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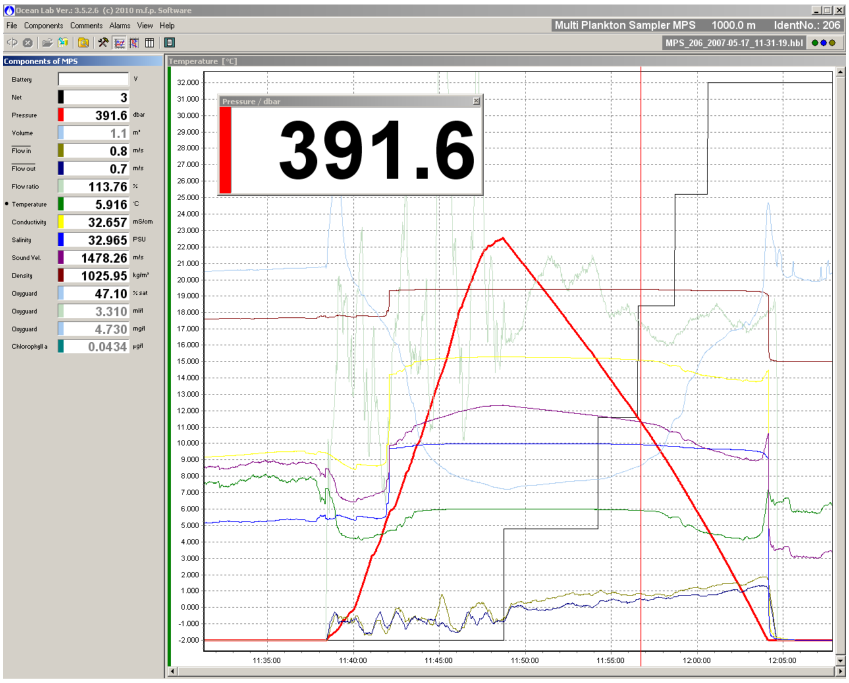
HYDRO-BIOS
Apparatebau GmbH

OceanLab 3

Data Acquisition Software for HYDRO-BIOS Instruments



Edition 05/22

1. SOFTWARE DESCRIPTION

The data acquisition software OceanLab 3 is an easy-to-use package for pre-deployment system set-up, real-time control of the complete system, real-time data acquisition, post-deployment data download, data processing, data visualization, data storing and data export for HYDRO-BIOS systems.

With OceanLab 3 you do not have to think about data storing any more. There is no way to forget to start recording because when connected to a HYDRO-BIOS system OceanLab 3 automatically stores the real-time measuring data into a disk file.

With OceanLab 3 there is no need to handle configuration files. OceanLab 3 is completely configured by the HYDRO-BIOS system and thus offers all modules, functions and calibration coefficients necessary to control the system actually connected. The complete configuration information is incorporated into the disk files.

Since the system is configured to special requirements, the appearance of OceanLab 3 will vary from system to system, including the fact that in some configurations MONITORING or CONTROLLING MODE may be not existent.

2. MINIMUM PC REQUIREMENTS

Celeron or Athlon PC 1 GHz, 2 GB RAM,
10 MB free space on hard-disk drive,
Windows 10 / Windows 8.1 / Windows 7 / Windows XP
Display 800 x 600 pix. minimum
1 free USB-port for serial port adaptor
2-Button Wheel-Mouse

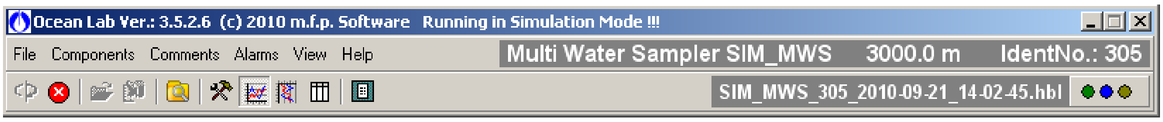
3. INSTALLATION

Ensure you have **Administrator Rights** for the installation.
To install OceanLab 3 at your PC start the PC and insert the supplied OceanLab USB-stick. With AUTORUN function enabled (see Windows manual) the installation will start automatically on XP. If the installation process is not started automatically please select START from the Windows task bar and click on RUN. Enter the installation command “D:\Setup.exe” (where D is the identification letter for the USB stick drive in your PC) and confirm the command with the OK button.

Follow the dialog box instructions to install the software. The installation directory (according to current Microsoft guidelines) is C:\Program Files (x86)\OceanLab3.

4. APPEARANCE OF OCEANLAB 3

OceanLab 3 consists of different program windows that can be independently modified in size and position at the Windows desktop.



The MAIN window incorporates the toolbar and the main menu. In the upper right of the MAIN window OceanLab 3 indicates the type of system connected in clear text and the identity number (IdentNo.) of the electronics board inside the Probe resp. Motor Unit.
Additionally three LEDs indicate the communication state of OceanLab 3:

Green LED indicates that OceanLab 3 is sending commands to the HYDRO-BIOS system.
Blue LED indicates that OceanLab 3 receives data from the HYDRO-BIOS system
Yellow LED indicates that an action device inside the instrument Unit is active.

Inside the tabulated COMPONENTS window real-time measuring data received from the instrument and data calculated from the measuring data are displayed in engineering units.

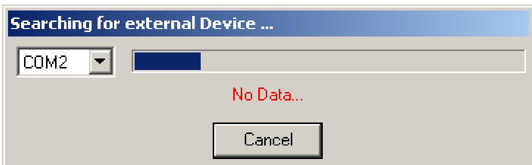
During online operations the GRAPHS window visualizes a currently updated time- or pressure-depending graph with the sets of measuring data received from the instrument. Alternatively the graph can be replaced by a tabulated data list.

For system set-up OceanLab 3 offers an individual CONTROLLING dialog window for each implemented device, offering all necessary features of the specific device.

A LOGFILE EDITOR is available enabling the user to add individual header information to the active data file and to mark events of special interest inside the active data file.

5. COMMUNICATION / CONNECTING

The communication between the PC and the HYDRO-BIOS system is made via a serial COM-port. Feel free to connect the HYDRO-BIOS system to any COM-port available at the PC. After starting OceanLab 3 and switching on the HYDRO-BIOS system click on button CONNECT inside the toolbar or select menu item CONNECT inside the FILE menu. During the connection process OceanLab 3 uses the first free COM-port to communicate with the HYDRO-BIOS system. When OceanLab 3 is unable to establish a connection to the HYDRO-BIOS system please select the appropriate COM-port inside the pull-down table COM-PORT of the CONNECT dialog. After having successfully connected OceanLab 3 in most configurations enters the MONITORING MODE and automatically starts to store the real-time measuring data into a disk file. In some configurations OceanLab 3 may switch into the CONTROLLING MODE automatically.



The CONNECTING process can only be started when no session or simulation is active and no file is opened inside OceanLab 3.

When communication problems occur during an online mission OceanLab 3 automatically tries to re-connect and, via LOGFILE EDITOR, marks date, time and kind of communication problem inside the LOGFILES. The positions of these error comments are marked with red boxes inside the GRAPHS window of MONITORING mode and VIEWER MODULE.

To stop the data transmission from the HYDRO-BIOS system to the PC please use the button STOP SESSION inside the toolbar or inside the FILE menu.

To close the actual data file and to prepare OceanLab 3 for the next mission use button CLOSE FILE inside the toolbar or inside the FILE menu.

6. FILE MANAGEMENT

The disk files to store measuring data from the instrument are automatically created by OceanLab 3. According to Microsoft guidelines the sub-directory LOGFILES of OceanLab3 is created inside an application data directory of Windows. The location of the application data directory depends on the Windows version used on your PC. To find the actual path of the LOGFILES directory **at your PC** please open the file DATA.TXT inside the OceanLab3 installation directory or use menu item ENTER FILES DIRECTORY inside the FILES menu to start the Windows Explorer inside the LOGFILES directory.

Inside the LOGFILES directory each instrument creates its own sub-directory, named with:

Type of system connected (e.g. MWS for Multi Water Sampler)
Identity number (IdentNo.) of the electronics board inside the Probe resp. Motor Unit

Inside the instruments sub-directory OceanLab 3 creates sub-directories to separate ONLINE and OFFLINE sessions.

A file set of one session consists of two files, named with:

Type of system connected, Identity number (IdentNo.), date and time of session start
File extensions: .hbl containing the measuring data of the session
.hbc containing additional user defined information to be stored in connection with the data file

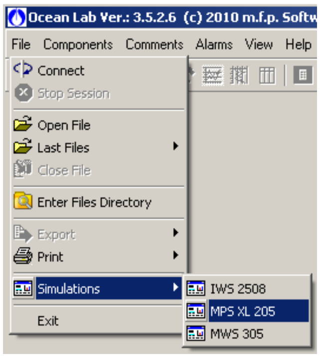
When data or comments files are modified after stopping the session the modified file sets are stored with numerical index:

name_x.hbl (x = numerical index) containing the modified data of the session
name_x.hbc (x = numerical index) containing modified user defined information

Please note that OceanLab 3 automatically starts a new session (and thus creates new data and comments file) when modifications are made inside the CONTROLLING dialogs of the CONTROLLING MODE.

7. SIMULATION

For training purposes OceanLab 3 can be started in SIMULATION MODE with no HYDRO-BIOS system connected. For general training and software evaluation OceanLab 3 offers simulations for some different standard HYDRO-BIOS systems. Additionally OceanLab 3 automatically creates a simulation for each HYDRO-BIOS system during the first connecting process. The simulations are accessible via menu item SIMULATIONS inside the FILE menu, offering all modules and functions necessary to control the specific HYDRO-BIOS system. The simulations can only be started when no session or simulation is active and no file is opened inside OceanLab 3.
Please note that the data file sub-directories and the data files of simulations are marked with SIM as leading expression.



8. HARDWARE CONSTELLATIONS

Depending on the kind of mission there are two main hardware constellations intended for the following applications:

The DEEP WATER ONLINE-OPERATION, where the PC is connected via Deck Command Unit or Hand Terminal and FSK-telemetry to the Probe resp. Motor Unit, is intended for ONLINE-OPERATIONS where OceanLab 3 monitors real-time measuring data (e.g. pressure, temperature etc.) and enables the user to control the complete system (including action devices) at the PC. The real-time measuring data are automatically stored into a disk file.

For PREPARING OFFLINE-OPERATIONS, where the PC is directly connected to the Probe resp. Motor Unit via serial port, OceanLab 3 offers a special programming dialog for instruments working in self contained mode where the user can enter a list of action events and programme the instrument electronics to execute this list.

The POST-DEPLOYMENT DATA DOWNLOAD, where the PC is directly connected to the Probe resp. Motor Unit via serial port, is needed to transfer measuring data having been stored inside the instruments data memory during OFFLINE-OPERATIONS after recovery.

9. OPERATING MODES

To meet the different hardware constellation requirements, OceanLab 3 incorporates three different operating modes:

In MONITORING MODE currently updated real-time data received from the instrument are stored into a disk file (for later analysis) and displayed in engineering units. Additionally the MONITORING MODE offers a user configurable graph to visualize the real-time data of the instrument. All action devices of the instrument can be controlled with an ACTION button.

The CONTROLLING MODE offers a list of all devices implemented into the instrument. It is intended to control all implemented devices in view of pre-deployment system set-up and post-deployment data download.

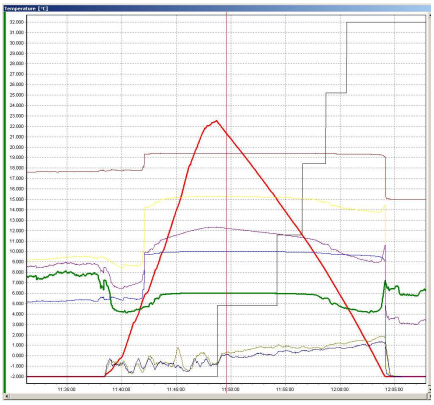
The VIEWER MODULE of OceanLab 3 is used to view and export disk files of previous operations.

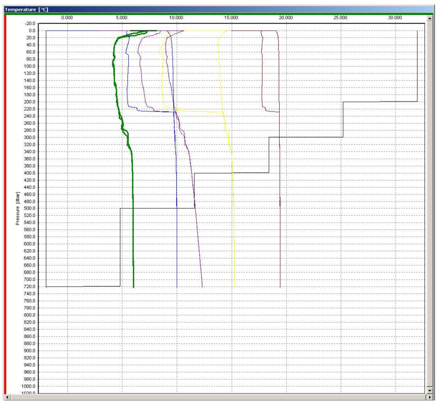
9.1. MONITORING MODE

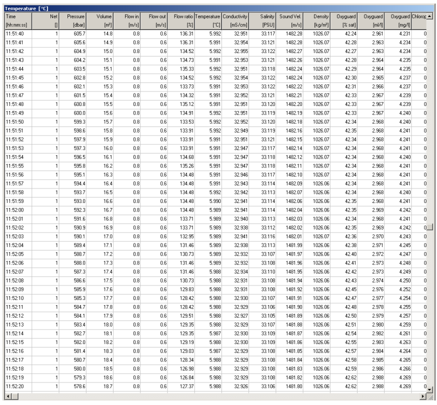
To enter the MONITORING MODE click on button MONITORING MODE inside the toolbar.
The MONITORING MODE incorporates independent program windows as follows:

9.1.1. GRAPHS WINDOW

Inside the GRAPHS window a currently updated time- or pressure-depending graph visualizes the sets of measuring data received from the instrument. Alternatively the graph can be replaced by a tabulated data list. The appearance of the GRAPHS window can be selected inside the VIEW menu of the MAIN window.







To temporarily enlarge a specific area inside the graphic mark the region of interest with the mouse whilst left button pressed.
To temporarily zoom the graphic please use the wheel of the mouse or + and – keys at the keyboard.
To temporarily navigate inside the GRAPHS window please use the right mouse button or the scroll bars.
To return to the default settings double-click inside the GRAHPS window.
To temporarily display the graph of the complete active mission please use button ZOOM ALL inside the toolbar.

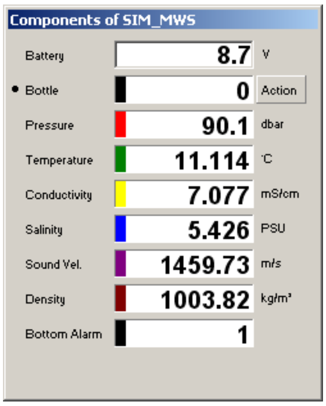
Please note that the GRAPHS window in MONITORING MODE will return to the default settings after 10 seconds automatically.

To select a parameter for the vertical axis of the GRAPHS window please click at the parameter inside the COMPONENTS window.

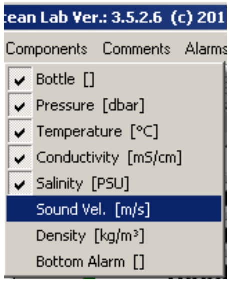
Inside the time-depending GRAPHS window blue boxes mark the positions of header information, yellow boxes mark the positions of LOGFILE EDITOR comments connected to the data file. Red boxes mark the positions of LOGFILE EDITOR comments automatically created by OceanLab 3 when communication problems occur during the mission. To open a LOGFILE EDITOR comment click once at the blue, yellow or red box or select it inside the COMMENTS menu.

9.1.2. COMPONENTS WINDOW

Inside the tabulated COMPONENTS window real-time measuring data received from the instrument and data calculated from the measuring data are displayed in engineering units. An ACTION button enables the user to activate action devices of the instrument.



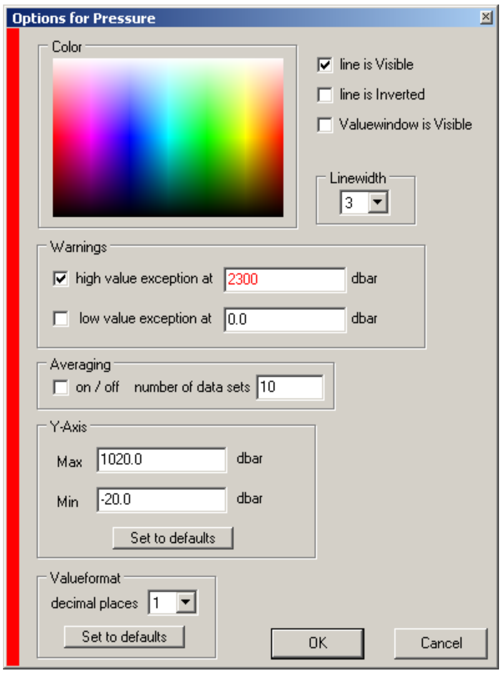
Since the instrument connected automatically configures OceanLab 3 the list of implemented components may vary from instrument to instrument.



To hide a parameter completely inside the MONITORING MODE unselect it inside the COMPONENTS menu.

9.1.2.1. OPTIONS DIALOG

A configuration dialog of a component is accessible by clicking with the right mouse button at the name of the component inside the COMPONENTS window and selecting OPTIONS inside the pop-up menu. Inside the OPTIONS dialog the component can be configured as follows:

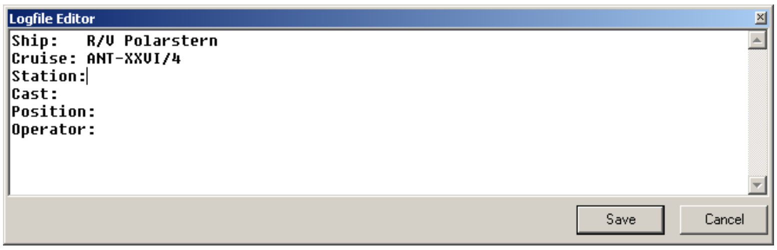


- COLOR: Select a color for the component to be used inside the graph.
- LINE IS VISIBLE: Use tick box to hide the component inside the graph.
- LINE IS INVERTED: Use tick box to mirror the graph of the component (lower limit of Y-axis at the top, upper limit of Y-axis at the bottom).
- VALUE WINDOW IS VISIBLE: Use tick box to create an additional value window for the component. This value window can be individually adjusted in size and position at the windows desktop.
- LINEWIDTH: Select line width to be used inside the graph from the pull-down box.
- WARNINGS: Each component can be associated with high and low value alarms. A pop-up window will indicate the crossing of the selected limit.

- AVERAGING: To smoothen a graph of a component and to average the physical data (in case of unstable or jumping readings) please use tick box to activate averaging and enter the number of data sets to be used for averaging. A component with active averaging is marked with an overline inside the COMPONENTS WINDOW.

- Y-AXIS: Enter upper and lower limit of Y-axis at will for a permanent magnification of the graph.
- VALUEFORMAT: Select number of decimal places for the component from the pull-down box. Please note that this function does NOT increase the accuracy!

9.1.3. LOGFILE EDITOR



When starting a session OceanLab 3 automatically creates a header information which is intended to enable the user to enter all necessary information to be stored in connection with the data file (e.g. ship, cruise no., station no., …). As template for this comment OceanLab 3 uses the file "header.txt" (located inside the OceanLab 3 application data directory) which can be individually configured according to the needs of the user. Inside the GRAPHS window a blue box marks the position of the header information which can be opened for modification with the LOGFILE EDITIOR by clicking at the blue box. The header information will be incorporated into the export files that can be created inside the VIEWER module of OceanLab 3.

Additional LOGFILE EDITOR comments can be created at any time (e.g. to connect additional information of interest to a specific moment) by simply pressing the space bar at the keyboard of the PC. Inside the time-depending GRAPHS window yellow boxes mark the positions of the LOGFILE EDITOR comments. The LOGFILE EDITOR comments will be incorporated into the export files that can be created inside the VIEWER module of OceanLab 3.

As template for the additional comments OceanLab 3 uses the file "comments.txt" (located inside the OceanLab 3 application data directory) which can be individually configured according to the needs of the user.

Please note that OceanLab 3 automatically starts a new session (and thus creates new data and comments files) when modifications are made inside the CONTROLLING dialogs of the CONTROLLING MODE.

9.2. CONTROLLING MODE

To enter the CONTROLLING MODE click on button CONTROLLING MODE inside the toolbar.

The CONTROLLING MODE incorporates the following independent program windows:

9.2.1. COMPONENTS WINDOW

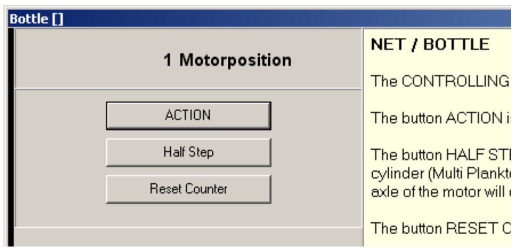
The tabulated COMPONENTS window is similar to the COMPONENTS window of the MONITORING MODE. It offers a list of all components implemented into the actual instrument.

Since the instrument connected automatically configures OceanLab 3 the list of implemented components may vary from instrument to instrument.

Clicking at one implemented device opens an individual CONTROLLING dialog for the selected device, offering all necessary features of the specific device (e.g. calibration coefficients, measuring ranges ...).

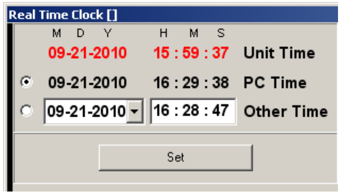
9.2.2.CONTROLLING DIALOGS

9.2.2.1. NET / BOTTLE



The CONTROLLING dialog NET resp. BOTTLE offers a dialog to control the motor of the instrument manually:
The button ACTION is used to activate the motor of the instrument to move to the next position.
The button HALF STEP is used for synchronization purposes to synchronize the motor with the position of steering cylinder (Multi Plankton Sampler), release mechanism (Multi Water Sampler) or rotary table (Multi Sediment Trap). The axle of the motor will carry out a half revolution and the motor counter (NET or BOTTLE) will be set to zero.
The button RESET COUNTER is used to set the motor counter (NET or BOTTLE) to zero for synchronization purposes.

9.2.2.2. REAL TIME CLOCK



The CONTROLLING dialog REAL TIME CLOCK is used to adjust the real time clock of the instrument. The real time clock of the instrument can be synchronized with the PC clock or adjusted at will.

The date format is	MM-DD-YYYY	MM = month, 2 digits DD = day, 2 digits YYYY = year, 4 digits within the interval 2000 … 2099)
The time format is:	hh:mm:ss	hh = hour, 2 digits within the interval 0 … 24 mm = minute, 2 digits ss = second, 2 digits

The button SET is used to transfer the new date and time to the instrument after modifications.

9.2.2.3. PRESSURE

The CONTROLLING dialog PRESSURE incorporates the indication of the sensors raw data and the possibility to read and modify the sensors calibration coefficients (cal 0 … cal 8). The calibration coefficients are used as follows:

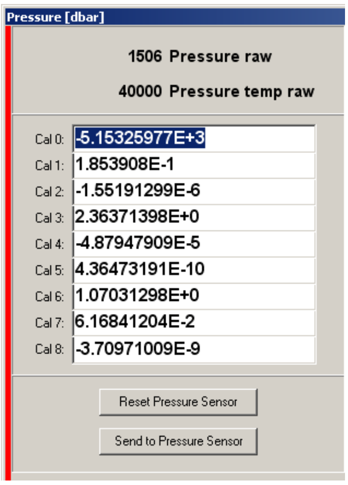
$$\text{pressure [dbar]} = \text{cal } 6 + \text{cal } 7 * \text{pressure\_tempcomp} + \text{cal } 8 * \text{pressure\_tempcomp}^2$$

$$\text{pressure\_tempcomp [dbar]} = \text{pressure\_data} * \text{pressure\_tk}$$

$$\text{pressure\_data} = \text{pressure\_raw} - \text{pressure\_offset}$$

$$\text{pressure\_offset} = \text{cal } 0 + \text{cal } 1 * \text{pressure\_temp\_raw} + \text{cal } 2 * \text{pressure\_temp\_raw}^2$$

$$\text{pressure\_tk} = \text{cal } 3 + \text{cal } 4 * \text{pressure\_temp\_raw} + \text{cal } 5 * \text{pressure\_temp\_raw}^2$$



The button SEND TO PRESSURE SENSOR is used to transfer the calibration coefficients to the instrument after modifications.

The button RESET PRESSURE SENSOR is used to re-calibrate the zero-offset of the pressure sensor (and modifies cal 6). Use function whilst instrument stands on deck at temperatures from +5°C up to +35°C when the instrument has reached the surrounding temperature only!
The re-calibration is irreversible!

9.2.2.4. PRESSURE WITH ZERO OFFSET

The CONTROLLING dialog PRESSURE WITH ZERO OFFSET incorporates the indication of the sensors raw data and the possibility to read and modify the sensors calibration coefficients (cal 0 … cal 9). The calibration coefficients are used as follows:

$$\text{pressure [dbar]} = \text{cal } 6 + \text{cal } 7 * \text{pressure\_tempcomp} + \text{cal } 8 * \text{pressure\_tempcomp}^2 + \text{cal } 9 / 1.019716$$

$$\text{pressure\_tempcomp [dbar]} = \text{pressure\_data} * \text{pressure\_tk}$$

$$\text{pressure\_data} = \text{pressure\_raw} - \text{pressure\_offset}$$

$$\text{pressure\_offset} = \text{cal } 0 + \text{cal } 1 * \text{pressure\_temp\_raw} + \text{cal } 2 * \text{pressure\_temp\_raw}^2$$

$$\text{pressure\_tk} = \text{cal } 3 + \text{cal } 4 * \text{pressure\_temp\_raw} + \text{cal } 5 * \text{pressure\_temp\_raw}^2$$

In some instrument configurations it is not possible to place the pressure sensor in the exact level of interest (see examples below). For these applications the entry mask ZERO OFFSET can be used to enter the vertical deviation from pressure sensor to level of interest, allowing for automatic clearing of this vertical distance during pressure measurements.
The vertical ZERO OFFSET (which equals calibration coefficient cal 9) has to be entered in meters.

Example 1: Integrating Water Sampler IWS
The inlet of the IWS has a vertical distance from the pressure sensor. For high precision samples the vertical ZERO OFFSET allows for automatic clearing of this vertical distance during sampling.

Example 2: Plankton Net
A probe (with integrated pressure sensor) is separately mounted to the towing cable of a plankton net. Thus the pressure sensor is placed above the mouth opening of the net. The vertical ZERO OFFSET can be used to eliminate the misreading of the pressure sensor (related to the mouth opening of the net).

The button SEND TO PRESSURE SENSOR is used to transfer the calibration coefficients to the instrument after modifications.

The button RESET PRESSURE SENSOR is used to re-calibrate the zero-offset of the pressure sensor (and modifies cal 6). Use function whilst instrument stands on deck at temperatures from +5°C up to +35°C when the instrument has reached the surrounding temperature only!
The re-calibration is irreversible!

9.2.2.5. LIMNIC DEPTH
The LIMNIC DEPTH is a virtual device with calculated data. The CONTROLLING dialog LIMNIC DEPTH displays the measuring data used for the calculation and the calculation formula as follows:

limnic_depth [m] = pressure [dbar] * 1.019716

Please note that the LIMNIC DEPTH is applicable for limnic operations only.

9.2.2.6. FLOW IN
The CONTROLLING dialog FLOW IN incorporates the indication of the sensors raw data (velocity) only. The calculation of the flow velocity is made according to:

flow_in [m/s] = 0.1 * flow_in_raw

9.2.2.7. VOLUME
The CONTROLLING dialog VOLUME incorporates the indication of the sensors raw data (volume) and the possibility to read and modify the sensors calibration coefficient cal 0 which equals the opening area of the net in square metres.
The calculation of the volume is made according to:

volume [m^3] = x * flow_vol_raw
with: x = 1 for cal 0 ≥ 0.25
x = 0.1 for cal 0 < 0.25

The button SEND TO FLOWMETER is used to transfer the calibration coefficient to the instrument after modifications.
Please note that the calibration coefficient cal 0 can not be modified after the operation!
In special configurations an additional button RESET VOLUME allows to set the measured volume to zero.

9.2.2.8. FLOW OUT
The CONTROLLING dialog FLOW OUT incorporates the indication of the sensors raw data (velocity) only. The calculation of the flow velocity is made according to:

flow_out [m/s] = 0.1 * flow_out_raw

9.2.2.9. FLOW RATIO
The FLOW RATIO is a virtual device with calculated data. The CONTROLLING dialog FLOW RATIO displays the measuring data used for the calculation and the calculation formula as follows:

flow_ratio [%] = 100% * flow_in / flow_out

or

flow_ratio [%] = 100% * flow_1 / flow_2

9.2.2.10. VELOCITY

The CONTROLLING dialog VELOCITY incorporates the indication of the sensors raw data and the possibility to read and modify the sensors calibration coefficients (cal 0 … cal 2) and the averaging time for the measuring cycle. The calibration coefficients are used as follows:

velocity [m/s] = cal 0 + cal 1 * velocity_raw + cal 2 * $velocity\_raw^2$

The AVERAGING time for the measuring cycle can be adjusted within the interval from 5 up to 30 seconds.

The button SEND TO VELOCITY SENSOR is used to transfer calibration coefficients and averaging time to the instrument after modifications.

9.2.2.11. TEMPERATURE

The CONTROLLING dialog TEMPERATURE incorporates the indication of the sensors raw data and the possibility to read and modify the sensors calibration coefficients (cal 0 … cal 2). The calibration coefficients are used as follows:

temperature [°C] = cal 0 + cal 1 * temperature_raw + cal 2 * $temperature\_raw^2$

The button SEND TO TEMPERATURE SENSOR is used to transfer the calibration coefficients to the instrument after modifications.

9.2.2.12. CONDUCTIVITY

The CONTROLLING dialog CONDUCTIVITY incorporates the indication of the sensors raw data and the possibility to read and modify the sensors calibration coefficients (cal 0 … cal 2). The calibration coefficients are used as follows:

conductivity [mS/cm] = cal 0 + cal 1 * conductivity_raw + cal 2 * $conductivity\_raw^2$

The button SEND TO CONDUCTIVITY SENSOR is used to transfer the calibration coefficients to the instrument after modifications.

9.2.2.13. SPECIFIC CONDUCTIVITY (SPEC. COND.)

The SPECIFIC CONDUCTIVITY delivers conductivity measurements **corrected to a standard temperature of 25°C**. It is a virtual device with calculated data. The CONTROLLING dialog SPECIFIC CONDUCTIVITY displays all measuring data used for the calculation and the calculation formula.

$$\text{specific conductivity [mS/cm]} = \frac{c}{1 + 0.02 \cdot (t - 25)}$$

with: c = conductivity

t = temperature * 1.00024

9.2.2.14. SALINITY

The SALINITY sensor is a virtual device with calculated data. The CONTROLLING dialog SALINITY displays all measuring data used for the calculation and the calculation formulas according to UNESCO Technical Papers in Marine Science 44.

$$\text{salinity [PSU]} = a_0 + a_1 \cdot R_t^{1/2} + a_2 \cdot R_t + a_3 \cdot R_t^{3/2} + a_4 \cdot R_t^2 + a_5 \cdot R_t^{5/2} + \Delta S$$

$$\Delta S = \frac{(t-15)}{1+k\cdot(t-15)} \cdot (b_0 + b_1 \cdot R_t^{1/2} + b_2 \cdot R_t + b_3 \cdot R_t^{3/2} + b_4 \cdot R_t^2 + b_5 \cdot R_t^{5/2})$$

$$R_t = \frac{R}{R_p \cdot r_t}$$

$$R_p = 1 + \frac{p\cdot(e_1 + e_2 \cdot p + e_3 \cdot p^2)}{1 + d_1 \cdot t + d_2 \cdot t^2 + (d_3 + d_4 \cdot t)\cdot R}$$

$$r_t = c_0 + c_1 \cdot t + c_2 \cdot t^2 + c_3 \cdot t^3 + c_4 \cdot t^4$$

with: p = pressure

t = temperature * 1.00024 (t_{90} to t_{68} conversion)

R = conductivity / 42.914

a_0 = 0.0080	b_0 = 0.0005	c_0 = 0.6766097
a_1 = - 0.1692	b_1 = - 0.0056	c_1 = 2.00564 e-2
a_2 = 25.3851	b_2 = - 0.0066	c_2 = 1.104259 e-4
a_3 = 14.0941	b_3 = - 0.0375	c_3 = - 6.9698 e-7
a_4 = - 7.0261	b_4 = 0.0636	c_4 = 1.0031 e-9
a_5 = 2.7081	b_5 = - 0.0144	k = 0.0162
d_1 = 3.426 e-2	e_1 = 2.070 e-5	
d_2 = 4.464 e-4	e_2 = - 6.370 e-10	
d_3 = 4.215 e-1	e_3 = 3.989 e-15	
d_4 = - 3.107 e-3		

9.2.2.15. SOUND VELOCITY

The SOUND VELOCITY sensor is a virtual device with calculated data. The CONTROLLING dialog SOUND VELOCITY displays all measuring data used for the calculation and the calculation formulas according to UNESCO Technical Papers in Marine Science 44.

$$\text{sound velocity [m/s]} = C_W + A \cdot S + B \cdot S^{3/2} + D \cdot S^2$$

$$C_W = C_{00} + C_{01} \cdot t + C_{02} \cdot t^2 + C_{03} \cdot t^3 + C_{04} \cdot t^4 + C_{05} \cdot t^5 + (C_{10} + C_{11} \cdot t + C_{12} \cdot t^2 + C_{13} \cdot t^3 + C_{14} \cdot t^4) \cdot p$$

$$+ (C_{20} + C_{21} \cdot t + C_{22} \cdot t^2 + C_{23} \cdot t^3 + C_{24} \cdot t^4) \cdot p^2 + (C_{30} + C_{31} \cdot t + C_{32} \cdot t^2) \cdot p^3$$

with: t = temperature * 1.00024 (t_{90} to t_{68} conversion)

p = pressure * 0.1

S = salinity

C_{00} = 1402.388	C_{10} = 0.153563	C_{20} = 3.1260 e-5
C_{01} = 5.03711	C_{11} = 6.8982 e-4	C_{21} = - 1.7107 e-6
C_{02} = - 5.80852 e-2	C_{12} = -8.1788 e-6	C_{22} = 2.5974 e-8
C_{03} = 3.3420 e-4	C_{13} = 1.3621 e-7	C_{23} = - 2.5335 e-10
C_{04} = - 1.47800 e-6	C_{14} = - 6.1185 e-10	C_{24} = 1.0405 e-12
C_{05} = 3.1464 e-9		
C_{30} = - 9.7729 e-9		
C_{31} = 3.8504 e-10		
C_{32} = - 2.3643 e-12		

$$A = A_{00} + A_{01} \cdot t + A_{02} \cdot t^2 + A_{03} \cdot t^3 + A_{04} \cdot t^4 + (A_{10} + A_{11} \cdot t + A_{12} \cdot t^2 + A_{13} \cdot t^3 + A_{14} \cdot t^4) \cdot p$$

$$+ (A_{20} + A_{21} \cdot t + A_{22} \cdot t^2 + A_{23} \cdot t^3) \cdot p^2 + (A_{30} + A_{31} \cdot t + A_{32} \cdot t^2) \cdot p^3$$

with:

A_{00} = 1.389	A_{10} = 9.4742 e-5	A_{20} = - 3.9064 e-7
A_{01} = - 1.262 e-2	A_{11} = - 1.2580 e-5	A_{21} = 9.1041 e-9
A_{02} = 7.164 e-5	A_{12} = - 6.4885 e-8	A_{22} = - 1.6002 e-10
A_{03} = 2.006 e-6	A_{13} = 1.0507 e-8	A_{23} = 7.988 e-12
A_{04} = - 3.21 e-8	A_{14} = - 2.0122 e-10	
A_{30} = 1.100 e-10		
A_{31} = 6.649 e-12		
A_{32} = - 3.389 e-13		

$$B = B_{00} + B_{01} \cdot t + (B_{10} + B_{11} \cdot t) \cdot p$$

with:

B_{00} = - 1.922 e-2	B_{10} = 7.3637 e-5
B_{01} = - 4.42 e-5	B_{11} = 1.7945 e-7

$$D = D_{00} + D_{10} \cdot p$$

with: D_{00} = 1.727 e-3 D_{10} = - 7.9836 e-6

9.2.2.16. DENSITY AT HIGH PRESSURE

The DENSITY sensor is a virtual device with calculated data. The CONTROLLING dialog DENSITY displays all measuring data used for the calculation and the calculation formulas according to Millero and Poisson, 1981.

$$\text{density [kg/m}^3\text{]} = \frac{\rho_{S,t,0}}{1 - p/K_{S,t,p}}$$

$$\rho_{S,t,0} = \rho_W + A \cdot S + B \cdot S^{3/2} + C \cdot S^2$$

$$\rho_W = 999.842594 + 6.793952 \cdot 10^{-2} \cdot t - 9.095290 \cdot 10^{-3} \cdot t^2 + 1.001685 \cdot 10^{-4} \cdot t^3 - 1.120083 \cdot 10^{-6} \cdot t^4 + 6.536332 \cdot 10^{-9} \cdot t^5$$

$$A = 8.24493 \cdot 10^{-1} - 4.0899 \cdot 10^{-3} \cdot t + 7.6438 \cdot 10^{-5} \cdot t^2 - 8.2467 \cdot 10^{-7} \cdot t^3 + 5.3875 \cdot 10^{-9} \cdot t^4$$

$$B = -5.72466 \cdot 10^{-3} + 1.0227 \cdot 10^{-4} \cdot t - 1.6546 \cdot 10^{-6} \cdot t^2$$

$$C = 4.8314 \cdot 10^{-4}$$

$$K_{S,t,p} = K_{S,t,0} + A \cdot p + B \cdot p^2$$

$$K_{S,t,0} = K_W + \left(54.6746 - 0.603459 \cdot t + 1.09987 \cdot 10^{-2} \cdot t^2 - 6.1670 \cdot 10^{-5} \cdot t^3\right) \cdot S + \left(7.944 \cdot 10^{-2} + 1.6483 \cdot 10^{-2} \cdot t - 5.3009 \cdot 10^{-4} \cdot t^2\right) \cdot S^{3/2}$$

$$A = A_W + \left(2.2838 \cdot 10^{-3} - 1.0981 \cdot 10^{-5} \cdot t - 1.6078 \cdot 10^{-6} \cdot t^2\right) \cdot S + 1.91075 \cdot 10^{-4} \cdot S^{3/2}$$

$$B = B_W + \left(-9.9348 \cdot 10^{-7} + 2.0816 \cdot 10^{-8} \cdot t + 9.1697 \cdot 10^{-10} \cdot t^2\right) \cdot S$$

$$K_W = 19652.21 + 148.4206 \cdot t - 2.327105 \cdot t^2 + 1.360477 \cdot 10^{-2} \cdot t^3 - 5.155288 \cdot 10^{-5} \cdot t^4$$

$$A_W = 3.239908 + 1.43713 \cdot 10^{-3} \cdot t + 1.16092 \cdot 10^{-4} \cdot t^2 - 5.77905 \cdot 10^{-7} \cdot t^3$$

$$B_W = 8.50935 \cdot 10^{-5} - 6.12293 \cdot 10^{-6} \cdot t + 5.2787 \cdot 10^{-8} \cdot t^2$$

with: S = salinity

p = pressure * 0.1

t = temperature * 1.00024 (t_{90} to t_{68} conversion)

9.2.2.17. OXYGUARD [% sat]

The CONTROLLING dialog OXYGUARD [% sat] incorporates the indication of the sensors raw data and the possibility to read and modify the sensors calibration coefficients (cal 0 … cal 1). The calibration coefficients are used as follows:

oxyguard [% sat] = cal 0 + cal 1 * oxyguard_raw

The button SET TO 100% SAT is used during field calibration to re-calculate the slope (cal 1) of the sensor. Care for an environment for the sensor of 100% saturation (see OXYGUARD manual) before using this function.

The button SEND TO OXYGUARD SENSOR is used to transfer the calibration coefficients to the instrument after modifications.

9.2.2.18. OXYGUARD [ml/l]
The OXYGUARD [ml/l] sensor is a virtual device with calculated data. The CONTROLLING dialog OXYGUARD [ml/l] displays all measuring data used for the calculation and the calculation formulas.

oxyguard [ml/l] = C * oxyguard [% sat] / 100

$$C = \exp\left(-173.4292 + 249.6339 \cdot \left(\frac{100}{T}\right) + 143.3483 \cdot \ln\left(\frac{T}{100}\right) - 21.8492 \cdot \left(\frac{T}{100}\right)\right.$$

$$\left. + S \cdot \left(-0.033096 + 0.014259 \cdot \left(\frac{T}{100}\right) - 0.001700 \cdot \left(\frac{T}{100}\right)^2\right)\right)$$

with: T = temperature + 273.15

S = salinity

9.2.2.19. OXYGUARD [mg/l]
The OXYGUARD [mg/l] sensor is a virtual device with calculated data. The CONTROLLING dialog OXYGUARD [mg/l] displays all measuring data used for the calculation and the calculation formulas.

oxyguard [mg/l] = oxyguard [ml/l] * 1.4289

9.2.2.20. OXY-AMT [% sat]
The CONTROLLING dialog OXY-AMT [% sat] incorporates the indication of the sensors raw data, the indication of all additional measuring data used for the calculation and the possibility to read and modify the sensors calibration coefficients (cal 0 … cal 8). The calibration coefficients are identical with the calibration coefficients of the CONTROLLING dialog OXY-AMT [mg/l]. The calibration coefficients are used as follows:

$$\text{oxy - AMT [\% sat]} = a_{20°C} \cdot (U - U_G) \cdot E_T \cdot \frac{100}{X_{O_2} \cdot (p_L - p_W)}$$

$$p_W = \exp\left(11.8571 - \left(\frac{3840.7}{T}\right) - \left(\frac{216961}{T^2}\right)\right)$$

U = cal 0 + cal 1 * oxy-AMT_raw

E_T = cal 2 + cal 3 * t + cal 4 * t^2 + cal 5 * t^3

with: T = temperature + 273.15
t = temperature
X_{O_2} = 0.2095
p_L = cal 6 (air pressure in bar)
U_G = cal 7 (zero offset in V)
$a_{20°C}$ = cal 8

The button SET TO 100% SAT is used during field calibration to re-calculate the slope (cal 8) of the sensor. Care for an environment for the sensor of 100% saturation (see AMT manual) before using this function.

The button SEND TO OXY-AMT SENSOR is used to transfer the calibration coefficients to the instrument after modifications.

9.2.2.21. OXY-AMT [mg/l]

The CONTROLLING dialog OXY-AMT [mg/l] incorporates the indication of the sensors raw data, the indication of all additional measuring data used for the calculation and the possibility to read and modify the sensors calibration coefficients (cal 0 … cal 8). The calibration coefficients are identical with the calibration coefficients of the CONTROLLING dialog OXY-AMT [% sat]. The calibration coefficients are used as follows:

$$\text{oxy-AMT [mg/l]} = a_{20°C} \cdot (U - U_G) \cdot E_T \cdot \frac{C_S}{X_{O_2} \cdot (p_N - p_W)}$$

$$C_S = \exp\left(-173.4292 + 249.6339 \cdot \left(\frac{100}{T}\right) + 143.3483 \cdot \ln\left(\frac{T}{100}\right) - 21.8492 \cdot \left(\frac{T}{100}\right)\right.$$

$$\left. + S \cdot \left(-0.033096 + 0.014259 \cdot \left(\frac{T}{100}\right) - 0.001700 \cdot \left(\frac{T}{100}\right)^2\right)\right) \cdot 1.4289$$

$$p_W = \exp\left(11.8571 - \left(\frac{3840.7}{T}\right) - \left(\frac{216961}{T^2}\right)\right)$$

U = cal 0 + cal 1 * oxy-AMT_raw

E_T = cal 2 + cal 3 * t + cal 4 * t^2 + cal 5 * t^3

with: T = temperature + 273.15

t = temperature

X_{O_2} = 0.2095

p_N = 1.013

U_G = cal 7 (zero offset V)

$a_{20°C}$ = cal 8

The button SEND TO OXY-AMT SENSOR is used to transfer the calibration coefficients to the instrument after modifications.

9.2.2.22. OXY-AMT [ml/l]

The OXY-AMT [ml/l] sensor is a virtual device with calculated data. The CONTROLLING dialog OXY-AMT [ml/l] displays all measuring data used for the calculation and the calculation formulas.

oxy-AMT [ml/l] = oxy-AMT [mg/l] / 1.4289

9.2.2.23. OXY-AMT [% sat] WITH PRESSURE COMPENSATION
The CONTROLLING dialog OXY-AMT [% sat] WITH PRESSURE COMPENSATION incorporates the indication of the sensors raw data, the indication of all additional measuring data used for the calculation and the possibility to read and modify the sensors calibration coefficients (cal 0 … cal 3). The calibration coefficients are used as follows:

$$\text{oxy - AMT [\% sat]} = O_2 \cdot \text{cal}\,3 \cdot \exp(T \cdot c_1 + D \cdot c_2)$$

$$O_2 = U - U_0$$

$$U[V] = \text{cal}\,0 + \text{cal}\,1 \cdot \text{oxy - AMT\_raw}$$

$$U_0 = \text{cal}\,2$$

$$\text{cal}\,3 = \frac{\text{oxy - AMT [\% sat]}}{\exp(T \cdot c_1) \cdot O_2}$$

with: T = temperature [°C]

D = pressure [dbar]

$c_1 = -0.029$

$c_2 = 0.000115$

The button SET TO 101.7% SAT is used during field calibration to re-calculate the slope (cal 3) of the sensor. Care for an environment for the sensor of 101.7% saturation (see AMT manual) before using this function.

The button SEND TO OXY-AMT SENSOR is used to transfer the calibration coefficients to the instrument after modifications.

9.2.2.24. OXY-AMT [ml/l] WITH PRESSURE COMPENSATION
The OXY-AMT [ml/l] WITH PRESSURE COMPENSATION sensor is a virtual device with calculated data. The CONTROLLING dialog OXY-AMT [ml/l] WITH PRESSURE COMPENSATION displays all measuring data used for the calculation and the calculation formulas.

$$\text{oxy - AMT[ml/l]} = \frac{C \cdot \text{oxy - AMT[\% sat]}}{100}$$

$$C = \exp\left(-173.4292 + 249.6339 \cdot \left(\frac{100}{T}\right) + 143.3483 \cdot \ln\left(\frac{T}{100}\right) - 21.8492 \cdot \left(\frac{T}{100}\right)\right.$$

$$\left. + S \cdot \left(-0.033096 + 0.014259 \cdot \left(\frac{T}{100}\right) - 0.001700 \cdot \left(\frac{T}{100}\right)^2\right)\right)$$

with: S = salinity

T = temperature + 273.15

9.2.2.25. OXY-AMT [mg/l] WITH PRESSURE COMPENSATION
The CONTROLLING dialog OXY-AMT [mg/l] WITH PRESSURE COMPENSATION is a virtual device with calculated data. The CONTROLLING dialog OXY-AMT [mg/l] WITH PRESSURE COMPENSATION displays all measuring data used for the calculation and the calculation formulas.

$$\text{oxy - AMT[mg/l]} = \text{oxy - AMT[ml/l]} \cdot 1.4289$$

9.2.2.26. CHLOROPHYLL A, 1 RANGE

The CONTROLLING dialog CHLOROPHYLL A incorporates the indication of the sensors raw data and the possibility to read and modify the sensors calibration coefficients (cal 0 … cal 1). The calibration coefficients are used as follows:

chlorophyll a [µg/l] = cal 0 + cal 1 * chla_raw

The button SEND TO CHLOROPHYLL A SENSOR is used to transfer the calibration coefficients to the instrument after modifications.

9.2.2.27. CHLOROPHYLL A, 2 RANGES

The CONTROLLING dialog CHLOROPHYLL A incorporates the indication of the sensors raw data, the indication of the actual measuring range, the possibility to read and modify the sensors calibration coefficients (cal 0 … cal 3) and to select a specific measuring range. The calibration coefficients are used as follows:

chlorophyll a [µg/l] = cal 0 + cal 1 * chla_raw
Measuring range 1

chlorophyll a [µg/l] = cal 2 + cal 3 * chla_raw
Measuring range 2

The RANGE SELECTION is utilized to select the measuring range of the CHLOROPHYLL A fluorometer. The table offers two fixed measuring ranges and the automatic range selection AUTO. With active automatic range selection the instrument automatically selects the ideal measuring range by microprocessor control:

When the actual measuring value falls below 7% of the max. value of the upper range the instrument will switch to the lower range.
When the actual measuring value exceeds 95% of the lower range the instrument will switch to the upper range.

The button SEND TO CHLOROPHYLL A SENSOR is used to transfer the calibration coefficients to the instrument after modifications.

9.2.2.28. CHLOROPHYLL A, 4 RANGES

The CONTROLLING dialog CHLOROPHYLL A incorporates the indication of the sensors raw data, the indication of the actual measuring range, the possibility to read and modify the sensors calibration coefficients (cal 0 … cal 7) and to select a specific measuring range. The calibration coefficients are used as follows:

chlorophyll a [µg/l] = cal 0 + cal 1 * chla_raw
Measuring range 1

chlorophyll a [µg/l] = cal 2 + cal 3 * chla_raw
Measuring range 2

chlorophyll a [µg/l] = cal 4 + cal 5 * chla_raw
Measuring range 3

chlorophyll a [µg/l] = cal 6 + cal 7 * chla_raw
Measuring range 4

The RANGE SELECTION is utilized to select the measuring range of the CHLOROHPYLL A fluorometer. The table offers four fixed measuring ranges and the automatic range selection AUTO. With active automatic range selection the instrument automatically selects the ideal measuring range by microprocessor control:

When the actual measuring value falls below 80% of the max. value of the previous range the instrument will switch to the range below.
When the actual measuring value exceeds 90% of the actual range the instrument will switch to the range above.

The button SEND TO CHLOROPHYLL A SENSOR is used to transfer the calibration coefficients to the instrument after modifications.

9.2.2.29. TURBIDITY, 4 RANGES

The CONTROLLING dialog TURBIDITY incorporates the indication of the sensors raw data, the indication of the actual measuring range, the possibility to read and modify the sensors calibration coefficients (cal 0 … cal 7) and to select a specific measuring range. The calibration coefficients are used as follows:

turbidity [FTU] = cal 0 + cal 1 * turb_raw
Measuring range 1

turbidity [FTU] = cal 2 + cal 3 * turb_raw
Measuring range 2

turbidity [FTU] = cal 4 + cal 5 * turb_raw
Measuring range 3

turbidity [FTU] = cal 6 + cal 7 * turb_raw
Measuring range 4

The RANGE SELECTION is utilized to select the measuring range of the TURBIDITY sensor. The table offers four fixed measuring ranges and the automatic range selection AUTO. With active automatic range selection the instrument automatically selects the ideal measuring range by microprocessor control:

When the actual measuring value falls below 80% of the max. value of the previous range the instrument will switch to the range below.

When the actual measuring value exceeds 90% of the actual range the instrument will switch to the range above.

The button SEND TO TURBIDITY SENSOR is used to transfer the calibration coefficients to the instrument after modifications.

9.2.2.30. MEMORY

The CONTROLLING dialog MEMORY is used to get access to the internal data memory of the instrument. The full dialog is only available when the PC is directly connected to the Probe resp. Motor Unit via serial COM-port.

The MEMORY dialog informs about the complete size of the data memory, the used size of the data memory and the remaining space inside the data memory. Additionally the MEMORY dialog offers the possibility to select data files for download into a disk file. Please note that, in case of not completely free memory, the instrument will automatically start to create a new data file inside the data memory when started in OFFLINE-MODE. The measuring data of previous OFFLINE-OPERATIONs will not be deleted, but the instrument will stop recording measuring data automatically when the memory is completely used.

All data files stored inside the instruments data memory are available inside the FILE table. Each file is marked with date and time of session start, file size and a green or red dot.

A GREEN DOT indicates that the file has already been transferred to and stored at the PC.
A RED DOT indicates that the file has not yet been stored at the PC.

Tick-boxes are used to select data files for data transfer to the PC.

The button READ SELECTED FILES is used to start the data transfer of the selected data files from the instrument into a disk file. The data files will be organized and named as described above (see FILE MANAGEMENT).

The button CLEAR MEMORY is utilized to clear the data memory of the instrument. **This function is irreversible! Therefore make sure having successfully transferred the measuring data from the instrument to a disk file!**

The additional button READ COMPLETE MEMORY can be used to save the complete data memory of the instrument into one single disk file, even if the data memory of the instrument has been cleared by mistake. Please note that OceanLab 3 cannot open this special disk file unless it is pre-processed by HYDRO-BIOS Apparatebau GmbH. Therefore the disk file has to be sent to our factory by email, floppy disk or CD-ROM.

In special configurations, when the instrument is NOT equipped with a main switch, an additional button ACTIVATE RECORDING resp. DEACTIVATE RECORDING inside the COMPONENTS WINDOW is used to START (= ACTIVE) or STOP (= INACTIVE) data storing inside the data memory of the instrument.

9.2.2.31. MEMORY FOR RHCM

The CONTROLLING dialog MEMORY FOR RHCM is used to get access to the internal data memory of the instrument.

All data files stored inside the instruments data memory are available inside the FILE table. To display a file please select it form the pull-down list. The data sets of the file will be displayed as tabulated list. Selecting an empty file will result in an empty list.

The button SAVE SELECTED FILE is used to start the data transfer of the selected data file from the instrument into a disk file. The disk file will stored at the PC in ASCII-format inside the LOGFILES directory of OceanLab. The file can be named at will.

The button SAVE ALL FILES is used to save all data files of the instrument in one single disk file. The disk file will stored at the PC in ASCII-format inside the LOGFILES directory of OceanLab. The file can be named at will.

The button DELETE SELECTED FILE is utilized to clear one single data file of the instrument (as actually selected inside the pull-down list).
This function is irreversible! Therefore make sure having successfully transferred data file from the instrument to a disk file!

The button DELETE ALL FILES is utilized to clear the complete data memory of the instrument.
This function is irreversible! Therefore make sure having successfully transferred all data files from the instrument to a disk file!

9.2.2.32. MEMORY FOR IWS

The CONTROLLING dialog MEMORY FOR IWS is used to get access to the protocol files, created by the Sampler during operation.

All protocol files are stored at the PC inside the disk file IWS_nnnn.hbp (where nnnn is the identification number of the Sampler). The disk file is located inside the logfiles directory of OceanLab. Please refer to chapter 6. FILE MANAGEMENT to locate the directory at your PC.

All new protocol files of the Sampler are automatically appended to this disk file when a communication between Sampler and OceanLab has been established. Thus the FILE table always incorporates the complete protocol history of the actually connected IWS in chronological order (bottom to top).

Each protocol file can be opened inside the FILE table by double-click (or button OPEN SELECTED FILE) to enter individual operation descriptions (operators name and location) and to print an operation protocol. A protocol file already connected with operation descriptions is marked by X inside the FILE table.

The number of FILES IN MEMORY inside the Sampler is limited to 500. Make sure to delete the files in memory by using button CLEAR MEMORY before reaching 500 FILES IN MEMORY.

9.2.2.33. REAL-TIME PROGRAMMING

The CONTROLLING dialog REAL-TIME PROGRAMMING is used to programme real time depending activating events for the action device of the instrument. This dialog is only available when the PC is directly connected to the Probe resp. Motor Unit via serial COM-port.

Please note that REAL-TIME PROGRAMMING can only be done whilst the instruments action device is in STARTPOSITION.

The first event has to be entered as full date and time.

The date format is	MM-DD-YYYY	MM = month, 2 digits DD = day, 2 digits YYYY = year, 4 digits within the interval 2000 … 2099)
The time format is:	hh:mm:ss	hh = hour, 2 digits within the interval 0 … 24 mm = minute, 2 digits ss = second, 2 digits

The button ▼ next to the date can be used to open a calendar for an easy selection of the date intended.

The following events can be programmed at will as full date and time or as time duration.
The duration format is: hhhh:mm   hhhh = hours, 4 digits
mm = minute, 2 digits
The duration must be less than one year (= 8760 hours)

The button 🡻 next to the duration can be used to copy the actual duration to all following events.

If you enter a duration OceanLab 3 will calculate the next events date and time, if you enter date and time OceanLab 3 will calculate the next events duration.

The button SEND TO INSTRUMENT is used to transfer the activating events to the instrument after modifications.

Please note: Some instrument configurations offer more than one programming function. In this case the activation of the favoured programming function **for the instrument** is made inside CONTROLLING MODE or MONITORING MODE by clicking at the name of the programming function. This selection is permanently stored inside the instrument. A green tick inside the tick box **indicates the active programming function of the instrument**.

9.2.2.34. INTERVAL PROGRAMMING

The CONTROLLING dialog INTERVAL PROGRAMMING is used to programme time depending activating events with individual duration for each event. This dialog is only available when the PC is directly connected to the Probe resp. Motor Unit via serial COM-port.

Please note that INTERVAL PROGRAMMING can only be done whilst the instruments action device is in STARTPOSITION.

The START TIME, which is the time interval between switching on the instrument and the first activation of the action device, has to be entered in the format:

hhhh:mm   hhhh = hours, 4 digits within the interval 0 … 1499
mm = minutes, 2 digits

The DURATIONS, which are the time intervals between two successive activation events of the action device, have to be entered in the format:

hhhh:mm   hhhh = hours, 4 digits within the interval 0 … 1499
mm = minutes, 2 digits

The buttons 🡻 next to the durations can be used to copy the actual duration to all following events.

The button SEND TO INSTRUMENT is used to transfer the activating events to the instrument after modifications.

Please note: Some instrument configurations offer more than one programming function. In this case the activation of the favoured programming function **for the instrument** is made inside CONTROLLING MODE or MONITORING MODE by clicking at the name of the programming function. This selection is permanently stored inside the instrument. A green tick inside the tick box **indicates the active programming function of the instrument**.

9.2.2.35. PRESSURE PROGRAMMING

The CONTROLLING dialog PRESURE PROGRAMMING is used to get access to a list of programmable activating pressures for the action device of the instrument. This dialog is only available when the PC is directly connected to the Probe resp. Motor Unit via serial COM-port.

Please note that PRESSURE PROGRAMMING can only be done whilst the instruments action device is in STARTPOSITION.

The first event to be entered is the UNLOCK PRESSURE. The action device of the instrument will be locked until exceeding the UNLOCK PRESSURE but will continuously record measuring data.

The activating pressures for the action device must be entered in descending order. That means that the first activating event will be carried out in the greatest scheduled depth. The first activating pressure must be smaller than the UNLOCK PRESSURE.

The button SEND TO INSTRUMENT is used to transfer the activating events to the instrument after modifications.

The buttons LOAD SCHEDULE and SAVE SCHEDULE give access to a list of operation templates that can be created, arranged and deleted by the end user. The position of the highlighted entry can be changed by means of the buttons ↑ and ↓. The button X is used to delete the highlighted entry. To re-name an entry just select it from the list and enter a new name.

The button PRINT SCHEDULE is used provide a hard copy of the current list of unlock and activating pressures on your printer.

The button EXPORT SCHEDULE is used store the current list of unlock and activating pressures in an ASCII-file.

Please note: Some instrument configurations offer more than one programming function. In this case the activation of the favoured programming function **for the instrument** is made inside CONTROLLING MODE or MONITORING MODE by clicking at the name of the programming function. This selection is permanently stored inside the instrument. A green tick inside the tick box **indicates the active programming function of the instrument**.

9.2.2.36. PRESSURE PROGRAMMING WITH SECONDARY UNLOCKING MECHANISM

The CONTROLLING dialog PRESURE PROGRAMMING WITH SECONDARY UNLOCKING MECHANISM is used to get access to a list of programmable activating pressures for the action device of the instrument. This dialog is only available when the PC is directly connected to the Probe resp. Motor Unit via serial COM-port.

Please note that PRESSURE PROGRAMMING can only be done whilst the instruments action device is in STARTPOSITION.

The first event to be entered is the UNLOCK PRESSURE. The action device of the instrument will be locked until exceeding the UNLOCK PRESSURE but will continuously record measuring data.

The activating pressures for the action device must be entered in descending order. That means that the first activating event will be carried out in the greatest scheduled depth. The first activating pressure must be smaller than the UNLOCK PRESSURE.

The SECONDARY UNLOCKING MECHANISM has been designed to avoid operations without results (and thus ships time) when failing to pass the programmed UNLOCK PRESSURE during the operation. This function automatically unlocks the action device of the instrument when detecting a considerable (pre-programmed) decrease of pressure values during the operation. This considerable decrease of pressure values implies the beginning of the upcast and cares - after unlocking the action device - for best possible execution of the scheduled mission.
The block SECONDARY UNLOCKING MECHANISM is used to set and activate/deactivate this additional function as follows:
The PRESSURE STEP (to be entered in dbar) represents the magnitude of the pressure value decrease to be exceeded before unlocking the action device. The minimum value for the PRESSURE STEP is 1% of measuring range of the pressure sensor.

The button ACTIVATE resp. DEACTIVATE is used to switch ON or OFF the SECONDARY UNLOCKING MECHANISM.

The button SEND TO INSTRUMENT is used to transfer the activating events to the instrument after modifications.

The buttons LOAD SCHEDULE and SAVE SCHEDULE give access to a list of operation templates that can be created, arranged and deleted by the end user. The position of the highlighted entry can be changed by means of the buttons ↑ and ↓. The button X is used to delete the highlighted entry. To re-name an entry just select it from the list and enter a new name.

The button PRINT SCHEDULE is used provide a hard copy of the current list of unlock and activating pressures on your printer.

The button EXPORT SCHEDULE is used store the current list of unlock and activating pressures in an ASCII-file.

Please note: Some instrument configurations offer more than one programming function. In this case the activation of the favoured programming function **for the instrument** is made inside CONTROLLING MODE or MONITORING MODE by clicking at the name of the programming function. This selection is permanently stored inside the instrument. A green tick inside the tick box **indicates the active programming function of the instrument**.

9.2.2.37. DEPTH PROGRAMMING FOR IWS

The CONTROLLING dialog DEPTH PROGRAMMING FOR IWS is used to programme START and END DEPTH of the sampling interval of the INTEGRATING WATER SAMPLER IWS.

The PHYSICAL UNIT can be selected at the Hand Unit as

Meter:	m (limnology)	**Please note:** Physical unit meter is not applicable in salt water!
Decibar:	dbar	

The button SEND TO INSTRUMENT is used to transfer the activating events to the instrument. Upon finishing the programming procedure, the entered data are checked and stored inside the Sampler. Additionally the maximum downward velocity v_max for the actual program is calculated and indicated.

The PROTOCOL message indicates the state of the previous operation:

OPERATION OK	The operation has been carried out successfully.
v max EXCEEDED	The maximum downward velocity was exceeded during the operation. The operation must be repeated with smaller velocity.
END PRESSURE MISSING	The Sampler did not pass the programmed end depth. The operation must be repeated with either longer rope or new program with smaller end depth.
BATTERY DISCHARGED	The accumulators of the Sampler are discharged. The operation must be repeated after charging the accumulators.

Please note, that programming can only be made when the Sampler is INACTIVE, the driving motor of the piston is not running and the FILLING level is 0%.

The button ACTIVATE resp. DEACTIVATE is used to switch the Sampler ON (ACTIVE) or OFF (INACTIVE).

Please note: Some instrument configurations offer more than one programming function. In this case the activation of the favoured programming function **for the instrument** is made inside CONTROLLING MODE or MONITORING MODE by clicking at the name of the programming function. This selection is permanently stored inside the instrument. A green tick inside the tick box **indicates the active programming function of the instrument**.

9.2.2.38. TIME PROGRAMMING FOR IWS

The CONTROLLING dialog TIME PROGRAMMING FOR IWS is used to programme START TIME and RUN TIME for time integrated samples.

The START TIME, which is the time of day (e.g. 10 o´clock) to start the sample, has to be entered in the format:

hh:mm	Hours and minutes within the interval 00:00 ... 23:59

Please note: The START TIME is programmed **WITHOUT** date specification, enabling the user to repeat a time integrated sampling scenario on regular basis without the need to re-programme the sampler.

The RUN TIME, which limits the integration time, has to be entered in the format:

hh:mm	Hours and minutes within the interval 00:01 ... 23:59

The button SEND TO INSTRUMENT is used to transfer the entered parameters to the instrument.

The PROTOCOL message indicates the state of the previous operation:

OPERATION OK	The operation has been carried out successfully.
END TIME MISSING	The Sampler has been deactivated before the RUN TIME had elapsed. The operation has to be repeated.
BATTERY DISCHARGED	The accumulators of the Sampler are discharged. The operation must be repeated after charging the accumulators.

Additionally the current date and time of the Sampler are displayed. To adjust the Samplers clock please select REAL TIME CLOCK inside the COMPONENTS WINDOW.

Please note that programming can only be made when the Sampler is INACTIVE, the driving motor of the piston is not running and the FILLING level is 0%.

The button ACTIVATE resp. DEACTIVATE is used to switch the Sampler ON (ACTIVE) or OFF (INACTIVE).

Please note: Some instrument configurations offer more than one programming function. In this case the activation of the favoured programming function **for the instrument** is made inside CONTROLLING MODE or MONITORING MODE by clicking at the name of the programming function. This selection is permanently stored inside the instrument. A green tick inside the tick box **indicates the active programming function of the instrument**.

9.2.2.39. SPOT SAMPLE FOR IWS

SPOT SAMPLING provides an easy way to achieve a sample of the complete sampler volume (full piston stroke) at a single depth level.

When immersed after activation, the sampler will automatically be armed upon detecting an increasing water depth within 3 successive seconds with a minimum lowering speed of 10 cm/s. The full piston stroke will start automatically when the sampler is stopped within a depth interval of max. ± 30 cm for min. 10 seconds. The piston stroke takes up to 50 seconds for the 2.5 l model and up to 100 seconds for the 5 l model.

The CONTROLLING dialog SPOT SAMPLE FOR IWS only allows to start (ACTIVATE) and stop (DEACTIVATE) the Sampler in spot sampling mode.

The PROTOCOL message indicates the state of the previous operation:

OPERATION OK	The operation has been carried out successfully.
BATTERY DISCHARGED	The accumulators of the Sampler are discharged. The operation must be repeated after charging the accumulators.

Please note that activation can only be made when the driving motor of the piston is not running and the FILLING level is 0%.

The button ACTIVATE resp. DEACTIVATE is used to switch the Sampler ON (ACTIVE) or OFF (INACTIVE).

Please note: Some instrument configurations offer more than one programming function. In this case the activation of the favoured programming function **for the instrument** is made inside CONTROLLING MODE or MONITORING MODE by clicking at the name of the programming function. This selection is permanently stored inside the instrument. A green tick inside the tick box **indicates the active programming function of the instrument**.

9.2.2.40. BOTTOM ALARM
The CONTROLLING dialog BOTTOM ALARM incorporates the indication of the sensors raw data only.

9.2.2.41. FILLING
The CONTROLLING dialog FILLING incorporates the indication of the sensors raw data and the possibility to read and modify the sensors calibration coefficient cal 0.
The calculation is made according to:

filling [%] = cal 0 * filling_raw

The button SEND TO FILLING SENSOR is used to transfer the calibration coefficient to the instrument after modifications.
The button FILL SAMPLER is used to run-out the piston of the Sampler.
The button EMPTY SAMPLER is used to run-down the piston of the Sampler.

9.2.2.42. REDOX (ORP)
The CONTROLLING dialog REDOX (ORP) incorporates the indication of the sensors raw data and the possibility to read and modify the sensors calibration coefficients (cal 0 … cal 1). The calibration coefficients are used as follows:

redox = cal 0 + cal 1 * redox_raw

The button SEND TO REDOX SENSOR is used to transfer the calibration coefficients to the instrument after modifications.

9.2.2.43. AMT-pH (DEEP SEA VERSION)

The CONTROLLING dialog AMT-pH (DEEP SEA VERSION) incorporates the indication of the sensors raw data, the indication of all additional measuring data used for the calculation and the possibility to read and modify the sensors calibration coefficients (cal 0 ... cal 3). The calibration coefficients are used as follows:

$U = cal\,0 + cal\,1 \cdot pH\_raw$ (needed during sensor calibration)

$$U = a_1 \cdot (pH - 7) + a_0$$

$$a_{1(20°C)} = a_1(T) \cdot f(T)$$

$$pH = \frac{f(T) \cdot (U - a_0)}{a_{1(20°C)}} + 7$$

$$f(T) = A_0 + A_1 T + A_2 T^2$$

with: T = temperature in °C

$A_0 = 1.0732$

$A_1 = -3.9093\,e-3$

$A_2 = 1.2333\,e-5$

$a_0 = cal\,2$

$a_{1(20°C)} = cal\,3$

The button SEND TO pH SENSOR is used to transfer the calibration coefficients to the instrument after modifications.

Assistance during sensor calibration is provided by a calculation tool, located in the lower area of the controlling dialog. Based on least squares method, this linear regression tool calculates cal 2 and cal 3 during calibration procedures as described in the AMT manual.

Enter temperature of buffer solutions (make sure that the temperature of the 3 buffer solutions is equal during calibration) into the "Temperature [°C]" box. Enter the pH values of the 3 buffer solutions into the "pH" boxes #1 ... #3. Enter the 3 "U [V]" values (as indicated in the top area of the controlling dialog) into the corresponding boxes or use buttons **<–** (located to the right of the "U [V]" boxes) to import actual "U [V]" value into the corresponding box.

The button CALIBRATE is used to calculate the calibration coefficients cal 2 and cal 3 and to transfer the coefficients to the instrument.

9.2.2.44. TriOS CHLOROPHYLL A, 2 RANGES

The CONTROLLING dialog CHLOROPHYLL A incorporates the indication of the sensors raw data, the indication of the actual measuring range, the possibility to read and modify the sensors calibration coefficients (cal 0 … cal 3) and to select a specific measuring range. The calibration coefficients are used as follows:

chlorophyll a [µg/l] = cal 0 + cal 1 * chla_raw
Measuring range 1

chlorophyll a [µg/l] = cal 2 + cal 3 * chla_raw
Measuring range 2

The RANGE SELECTION is utilized to select the measuring range of the CHLOROPHYLL A fluorometer. The table offers two measuring ranges.

Please note: Since the analogue interface of the TriOS fluorometer is used as interface to the HYDRO-BIOS equipment, the user must select the appropriate measuring range IDENTICALLY at two locations:
a) via OceanLab 3 or Deck Command Unit for the HYDRO-BIOS equipment
AND
b) via TriOS power supply and MSDA-XE software for the TriOS equipment
The auto-ranging function of the TriOS fluorometer is NOT applicable!

The button SEND TO CHLOROPHYLL A SENSOR is used to transfer the calibration coefficients to the instrument after modifications.

9.2.2.45. TriOS BLUE ALGAE, 2 RANGES

The CONTROLLING dialog BLUE ALGAE incorporates the indication of the sensors raw data, the indication of the actual measuring range, the possibility to read and modify the sensors calibration coefficients (cal 0 … cal 3) and to select a specific measuring range. The calibration coefficients are used as follows:

blue algae [µg/l] = cal 0 + cal 1 * blue_raw
Measuring range 1

blue algae [µg/l] = cal 2 + cal 3 * blue_raw
Measuring range 2

The RANGE SELECTION is utilized to select the measuring range of the BLUE ALGAE fluorometer. The table offers two measuring ranges.

Please note: Since the analogue interface of the TriOS fluorometer is used as interface to the HYDRO-BIOS equipment, the user must select the appropriate measuring range IDENTICALLY at two locations:
a) via OceanLab 3 or Deck Command Unit for the HYDRO-BIOS equipment
AND
b) via TriOS power supply and MSDA-XE software for the TriOS equipment
The auto-ranging function of the TriOS fluorometer is NOT applicable!

The button SEND TO BLUE ALGAE SENSOR is used to transfer the calibration coefficients to the instrument after modifications.

9.2.2.46. OXYGEN (JFE ALEC RINKO 3) [%sat]

The CONTROLLING dialog OXYGEN (JFE ALEC RINKO 3) [% sat] incorporates the indication of the sensors raw data, the indication of all additional measuring data used for the calculation and the possibility to read and modify the sensors calibration coefficients (cal 0 ... cal 15).

Due to a non-disclosure agreement with the manufacturer of the sensor we are not allowed to publish the complete algorithms used for the computation. The calibration coefficients are used as follows:

oxygen [% sat] = **confidential formula**

with: cal 4 = A (oxygen) of RINKO 3
cal 5 = B (oxygen) of RINKO 3
cal 6 = C (oxygen) of RINKO 3
cal 7 = D (oxygen) of RINKO 3
cal 8 = E (oxygen) of RINKO 3
cal 9 = F (oxygen) of RINKO 3
cal 10 = G (oxygen) of RINKO 3
cal 11 = H (oxygen) of RINKO 3

$$U_O = cal\,0 + cal\,1 \cdot oxygen\_raw$$

$$d = pressure\,[dbar] \cdot 0.01$$

$$U_T = cal\,2 + cal\,3 \cdot oxygen\_temp\_raw$$

$$t = cal\,12 + cal\,13 \cdot U_T + cal\,14 \cdot U_T^2 + cal\,15 \cdot U_T^3$$

cal 12 = A (temperature) of RINKO 3
cal 13 = B (temperature) of RINKO 3
cal 14 = C (temperature) of RINKO 3
cal 15 = D (temperature) of RINKO 3

The button SEND TO OXYGEN SENSOR is used to transfer the calibration coefficients to the instrument after modifications.

Assistance during sensor calibration is provided by a calculation tool, located in the lower area of the controlling dialog. Based on the original JFE ALEC calibration formulas, this regression tool re-calculates G (= cal 10) and H (= cal 11) of the oxygen channel during calibration as described in the JFE ALEC manual.

$$cal\,10\,new = \frac{cal\,10\,old - oxygen_1}{oxygen_2 - oxygen_1} \cdot O_{sat}$$

$$cal\,11\,new = \frac{O_{sat}}{oxygen_2 - oxygen_1} \cdot cal\,11\,old$$

with: $oxygen_1$ = calculated oxygen saturation level inside the 0% - oxygen water
$oxygen_2$ = calculated oxygen saturation level inside the 100% - oxygen water

$$O_{sat} = \frac{p - p_v}{1013.25 - p_v} \cdot 100$$

with: p = atmospheric pressure [hPa] during calibration

$$p_v = 6.11 \cdot 10^{\frac{7.5 \cdot t}{237.3 + t}}$$

Enter atmospheric pressure [hPa] (to be detected during calibration process) into the appropriate box (default value: standard atmospheric pressure at sea level of 1013.25 hPa).
Create "100% - oxygen water" according to the JFE ALEC manual. Put the sensor into the water and use button **<–** (located to the right of the "100% - oxygen water" box) to import actual oxygen saturation into the corresponding box.
Create "0% - oxygen water" according to the JFE ALEC manual. Put the sensor into the water and use button **<–** (located to the right of the "0% - oxygen water" box) to import actual oxygen saturation into the corresponding box.
Use button CALIBRATE to calculate the new coefficients cal 10 and cal 11 and to transfer the coefficients to the instrument.

9.2.2.47. OXYGEN (JFE ALEC RINKO 3) [ml/l]
The OXYGEN (JFE ALEC RINKO 3) [ml/l] sensor is a virtual device with calculated data.
The CONTROLLING dialog OXYGEN (JFE ALEC RINKO 3) [ml/l] displays all measuring data used for the calculation and the calculation formulas.

oxygen [ml/l] = C * oxygen [% sat] / 100

$$C = \exp\left(-173.4292 + 249.6339 \cdot \left(\frac{100}{T}\right) + 143.3483 \cdot \ln\left(\frac{T}{100}\right) - 21.8492 \cdot \left(\frac{T}{100}\right) + S \cdot \left(-0.033096 + 0.014259 \cdot \left(\frac{T}{100}\right) - 0.001700 \cdot \left(\frac{T}{100}\right)^2 \right)\right)$$

with: $T = t + 273.15$
S = salinity

9.2.2.48. OXYGEN (JFE ALEC RINKO 3) [mg/l]
The OXYGEN (JFE ALEC RINKO 3) [mg/l] sensor is a virtual device with calculated data.
The CONTROLLING dialog OXYGEN (JFE ALEC RINKO 3) [mg/l] displays all measuring data used for the calculation and the calculation formulas.

oxygen [mg/l] = oxygen [ml/l] * 1.4289

9.2.2.49. ALTIMETER
The CONTROLLING dialog ALTIMETER incorporates the indication of the sensors raw data and the possibility to read and modify the sensors calibration coefficients (cal 0 … cal 1). The calibration coefficients are used as follows:

altimeter [m] = cal 0 + cal 1 * alti_raw

The button SEND TO ALTIMETER SENSOR is used to transfer the calibration coefficients to the instrument after modifications.

9.2.2.50. PITCH AND ROLL
The CONTROLLING dialog PITCH AND ROLL incorporates the indication of the sensors raw data and the possibility to read and modify the sensors calibration coefficients (cal 0 … cal 3). The calibration coefficients are used as follows:

pitch [°] = arcsin ((pitch_raw - cal 0) / cal 1)

roll [°] = arcsin ((roll_raw - cal 2) / cal 3)

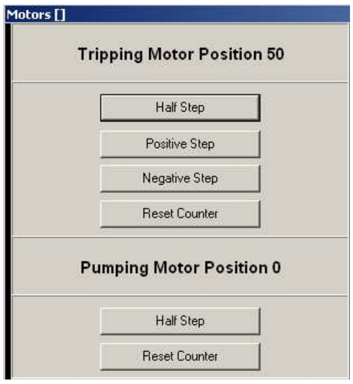
Please note: The measuring range of both channels is limited to ± 60° related to the horizontal. When exceeding this range the displayed value will be replaced by " - - - ".

The button SEND TO PITCH AND ROLL SENSOR is used to transfer the calibration coefficients to the instrument after modifications.

The button RESET PITCH AND ROLL SENSOR is used to re-calibrate the zero-offset of the pitch and roll sensor (and modifies cal 0 and cal 2). Use function whilst Underwater Unit stands on flat grounds in exact horizontal position only! This function is not applicable when the Underwater Unit stands on a ship!

Please note that both channels (PITCH and ROLL) are always re-calibrated simultaneously.

9.2.2.51. MOTORS (AFIS)



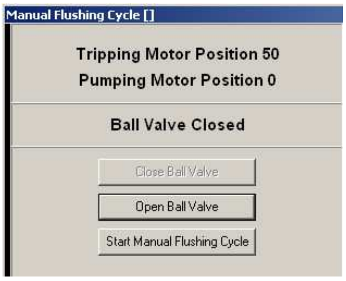
The CONTROLLING dialog MOTORS (AFIS) is used to control the electric motors of the AFIS manually. The functions of this dialog are needed for factory adjustments and synchronization purposes only and thus are **disabled for regular operations to avoid damages at the instrument due to misuse**. Please contact the HYDRO-BIOS office for additional instructions in case you need to use the functions.

The dialog is divided in two blocks: TRIPPING MOTOR for the ball valves and the injection valve, PUMPING MOTOR for the piston pump.

TRIPPING MOTOR:
The button HALF STEP is used for synchronization purposes of electric motor and valve mechanics. The motor axle will carry out a **half** revolution (positive direction) and the position counter will be set to zero.
The button POSITIVE STEP is used for synchronization purposes of electric motor and valve mechanics. The motor axle will carry out a **full** revolution (direction: **close** ball valve and injection valve) and the position counter will be set to zero.
The button NEGATIVE STEP s used for synchronization purposes of electric motor and valve mechanics. The motor axle will carry out a **full** revolution (direction: **open** ball valve and injection valve) and the position counter will be set to zero.
The button RESET COUNTER is used to set the position counter to zero **without** a rotating the axle.

PUMPING MOTOR:
The button HALF STEP is used for synchronization purposes of electric motor and piston pump mechanics. The motor axle will carry out a **half** revolution and the position counter will be set to zero.
The button RESET COUNTER is used to set the position counter to zero **without** a rotating the axle.

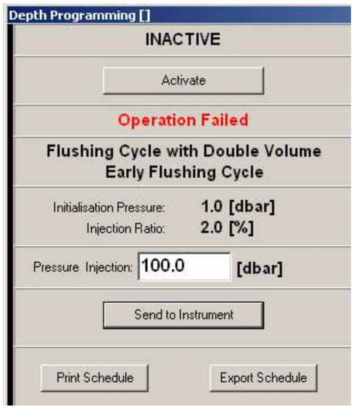
9.2.2.52. MANUAL FLUSHING CYCLE (AFIS)



The MANUAL FLUSHING CYCLE (AFIS) provides an easy tool to prime the injection system with injection fluid after mounting a new injection fluid bag and to clean the injection system with fresh water before storage.
The button START MANUAL FLUSHING CYCLE automatically **closes** the ball valve of the sampler and flushes the injection system with approx. 250ml of the injection fluid.
Use the button OPEN BALL VALVE to remove the injection fluid used for flushing and to clean the inside of the sampling tube.
Use the button CLOSE BALL VALVE to close the sampler for storage.

9.2.2.53. DEPTH PROGRAMMING (AFIS)

The CONTROLLING dialog DEPTH PROGRAMMING (AFIS) is used to programme the activating depth (pressure) for the Automatic Fluid Injection Sampler AFIS.



Please note, that programming can only be made when the Sampler is INACTIVE.

The PRESSURE INJECTION, representing the depth to start the sampling process, has to be entered in dbar.

The button SEND TO INSTRUMENT is used to transfer the activating event to the instrument. Upon finishing the programming procedure, the entered data are checked and stored inside the instrument.

The PROTOCOL message indicates the state of the **previous** operation:

OPERATION OK	The operation has been carried out successfully.
OPERATION FAILED	The operation could not be executed. Please repeat the operation after checking configuration and programming of the sampler and make sure that your mission corresponds to the sampler settings.
BATTERY DISCHARGED	The batteries of the Sampler are discharged. The operation must be repeated after charging the batteries.
SAMPLER MANUALLY DEACTIVATED	The operation has manually been interrupted by a user command

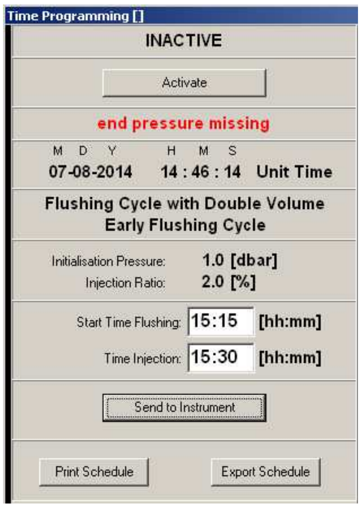
Additionally the current instrument configuration in view of initialization pressure, flushing cycle and injection fluid ratio is displayed for your information.
Pay special attention to the initialization pressure value because the sampler is locked until passing the initialization pressure **and** an EARLY FLUSHING CYCLE (when activated inside the SAMPLER SETTINGS) will only be carried out when passing the initialization pressure.

The button ACTIVATE resp. DEACTIVATE is used to switch the instrument ON (ACTIVE) or OFF (INACTIVE).

Please note: Some instrument configurations offer more than one programming function. In this case the activation of the favoured programming function **for the instrument** is made inside CONTROLLING MODE by clicking at the name of the programming function. This selection is permanently stored inside the instrument. A green tick inside the tick box **indicates the active programming function of the instrument**.

9.2.2.54. TIME PROGRAMMING (AFIS)

The CONTROLLING dialog TIME PROGRAMMING (AFIS) is used to programme the activating time for the Automatic Fluid Injection Sampler AFIS.



Please note, that programming can only be made when the Sampler is INACTIVE.

The TIME INJECTION, which is the **time of day** (e.g. 10 o´clock) to start the sampling process, has to be entered in the format:

hh:mm Hours and minutes within the interval 00:00 ... 23:59

Please note: The TIME INJECTION is programmed **WITHOUT** date specification!

The START TIME FLUSHING, which is the **time of day** (e.g. 10 o´clock) to start the flushing cycle as selected inside the SAMPLER SETTINGS, has to be entered in the format:

hh:mm Hours and minutes within the interval 00:00 ... 23:59

Please note: The START TIME FLUSHING is programmed **WITHOUT** date specification!

The button SEND TO INSTRUMENT is used to transfer the entered parameters to the instrument.

The PROTOCOL message indicates the state of the **previous** operation:

OPERATION OK	The operation has been carried out successfully.
OPERATION FAILED	The operation could not be executed. Please repeat the operation after checking configuration and programming of the sampler and make sure that your mission corresponds to the sampler settings.
BATTERY DISCHARGED	The batteries of the Sampler are discharged. The operation must be repeated after charging the batteries.
SAMPLER MANUALLY DEACTIVATED	The operation has manually been interrupted by a user command

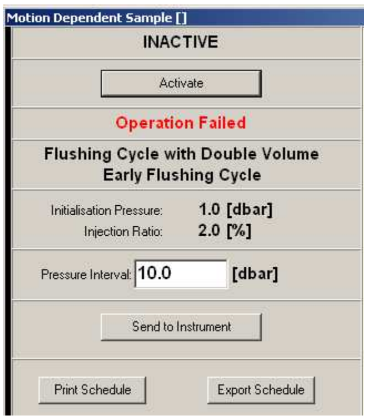
Additionally to date and time of the instruments real-time clock the current instrument configuration in view of initialization pressure, flushing cycle and injection fluid ratio is displayed for your information.
Pay special attention to the initialization pressure value because the sampler is locked until passing the initialization pressure.

The button ACTIVATE resp. DEACTIVATE is used to switch the Sampler ON (ACTIVE) or OFF (INACTIVE).

Please note: Some instrument configurations offer more than one programming function. In this case the activation of the favoured programming function **for the instrument** is made inside CONTROLLING MODE by clicking at the name of the programming function. This selection is permanently stored inside the instrument. A green tick inside the tick box **indicates the active programming function of the instrument**.

9.2.2.55. MOTION DEPENDENT SAMPLE (AFIS)

MOTION DEPENDENT SAMPLE (AFIS) provides an easy way to achieve a sample by simply lowering the sampler to the scheduled depth and thereafter keeping it within a pre-defined depth interval.



When immersed after activation, the sampler will automatically take a sample when stopped after lowering within a programmable PRESSURE INTERVAL for at least 1 minute.

The PRESSURE INTERVAL has to be entered in dbar.

Please note, that programming can only be made when the Sampler is INACTIVE.

The button SEND TO INSTRUMENT is used to transfer the entered parameters to the instrument.

The PROTOCOL message indicates the state of the **previous** operation:

OPERATION OK	The operation has been carried out successfully.
OPERATION FAILED	The operation could not be executed. Please repeat the operation after checking configuration and programming of the sampler and make sure that your mission corresponds to the sampler settings.
BATTERY DISCHARGED	The batteries of the Sampler are discharged. The operation must be repeated after charging the batteries.
SAMPLER MANUALLY DEACTIVATED	The operation has manually been interrupted by a user command

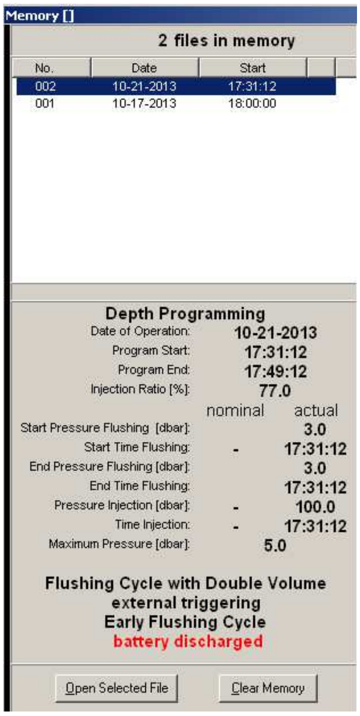
Additionally the current instrument configuration in view of initialization pressure, flushing cycle and injection fluid ratio is displayed for your information.
Pay special attention to the initialization pressure value because the sampler is locked until passing the initialization pressure **and** an EARLY FLUSHING CYCLE (when activated inside the SAMPLER SETTINGS) will only be carried out when passing the initialization pressure.

The button ACTIVATE resp. DEACTIVATE is used to switch the Sampler ON (ACTIVE) or OFF (INACTIVE).

Please note: Some instrument configurations offer more than one programming function. In this case the activation of the favoured programming function **for the instrument** is made inside CONTROLLING MODE by clicking at the name of the programming function. This selection is permanently stored inside the instrument. A green tick inside the tick box **indicates the active programming function of the instrument**.

9.2.2.56. MEMORY (AFIS)

The CONTROLLING dialog MEMORY (AFIS) is used to get access to the protocol files, created by the Sampler during operation.



All protocol files are stored at the PC inside the disk file AFIS_nnnn.hbp (where nnnn is the identification number of the Sampler). The disk file is located inside the logfiles directory of OceanLab. Please refer to chapter 6. FILE MANAGEMENT to locate the directory at your PC.

All new protocol files of the Sampler are automatically appended to this disk file when a communication between Sampler and OceanLab has been established. Thus the FILE table always incorporates the complete protocol history of the currently connected AFIS in chronological order (bottom to top).

Each protocol file can be opened inside the FILE table by double-click (or button OPEN SELECTED FILE) to enter individual operation descriptions (operators name and location) and to print an operation protocol. A protocol file already connected with operation descriptions is marked by X inside the FILE table.

The number of FILES IN MEMORY inside the Sampler is limited to 500. Make sure to delete the files in memory by using button CLEAR MEMORY before reaching 500 FILES IN MEMORY.

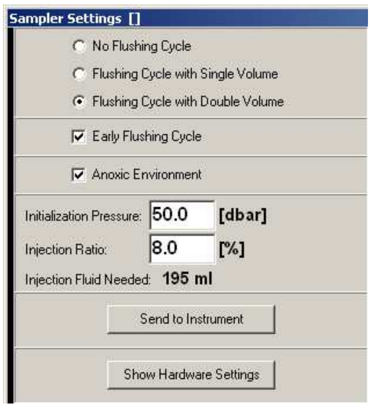
9.2.2.57. SAMPLER SETTINGS (AFIS)

The CONTROLLING dialog SAMPLER SETTINGS (AFIS) is used to get access to the configuration of the Sampler. The dialog is divided in two sections: Settings for individual operations (always visible) and global settings (hidden).

Please note, that the settings can only be modified when the Sampler is INACTIVE.

Settings for individual operations:

Tick boxes are used to select the type of flushing cycle (NO / SINGLE VOLUME / DOUBLE VOLUME).



Activate EARLY FLUSHING CYCLE when the flushing cycle shall be started upon passing the INITIALIZATION PRESSURE.

Activate ANOXIC ENVIRONMENT for sampling in areas with low-oxygen concentration. This function automatically CLOSES and OPENS the ball valves of the sampler once (immediately after finishing the FLUSHING CYCLE) and removes residual air bubbles which may stick to the ball or ball valve housing. This function is **inactive** when selecting NO FLUSHING CYCLE.

The INITIALIZATION PRESSURE is a safety function which disables the complete sampler until passing this pressure value. On the one hand it avoids accidental spillage of potentially harmful injection fluid when the sampler is onboard. On the other hand this pressure value is also used to start the EARLY FLUSHING CYCLE (when activated) and to start filling of the injection cylinder.
Please enter the INITIALIZATION PRESSURE in dbar.

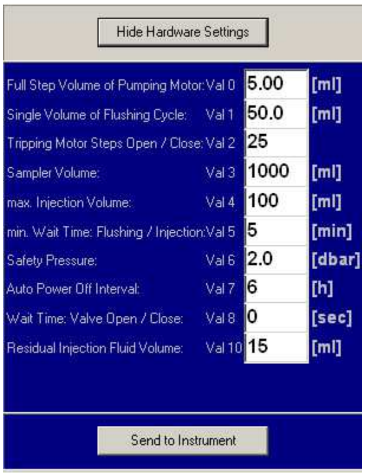
Enter the INJECTION RATIO, representing the desired concentration of fixing agent inside the sample in percent by volume. Thereupon OceanLab computes and indicates the injection fluid volume needed for the operation.

The button SEND TO INSTRUMENT is used to transfer the entered parameters to the instrument.

The button SHOW HARDWARE SETTINGS opens the global settings of the sampler which need no regular modification. Some of the functions of this dialog are needed for factory adjustments only and thus are **disabled for regular operations to avoid damages at the instrument due to misuse**. Please contact the HYDRO-BIOS office for additional instructions in case you need to use the functions.

Global settings of the sampler for all operations:

The FULL STEP VOLUME OF PUMPING MOTOR is a coefficient which is used to balance production tolerances for the pump - **do NOT modify!**



The SINGLE VOLUME OF FLUSHING CYCLE is factory-adjusted to a value that completely flushes the entire injection system. It can be increased when flushing with excess volume is needed.

The number of TRIPPING MOTOR STEPS OPEN / CLOSE is a coefficient which is used to balance production tolerances for the ball valve gear - **do NOT modify!**

The SAMPLER VOLUME is a device constant - **do NOT modify!**

The MAX. INJCETION VOLUME represents the max. capacity of the injection fluid bags and thus is a device constant - **do NOT modify!**

The MIN. WAIT TIME FLUSHING / INJECTION limits the minimum lapse of time between flushing and starting the sampling process. It may be increased when operating the sampler without early flushing to ensure full exchange of water inside the sampler after flushing.

The SAFETY PRESSURE is used to adjust the minimum submerging depth of the sampler during sampling. When passing the SAFETY PRESSURE during upcast, the sampler will be de-activated and any pressure inside the injection cylinder will be released.

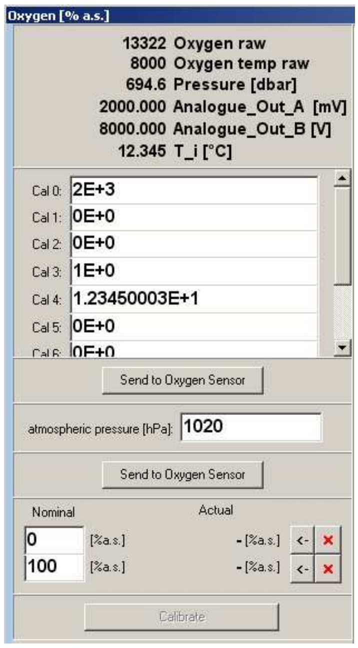
The AUTO POWER OFF INTERVAL only influences depth dependent, time dependent and motion dependent sampling. It adjusts the waiting time of the power saving function.
When operating the sampler with mechanical activation inside a rosette system the AUTO POWER OFF INTERVAL is not applicable.

The WAIT TIME: VALVE OPEN / CLOSE is factory-adjusted to a proven value - **do NOT modify!**

The RESIDUAL INJECTION FLUID VOLUME represents the minimum volume of injection fluid that has to remain inside the injection fluid bag due to technical reasons - **do NOT modify!**.

The button SEND TO INSTRUMENT is used to transfer the entered parameters to the instrument.

9.2.2.58. OXYGEN (SST) [% a.s.]



The CONTROLLING dialog OXYGEN (SST) [% a.s.] incorporates the indication of the sensors raw data, the indication of all additional measuring data used for the calculation and the possibility to read and modify the sensors calibration coefficients (cal 0 ... cal 9). The calibration coefficients are used as follows:

Analogue_Output_A [mV]:
Analogue_Output_A [mV] = cal 0 + cal 1 * oxygen_raw
cal 0 = A[0] of SST/rawO2
cal 1 = A[1] of SST/rawO2

Analogue_Output_B [V]:
Analogue_Output_B [V] = cal 2 + cal 3 * oxygen_temp_raw
cal 2 = A[0] of SST/T_iS
cal 3 = A[1] of SST/T_iS

actual temperature [°C]:
T_i [°C] = cal 4 + cal 5 * Analogue_Output_B
cal 4 = A[2] of SST/T_iS
cal 5 = A[3] of SST/T_iS

actual oxygen partial pressure [mbar]:
pO2 [mbar] = (Analogue_Output_A - cal 6) * cal 7 * cal 8
cal 6 = A[4] of SST/rawO2
cal 7 = A[1] of SST/O_P
cal 8 = A[5] of SST/rawO2

water pressure compensated oxygen partial pressure [mbar]:
pO2wpc [mbar] = pO2 [mbar] * (1 + pressure [dbar] * cal 9)
cal 9 = A[3] of SST/O_P

dissolved oxygen % air saturation [% a.s.]:
oxygen [% a.s.] = 100 % * pO2wpc [mbar] / p100O2 [mbar]
p100O2 [mbar] = 0,2095 * (cal 10 - pH2O(T) [mbar])
cal 10 = atmospheric pressure [mbar]
pH2O(T) [mbar] = 6,112 * exp(17,62 * T_i [°C] / (243,12 + T_i [°C]))

Assistance during sensor calibration is provided by a calculation tool, located in the lower area of the controlling dialog. Based on the original SEA & SUN TECHNOLOGY formulas, this regression tool re-calculates cal 6 (zero offset) and cal 8 (slope) of the oxygen channel as described in the SEA & SUN TECHNOLOGY manual.

$$cal6_{new} = Analogue\_Output\_A_1 - \frac{Analogue\_Output\_A_2 - Analogue\_Output\_A_1}{pO2_2 - pO2_1} \cdot pO2_1$$

$$cal8_{new} = \frac{pO2_2 - pO2_1}{(Analogue\_Output\_A_2 - Analogue\_Output\_A_1) \cdot cal7}$$

$$pO2_i = \frac{oxygen_i \cdot 0.2095 \cdot \left(cal10 - \left(6.112 \cdot \exp\left(\frac{17.62 \cdot T\_i_i}{243.12 + T\_i_i}\right)\right)\right)}{100 \cdot (1 + pressure_i \cdot cal9)}$$

with: i = 1, 2
where $oxygen_i$ is the respective NOMINAL value as entered inside OceanLab

Enter atmospheric pressure [hPa] (to be detected during calibration process) into the appropriate box (default value: standard atmospheric pressure at sea level of 1013.25 hPa) and click button SEND TO OXYGEN SENSOR once.

Please note: The current atmospheric pressure [hPa] directly affects the oxygen measurements and thus is handled as additional calibration coefficient and stored inside the instrument. For accurate oxygen measurements it is advisable to check the current atmospheric pressure and, if necessary, enter it into the appropriate box before any operation.

Create "0% - oxygen water" according to the SEA & SUN TECHNOLOGY manual. Enter "0" into the UPPER nominal oxygen value box. Put the sensor into the water and use button **<–** (located to the right of the "0% - oxygen water" box) to import actual oxygen saturation into the calibration table. Use button x to remove the value from the calibration table when needed.
Create "100% - oxygen water" according to the SEA & SUN TECHNOLOGY manual. Enter "100" into the LOWER nominal oxygen value box. Put the sensor into the water and use button **<–** (located to the right of the "100% - oxygen water" box) to import actual oxygen saturation into the calibration table. By clicking button x once the value from the calibration table will be removed when needed.
(When performing the calibration with the optional SEA & SUN TECHNOLOGY air cap make sure to enter "97.5%" into the LOWER nominal oxygen value box.)
Use button TWO POINT CALIBRATION to calculate the new coefficients cal 6 and cal 8 and to transfer the coefficients to the instrument.

In case just the slope shall be corrected (without touching the zero offset value) also a ONE POINT CALIBRATION can be carried out:

$$cal6_{new} = cal6_{old}$$

$$cal8_{new} = \frac{pO2_2}{(Analogue\_Output\_A_2 - cal6_{new}) \cdot cal7}$$

Create "100% - oxygen water" according to the SEA & SUN TECHNOLOGY manual. Enter "100" into the LOWER nominal oxygen value box. Put the sensor into the water and use button **<–** (located to the right of the "100% - oxygen water" box) to import actual oxygen saturation into the calibration table. By clicking button x once the value from the calibration table will be removed when needed.
(When performing the calibration with the optional SEA & SUN TECHNOLOGY air cap make sure to enter "97.5%" into the LOWER nominal oxygen value box.)
Use button ONE POINT CALIBRATION to calculate the new coefficient cal 8 and to transfer the coefficient to the instrument.

9.2.2.59. OXYGEN (SST) [mg/l]

The OXYGEN (SST) [mg/l] sensor is a virtual device with calculated data.
The CONTROLLING dialog OXYGEN (SST) [mg/l] displays all measuring data used for the calculation and the calculation formulas (according to Benson and Krause 1980 / 1984) as follows:

oxygen [mg/l] = DO [mg/l] * oxygen [% a.s.] / 100 %

oxygen saturation concentration [mg/l]:

$$DO = DO_0 \cdot F_S \cdot F_P$$

baseline oxygen saturation concentration at zero salinity and one atmosphere [mg/l]:

$$DO_0 = \exp\left(-139.34411 + \frac{1.575701 \cdot 10^5}{T} - \frac{6.642308 \cdot 10^7}{T^2} + \frac{1.243800 \cdot 10^{10}}{T^3} - \frac{8.621949 \cdot 10^{11}}{T^4}\right)$$

salinity correction factor:

$$F_S = \exp\left(-S \cdot \left(0.017674 - \frac{10.754}{T} + \frac{2140.7}{T^2}\right)\right)$$

pressure correction factor:

$$F_P = \frac{(P-u) \cdot (1-\theta_0 \cdot P)}{(1-u) \cdot (1-\theta_0)}$$

correction factor for non-ideal gases:

$$\theta_0 = 0.000975 - 1.426 \cdot 10^{-5} \cdot T\_i + 6.436 \cdot 10^{-8} \cdot T\_i^2$$

vapor pressure of water [atm]:

$$u = \exp\left(11.8571 - \frac{3840.70}{T} - \frac{216961}{T^2}\right)$$

temperature [K]:

$$T = T\_i + 273.15$$

barometric pressure [atm]:

$$P = \frac{cal10}{1013.25}$$

salinity [PSU]:

$$S = salinity$$

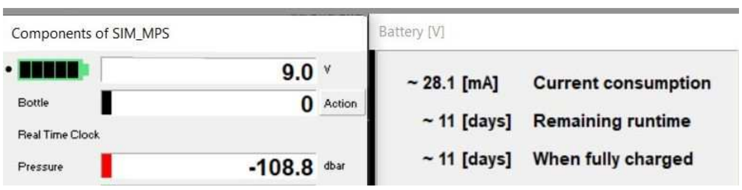
9.2.2.60. OXYGEN (SST) [ml/l]

The OXYGEN (SST) [ml/l] sensor is a virtual device with calculated data.
The CONTROLLING dialog OXYGEN (SST) [ml/l] displays the measuring data used for the calculation (OXYGEN (SST) [mg/l]) and the calculation formula as follows:

oxygen [ml/l] = oxygen [mg/l] / 1.42905

9.2.2.61. RECHARGEABLE BATTERY PACK

For the Rechargeable Battery Pack LiFePo 7500mAh this dialog provides information about state of charge, present power consumption, estimated remaining runtime and total runtime of a fully charged battery.



9.3. VIEWER MODULE

To view disk files of previous operations OceanLab 3 offers the VIEWER MODULE. It is accessible via the button OPEN FILE inside the toolbar or menu item OPEN FILE inside the FILE menu.
The 6 previous data files are accessible by menu item LAST FILES inside the FILE menu.

The disk files are located inside the sub-directory LOGFILES of the installation directory of OceanLab 3. The default directory is C:\HYDRO-BIOS\OceanLab3\Logfiles.

Please note that the VIEWER MODULE can not open files in ASCII-format (file extension “txt”), even if created by OceanLab 3 itself!

The VIEWER MODULE can only be started when no session or simulation is active and no file is opened inside OceanLab 3.

The VIEWER MODULE incorporates the following independent program windows.

9.3.1. GRAPHS WINDOW

Inside the GRAPHS window a time- or pressure-depending graph visualizes the measuring data of the complete selected mission. Alternatively the graph can be replaced by a tabulated data list. The appearance of the GRAPHS window can be selected inside the VIEW menu of the MAIN window.

To enlarge a specific area inside the graphic mark the region of interest with the mouse whilst left button pressed. To zoom the graphic please use the wheel of the mouse or + and – keys at the keyboard. To navigate inside the GRAPHS window please use the right mouse button or the scroll bars. To return to the initial state of the graphs window (displaying the complete operation) double-click somewhere inside the graph.

To select a parameter for the vertical axis of the GRAPHS window please click at the parameter inside the COMPONENTS window.

Inside the time-depending GRAPHS window blue boxes mark the positions of the header information, yellow boxes mark the positions of LOGFILE EDITOR comments connected to the data file. Red boxes mark the positions of LOGFILE EDITOR comments automatically created by OceanLab 3 when communication problems occur during the mission. To open a LOGFILE EDITOR comment click once at the blue, yellow or red box or select it inside the COMMENTS menu.

To mark a point of interest the time-depending graph offers a vertical red marking line. This marking line can be moved via drag-and-drop (left mouse button) or ← and → keys of the keyboard (use STRG- resp. CTRL-key of the keyboard to increase the step size).

9.3.2. COMPONENTS WINDOW

Inside the tabulated COMPONENTS window the measuring data of the point of interest, marked with a vertical red line inside the time-depending GRAPHS window, and data calculated from the measuring data are displayed in engineering units.

To hide a parameter completely inside the VIEWER MODULE unselect it inside the COMPONENTS menu.

The configuration dialog of a parameter is accessible by clicking with the right mouse button at the parameter inside the COMPONENTS window and selecting OPTIONS inside the pop-up menu. Inside the OPTIONS dialog the user can adjust the settings of the GRAHPS window (line colour, line width, visibility of line, line inverted, upper and lower limit of the vertical axis), the settings of the engineering units (number of digits after decimal point) and the visibility of an additional VALUE window.

9.3.3. LOGFILE EDITOR

The LOGFILE EDITOR comments connected to the data files (see MONITORING MODE) are accessible by clicking once at the blue, yellow or red boxes of interest inside the time-depending GRAPHS window or by selecting them inside the COMMENTS menu. Existing comments can be modified inside the LOGFILE EDITOR. New comments can be created at the point of interest, marked with the vertical red line inside the time-depending GRAPHS window (see above), by pressing the space bar at the keyboard of the PC.

Please note that all modifications force OceanLab 3 to create new data and comments files (with numerical index) inside the corresponding sub-directory (see FILE MANAGEMENT).

9.3.4. CONTROLLING

The CONTROLLING dialogs of the VIEWER MODULE are intended to enable the user to modify calibration coefficients of the sensors when a HYDRO-BIOS system has been operated with wrong calibration by mistake.

To get access to the CONTROLLING dialogs of the VIEWER MODULE click on button CONTROLLING inside the toolbar.

The appearance of the controlling dialogs is similar to the CONTROLLING dialogs of the CONTROLLING MODE but allows only to modify the calibration coefficients of the instruments sensors.

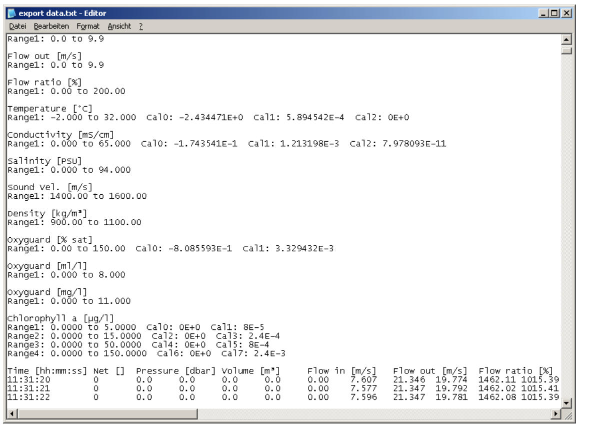
Please note that all modifications force OceanLab 3 to create new data and comments files (with numerical index) inside the corresponding sub-directory (see FILE MANAGEMENT).

9.3.5. EXPORT

9.3.5.1. DATA

The data files created by OceanLab 3 are stored at the PC in binary format. To export physical data of complete binary files in ASCII-format for use with current word-processing, spreadsheet and data base software please use item DATA of the EXPORT menu inside the FILE menu.

The LOGFILE EDITOR comments will be incorporated into the export files.



```
Range1: 0.0 to 9.9

Flow out [m/s]
Range1: 0.0 to 9.9

Flow ratio [%]
Range1: 0.00 to 200.00

Temperature [°C]
Range1: -2.000 to 32.000  Cal0: -2.434471E+0  Cal1: 5.894542E-4  Cal2: 0E+0

Conductivity [mS/cm]
Range1: 0.000 to 65.000  Cal0: -1.743541E-1  Cal1: 1.213198E-3  Cal2: 7.978093E-11

Salinity [PSU]
Range1: 0.000 to 94.000

Sound Vel. [m/s]
Range1: 1400.00 to 1600.00

Density [kg/m³]
Range1: 900.00 to 1100.00

Oxyguard [% sat]
Range1: 0.00 to 150.00  Cal0: -8.085593E-1  Cal1: 3.329432E-3

Oxyguard [ml/l]
Range1: 0.000 to 8.000

Oxyguard [mg/l]
Range1: 0.000 to 11.000

Chlorophyll a [µg/l]
Range1: 0.0000 to 5.0000  Cal0: 0E+0  Cal1: 8E-5
Range2: 0.0000 to 15.0000  Cal2: 0E+0  Cal3: 2.4E-4
Range3: 0.0000 to 50.0000  Cal4: 0E+0  Cal5: 8E-4
Range4: 0.0000 to 150.0000  Cal6: 0E+0  Cal7: 2.4E-3

Time [hh:mm:ss] Net []  Pressure [dbar] Volume [m³]     Flow in [m/s]   Flow out [m/s]   Flow ratio [%]
11:31:20        0       0.0     0.0     0.0     0.0     0.00    7.607   21.346  19.774   1462.11 1015.39
11:31:21        0       0.0     0.0     0.0     0.0     0.00    7.577   21.347  19.792   1462.02 1015.41
11:31:22        0       0.0     0.0     0.0     0.0     0.00    7.596   21.347  19.781   1462.08 1015.39
```

9.3.5.2. ZOOMED DATA

With active time-depending graph an additional menu item ZOOMED DATA is enabled. It allows to export physical data files in ASCII format of the time interval actually visible inside the GRAPHS window.

9.3.5.3. RAW DATA

The data files created by OceanLab 3 are stored at the PC in binary format. To export raw data of the complete binary files in ASCII-format for use with current word-processing, spreadsheet and data base software please use item RAW DATA of the EXPORT menu inside the FILE menu.

The LOGFILE EDITOR comments will be incorporated into the export files.

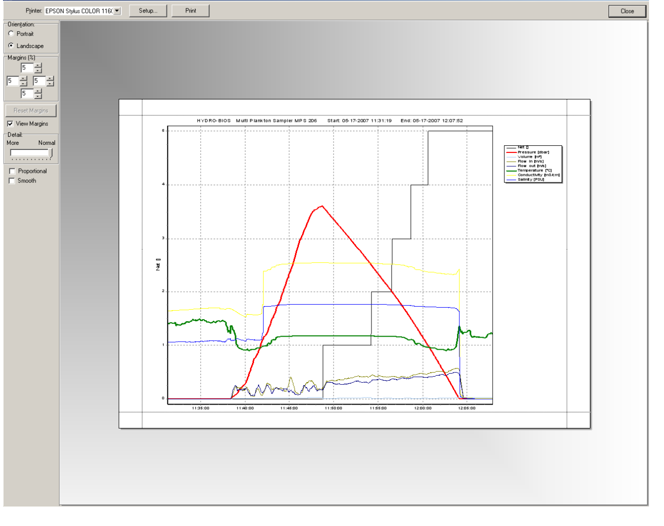
9.3.5.4. ZOOMED RAW DATA

With active time-depending graph an additional menu item ZOOMED RAW DATA is enabled. It allows to export raw data files in ASCII format of the time interval actually visible inside the GRAPHS window.

9.3.6. PRINT

9.3.6.1 GRAPH

All printers available inside the actual PC configuration can be used to create a hardcopy of the graph as actually visible inside the GRAPHS window. Please use item GRAPH of the PRINT menu inside the FILE menu.

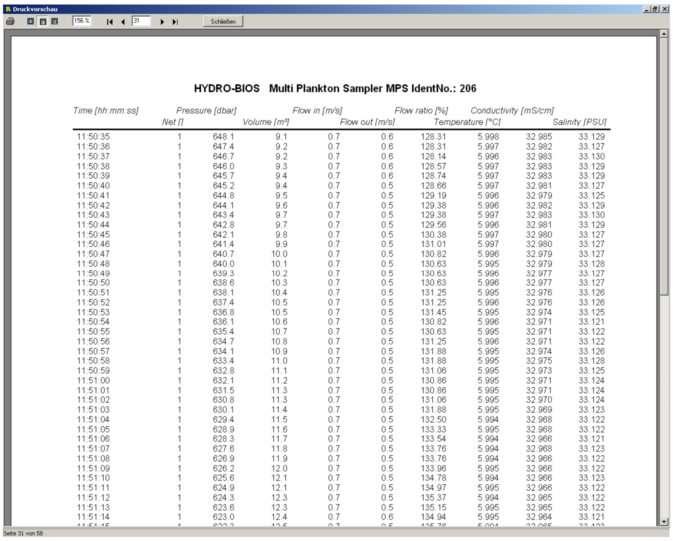


9.3.6.2. DATA

All printers available inside the actual PC configuration can be used to print the complete physical data file as tabulated list. Please use item DATA of the PRINT menu inside the FILE menu.

9.3.6.3. RAW DATA

All printers available inside the actual PC configuration can be used to print the complete raw data file as tabulated list. Please use item RAW DATA of the PRINT menu inside the FILE menu.

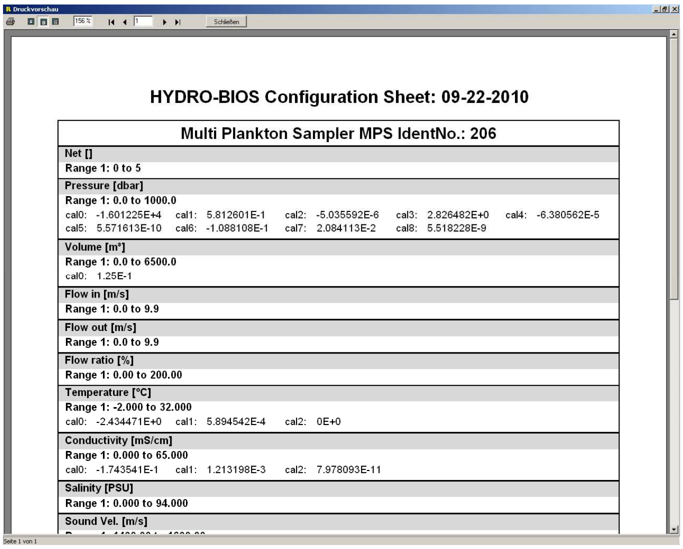


HYDRO-BIOS Multi Plankton Sampler MPS IdentNo.: 206

Time [hh:mm:ss]	Net []	Pressure [dbar]	Volume [m³]	Flow in [m/s]	Flow out [m/s]	Flow ratio [%]	Temperature [°C]	Conductivity [mS/cm]	Salinity [PSU]
11:50:35	1	648.1	9.1	0.7	0.6	128.31	5.998	32.985	33.129
11:50:36	1	647.4	9.2	0.7	0.6	128.31	5.997	32.982	33.127
11:50:37	1	646.7	9.2	0.7	0.6	128.14	5.996	32.983	33.130
11:50:38	1	646.0	9.3	0.7	0.6	128.57	5.997	32.983	33.129
11:50:39	1	645.7	9.4	0.7	0.6	128.74	5.997	32.983	33.129
11:50:40	1	645.2	9.4	0.7	0.5	128.66	5.997	32.981	33.127
11:50:41	1	644.8	9.5	0.7	0.5	129.19	5.996	32.979	33.125
11:50:42	1	644.1	9.6	0.7	0.5	129.38	5.996	32.982	33.129
11:50:43	1	643.4	9.7	0.7	0.5	129.38	5.997	32.983	33.130
11:50:44	1	642.8	9.7	0.7	0.5	129.56	5.996	32.981	33.129
11:50:45	1	642.1	9.8	0.7	0.5	130.38	5.997	32.980	33.127
11:50:46	1	641.4	9.9	0.7	0.5	131.01	5.997	32.980	33.127
11:50:47	1	640.7	10.0	0.7	0.5	130.82	5.996	32.979	33.127
11:50:48	1	640.0	10.1	0.7	0.5	130.63	5.995	32.979	33.128
11:50:49	1	639.3	10.2	0.7	0.5	130.63	5.996	32.977	33.127
11:50:50	1	638.6	10.3	0.7	0.5	130.63	5.996	32.977	33.127
11:50:51	1	638.1	10.4	0.7	0.5	131.25	5.995	32.976	33.126
11:50:52	1	637.4	10.5	0.7	0.5	131.25	5.996	32.976	33.126
11:50:53	1	636.8	10.5	0.7	0.5	131.45	5.995	32.974	33.125
11:50:54	1	636.1	10.6	0.7	0.5	130.82	5.996	32.971	33.121
11:50:55	1	635.4	10.7	0.7	0.5	130.63	5.995	32.971	33.122
11:50:56	1	634.7	10.8	0.7	0.5	131.25	5.996	32.971	33.122
11:50:57	1	634.1	10.9	0.7	0.5	131.88	5.995	32.974	33.126
11:50:58	1	633.4	11.0	0.7	0.5	131.88	5.995	32.975	33.128
11:50:59	1	632.8	11.1	0.7	0.5	131.06	5.995	32.973	33.125
11:51:00	1	632.1	11.2	0.7	0.5	130.86	5.995	32.971	33.124
11:51:01	1	631.5	11.3	0.7	0.5	130.86	5.995	32.971	33.124
11:51:02	1	630.8	11.3	0.7	0.5	131.06	5.995	32.970	33.124
11:51:03	1	630.1	11.4	0.7	0.5	131.88	5.995	32.969	33.123
11:51:04	1	629.4	11.5	0.7	0.5	132.50	5.994	32.968	33.122
11:51:05	1	628.9	11.6	0.7	0.5	133.33	5.995	32.968	33.122
11:51:06	1	628.3	11.7	0.7	0.5	133.54	5.994	32.966	33.121
11:51:07	1	627.6	11.8	0.7	0.5	133.76	5.994	32.968	33.123
11:51:08	1	626.9	11.9	0.7	0.5	133.76	5.994	32.966	33.122
11:51:09	1	626.2	12.0	0.7	0.5	133.96	5.995	32.966	33.122
11:51:10	1	625.6	12.1	0.7	0.5	134.78	5.994	32.966	33.123
11:51:11	1	624.9	12.1	0.7	0.5	134.97	5.995	32.966	33.122
11:51:12	1	624.3	12.3	0.7	0.5	135.37	5.994	32.965	33.122
11:51:13	1	623.6	12.3	0.7	0.5	135.15	5.995	32.965	33.122
11:51:14	1	623.0	12.4	0.7	0.6	134.94	5.995	32.964	33.121

9.3.6.4. CONFIGURATION

All printers available inside the actual PC configuration can be used to print the actual configuration of the HYDRO-BIOS system (including the complete set of calibration coefficients). Please use item CONFIGURATION of the PRINT menu inside the FILE menu.



HYDRO-BIOS Configuration Sheet: 09-22-2010

Multi Plankton Sampler MPS IdentNo.: 206

Net []
Range 1: 0 to 5

Pressure [dbar]
Range 1: 0.0 to 1000.0
cal0: -1.601225E+4 cal1: 5.812601E-1 cal2: -5.035592E-6 cal3: 2.826482E+0 cal4: -6.380562E-5
cal5: 5.571613E-10 cal6: -1.088108E-1 cal7: 2.084113E-2 cal8: 5.518228E-9

Volume [m³]
Range 1: 0.0 to 6500.0
cal0: 1.25E-1

Flow in [m/s]
Range 1: 0.0 to 9.9

Flow out [m/s]
Range 1: 0.0 to 9.9

Flow ratio [%]
Range 1: 0.00 to 200.00

Temperature [°C]
Range 1: -2.000 to 32.000
cal0: -2.434471E+0 cal1: 5.894542E-4 cal2: 0E+0

Conductivity [mS/cm]
Range 1: 0.000 to 65.000
cal0: -1.743541E-1 cal1: 1.213198E-3 cal2: 7.978093E-11

Salinity [PSU]
Range 1: 0.000 to 94.000

Sound Vel. [m/s]

10. GPS MODULE

The integration of GPS data is made at the PC directly inside the data acquisition software OceanLab 3. The GPS data must be provided via a virtual serial COM-port. This is accomplished by:

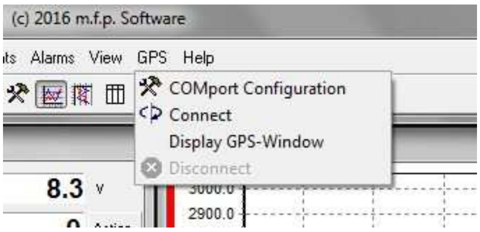
a) Connecting an external GPS receiver to the PC (via USB port). In this case the driver of the GPS receiver creates a virtual serial COM-port which is accessible by OceanLab 3.
b) On board of some research vessels the GPS data are available at serial COM-ports (at a junction box in the dry lab). In this case use an USB-adaptor to link the port to your PC.
c) Some ships distribute the GPS data via the ships network. In this case please contact the ships network administrator to evaluate if the GPS data can be re-directed to a virtual serial COM-port at your PC.

OceanLab 3 can handle GPS data according to NMEA 0183 provided that the GPS receiver delivers the $GPRMC sentence (Recommended Minimum Sentence).

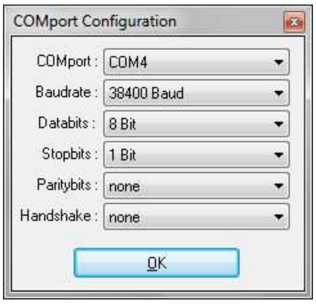
Please note:
The GPS data can only be merged with OcenLab data files created in online mode (with communication between PC and instrument during the operation).
The GPS have to be recorded inside OceanLab during the operation of the HYDRO-BIOS instrument.
Therefore **always start the GPS module** and verify the GPS status before starting the communication between the PC and the HYDRO-BIOS instrument!

10.1. CONFIGURATION OF GPS INTERFACE

The GPS-MODULE is accessible via the GPS menu inside the MAIN window of OceanLab.



Use the menu item “COMport configuration” to adjust the port according to the specification of the GPS receiver connected.



The COM-port number normally is indicated during the driver installation.

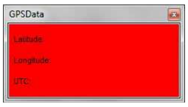
A typical configuration employs a baud rate of 4800, 8 data bits, 1 stop bit, no parity and no handshake. Modern GPS receiver also may use a high-speed communication at 38400 baud. Verify the correct configuration of your GPS receiver with the manufacturer´s manual.

Activate the GPS data transmission by clicking the button “Connect” once.
Alternatively use button “Display GPS-Window” to activate the GPS data transmission **and** to open the GPS data window simultaneously.

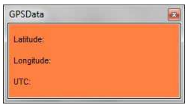
10.2. INDICATION OF GPS STATUS

The status of the GPS data is indicated by different background coloring of the GPS data window:

Red: No data at serial COM-port.
GPS receiver is switched off or
connected to wrong COM-port.

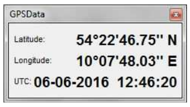


Orange: Bad data at serial COM-port.
Incorrect configuration of COM-port.
GPS receiver does not provide $GPRMC sentence.
Wrong instrument connected to COM-port.



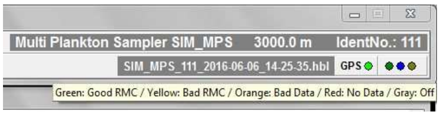
Yellow: GPS data with too low quality detected.
The GPS receiver has too low number of
satellites in sight.
Reposition the GPS receiver.

Light gray: GPS data in good quality detected.
GPS module is automatically recording data.



Additionally different coloring of an LED inside the MAIN screen indicates the status of the GPS data:

Red:	No data
Orange:	Bad data
Yellow:	Bad GPS data
Green:	Good GPS data, automatically recorded



Please note:
There is no need to actively start the recording of GPS data. The GPS module automatically records the GPS data into a disk file when detecting GPS data in good quality.

10.3. MERGING OF GPS DATA AND DATA FILES

The merging of GPS data and the OceanLab 3 data files is automatically made. When finishing the operation use the button STOP SESSION inside the toolbar or the FILE menu to stop data transmission between PC and HYDRO-BIOS instrument. Afterwards close the current data file by using the button CLOSE FILE inside toolbar or FILE menu.

Now OceanLab 3 automatically creates a third file for the session. The naming is identical to the basic two files (data file and comment file) and is identified as GPS data file by the extension .hbg (see chapter 6. FILE MANAGEMENT).

After re-opening the data file you can export the complete file into an ASCII file according to chapter 9.3.5. EXPORT.

Net []

Time [hh:mm:ss]	Net []	Pressure [dbar]	Volume [m³]	Flow in [m/s]	Flow out [m/s]	Flow ratio [%]	Latitude	Longitude	UTC
14:05:54	0	52.5	38.2	8.0	8.0	100.00	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:35:53
14:05:55	0	54.3	39.6	8.0	8.0	100.00	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:35:54
14:05:56	0	56.1	40.9	7.9	7.9	100.00	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:35:55
14:05:57	0	58.0	42.2	7.9	7.9	100.00	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:35:56
14:05:58	0	59.8	43.6	7.8	7.9	98.73	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:35:57
14:05:59	0	61.7	45.0	7.8	7.8	100.00	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:35:58
14:06:00	0	63.6	46.4	7.7	7.8	98.72	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:35:59
14:06:01	0	65.6	47.8	7.7	7.7	100.00	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:36:00
14:06:02	0	67.7	49.3	7.6	7.7	98.70	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:36:01
14:06:03	0	69.7	50.8	7.5	7.6	98.68	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:36:02
14:06:04	0	71.9	52.3	7.5	7.6	98.68	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:36:03
14:06:05	0	74.0	53.8	7.4	7.5	98.67	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:36:04
14:06:06	0	76.2	55.3	7.4	7.5	98.67	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:36:05
14:06:07	0	78.4	56.9	7.3	7.4	98.65	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:36:06
14:06:08	0	80.6	58.5	7.3	7.4	98.65	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:36:07
14:06:09	0	83.0	60.1	7.2	7.3	98.63	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:36:08
14:06:10	0	85.3	61.7	7.1	7.3	97.26	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:36:09
14:06:11	0	87.7	63.3	7.1	7.2	98.61	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:36:10
14:06:12	0	90.1	65.0	7.0	7.1	98.59	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:36:11
14:06:13	0	92.5	66.7	6.9	7.1	97.18	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:36:12
14:06:14	0	95.1	68.4	6.9	7.0	98.57	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:36:13
14:06:15	0	97.6	70.1	6.8	7.0	97.14	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:36:14
14:06:16	0	100.1	71.9	6.8	6.9	98.55	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:36:15
14:06:17	0	102.8	73.7	6.7	6.9	97.10	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:36:16
14:06:18	0	105.4	75.5	6.6	6.8	97.06	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:36:17
14:06:19	0	108.2	77.3	6.6	6.8	97.06	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:36:18
14:06:20	0	110.9	79.1	6.5	6.7	97.01	54°22'46.74" N	10°07'47.95" E	2016-06-06 12:36:19

Make sure that you always copy the full set of three data files (extensions .hbl .hbc .hbg) in case you want to transfer the data files to another PC.

11. SERIAL PRESSURE OUT

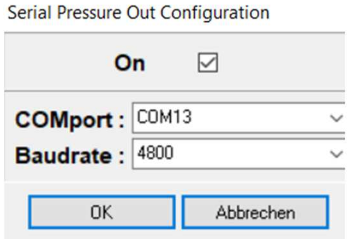
When enabled the SERIAL PRESSURE OUT module distributes the real-time measuring data of the pressure sensor via the selected serial COM-port in ASCII format. Output is made in the style of NMEA 0183.

Example String that is output over serial: *$PHBIP,73.12 <CR> <LF>*

The SERIAL PRESSURE OUT module is accessible via the MAIN menu.

11.1. CONFIGURATION OF SERIAL PRESSURE OUT INTERFACE

Use the menu item “COMport configuration” inside the SERIAL PRESSURE OUT menu to adjust the port according to the requirements of the receiver.



The COM-port number normally is indicated during the driver installation.

The standard configuration employs a baud rate of 115200. According to the NMEA 0183 standard the interface uses 8 data bits, 1 stop bit, no parity and no handshake.

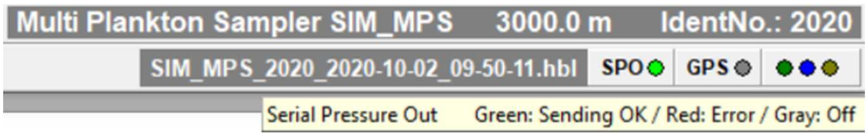
To ease the selection of the correct COM-port it is recommended to always start communication with the HYDRO-BIOS instrument before selecting the SERIAL PRESSURE OUT interface.

Please note:
The selected COM-port will not be occupied by the SERIAL PRESSURE OUT until a successful communication with a HYDRO-BIOS instrument has been established. This leads to the fact that whilst executing the CONNECTING process (see chapter 5. COMMUNICATION / CONNECTING) OceanLab 3 may send data other than those specified above at a different baud rate.

Enable the SERIAL PRESSURE OUT transmission by activating the tick box “On”.

11.2. INDICATION OF SERIAL PRESSURE OUT STATUS

The status of the SERIAL PRESSURE OUT module is indicated in the upper right of the MAIN window:



Green: OK
Red: Error (e.g. the selected COM-port is occupied by a HYDRO-BIOS instrument)
Grey OFF