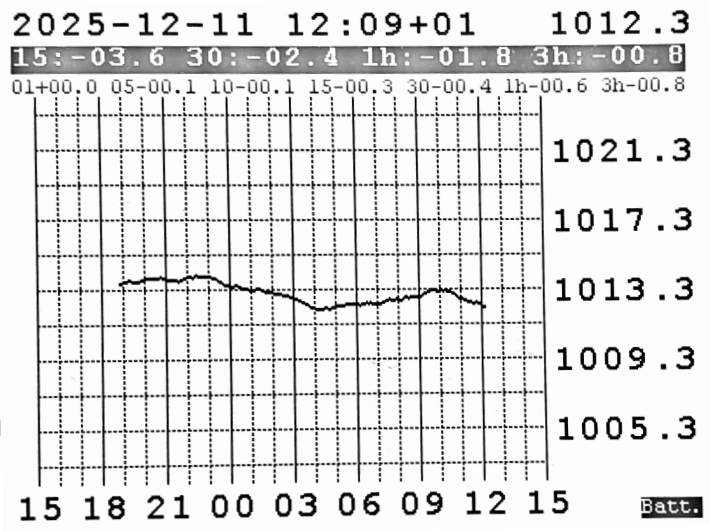
mBarograph



OPERATION MANUAL - DRAFT VERSION

Contents

1 Functional description **4**

2 Technical data **5**

3 Get started **6**

3.1 Precautionary measures 6

3.2 First usage 7

3.3 Mounting 9

3.4 Storage 10

3.5 Maintenance 10

4 Basic Operation **11**

5 Pressure Tendency Alarm **15**

6 Settings **17**

7 Troubleshooting **22**

8 Notes **24**

First published, March 2026

1 Functional description

The mBarograph is a fully electronic digital barograph that measures the atmospheric pressure at regular intervals and records it. The records can be visualised in a 24 h graph or alternatively in a 4 d graph. The 4 d are 3 d plus the current day. The atmospheric pressure values are recorded and displayed every 5 min for the 24 h graph and displayed every 20 min for the 4 d graph. The pressure sensor has a built-in IIR filter to minimise short-term disturbances due to wave motion or wind gusts.

Pressure changes from now to 1, 5, 10, 15, 30 min, 1 and 3 h ago are calculated and visualised. Based on the pressure change from 15, 30 min and 1 h ago the pressure tendency over 3 h is estimated. If any of these and/or the effective 3 h pressure tendency is above or below the preset tendency limit an alarm bar appears on the screen and an acoustic alarm is sounded. In the alarm bar the estimated tendency values are visualised.

The device includes a high accuracy real time clock. Visualization is done on a high-contrast sunlight readable 4.2-inch e-paper screen and the device can be powered by a standard USB Type-C cable. It has an internal Li-Polymer Battery to run the mBarograph independent from the power supply for about 10 d.

The firmware can be updated by the user using a personal computer.

The mBarograph is only an aid for the prediction of weather conditions. It can only integrate a proper weather forecast and continuous nowcasting!
It remains paramount to have proper preparation for adverse weather conditions!

2 Technical data

Operating pressure range	900 hPa to 1100 hPa
Absolute accuracy pressure	±0.50 hPa
Relative accuracy pressure	±0.03 hPa
Offset temperature coefficient	$\pm 0.6\,\mathrm{Pa\,K^{-1}}$
Temperature stability pressure	±0.16 hPa within 1 year
Altitude correction range	0 m to 50 m
Time accuracy better than	±5 s per month
Leap-Year Compensation	Up to 2100
Built-in battery	Li-Polymer 2.5 A h 3.7 V
External power supply	USB Type-C max. 2 A
Clock backup battery	CR1220
Active viewing area on display panel	85 x 64 mm
Graphic resolution of display	400 x 300 pixel
Timescale	24 hours or 4 days
Pressure viewing range	22 hPa over 24 hours
	220 hPa over 4 days
Resolution of pressure value	0.1 hPa
Resolution of pressure curve	0.1 hPa per pixel 24 hours
	1.0 hPa per pixel 4 days
Operating temperature range	−10 °C to 45 °C
Dimensions (W x H x D)	101 x 107 x 22 mm
Weight	500 g

Package Content

mBarograph	Li-Polymer 2.5 A h 3.7 V
Owner's manual	Coin cell CR1220

3 Get started

The absolute atmospheric pressure value alone is known to have little influence upon wind and weather. What does have meteorological significance, however, is the extent of any alteration in pressure on a unit-time basis, i.e. the pressure tendency. This is why barographs are superior to straightforward barometers, as the atmospheric pressure is graphically visualised at regular intervals.

Alongside typical fields of application onboard ships, at meteorological stations and in alpine mountaineering huts, the mBarograph is equally at home in your living room or on your desk.

The mBarograph automatic pressure tendency prediction system allows the detection of local winds much sooner (useful for e.g. yachts riding, at anchor during the night, farmers, mountain climbers etc.).

3.1 Precautionary measures

Avoid exposing the unit to direct sunlight and/or high temperatures. Never use solvents for cleaning the unit.

When used in ocean-going yachts, the unit should be located in the splash-proof navigation area and properly fixed (i.e. not break free in stormy weather) at least 1 m from transmitter antennas. The same holds if the unit is used outdoors.

It is essential that the electrical connection and supply voltage are correct! Only use the correct batteries! Use a proper USB charger with at least 2 A power output and quality USB Type-C cables. Only charge the battery (connect the power through

the USB Type-C cable) when the temperature is within 6 °C to 40 °C. Charge frequently, do not leave the Li-Polymer Battery in an uncharged state for too long.

Avoid shaking, knocks or exposure to vibrations as this can lead to damage of the pressure sensor.

Never press down onto the e-ink display panel as this can cause irreparable damage.

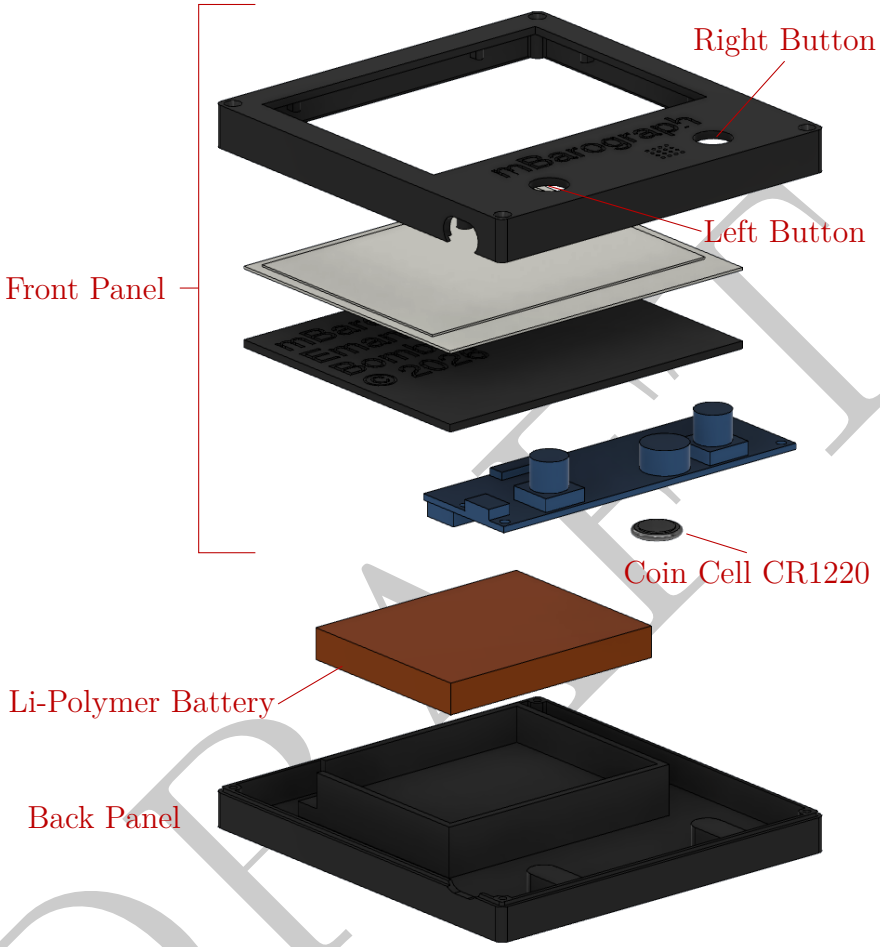
Never leave graphics on the e-ink display when removing the internal battery and having no power connection for an extended period of time (24 h), see section 3.4 for how to store the mBarograph properly.

3.2 First usage

Before the mBarograph can be used, a few simple steps must be carried out. Disassemble the unit by removing the four screws on the Front Panel. Once the Front and Back Panel are separated the Back Panel can be mounted, see section 3.3.

Before reassembling the Front and Back Panel the Li-Polymer Battery needs to be connected to the circuit board. Connect the JST PH connector carefully!

Once the Li-Polymer Battery is connected the unit will power up. In case it does not, connect the USB Type-C cable to provide power to the unit. Keep a careful look at the startup screen sequence. Flickering is normal and clears ghosting from the previous image so to ensure better clarity and legibility for the new image.



Reassemble the unit, do not squeeze any cable and tighten the Front Panel screws carefully.

Connect a USB Type-C to charge the Li-Polymer Battery. Full charging will take about 3.5 h. With a full charge the mBarograph will last about 10 d without needing to be recharged.

Remember, if the mBarograph is not powered through the USB Type-C cable while disconnecting the Li-Polymer Battery the mBarograph will reset and lose all pressure recordings and settings!

To protect the screen, it is turned OFF after 5 min if no button is pressed. Press any button to turn the screen ON again. The screen will turn ON automatically in case an alarm is triggered.

3.3 Mounting

The mBarograph must remain in a fixed location, even small changes in elevation (such as carrying the device from floor to another or passing through a lock with the yacht) will influence the pressure measurement, see section 8 for further explanations.

The mBarograph is designed so that it may be specially mounted on a wall. The Back Panel has two holes ∅4 mm through which the Back Panel can easily be fastened.

3.4 Storage

If the mBarograph is not used for a longer time, ensure that both the batteries (Li-Polymer battery and Coin Cell) are removed after the screen has turned itself off.

How to properly turn OFF the mBarograph

1. disassemble the device
2. wait for the screen to turn OFF (after last button press, it takes 5 min)
3. unplug the Li-Polymer battery. Use pliers to disconnect the JST PH connector carefully. Remove also the Coin Cell.

Store the device horizontally in a dry place. Store the Li-Polymer Battery separately from the device and keep it in a charged state all the time.

3.5 Maintenance

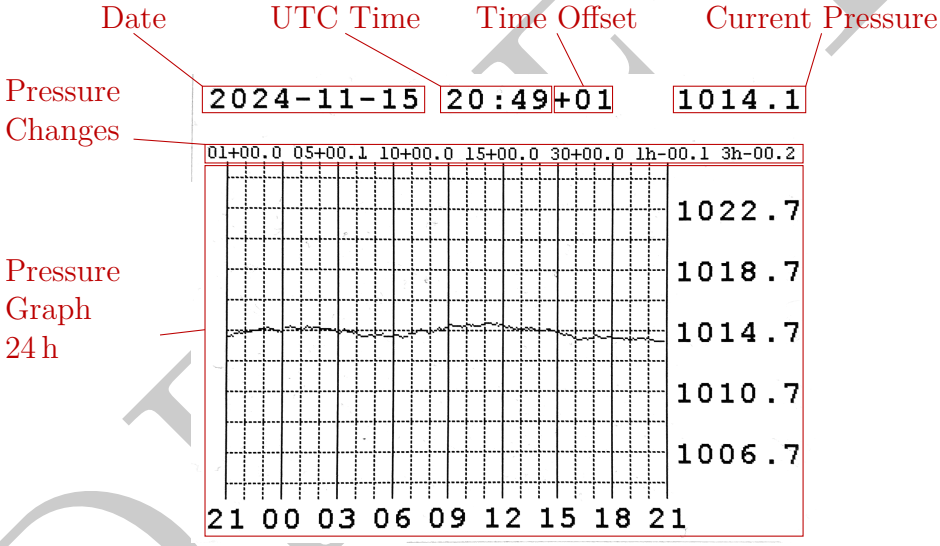
The mBarograph should be cleaned using a soft cloth or tissue. No cleaning solvents should be used!

Apart from charging and, when required, changing the batteries, the mBarograph does not require any maintenance.

The firmware can be updated. Check the https://bombasaro.org/mBarograph if a new firmware version is available, see section 6 where to find the installed firmware version.

4 Basic Operation

When you turn on the mBarograph a welcome screen is visualised. After that the system is started up, and several checks are performed. Verify that all displayed tests are passed successfully and no warnings are shown. After that, the mBarograph switches into 24 h view.



Date shows the current date

UTC Time displays the current UTC time

Time Offset offset in h from UTC time to local time

Current Pressure is displayed and updated every 1 min

Pressure Changes the differences between the Current Pressure and the pressure measured 1 min, 5 min, 10 min, 15 min,

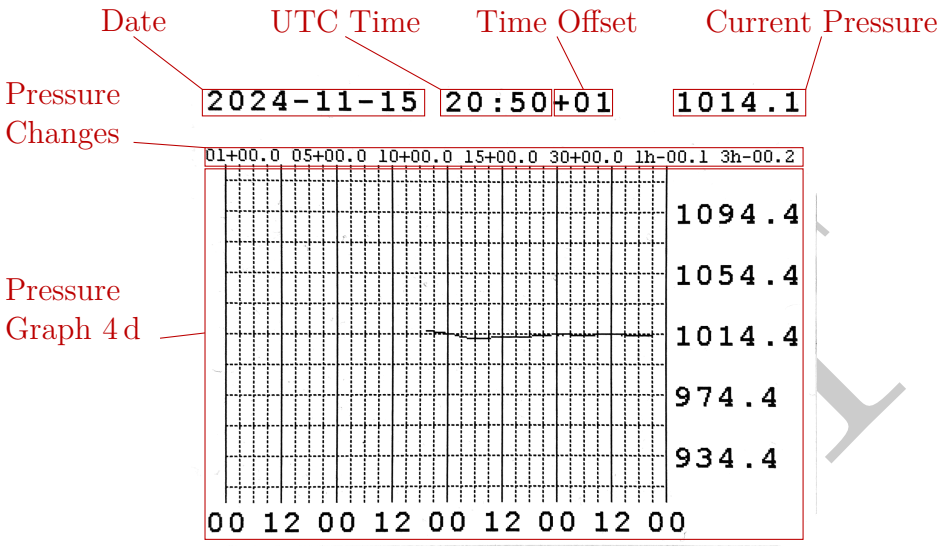
30 min, 1 h and 3 h is shown. The values are displayed as ttspp.p, where tt is the time, s the sign (positive or negative) and pp.p the pressure change value. If the pressure difference is negative (−), the pressure in the past was higher than now, if the pressure difference is positive (+) the pressure in the past was lower than now.

Pressure Graph 24 h showing the pressure trend for the past 18 h and the pressure in the current 3 h epoch. The pressure trend line is plotted inside the Pressure Graph. The line is composed of two pixels the upper pixel is the one in the vertical position corresponding to the recorded pressure.

The horizontal dashed lines are spaced 2.0 hPa, for every 4.0 hPa the corresponding numeric pressure value is shown on the right. These pressure values are regularly updated to keep the pressure trend line centred on the screen.

The graph is composed of solid and dashed vertical lines corresponding to 1 h intervals. The 3 h intervals are the solid lines. The rightmost 3 h interval is the current epoch. In this case the interval is starting at 18:00 and ends at 21:00, the last pressure data point was drawn at 20:45 and the next will be drawn at 20:50. Every 3 h the graph will move to the left and a new 3 h epoch, i.e. time of the rightmost line will become 00 the one before 21.

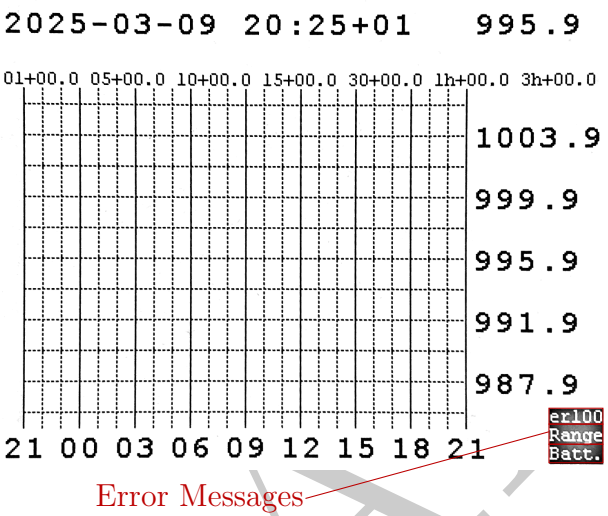
With a short press (hold and count till one) on the left button the mBarograph switches into the 4 d view. Always wait a few seconds before switching view again.



Pressure Graph 4 d showing the pressure trend for the past 3 d and the pressure trend in the current day. The horizontal dashed lines are spaced 20.0 hPa, for every 40.0 hPa the corresponding numeric pressure value is shown on the right. These pressure values are regularly updated to keep the pressure trend line centred on the screen.

The graph is composed of solid and dashed vertical lines corresponding to 3 h intervals. The solid lines are at midnight 00 and midday 12. The rightmost 1 d interval is the current day. Every day at midnight the plot is moved to the left 1 d.

The mBarograph shows in case of errors following independent messages.



er100 is shown in case the pressure sensor cannot perform a reading. The error should disappear at the next pressure reading, i.e. after about 1 min. If the error message persists, see section 7.

Range is shown when some part of the pressure trend line is outside the pressure graph area. The error is shown individually on the 24 h or 4 d graph, i.e. the error may only appear on one of the two. All values within the graph area are shown as normal. No operator input is necessary; the error will disappear once the trend line fits in the graph area again.

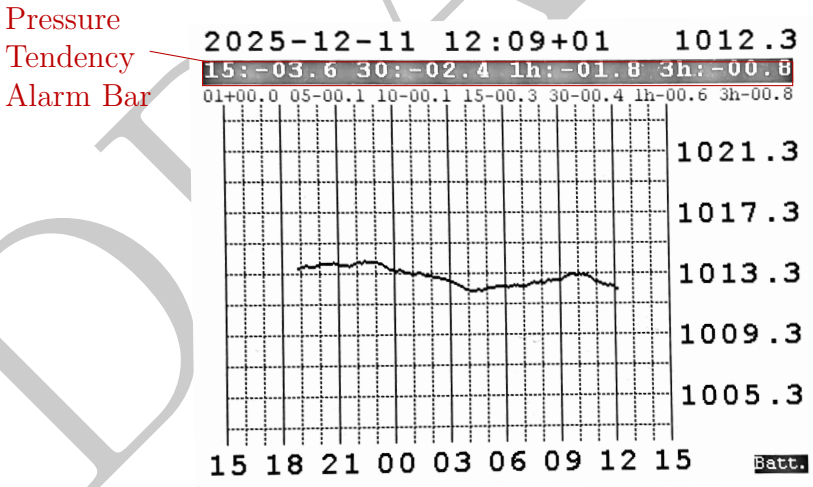
Batt. is shown once the internal Li-Polymer Battery is running low. Connect the mBarograph the soonest to external power to not lose the atmospheric pressure recordings. Fully charging the empty battery takes about 3.5 h.

5 Pressure Tendency Alarm

The mBarograph based on the pressure change from 15, 30 min and 1 h ago extrapolates the pressure tendency over the future 3 h. If any of these and or the effective 3 h pressure tendency is above (Rising) or below (Falling) preset tendency limit (if a value is set) an alarm bar appears on the screen, and an acoustic alarm is sounded (if Buzzer is turned ON in settings).

This allows the user to become aware of dangerously rapid pressure changes before the effect can be felt and thus be prepared.

The acoustic alarm can be acknowledged by pressing any button. The alarm will start to sound again every time the mBarograph new pressure tendency alarm is identified.



Looking at the pressure tendency alarm bar, we understand that if the pressure will continue to decrease at the same rate as in the last

15 min we will have 3 h tendency of −3.6 hPa/3h, the last
30 min we will have 3 h tendency of −2.4 hPa/3h, the last
1 h we will have 3 h tendency of −1.8 hPa/3h and
we have an effective 3 h tendency of −0.8 hPa/3h.

The tendency alarm was triggered by the 15 min estimation which is below the set falling alarm limit of −3.5 hPa/3h.

The above example is shown for falling atmospheric pressure, exactly the same holds if rising (pressure increase) is analysed.

The estimation based on the 15 min shows to be particularly sensitive and triggers the alarm quite frequently. As much this may be annoying, it is these predictions which allow to protect against sudden and difficult to predict events.

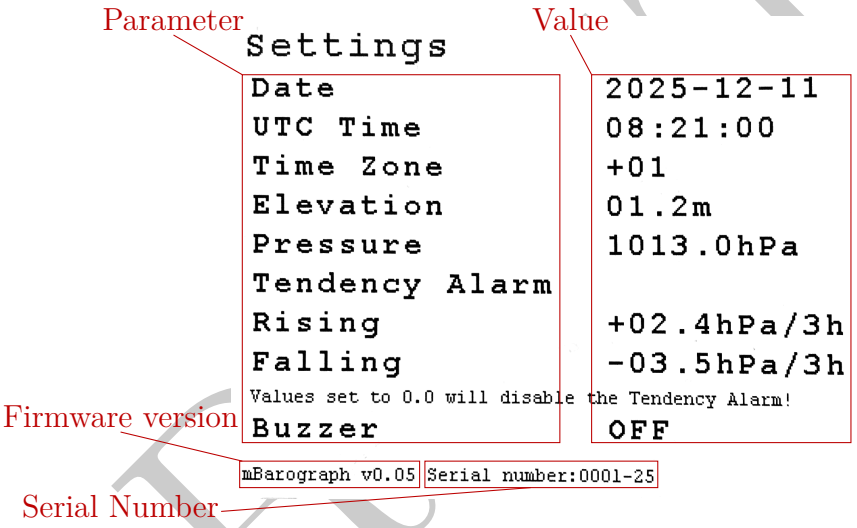
The pressure tendency alarm value for Falling is chosen highly dependent upon the operating location and the extent of personal experience. The following non-binding standard values apply to:

On open sea: −1.5 hPa/3h to −3 hPa/3h
In wind-exposed areas on land: −1.5 hPa/3h to −6 hPa/3h
In built-up and hilly areas: −3 hPa/3h to −10 hPa/3h

For the Rising pressure tendency alarm value, it is up to the personal experience. Or in case not of interested can be disabled by setting it to 0 hPa/3h.

6 Settings

With a long press (hold a count till four) of the left button the mBarograph enters the settings screen. Inside the setting screens the right button is used. Always wait a second before taking the next action. A short press on the left will exit the setting screen.



Note the display will be updated every 1 min.

Date User set Date. If a non-existing date is entered the system will correct to the next closest existing date.

UTC Time User set UTC hours and minutes, seconds are set to 00 at every change. When the time is changed the pressure trend is cleared. It is highly recommended to keep the UTC time and only correct possible second offset overtime and account for local time using the Time Zone setting.

Time Zone User set offset in h from UTC time to local time, allowed from −12 h to +12 h. Default value +1 h.

Elevation User set elevation above sea level at which the mBarograph is installed. Allowed values 0 m to 50 m.
Once an elevation is set the pressure value displayed and recorded by the mBarograph is the atmospheric pressure at a station-level reduced to sea level according to the *standard atmosphere*, see section 8. In case the mBarograph is installed more than 50 m above the sea level, the elevation should be set to zero and the correction made by adjusting the pressure. Default value 1.2 m.

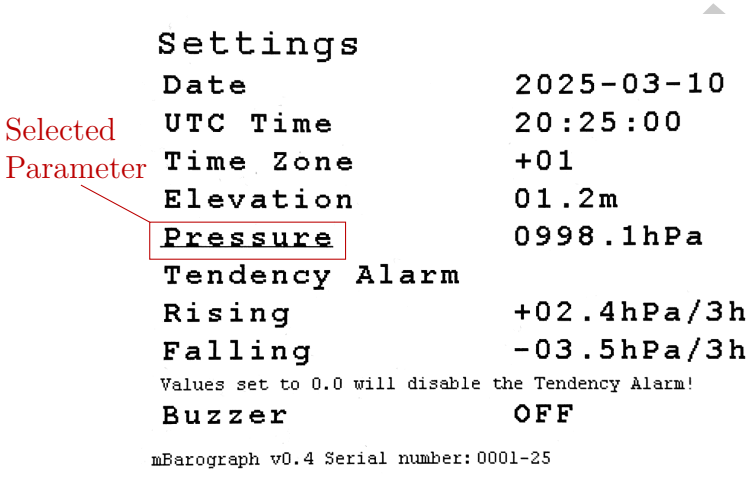
Pressure The atmospheric pressure at sea level (i.e. corrected to sea level in case Elevation is set). The user can change these values in case a reliable atmospheric pressure reading is available and differs from this reading. The values should be changed after the Elevation is set. The entered values must be the atmospheric pressure at sea level. Allowable values 900 hPa to 1100 hPa. However, remember it is not about having the absolute pressure value correct (this is not a metrological station), what is of importance is the pressure tendency.

Rising User set level at which the Rising pressure tendency alarm is triggered. Allowed values 0 hPa/3h to +99.9 hPa/3h, setting 0 hPa/3h disables the alarm. Default value 0 hPa/3h.

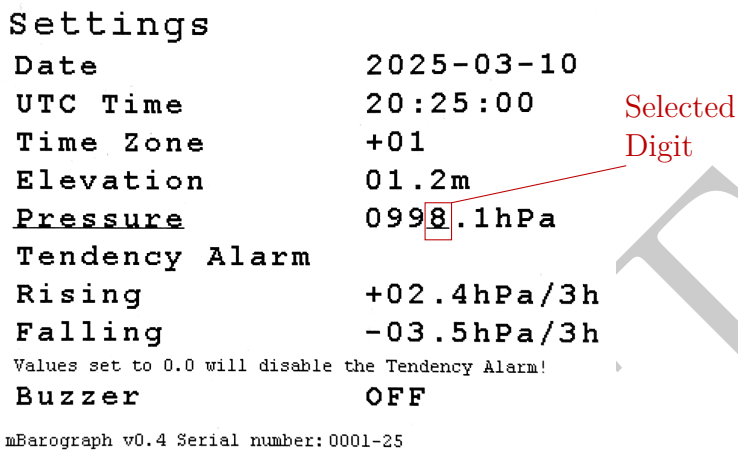
Falling User set level at which the Falling pressure tendency alarm is triggered. Allowed values 0 hPa/3h to −99.9 hPa/3h, setting 0 hPa/3h disables the alarm.
Default value −3.5 hPa/3h.

Buzzer If ON, an acoustic alarm is sounded when a Pressure Tendency Alarm is triggered. If OFF, no acoustic alarm will be sounded. Default value OFF.

With a short press of the right button (remember to wait a few seconds after every press) the first parameter is selected. The selected parameter is underlined.

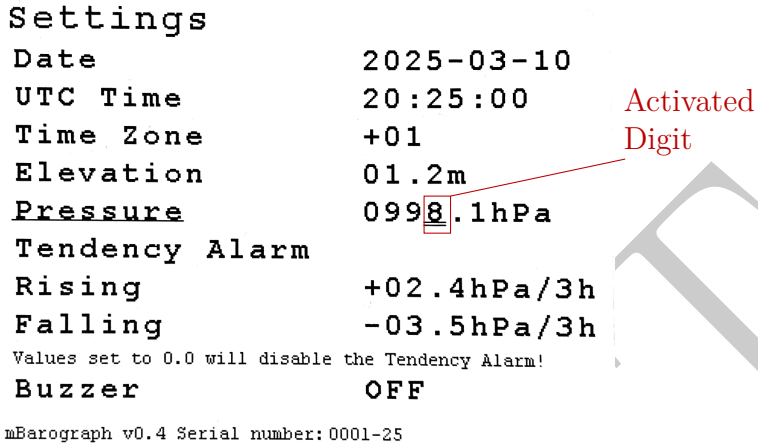


With a long press on the right button the value associate with the parameter is selected.
In case of Time Zone or Buzzer the whole value is underlined and shown as selected.
In case of Elevation, Pressure and Tendency Alarms an individual digit is selected. With a short press on the right button one can jump to the next digit.
In case of Date and UTC Time the complete number of minutes, hours, days, month or the last two digits of the year are selected.



With a short press on the right button one can jump to the next element.

With a long press on the right button the value, digit or element is activated. Short presses on the right button change the value. A long press on the right button exits the value selection. Every change is immediate, i.e. as the value is changed it takes effect immediately.



After the UTC Time, Elevation and or the Pressure was changed, the device will not predict accurately the pressure tendency. Wait at least 3 h to get reliable predictions.

Changing the settings is somewhat cumbersome; however, the settings need to be adjusted only once and in future software releases the possibility to change the settings using a mobile app is considered.

7 Troubleshooting

Below is a list of possible problems the mBarograph could run into and what actions to take to resolve the problems. How to execute the solutions is described below the table.

er100 is shown for a prolonged time.	Restart the device.
The mBarograph either malfunctions or does not function at all after being switched on for the first time with USB type-C cable connected.	Restart the device.
The mBarograph does not turn on without the USB Type-C cable connected.	Replace the battery.
The Barograph only lasts a few hours before the battery needs to be recharged.	Replace the battery.
The mBarograph freezes.	Restart the device.
After restarting the device (or turning on for the first time) the clock shows completely wrong time.	Replace backup battery.
During startup, the warning *REAL TIME CLOCK lost power, check the Backup Battery!* is shown.	Replace backup battery.

Restart the device To restart the device, disconnect the external power (USB Type-C cable) and remove the internal battery. Use pliers to disconnect the JST PH connector care-

fully. Wait a few seconds and reconnect the battery.

Replace battery Connect the mBarograph to external power (USB Type-C cable) to not lose any data. Use pliers to disconnect the JST PH connector carefully and remove the battery. Install and connect new battery to the device. **Dispose of the old battery in accordance with local laws and regulations! Do not dispose in trash!**

Replace backup battery While the mBarograph is powered either externally (USB Type-C cable) or internally (battery) remove the backup battery of CR1220 type. Install the new backup battery, only CR1220 type are allowed. **Dispose of the old battery in accordance with local laws and regulations! Do not dispose in trash!**

In case the above is not solving the issue contact support via e-mail at mBarograph@icloud.com clearly describing the faced problem.

8 Notes

This short section recalls some parts of relevance from *Guide to Instruments and Methods of Observation Volume I – Measurement of Meteorological Variables* WMO-No. 8, 2023 edition.

As per section *3.1.2 Units and scales* the basic unit for atmospheric pressure measurements is the pascal (Pa) (or newton per square metre, $\mathrm{N\,m^{-2}}$). It is accepted practice to add the prefix "hecto" to this unit when reporting pressure for meteorological purposes, making the hectopascal (hPa), equal to 100 Pa, the preferred terminology. This is largely because one hectopascal equals one millibar (mbar), the formerly used unit.

For reference following conversion factors apply:

1 hPa	=	0.750 062 mmHg
1 mmHg	=	1.333 224 hPa
1 hPa	=	0.029 530 inHg
1 inHg	=	33.8639 hPa
1 mmHg	=	0.039 370 08 inHg

In analogy to section *3.11.2 Low-level stations* for low-level stations (namely, those at a height of less than 50 m above mean sea level), pressure should be corrected to mean sea level. This is done by multiplying the measured pressure with

$$1 + H_p \frac{g}{R\,T_0}$$

to obtain the pressure at mean sea level. Where in the above equation H_p station elevation in m, $g = 9.80665$ standard acceleration of gravity $\mathrm{m\,s^{-2}}$, $R = 287.05$ gas constant of dry air $\mathrm{J\,kg^{-1}\,K^{-1}}$ and as a general value (and thus not location and condition specific) $T_0 = 288.16$ average sea level standard temperature K.