

ppO2 and CO2 Display

manual

version 2.00---

Firmware: 3.03 or higher,

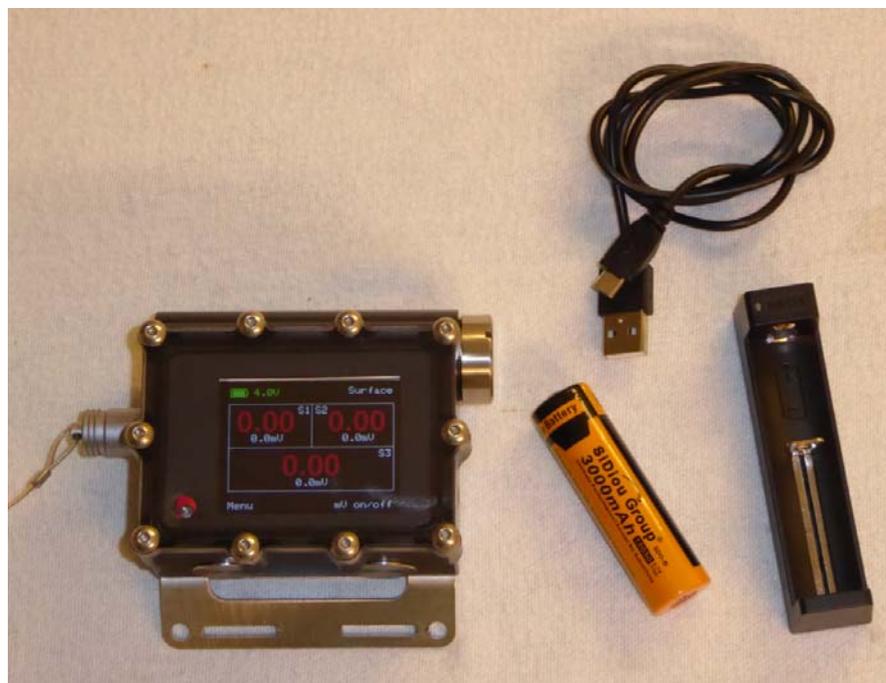
Hardware: 2.11

This device is a standard ppO2 and ppCO2 display and can display the following combinations

1 to 4 Oxygen Sensors

1 to 3 Oxygen Sensors and 1 CO2 sensor

1 CO2 Sensor (only available on hardware 2.11 and firmware 3.03 or higher)



Cable connections

The display is fitted with a 7 pin Fischer plug with standard pin code. So all standard wired Fischer cable can be used to monitor the Oxygen sensors and will show the sensors in the same row as on standard dive computers.

If you use your own cable to monitor cells the code is the following

Pin 1 (center) MINUS

Pin 2 Sen 1 plus

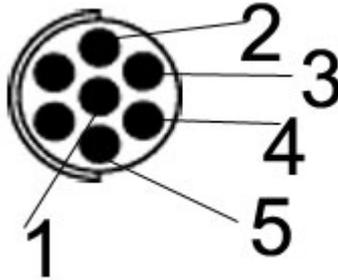
Pin 3 Sen 2 plus

Pin 4 Sen 3 plus

Pin 5 Sen 4 plus (or CO2 cell data)

Pin 6 CO2 cell plus

Pin 7 CO2 cell minus



Pin 1 is the center pin and Pin 2 is the pin at the red mark always.

Color coding if using our Fischer Cable

Pin 1 (center) MINUS GREEN

Pin 2 Sen 1 plus YELLOW

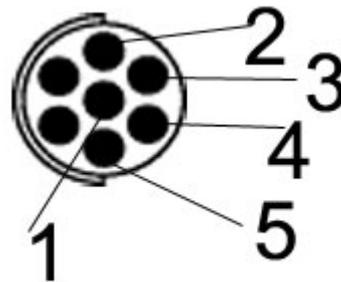
Pin 3 Sen 2 plus GREY

Pin 4 Sen 3 plus ROSE

Pin 5 Sen 4 plus (or CO2 cell data) BLUE

Pin 6 CO2 cell plus WHITE

Pin 7 CO2 cell minus BROWN



Battery.

The display comes with a rechargeable 18650 battery plus a spare battery and charger.

We strongly recommend to use only this model of battery. This battery has a built in circuitry to protect the battery. Using other models can cause damage on battery or unit.

Also the delivered batteries are mechanically protected against wrong polarity. Insert a battery in wrong polarity may destroy the unit.

A full battery is 4.0 to 4.2V and allows **aprox 20 hours of diving** - with medium brightness of display if only O2 sensors are connect. If the CO2 sensors is connected and enabled the fully charged battery allows about 15 hours of diving

In standby, not using the display, a fully charged battery can be stored in the ppO2 display for aprox 6 month. After 3 month it should be charged or a new fully loaded installed prior to use it for diving.

Full charged battery



Battery icon full, green color, battery voltage is shown (if chosen in the setup)



at 3.8V the icon shows 1/4 less, green color (V shown if chosen)



at 3.6V icon half bar only, yellow color (V shown if chosen)



at 3.4V last quarter of bar shown, red color (V shown if chosen)

Battery should be charged or replaced before diving as voltage may drop down and display will not work during the complete dive.

Unit reduces color brightness due low battery voltage.



at 3.3V the battery bar is clear, red color (V shown if chosen)

DO NOT use the display with such a low voltage for a dive! Battery must be charged or replaced.



At 3.0V the unit turns off and this locking display is shown. It only can be deactivated by replacing the battery. Piezo buttons are also deactivated. Battery must be taken off and a full battery must be reinstalled.

In surface mode you can get in setup menus by pressing left button "Menu". This is not possible in divemode.

Menus

Two piezo buttons allow the setup and several adjustments

The left one is always the menu and scroll down button.

The right on is to enter a sub menu (where available) and to confirm adjustments.

Only in **surface mode** it is possible to enter the menus

If no action is done display goes back from any menu/submenu to the main display, showing the O2/Co2 readings after 2 minutes

Main menu window



when O2 sensor(s) is enable

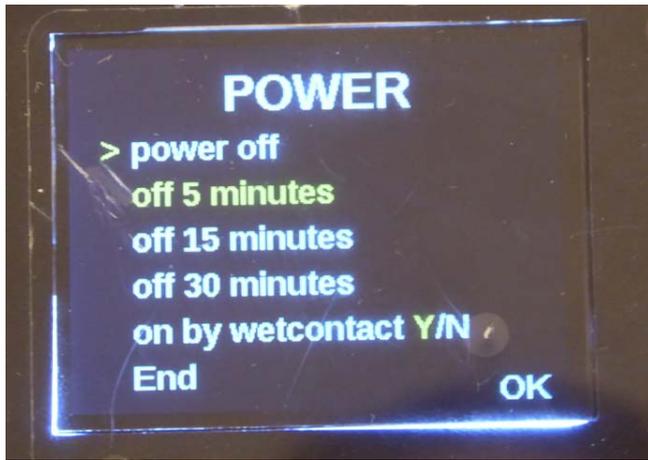


Calibration is NOT shown if all O2 sensors are disabled

Left button scrolls down, right button enters a sub menu

On top in small yellow letters the software version and serial number of unit will be shown.

The power point



The power submenu allows various setting.

power off: unit turns off right away.

off in xx minutes. Turns unit off after xx minutes when unit is in **surface mode** and no action on the piezo button during this time has been performed and wet contacts are dry.

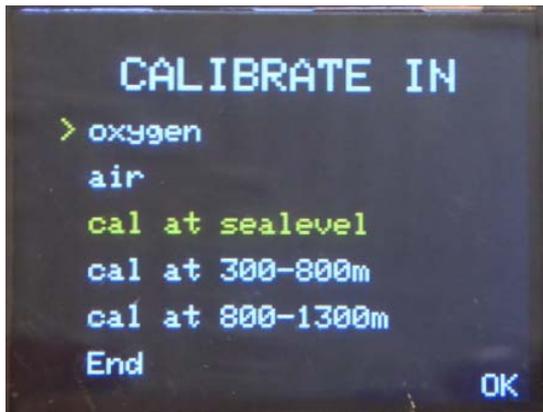
New: auto turn on when wet contacts are brigaded (wet)

Active setup is marked **yellow** and stored.

END always returns to main surface display

The calibration point

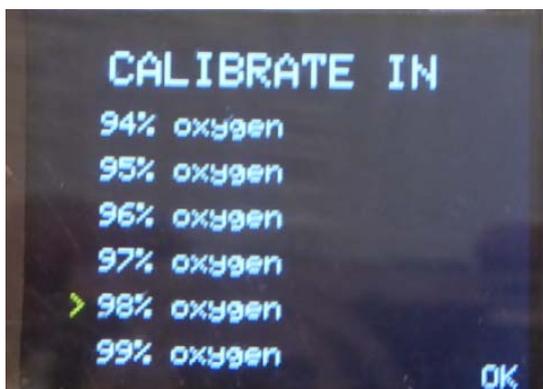
Calibration is only done for O2 sensors. The CO2 sensor is factory calibrated and cannot be calibrated



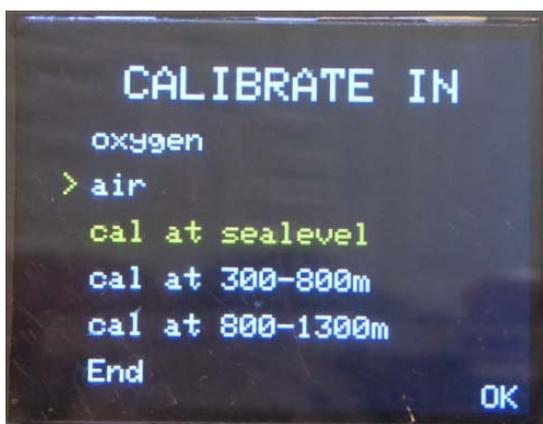
opens also a submenu to adjust settings of altitude. Active setup is marked yellow.

Yellow marked settings is the active point. You can change the settings of altitude by choosing the required level, after pressing OK the unit returns to this menu with new settings of altitude (yellow marked). **After finishing the whole calibration procedure or choosing End the setting is always "cal at sealevel"**.

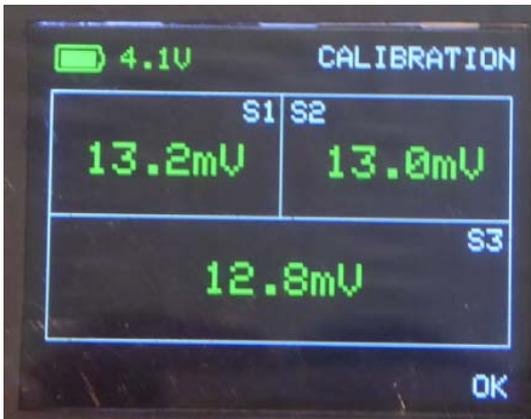
Calibrating gas can be air or oxygen. We strongly recommend to calibrate with oxygen (if available) to maintain best calibration results. The percentage of available oxygen can be adjusted in the following submenu. Standard is always 98%, which is also the recommended value for most cases.



Sample calibrating procedure in air

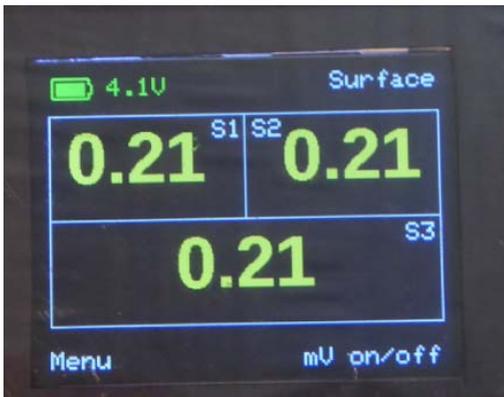


the correct calibration gas is chosen, press OK



After OK is pressed, display switches to the left shown display.

mV of connected sensors is shown. Make sure the sensors are exposed to clean air. The color of mV values change to red if calibration will not be accepted by the unit due to too low or too high mV value of the sensor. Press OK again and the following display appears



Calibration is done and data is stored. When disconnecting and reconnecting the same cells at same position of course calibrations stays. If a sensor is changed, or the number of displayed sensors is changed new calibration must be done.

We strongly recommend to perform a calibration each time when using the display!

If a sensors is below 6.2 mV or higher than 14.5 mV in air the sensor will not be calibrated and **fail** will be shown after the calibration process.

For successful calibrating a sensor in O2 the minimum value is 28 mV and the maximum of 70 mV is needed.

The value for 25 mV in air sensors are the following

22- 27 mV in air and 100 to 130 mV in O2 is needed.

The Display menu



This menu allows the adjustment of brightness- and to flip screen.

No further submenus available

Recommended setting is AUTO. Setting high will drain the battery faster and is normally only needed in very very bright/sunny areas

The direct adjustment of brightness is also available in dive mode. But not the flip screen function.

The Auxiliary menu



The menu does have 5 settings with the possibility of storing the setting (yellow marked)

battery voltage on/off shows/turns off the battery voltage right of battery icon. Standard setting is OFF

Alarm blink on/off allows the settings of flashing the display blue at the bottom on alarms **but in dive mode only**. An alarm occurs when one active sensor a ppO2 above 1.65 or below 0.4 shows. Standard setting is OFF

altern.colors allows to set up a different color scheme for the ppO2 values in dive mode. Standard setting is OFF

1 sensor at S2 on/off (available on SW 2.07 and higher)

Details to explain that point at end the next chapter.

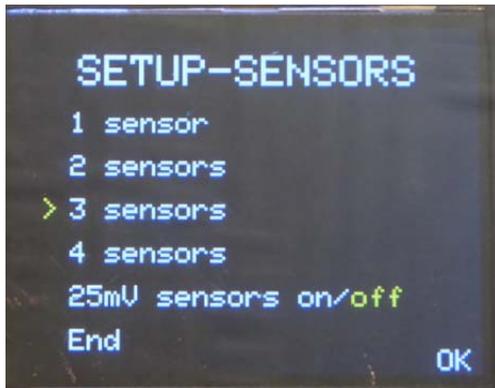
Standard setting is OFF

CO2 sensor on/off activates or disables the CO2 sensor reading. If CO2 sensor ON is chosen the max O2 sensors to be displayed in the sensor menu are 3 !

Sample display with 3 activated O2 sensors (not connected here) and CO2 sensors enabled



Sensor Display (O2 cells)

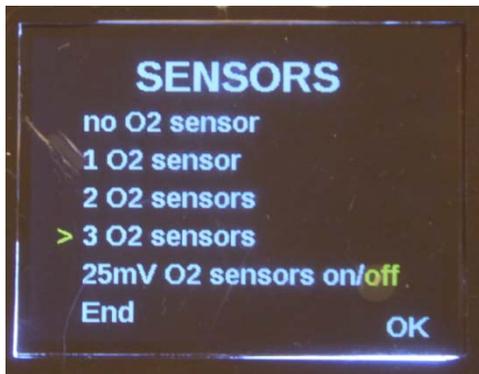


No further submenu available. The menu allows to select the number of sensors displayed and enables high voltage O2 sensors (25mV in air)

If in AUXILIRAY MENU CO2 sensor is set to ON, only 3 sensors can be displayed.

Also a setting NO O2 SENSOR is available if CO2 sensor is set to ON. If this point is activated no O2 sensor will be displayed.

Display acts then as CO2 monitor only

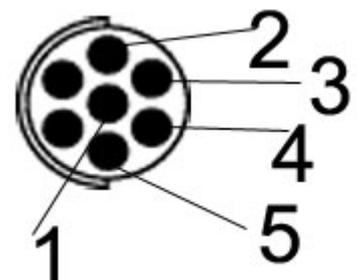


If the number of displayed cells is changed or high voltage O2 sensors are activated/deactivated a **new calibration must be done**.

If a calibration is necessary (indicated by blue "Not calibrated!" top right) or a done calibration on a certain sensor has failed (e.g.- wrong mV values or not connected sensor) instead of a ppO2 value the word "fail" will be shown.

Using and showing a single sensor you have two options.

Option one is wiring your own made cable and connect the single sensor to standard Sen 1 ports.



Minus to the center pin and plus to the top of the Fischer connector (indicated by the red point on the female Fischer plug)

In (the rare) case you have a special made display with fixed cable with our standard cable the color code is the following for 1 sensor at position 1

Pin 1 Minus : GREEN

Pin 2 Plus: YELLOW

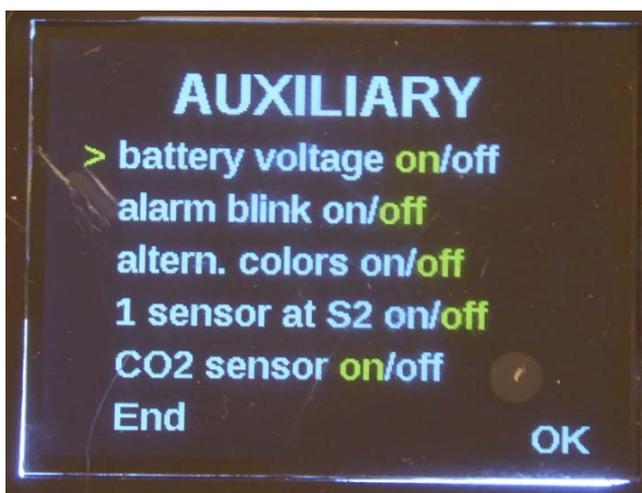
In this case no further settings have to be made in the menus to have a single sensor displayed. Just choose 1 sensor in the sensor setup, calibrate and the sensor will be displayed

Option two is using a standard wired Fischer cable, which already has a standard connection to the sensor.

These cables do have the connection

Pin 1 Minus and Pin 3 plus. You see this cell normally as the center cell (sen 2) on triple displays/dive computers.

If you use this cable and want to monitor a single sensor on the display an extra setting has to be made in the AUXILIARY menu.



You must set "1 sensor at S2" to ON **and** choose 1 Sensor in the SETUP-SENSORS menu.

DO a calibration with the connected cell and display will show only 1 sensor



Only choosing "1 sensor at S2" to ON in the AUXILIARY menu does not show the single sensor. Only in combination with the selection "1 Sensor" in the SETUP-SENSORS it will work.

For example if "1 sensor at S2" is set to ON but you have chosen 2 (or 3 sensors) to be displayed the sensor will still be shown as sensor 2 and Sen 1 (and Sen 3) will be shown as FAIL.

The End point



this leaves the SETUP and brings you always back to the main standard ppO2/Co2 display

Also from submenus END brings you back to main standard ppO2/CO2 display.

All settings and calibration values are stored in the unit and remain there even if no battery is installed or will be changed.

Each setup or calibration menu will be canceled at once if the unit is forced into dive mode by the wet contacts.

ppO2 display colors

During **divemode** the shown ppO2 values switches colors depending on the reading

Standard settings:

Below 0.4 the display is **RED**.

From 0.4 to 0.69 display is **YELLOW**.

From 0.7 to 1.40 display is **GREEN**.

From 1.41 to 1.6 display is **YELLOW**.

Above 1.6 the display is **RED**.

Above 1.65 and below 0.4 additionally the display bottom is FLASHING blue, when "alarm blink" activated in AUXILIARY SETUP

Alternative settings (chosen by "altern. colors" in AUXILIARY SETUP)

Below 0.21 the display is **RED**.

From 0.21 to 0.69 display is **YELLOW**.

From 0.7 to 1.59 display is **GREEN**.

Above 1.6 the display is **RED**.

Above 1.65 and below 0.4 additionally the display bottom is FLASHING blue, when “alarm blink” activated in AUXILIARY SETUP

During **surface mode** the shown ppO₂ values switches colors depending on the reading

Settings:

Below 0.18 the display is **RED**.

From 0.18 to 0.39 display is **YELLOW**.

From 0.4 to 1.59 display is **GREEN**. (**high value** obviously not reachable on surface)

Above 1.6 the display is **RED**. (**value** obviously not reachable on surface)

CO2 display

The display can read a GSS CO2 sensor with a special electronics. The connection is also a 3 pin molex male connector with three wires. It can be connected instead the 4th O2 sensor. The same wires are used.

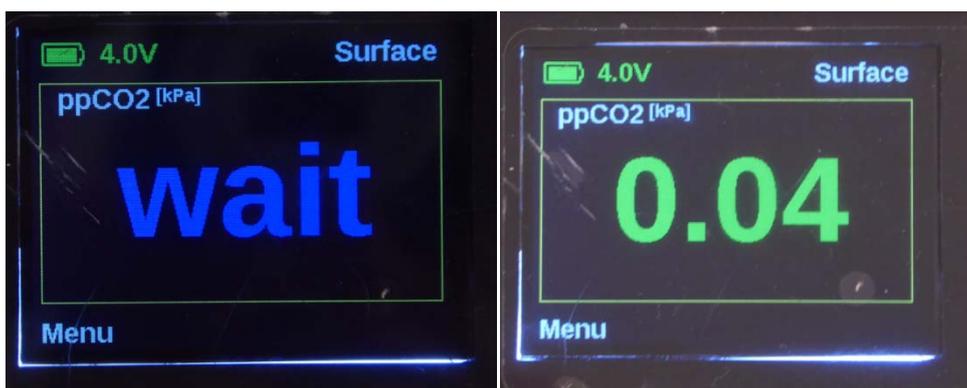


The size of the CO2 sensor is similar to PSR 11 39 TME/MDSX1 cells and smaller compared to standard O2 cells like the PSR 11 39 MD3.



The CO2 sensor is pre calibrated and cannot be calibrated by the user. In fresh standard air it should read ppCO2: 0,04 which is at sea level equivalent to 0,04% (the natural amount) CO2. Higher readings will be seen in closed rooms of course.

When you turn on the display and CO2 reading is activated and a sensor is connected you will first always see: **wait** in blue letters for aprox 6-7 second. Then the actual CO2 value is shown.



If no sensor is connected you still see the **wait** but after the 6-7 seconds **ERR** will be shown .



The sensor can read to a maximum of 5% CO₂, so a ppCO₂ of 5.00 at sea level.

0,0 to 0,5 is displayed in **GREEN**

0,51 to 2.0 is displayed in **YELLOW**

above 2.01 value is displayed in **RED**

The standard for ppCO₂ in air based on various publications is as follows

0,035 to 0,04 fresh clean air

0,05 to 0,07 "city air"

0,10 max allowed indoor limit in bureaus, working areas and so on

0,50 maximum allowed long time exposure limit

0,5- 1,0 short exposure does not show significant irritations to the body

1,0-3,0 irritation of respiratory center starts, breathing seems harder, you get "hungry for air", pulse will raise

3,0-6,0 symptoms described above increase, brain blood circulation is effected, disorientation, tinnitus and nausea will appear

4,0 to 5,0 exhaled air !

above 6,0 same as above plus unconsciousness leading to death

Dive mode

When the water contacts are bridged manually or when entering the water the display goes automatically into dive mode and in the upper right corner the word DIVEMODE is displayed. If the display needs calibration e.g. after changing settings “Not calibrated!” is shown instead.

While in dive mode menus are not available.

The right button allows you to turn on/off the mV values displayed below the ppO₂ of each sensor.

The left button allows you to adjust the display brightness (the flip screen is not available in divemode).

Every touch switches the display brightness to the next point in recurring sequence “auto” - “high” – “medium” – “low”.

No further menu or adjustment possible while unit is in dive mode

Surface mode

When the water contacts are dry and not bridged manually the display goes automatically into surface mode and in the upper right corner the word SURFACE is displayed. If the display needs calibration e.g. after changing settings “Not calibrated!” is shown instead.

The right button allows you to turn on/off the mV values displayed below the ppO₂ of each sensor.

The left button allows you enter the SETUP.

After 2 minutes with no action while in any SETUP menu the unit cancels SETUP automatically and returns to ppO₂ display.

Maintenance

After using the unit in saltwater it is strongly recommended to rinse it with fresh water.

After charging or changing the battery visually inspect the o-ring of the battery cap. In case something is not OK change the o-ring. Always clean and grease the o-ring a bit after opening the battery compartment.

There are two water contacts. If they are wet/bridged the display switches to divemode. Keep these contact clean.

We strongly recommend only to use the provided battery. It has a built in electronics so it cannot be drained complete. The battery has to be placed in with the PLUS side into the case. The MINUS is in the battery cap.