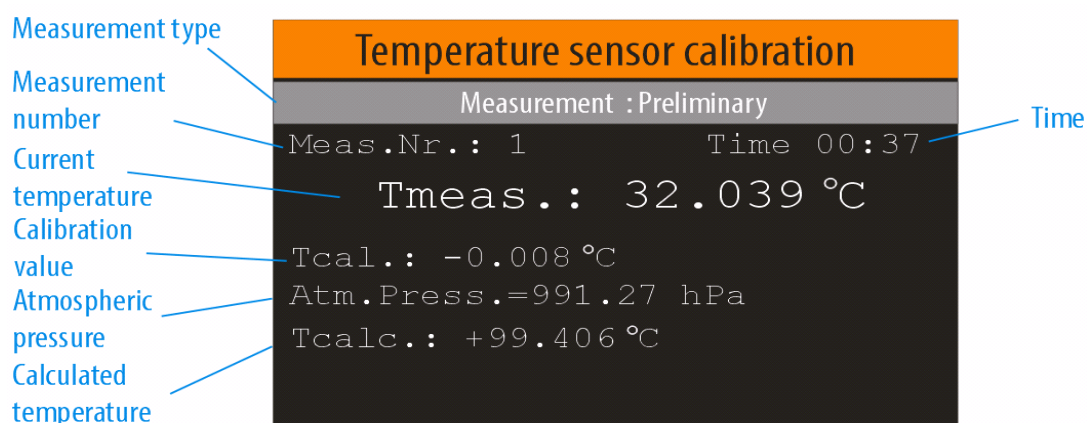
Measurement type - Preliminary or Calibration
Measurement number - The number or the current measurement
Current temperature - Currently measured temperature
Calibration value - Current calibration value (from the previous calibration)
Atmospheric pressure - Currently measured atmospheric pressure
Calculated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

The measurement process is fully automated and the user does not need to perform any actions. If the user wants to interrupt the process, this can be done with the <MODE> or <HOME> buttons.

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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:
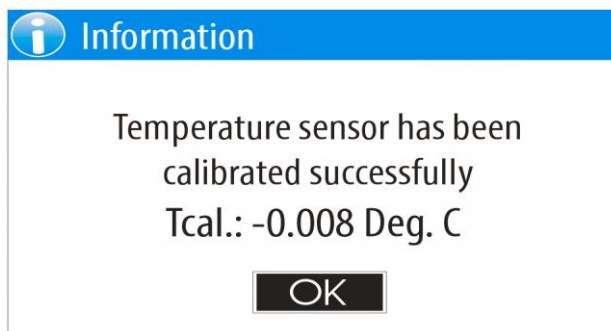
If you have a printer connected to the device and you have selected it (see item 5.4.6.5), the measurement results will be printed automatically.

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
```

5.4.5.2. Alcohol contents calibration

This procedure allows calibration of the device measuring system   (reactor, cooler, heater) for accurate measurement of the absolute value of the alcohol content.

Important:
**To perform this procedure you need an water-alcohol solution with a previously known alcohol content. The water-alcohol solution used for calibration must have a nominal value in the range of 9.00% to 13.00% and a deviation from the nominal value no more than +/- 0.02%.**
The minimum amount of water-alcohol solution required to perform a calibration procedure is 600 mL.
This procedure must be performed very careful, as it determines the absolute accuracy of the measured alcohol content of all subsequent measurements until the next calibration.

Note: In case the pressure sensor is disabled, the procedure for calibration of the alcohol content includes (starts with) several measurements of the boiling temperature of distilled water.
The minimum required amount of distilled water is 400 mL.

To select the alcohol content calibration mode from the "Calibration" menu (see section 5.4.5), select the "Alcohol content calibration" option using <Down arrow> / <Up arrow> and then confirm with the <OK> button.

At the beginning of the calibration procedure, you must enter the nominal value of the alcohol content in the water-alcohol solution that you will use for calibration. The entered value must be in the range of 9.00% to 13.00%.

Alcohol contents calibration
Enter the alcohol content nominal
value of the water-alcohol
calibration solution

Value + 1 1.0 0 %
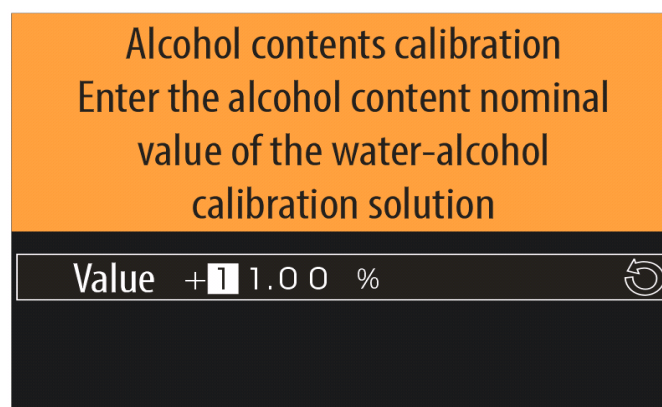
All measurements included in the calibration procedure (including the preliminary one) must be performed in strict compliance with the instructions described in section 5.3. Measurement mode, using the calibration water-alcohol solution as a sample.

It is especially important:
- Make sure the cooling water circulation is switched on
- Flushing must be done with 100 mL of water-alcohol calibration solution
- The level of the sample must be in accordance with the marking

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

Information

Please flush and load sample
for preliminary measurement
Nr: 1

OK
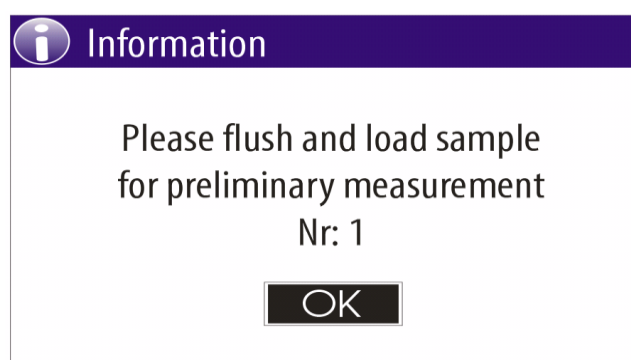
After flushing with 100 mL of water-alcohol solution, empty the measuring system and pour the water-alcohol solution to the level line, confirm with the <OK> button to start the measurement.

After the completion of the preliminary measurement, several (three) similar measurements will be performed, from which the calibration parameters will be calculated. Each subsequent measurement will start with an information message of the type:

Information

Please flush and load sample
for measurement
Nr: 1

OK
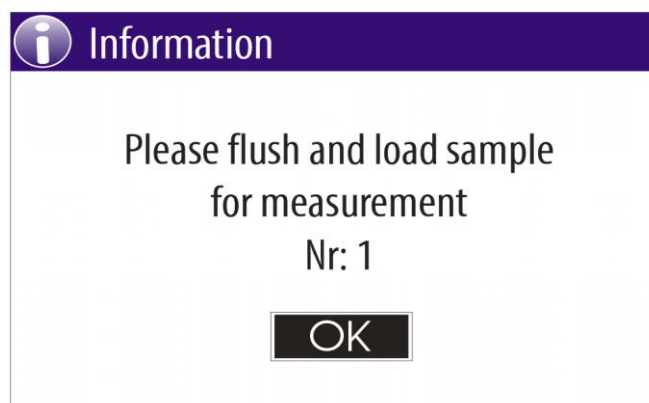
After completion of all measurements included in the calibration procedure, the data from them are checked for repeatability and absolute accuracy.

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 on the screen:

After successfully completion of the calibration procedure the following warning message will appear on the display:
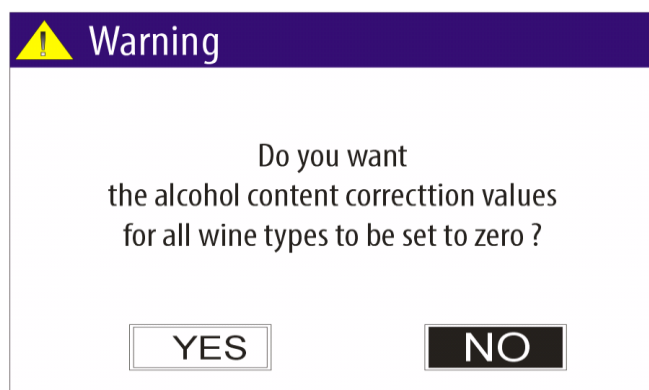
If you select "YES" using the <Left arrow> / <Right arrow> buttons and confirm with the <OK> button, all alcohol content correction values for all wine types will be set to zero.

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

5.4.5.3. Factory alcohol calibration restore

Note: This menu item is available only in case there is stored factory alcohol calibration values. The devices produced before 04.07.2024 have not stored factory alcohol calibration values and this function is not available, even the firmware version to be updated with ET01.20B or upper.

This function allows you to replace (restore) current alcohol calibration values with the factory ones.

To select the factory alcohol calibration restore function from the "Calibration" menu (see section 5.4.5), select the "Factory alcohol calibration restore" option using <Down arrow> / <Up arrow> and then confirm with the <OK> button.

The following dialog panel will appear on the display:
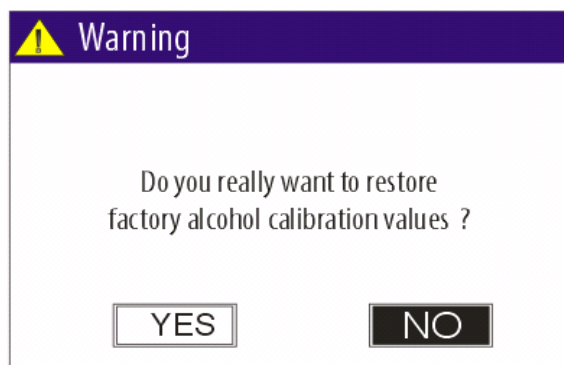
If you select "YES" using the <Left arrow> / <Right arrow> buttons and confirm with the <OK> button, alcohol content calibration values will be replaced with the factory ones.

If you select "NO" using the <Left arrow> / <Right arrow> buttons and confirm with the <OK> button the current calibration values stay without change.

5.4.6. "Configuration" menu

To enter in "Configuration" menu form the "Settings" menu (see item 5.4.) select "Configuration" option, using the buttons <Up arrow> /<Down arrow> and confirm with <OK> button.
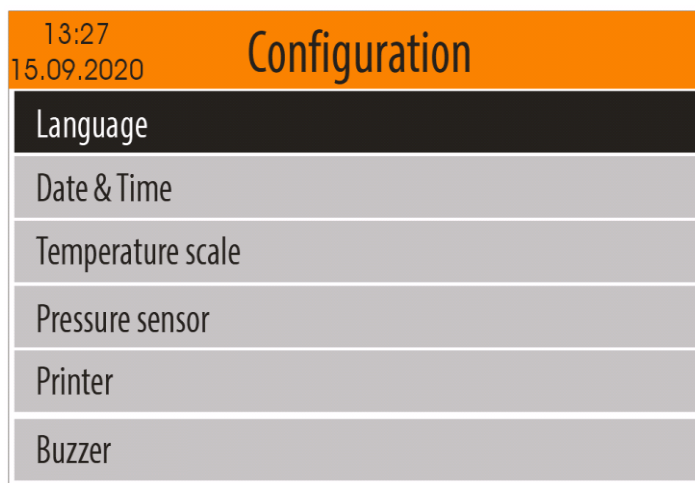
To return to the "Settings" Menu, press the <MODE> button. To return to the "Home screen", press the <HOME> button.

5.4.6.1. Language select

To select the "Language" menu, from the "Configuration" menu (see item 5.4.6.), 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 preferred 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.

5.4.6.2. Date & Time

To enter in "Date & Time" setting mode, from the "Configuration" menu (see item 5.4.6.), 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.
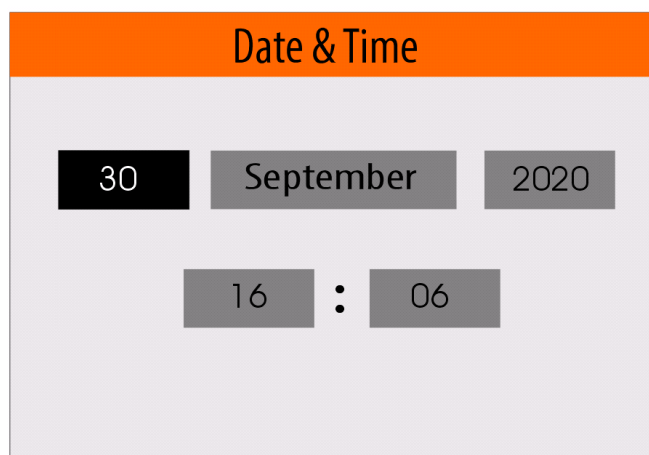
From this screen, using the <Left arrow> / <Right arrow> buttons select the date, month, year, hour or minute field.

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.

5.4.6.3. Temperature scale

To enter in "Temperature scale" menu, from the "Configuration" menu (see item 5.4.6.), 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.

5.4.6.4. 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 5.4.6.), select the " Pressure sensor" option using <Down arrow> / <Up arrow> buttons and then confirm with the <OK> button.
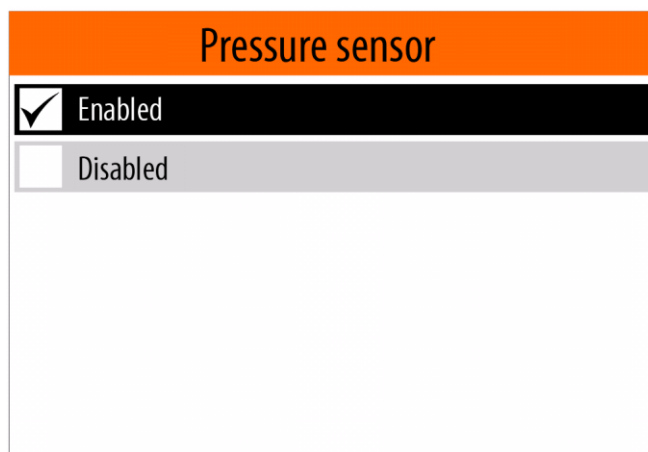
A menu with two options - "Enabled" and "Disabled" will appear on the display and the currently selected state be marked.
Use <Down Arrow> / <Up Arrow> to select your preferred state and then confirm with the <OK> button. Your selection will be stored in the non-volatile memory of the device and will 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 5.4.4.)

5.4.6.5. Printer

This menu allows you to select the type of external printer, which the measurement results will be printed.

To enter in "Printer" menu, from the "Configuration" menu (see item 5.4.6.), select the "Printer" menu option using <Down arrow> / <Up arrow> buttons and then confirm with the <OK> button.

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

Notes:
1).The "None" option means that no external printer is connected or that you do not want the results to be printed on paper.
2). The devices that do not have a built-in panel printer, the "Panel Printer -9600/8/N/1" option is not available.

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.

Example: If you have connected DEP 50 ESC / POS printer to the ebulliometer using the RS232 cable, and if you want to print the measurement results on paper, you need to select the "RS232 Printer - 1200/8 / E / 1" option. When the measurement is completed (in "Measurement" or "Water" mode), the results will be printed automatically. Examples of printouts can be seen in item 5.3 and item 5.4.4.

5.4.6.6. Buzzer
This option allows you to enable or disable the beeps of the built-in buzzer.

In case the buzzer is enabled, the device emits characteristic beeps in the following cases:
  - After completing the start-up procedure
  - After completion of measurement
  - In case of an error

Note: Some devices do not have a built-in buzzer and this option is not available.

5.4.6.7. 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 5.4.6.), select the "Measurements counter" menu option using <Down arrow> / <Up arrow> buttons and then confirm with the <OK> button.
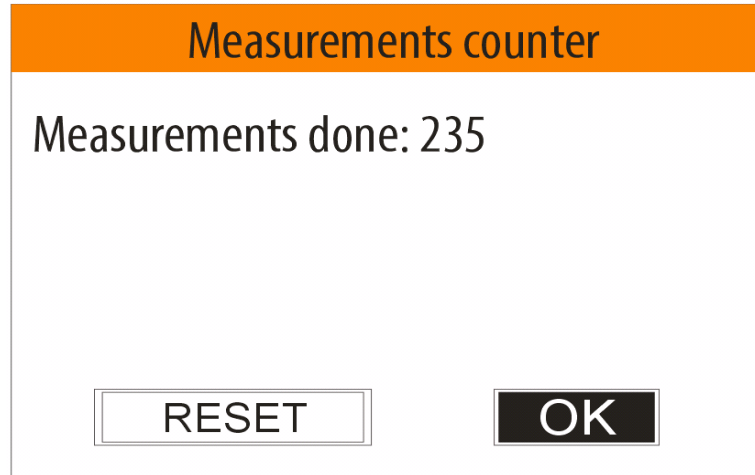
Use the <Left arrow> / <Right arrow> buttons to focus "OK" or "Reset" and confirm with the <OK> button.
In case you confirm "Reset" the measurement counter will be set to zero.

5.4.7. "File management" menu

To enter in " File management " menu, from the "Configuration" menu (see item 5.4.6.), select the " File management " menu option using <Down arrow> / <Up arrow> buttons and then confirm with the <OK> button.
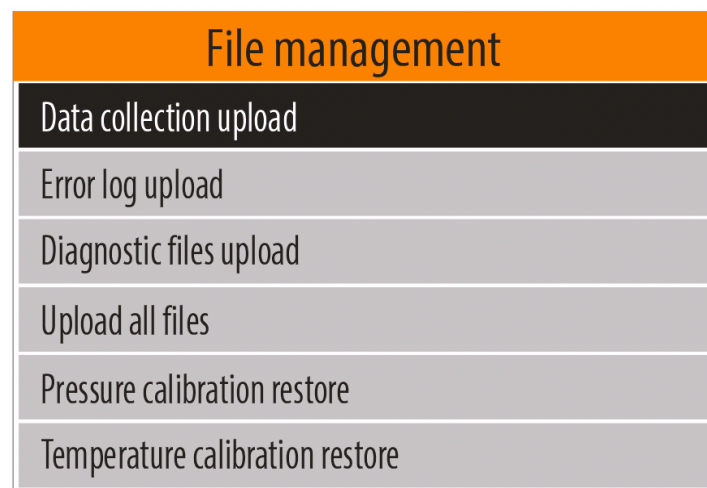
This menu includes the following options:
 - Data collection upload
 - Error log upload
 - Diagnostic files upload
 - Upload all files
 - Pressure calibration restore

- Serial number restore

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

5.4.7.1. 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:

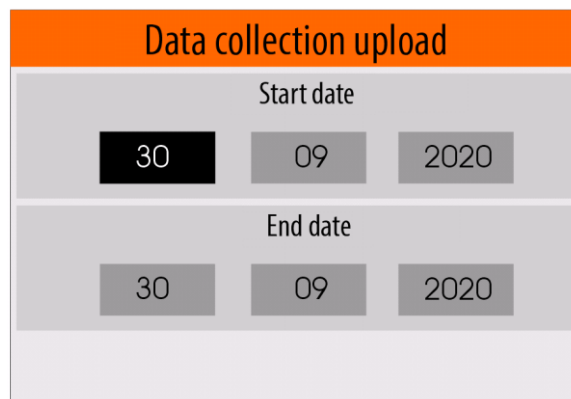| M	Minute
0	0
1	2
2	4
3	6
4	8
5	10
6	12
7	14
8	16
9	18
A	20
B	22
C	24
D	26
E	28
F	30
J	32
H	34
I	36
J	38
K	40
L	42
M	44
N	46
O	48
P	50
Q	52
R	54
S	56
T	58

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 5.4.7.), 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.
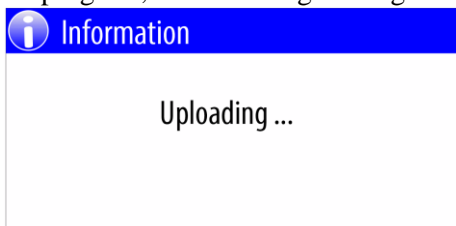
Example:
K:\EBULL\U0200001\DATFILES
where :
 K - Device label (USB flash pen drive)
EBULL - Ebulliometer folder
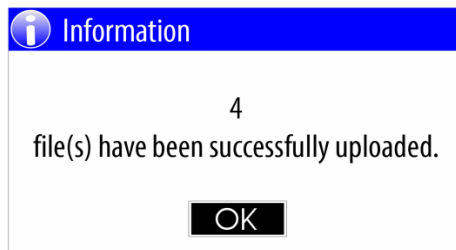**U0200001** - Ebulliometer Main PCB serial number (see item 5.4.9.)
DATFILES - Data collection files folder

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:U0200001 FWV:ET01.10B - Main PCB 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

Example of opened file using text editor:

```
*SN:U0200001  FWV:ET01.10B
*Date,Time,Mode,Sample Type,Wine Type,Wine Sugar Content [g/L],Wine Alcohol Correction [%],Wine
Note,Sample Alcohol Content[%],Sample Boiling Temp.[^C],Atmospheric Pressure[hPa],Water Boiling
Temp.[^C]
14/07/2020,15:48:57,Automatic,Wine,Dry,000.0,0.00,normal dry wine,12.27, 90.594, 993.5, 99.467
14/07/2020,15:58:08,Manual,Wine,Dry,000.0,0.00,normal dry wine,12.64, 90.407, 993.5, 99.466
14/07/2020,16:00:55,Automatic,Wine,Dry,000.0,0.00,normal dry wine,12.41, 90.521, 993.4, 99.466
```

Example of opened file using LibreOffice Calc:

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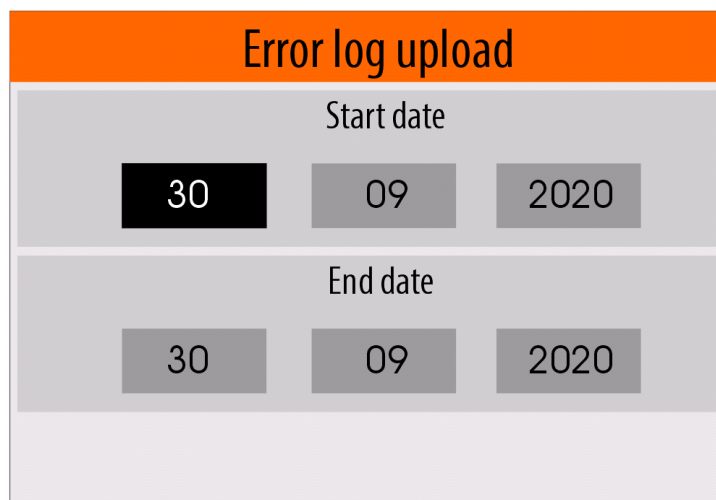
Any errors that occur during the device operation are automatically saved (added) to a file (Error Log File) on the built-in SD card in the device. Each file contains the registered errors from one day and is kept up to 90 days.

Note: The obsolete files are deleted during Startup 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 5.4.7.), 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:\EBULL\U0200001\ ERRLOG
where :
K - Device label (USB flash pen drive)
EBULL - Ebulliometer folder
U0200001 - Ebulliometer Main PCB serial number (see item 5.4.9.)
ERRLOG - Error log files folder

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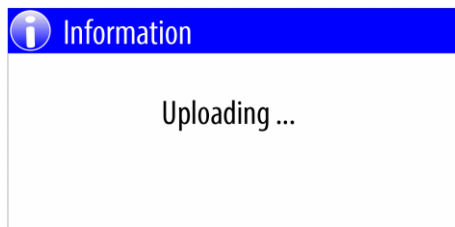
When the copying (uploading) is complete, a message will appear on the screen about the number of files copied.
Example:
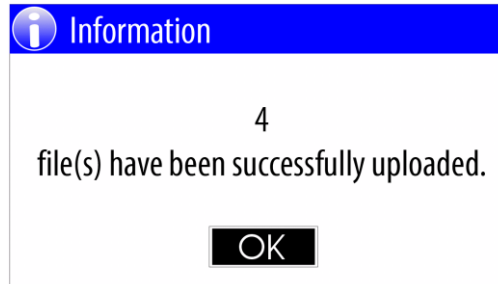
Error log files have LOG file extension and can be opened with each text editor.

Example of file name:
20200729.LOG
where:
2020 - year
07 - month
29 - date

The rows that start with asterisk are header rows.
- *Error Log SN:U0200001 FWV:ET01.10B - Ebulliometer Main PCB 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:U0200001 FWV:ET01.10B
*Date,Time,Err Group, Err Code
21/09/2020,09:17:24, 6, 12
21/09/2020,09:48:08, 6, 4

More details about errors see item 6.

5.4.7.3. 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.
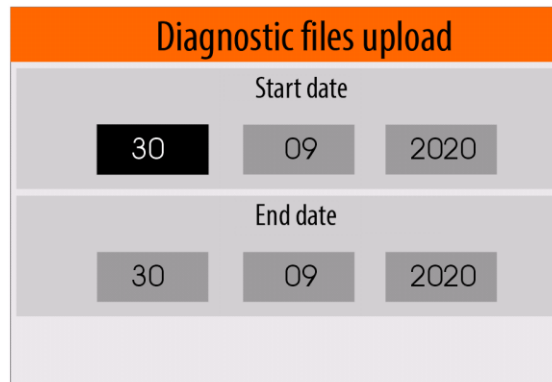
Note: The obsolete files are deleted during Startup procedure (see item. 5.1.).

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 5.4.7.), 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:\EBULL\U0200001\ DIAG
where :
K - Device label (USB flash pen drive)
EBULL - Ebulliometer folder
U0200001 - Ebulliometer Main PCB serial number (see item 5.4.9.)
DIAG - diagnostic files folder

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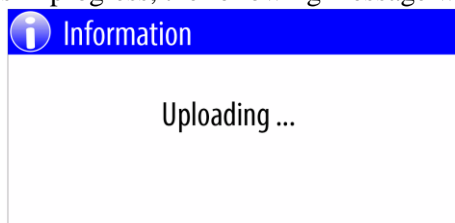
When the copying (uploading) is complete, a message will appear on the screen about the number of files copied.
Example:
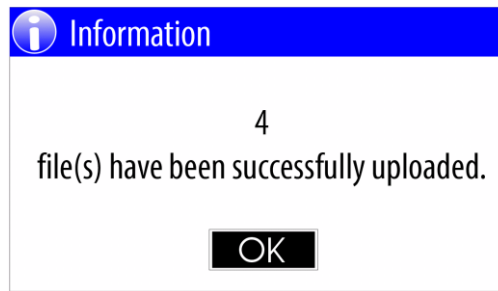
The diagnostic files have "EDG" file extension. They can not be open and they are intended to be used for analysis from the producer.

Example of file name:
200908F4.EDG
where:
20 - year
09 - month
08 - date
F - hour (encoded, in this example - 15)
4 - minute (encoded, in this example 8)

5.4.7.4. 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
- 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.

5.4.7.5. 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:\EBULL\ CALDATA\U0200001.EPC
where :
K - Device label (USB flash pen drive)
EBULL - Ebulliometer folder
CALDATA - Folder containing calibration files
U0200001.EPC - Pressure calibration recovery file for Ebulliometer Main PCB serial number U0200001

Note: The EBULL 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 5.4.7.), 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 :
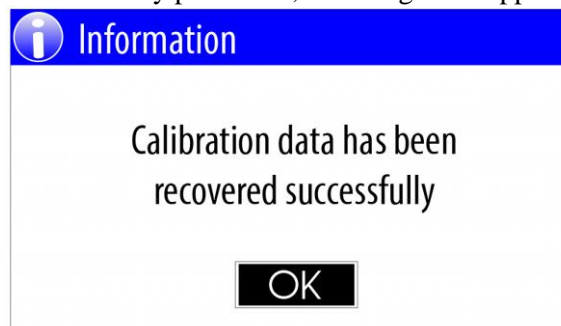
5.4.7.6. Serial number restore

During the producing the producer store unique Main PCB serial number in the non-volatile memory, as well as in the factory database.

In case of damage of the Main PCB serial number 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:\EBULL\CALDATA\U0200001. ESN
where :
K - Device label (USB flash pen drive)
EBULL - Ebulliometer folder
CALDATA - Folder containing calibration files
U0200001. ESN - Main PCB Serial number recovery file for Ebulliometer with Main PCB serial number U0200001

Note: If the EBULL 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 5.4.7.), 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:

Note:
To enter Main PCB serial number you must connect external USB keyboard to the one of the USB connectors, mounted on the back panel.

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:
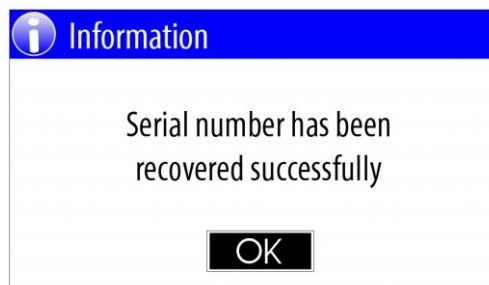
5.4.8. Firmware update

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:\EBULL\ FWUPDATE\ ET0102B.SUF
where :
K - Device label (USB flash pen drive)
EBULL - Ebulliometer folder

FWUPDATE- Firmware update files folder
ET0102B.SUF - Firmware update file

Note: If the EBULL 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 5.4.), select the " Firmware update " menu option using the <Down arrow> / <Up arrow> buttons and then confirm with the < OK>.
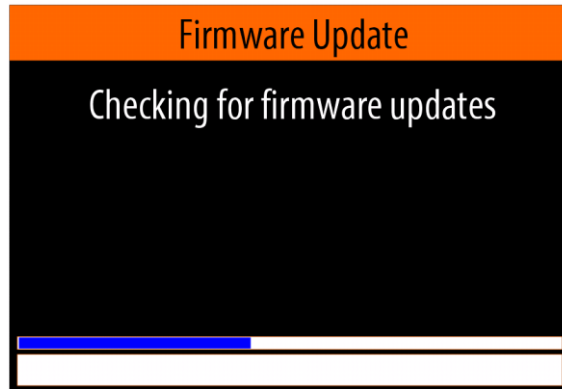
After the device finds suitable firmware update files located on the USB flash-pen drive, displays a menu for selecting the desired update file.
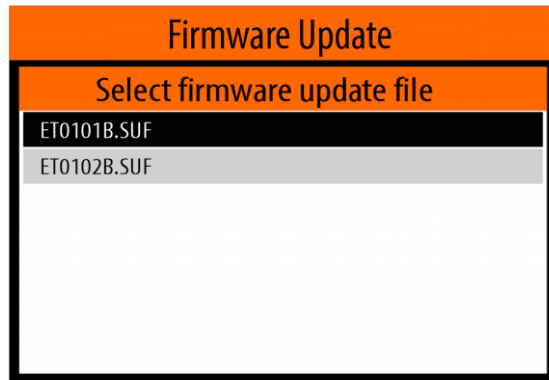
Using the <Down arrow> / <Up arrow> buttons select the desired file and then confirm with the < OK>.
A panel with warning message will appear on the screen:
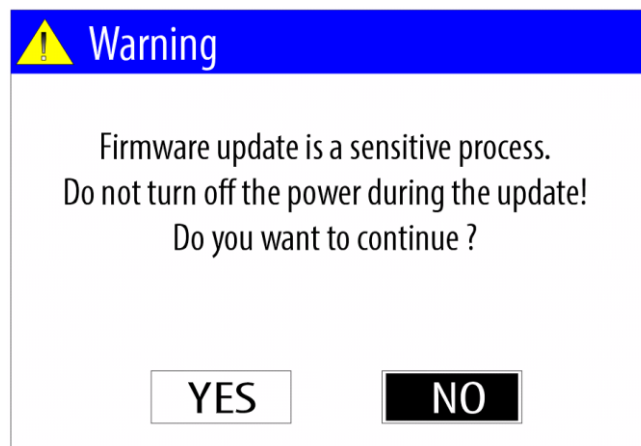
From this panel, using <Left arrow> / <Right arrow> select <YES> and confirm with <OK> button.

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:

5.4.9. About device

To enter in the "About device" mode from the "Settings" menu (see item 5.4.), select the " About device" menu option using the <Down arrow> / <Up arrow> buttons and then confirm with the < OK>.

Example of "About device" panel:
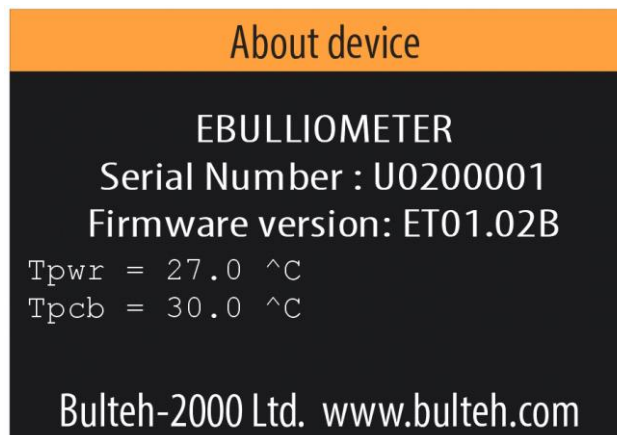
where:
EBULLIOMETER - device type
Serial Number - Main PCB serial number
Firmware version - Current firmware version

Tpwr - Current power block temperature
Tpcb - Current PCB temperature

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

5.4.10. System

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

5.5. "Cooling" mode

In case the temperature of the power block of the device rises above 45.0 ° C or the temperature of PCB rises above 40.0 ° C, the device automatically switches to "Cooling" mode.
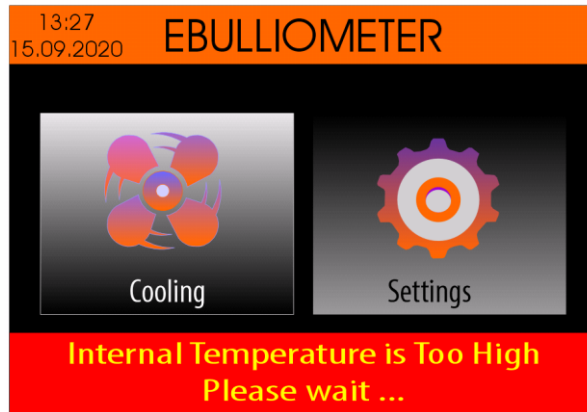
Note: This mode does not allow measurements to be made on either wine or water.

To monitor the current temperatures, select the <Cooling> icon using the <Left Arrow> / <Right Arrow> buttons and then press the <OK> button.
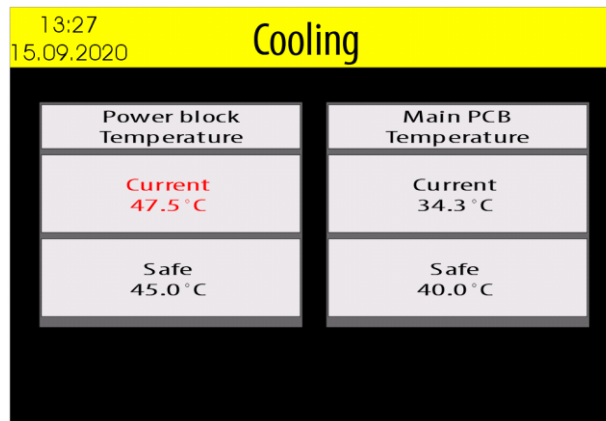
Once the power block temperature drops below 45.0 ° C and the PCB temperature drops below 40.0 ° C, the device automatically exits this mode and measurements are allowed.

6. Errors description

When an error occurs, the device displays a error message.
Example:
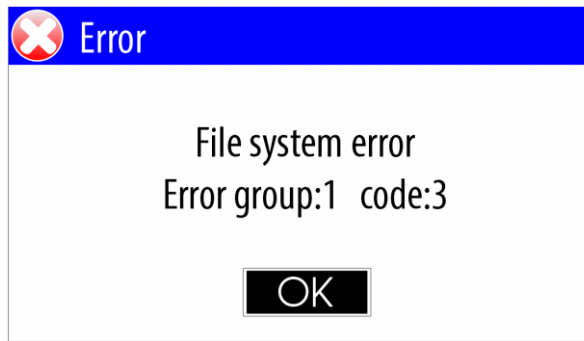
where :
Error group - The error group code
code - The error code in the group

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	Power block and power management related errors
7	EEPROM related errors
8	System timers related errors
9	Atmospheric pressure sensor related errors
10	Temperature sensor related errors
11	Cooling fan related errors
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
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 Main PCB serial number
2	Main PCB Serial number encoding error
3	Unknown wine type
4	Main PCB Serial number need restoring
5	Atmospheric pressure sensor calibration need restoring
6	Temperature sensor calibration need restoring
7	Wrong defined time period
8	Damaged measurements counter
9	Measurements counter check-sum error
10	No pressure sensor found

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 checksum 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	File version error

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	The clock does not work

6.7. Description of error group 6: Power block and power management related errors

Code	Description
1	Heater power value is out of range
2	Error in heater over current comparator
3	Heater over current, registered from the comparator
4	Power voltage 24V in active state and relay turned on is over maximum value
5	Power voltage 24V in active state and relay turned on is under minimum value
6	Power voltage 24V in passive state and relay turned on is over maximum value
7	Power voltage 24V in passive state and relay turned on is under minimum value
8	Reference voltage used for heater current measurement is over maximum value
9	Reference voltage used for heater current measurement is under minimum value
10	No determined reference voltage used for heater current measurement is
11	Measured heater current in active state and relay turned on is over maximum value
12	Measured heater current in active state and relay turned on is under minimum value
13	Measured heater current in passive state and relay turned on is over maximum value
14	Measured heater current in passive state and relay turned on is under minimum value
15	Measured heater voltage in active state and relay turned on is over maximum value
16	Measured heater voltage in active state and relay turned on is under minimum value
17	Measured heater voltage in active state and relay turned off is over maximum value
18	Measured heater voltage in active state and relay turned off is under minimum value
19	Measured heater voltage in passive state is over maximum value
20	Measured heater voltage in passive state is under minimum value
21	Error in heater current measurement test
22	Dangerous high temperature of the power block.
23	Heater temperature is over maximum value
24	Heater temperature in the start of the measurement is over maximum value
25	Heater temperature is under minimum value
26	The time while the heater is powered with high power is too long
27	Heater temperature while the heater is powered with low power is over maximum value
28	Heater current is over maximum value
29	Power block temperature under minimum specified value
30	Power block temperature over maximum specified value

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 checksum error
28	Calibration value is out of range
29	Invalid ODR/OSR settings
30	Command execution failed
31	Configuration error
32	FIFO WATERMARK not reached
33	Unknown error
34	Sensor is nor enabled
35	Invalid FIFO REQ FRAME CNT

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	Calibration - Input temperature is too high
13	Calibration - Unstable results

6.12. Description of error group 11: Cooling fan related errors

Code	Description
1	Speed measurement error

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

Code	Description
3	Distilled water boiling temperature is under the minimum value
4	Distilled water boiling temperature is over the maximum value
5	Alcohol contents calibration - Entered alcohol calibration Nominal value is out of range
6	Alcohol contents calibration - Maximal difference between measurements > 0.1 %
7	Alcohol contents 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 ebulliometer 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: