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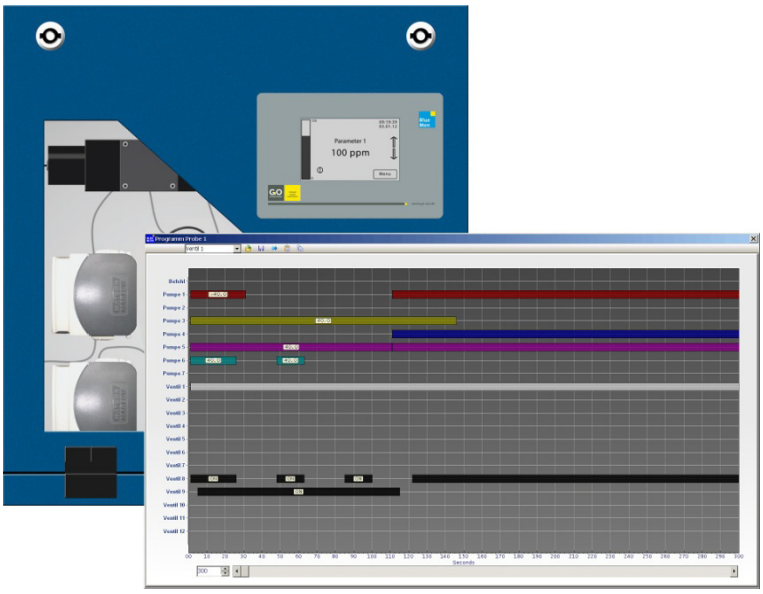
Manual
BlueMon PC Software



BlueMon Soft

Version of this manual: 2.4 en

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Table of content

1 Overview 6
1.1 Main program BlueMon SQL 6
1.2 Programs for data display and visualisation 6
1.3 Program functions BlueMon SQL 7
1.4 Bundled programs 9
1.4.1 The CodeMeter Software 9
1.4.2 The MySQL™ Server Software 9
1.4.3 GO-HelpDesk 10

2 Content of the USB memory stick and the USB-Dongle 11
2.1 Installation notes 11

3. Procedure after installing the BlueMon PC Software 12

4 BlueMon SQL Software 13
4.1 Language selection 13
4.2 File drop-down menu 14
4.2.1 Open setup 14
4.2.2 Get Data 15
4.2.3 Update BlueMon 16
4.2.4 Export/Import 16
4.2.5 Live Status 17
4.2.5.1 Sequence buttons 18
4.2.5.2 Area State 18
4.2.5.3 Display program sequence 19
4.2.5.4 Buttons Calibration to Service 19
4.2.5.4.1 Input calibration factors, calibration concentrations and warning/alarm limits 20
4.2.5.4.2 Calibration pH sensor 21
4.2.5.4.3 Calibration Redox sensor 22
4.2.5.4.4 Spectrum diagrams 23
4.2.5.4.4.1 Automatic intensity calibration 24
4.2.5.4.5 Titration log 25
4.2.5.4.6 Service 26
4.2.5.5 Heating 27
4.2.5.6 Valve outputs | Digital inputs | Liquid detector 27
4.2.6 Close Program 28
4.3 Setup drop-down menu 29
4.3.1 Connection setup 29
4.3.1.1 Setup of a new BlueMon 30
4.3.1.2 RAS setup (Modem configuration) 31
4.3.2 Database setup 32
4.3.3 Language selection 33
4.4 Configuration drop-down menu 34
4.4.1 Main setup 34
4.4.1.1 Samples – Sensors 35
4.4.1.1.1 Sensors – Internal sensors 35
4.4.1.1.2 Sensors – Virtual Sensors 40
4.4.1.1.2.1 Multi-point calibration 42

4.4.1.1.3 Sensors – CAN-Bus sensors 45
4.4.1.2 Samples – Sample lines 45
4.4.1.2.1 Sample lines – Add and delete measurement value 45
4.4.1.2.2 Sample lines – Sensor 46
4.4.1.2.3 Sample lines – Program (analysis sequence) 47
4.4.1.2.4 Sample lines – Formula 54
4.4.1.3 Samples – System 59
4.4.1.3.1 System – System settings 59
4.4.1.3.2 System – Cancel sequence 60
4.4.1.3.3 System – Cleaning sequence 60
4.4.1.3.4 System – Calibration (Calibration sequence) 61
4.4.1.3.5 System – Heater 1 - 2 62
4.4.1.3.6 System – Liquid detectors 63
4.4.1.3.7 System – Service Timer 64
4.4.1.3.8 System – Stirrer setup 64
4.4.1.3.9 Timer 65
4.4.1.3.10 Messages 66
4.4.2 Analog outputs (current output settings) 69
4.4.3 Digital outputs (relay setup) 70
4.4.3.1 Digital outputs (relay setup) - System 70
4.4.3.2 Digital outputs (relay setup) - Sensors 71
4.4.4 Digital inputs 72
4.4.5 Serial Protocol 73
4.5 History drop-down menu 74
4.5.1 Measured values 74
4.5.2 Calibration history 76
4.5.3 Status history 77
4.5.4 Error history 78
4.6 Help drop-down menu 79
4.6.1 Add System Information 79
4.6.2 Show System Information 79
4.6.3 About 79

5 Programs for data display and visualisation 80
5.1 Visual 1 80
5.2 VisualN 86

Appendix A - The configuration data sheet 89
Appendix B - Installation MySQL™ Server 92
Appendix C - Installation BlueMon PC Software 99
Appendix D - BlueMon SQL in server operation 104
Appendix E - Requesting a dongle upgrade for a license upgrade 109
Appendix F - Warning and error messages 111
Appendix G - AMS Formula 113
1 Formula structure 114
2 The AMS Formula input assistant 115
2.1 Formula elements of the input assistant 116
Appendix H - List of the AMS Formula elements 121
Specific formula elements of the BlueMon 121
Common formula elements 123

1 Overview

This manual describes the Windows-PC-Software for a BlueMon-System.
The program package delivered with the BlueMon always consists of the main program BlueMon SQL and further programs.

A MySQL™ Server is a mandatory necessary for the running of the BlueMon PC Software

If you did not choose another folder during installation, the programs are stored in „C:\Program files\BlueMon“.

1.1 Main program BlueMon SQL

- The BlueMon SQL Software is the administration software for all connected BlueMon systems. This program is used to retrieve the data stored in a BlueMon into a database. Furthermore you can change settings of a BlueMon.
- The integrated user-friendly methods software makes it easy to design analysis sequences, calibration programs and cleaning sequences.
- Possible hardware elements:
    - Internal sensors
        - Photometer
        - Spectrometer
        - pH sensor
        - Redox sensor
        - Analogue sensor (0 - 20 mA / 4 - 20 mA)
    - 5[1] virtual sensors
    - more than 200 external sensors/actuators via CAN-bus
    - 7 pumps[2]
    - 12 valve relays[2]
    - 2 heaters[2]
    - 6 liquid detectors
    - 1 stirrer

1.2 Programs for data display and visualisation

- **Visual1**
  Enables the display of measured values of up to four different sensors out of the database at the same time, these sensors can also be connected to different BlueMon-Systems.
- **VisualN**
  Enables the display of measured values from several sensors out of the database at the same time. Unlike Visual1, VisualN shows the graphs of measured values in only one chart.

[1] Default number of virtual sensors, more are possible.
[2] with additional board

1.3 Program functions BlueMon SQL

1. Up to 6 sample lines could be processed sequentially.
2. In each sample line up to 3 measuring points can be defined.
3. For each sample line its own calculation formula can be created.
4. For each sample line its own analysis sequence program can be created.
5. The maximum runtime of a sequence program* is about 18h.
6. Through a sequence program* the following events can be programmed.
    a. Switching of valve 1 to 12.
    b. Switching of pumps 1 to 7 with setting of the desired speed.
    The direction of rotation of pump 1 and 4 the can be adjusted.
7. Every sequence program may contain the following commands:
    a. Capturing current measured values of the internal sensors for up to 5 times.
    b. Calculation of the result(s)
    c. Performing of any input formula, e.g. to perform a jump in the sequence program depending on a sensor measured value.
    d. Defining waiting times
    e. Periodic calculation of measurement results.
    f. Capturing of sample spectrum.
    g. Capturing of reference spectrum.
    h. Capturing of self-check spectrum.
    i. Saving absorbance spectrum.
    j. Saving reference spectrum.
    k. Saving sample spectrum.
    l. Performing an intensity calibration.
    m. Performing a self-check test with the self-check spectrum.
    n. Performing a titration. The maximum number of titrations in a sequence program is limited to 5t. Both individual titrations and interrelated multiple titrations can be executed.
8. A cleaning program can be created.

* Sequence program is the umbrella term for analysis sequence, calibration sequence and cleaning sequence.

9. A calibration can be created which calculates up to 5 calibration factors.
   For each calibration factor, there are two range tests. If a calibration factor exceeds or falls below the warning area, a warning message is displayed.
   If a calibration factor exceeds or falls below the warning area, the calibration is repeated. If a calibration factor exceeds or falls below the warning area while repeating, the calibration is stopped and an alarm message is displayed.

10. When a sequence program was aborted, a cancel sequence is executed.
    Settings of the cancel sequence:

    a. Runtime

    b. Rotating speed of the pumps (the same for all pumps), rotating direction of pump 1 and 4

    c. Valves on/off

11. Up to 10 timers can be created.

    Every timer has the following settings:

    a. Time of day at certain days of the week

    b. Runtime

    c. Interval

    Each timer can perform the following activities:

    d. Measurement start

    e. Measurement stop

    f. Calibration sequence run

    g. Cleaning sequence run

    h. Measurement in sample lines 1 to 6 (performing the analysis sequences of the 6 sample lines)

    i. Measurement of a sample line sequence (performing the process sequence)

12. Up to 10 messages can be defined, they will be sent via E-mail or SMS.
    The triggering of the message can be determined almost at will.

13. Up to 18 current outputs can administered (2 internal and 16 external via CAN-bus modules).

14. Up to 200 CAN-bus sensors can be connected.

1.4 Bundled programs

1.4.1 The CodeMeter Software

Using the CodeMeter-Software and the corresponding USB-Dongle the BlueMon PC Software is protected against unauthorized access*. If not already present, this software will be installed at the installation of the BlueMon PC Software automatically.
You can install the BlueMon PC Software on your computers and can use it with the USB-Dongle.
The CodeMeter Runtime Server is installed by default as a service and starts therefore automatically at every system startup.
If the CodeMeter Runtime Server is not running, it can easily be started from the CodeMeter Control.
The CodeMeter Runtime Server can be started only once on each computer!

USB-Dongle

In the info area of the Windows task menu different colours of CodeMeter symbols represent the status of USB-Dongle (here called **CMStick**).

	grey	No CmStick is connected or the CodeMeter Runtime Server is not started.
	green	An activated CmStick is connected.
	blue double	Several CmSticks are connected and activated until disconnection.
	yellow	A CmStick is connected and activated until it is disconnected.
	red	A deactivated CmStick is connected.

Double click with the left mouse key or click with the right mouse key leads to the CodeMeter-Control center and to the CodeMeter-Webadmin (will be opened within your standard browser).
Here you can change settings, modify licenses, see license information and call up an Online-help.

1.4.2 The MySQL™ Server Software

MySQL ™ Server is a so-called relational database management system, the installation will also set up a database. The retrieval of the BlueMon SQL software (see 3.4) saves the data in this database.

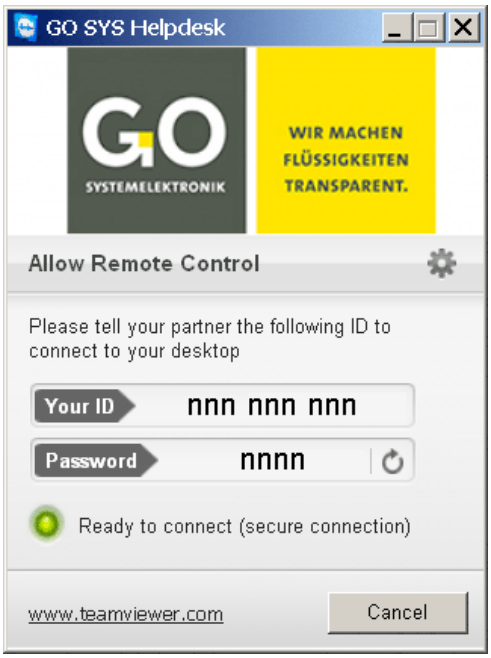
Installation see *Appendix B - Installation MySQL™ Server*

A MySQL™ Server is mandatory for the running of the BlueMon PC Software..

* The programs Visual1 and VisualN also run without dongle.

1.4.3 GO-HelpDesk

Double click on the file "TeamViewerQS.exe" in folder „GO-Systemelektronik HelpDesk“ starts the GO helpdesk.
The digits of "Your ID" and "Password" are generated at each startup of TeamViewerQS.exe.
If you need remote access to your computer GO Systemelektronik requires these digits. This allows a one-time connection to GO Systemelektronik to be established.
The connection ends with the program.



2 Content of the USB memory stick and the USB-Dongle

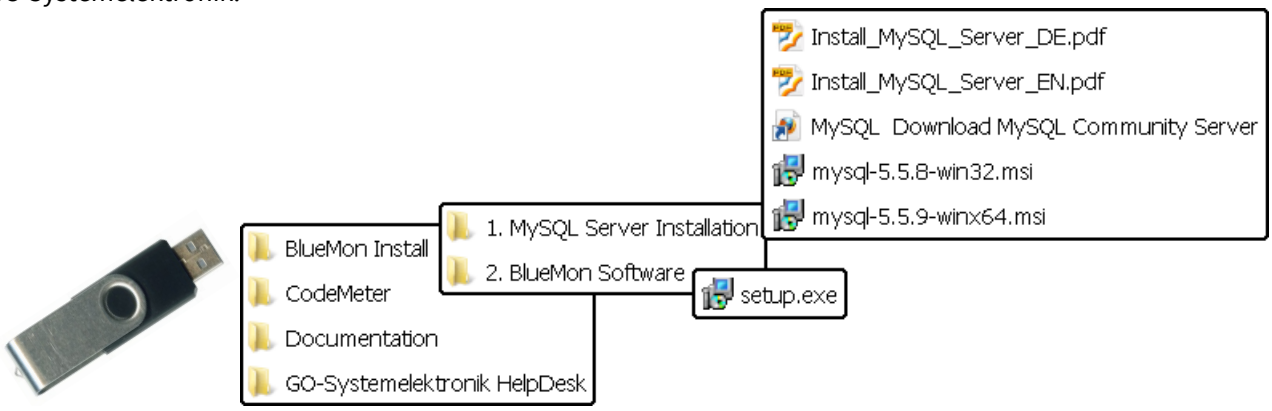
You have received all of the software on a USB memory stick.
You need this USB stick and the supplied USB dongle.
The USB-Dongle and the CodeMeter Software work together to protect the BlueMon PC Software against unauthorized use.

USB memory stick

USB dongle

The USB memory stick contains the program data.
To operate the software, you need the USB dongle.

Please understand this requirement, in case of loss of the USB dongle you will of course get replacement from GO Systemelektronik.



2.1 Installation notes

The BlueMon PC Software runs on Windows 2000, Windows XP, Windows Vista and Windows 7.

Recommended order *:

- If no SQL server exists on your PC or a connected network, install the MySQL Server ™ software with "**mysql-5.5.8-win32.msi**" (32-bit system) or with "**mysql-5.5.8-win32 . msi** "(64-bit system) from the folder "**1. MySQL Server Installation**".
- Then install the BlueMon PC Software with "**setup.exe**" from the folder "**2. Bluemon Software**".

Installation see *Appendix C - Installation BlueMon PC Software*

* In general, the order of installation is arbitrary.

3. Procedure after installing the BlueMon PC Software

Pre-condition: installed MySQL™ Server, installed BlueMon PC Software, operational BlueMon, active network connection with the BlueMon.

1. **Selection of a MySQL™ Server**
   see *4.3.1 Connection setup*

2. **Selection of a BlueMon**
   see *4.3.1.1 Setup of a new BlueMon*

3. **Selection of a BlueMon configuration**
   see *4.2.1 Open setup*

4. **Transfer of the BlueMon data into the data base**
   see *4.2.2 Get Data*
   Only required if CAN-bus sensors are connected.

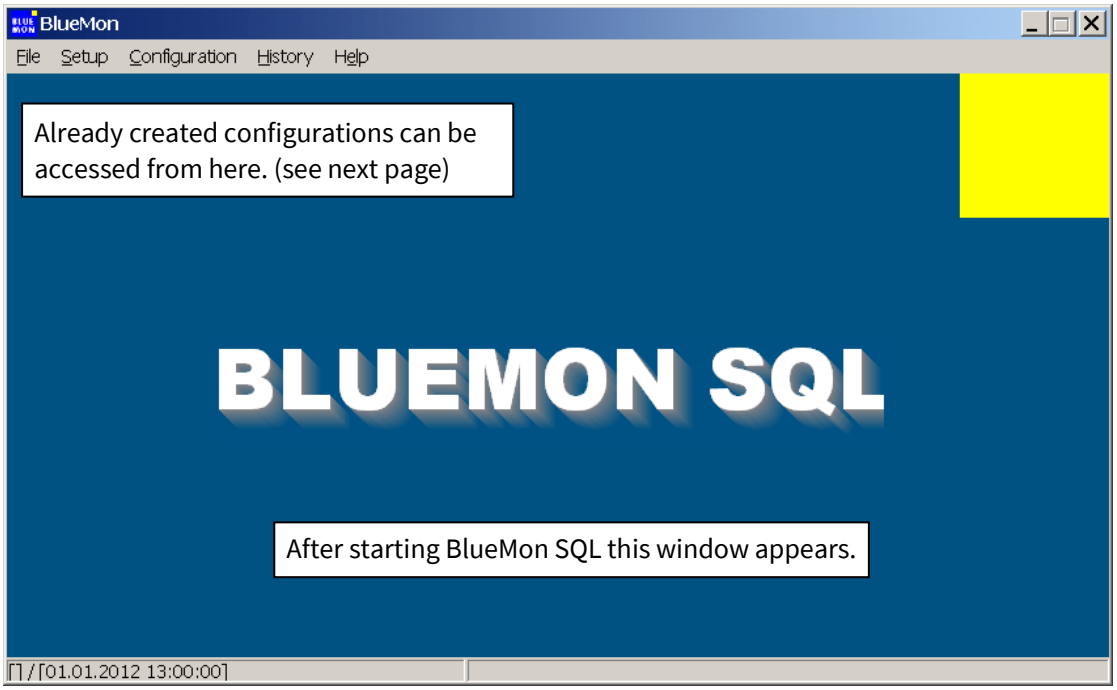
5. **Configuration:** Parameterization and programming of the BlueMon
   see *4.4.1 Programm*

6. **Transfer of the configuration onto the BlueMon**
   see *4.2.3 Update BlueMon*

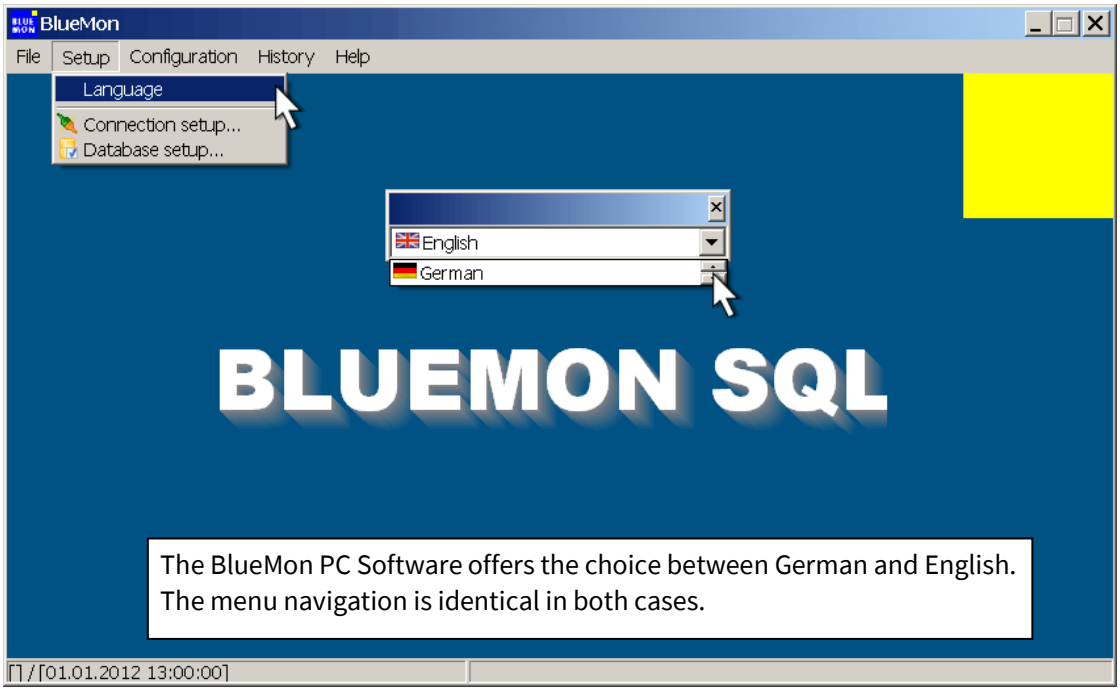
7. **Running the system**
   see *4.2.5 Live Status*

4 BlueMon SQL Software

This software is a database application for processing and archiving measured values and device data and is used to manage any number of BlueMon online analysers.
All relevant data is stored in a MySQL ™ database server.



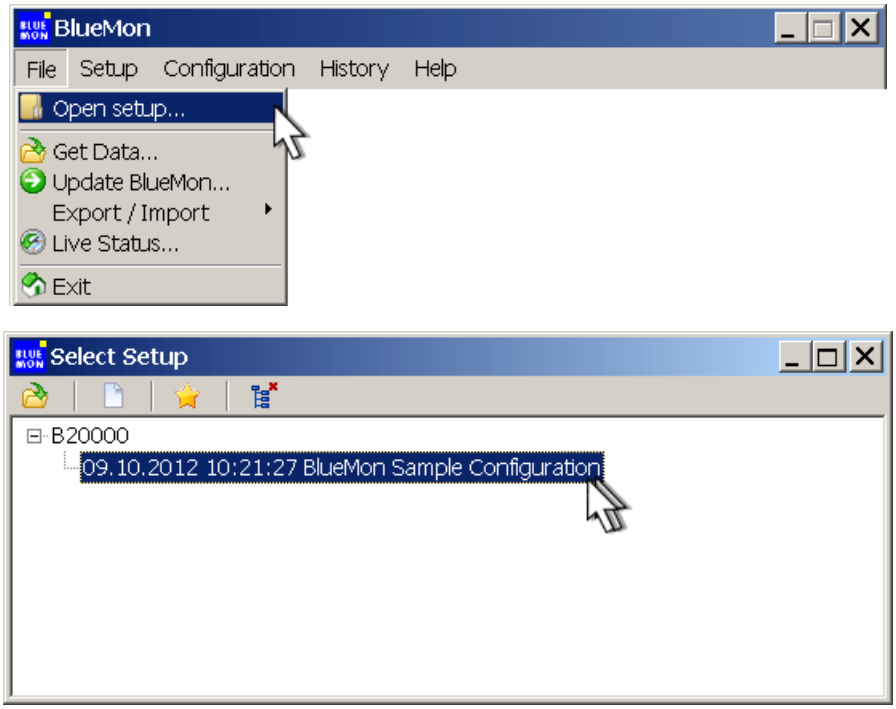
4.1 Language selection



4.2 File drop-down menu

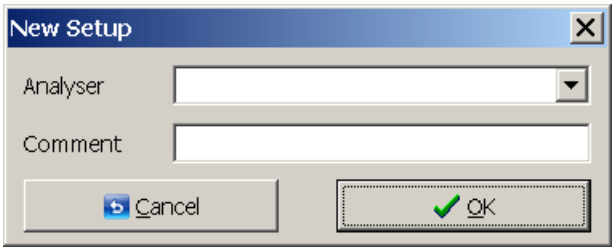
4.2.1 Open setup

Select the desired BlueMon configuration by double-clicking in the Select Setup window, or create a new configuration.



Open ⇒ Replaces the double click at a selected configuration.

New Setup ⇒ Creates a new configuration.



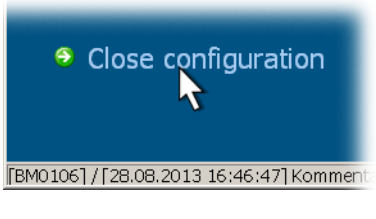
Analyser Selection field BlueMon
Comment Comment

The name of the new configuration is composed of:
BlueMon serial number | Date | Time | Comment

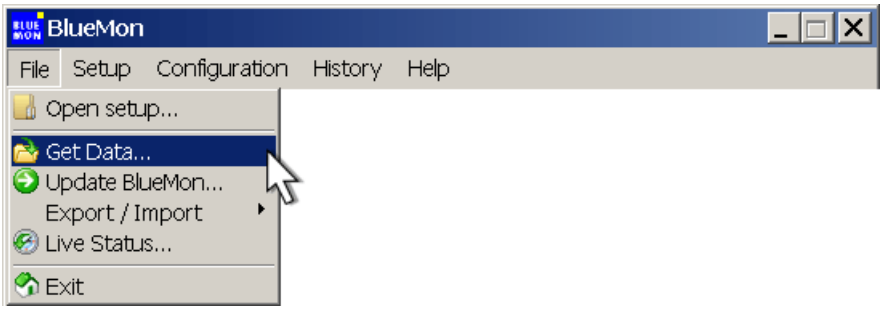
Create from sample ⇒ Creates a copy of the selected configuration.

Delete ⇒ Deletes the selected configuration.

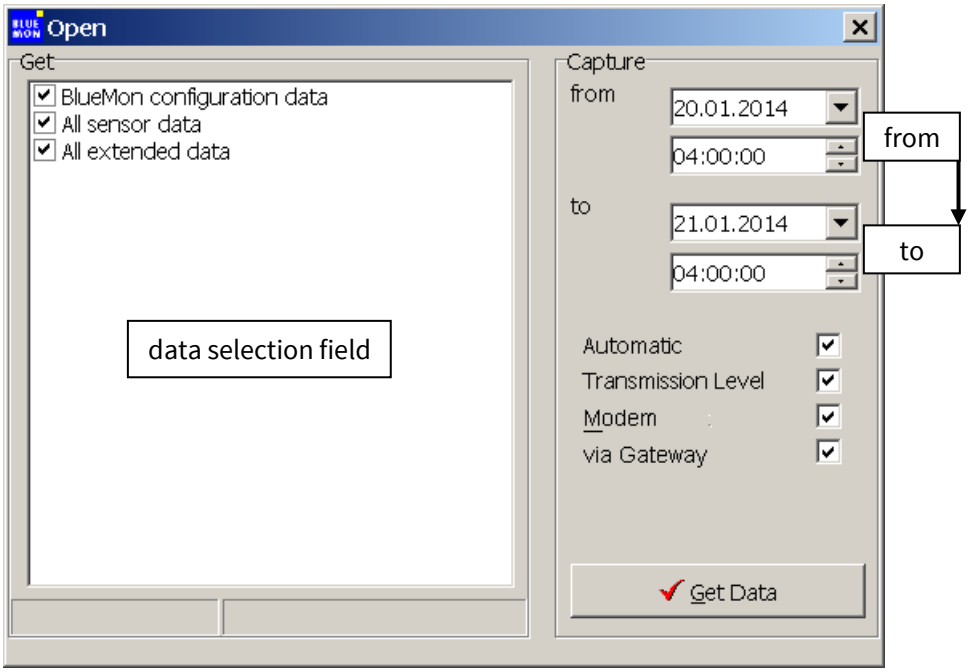
For each BlueMon active in the network a button is created in the start window. Via this each last created configuration can be opened.
Opened configurations will be closed by clicking on "Close configuration" on the bottom left of the start window.



4.2.2 Get Data



Use this window to load the BlueMon data into the database of the MySQL™ Server selected under 4.3.2 MySQL Database Setup.



Automatic ☑ If this checkbox is activated, all new data since the last data transfer of the selected sensor will be transferred automatically. The transfer is based on the last record in the database that was retrieved for the BlueMon.
If this checkbox is deactivated, only the data within the delimited time period “from” “to” of the selected sensor will be transferred.

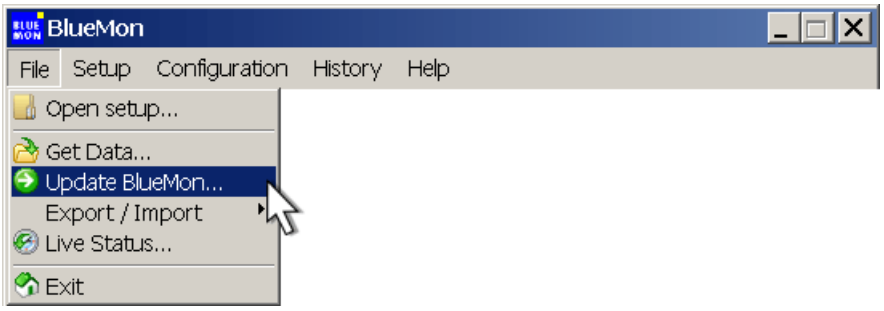
Transmission Level ☑ Transmits only the measured values of the selected sensors that differ from the forgoeing measured value .
This function saves memory and allows a shorter data transfer time. However, at least one value per hour is transmitted.

Modem ☑ The connection will be established via modem.

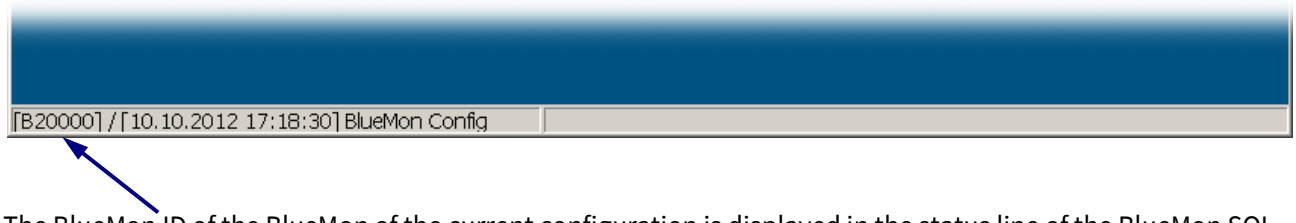
via Gateway ☑ The connection will be established via a gateway.

✓ Get Data Transfers the data .

4.2.3 Update BlueMon

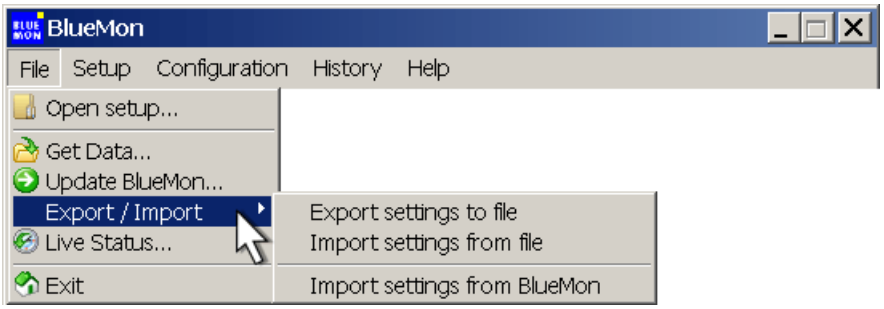


Transfers the current configuration onto the BlueMon.
Almost every change must be transferred to the BlueMon with this function. Only messages (see *4.4.1.3.10 Messages*) and calculated sensors (see *4.4.1.1.2 Sensors – Virtual Sensors*) are transferred directly.



The BlueMon ID of the BlueMon of the current configuration is displayed in the status line of the BlueMon SQL startup window, next to the timestamp of the setup configuration and the setup comment.

4.2.4 Export/Import

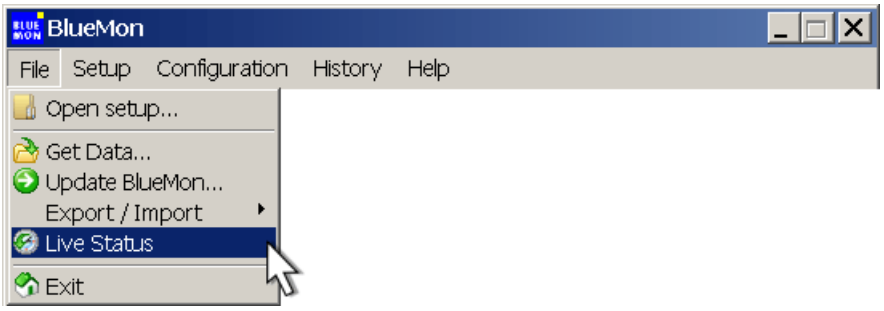


⇒ **Export settings to file**
Saves the current settings as a .bms-file.

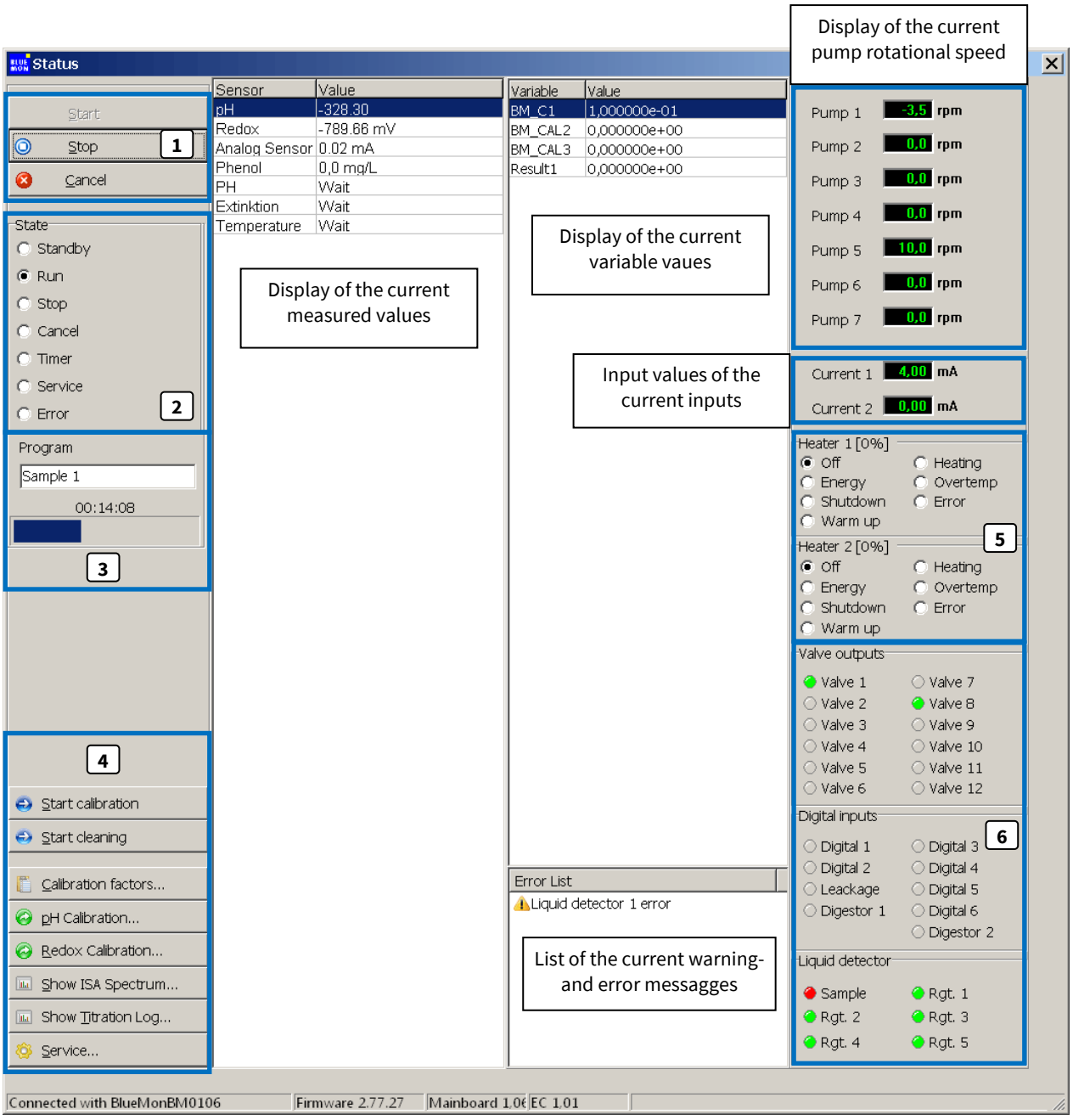
⇒ **Import settings from file**
Loads saved settings as a .bms-file.

⇒ **Import settings from BlueMon**
Tranfers the current settings from the BlueMon into the in *4.3.2 Database setup* determined database.

4.2.5 Live Status



- Displays the current state of the system.
- Displays warning messages and alarm messages.
- Starts and stops sequences and procedures.



The window is divided into 11 areas.

[1] see *4.2.5.1 Sequence buttons*

[2] see *4.2.5.2 Area state*

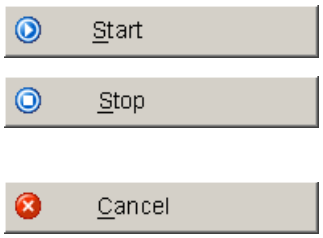
[3] see *4.2.5.3 Display program sequence*

[4] see *4.2.5.4 Buttons Calibration to Service*

[5] see *4.2.5.5 Heater*

[6] see *4.2.5.6 Valve outputs* | *Digital inputs* | *liquid detector*

4.2.5.1 Sequence buttons



Starts the program sequence after the last measurement value.

Each measurement in process is carried out to it's end (except waiting), and then stops the system.

Interupts the current measurement and performs a cleaning. Thereafter, the system goes into the "Standby" state.

4.2.5.2 Area State

- **Standby** - The System is ready.
- **Run** - A measurement is running.
- **Stop** - A measurement has been stopped.
  That means: Each measurement in process was carried out to it's end (except waiting).
- **Cancel** - The process sequence is currently being finished after canceling.
  That means: Any running process is stopped and then (if existing) the cancel sequence runs to it's end.
- **Timer** - A timer program is running. (see *4.4.1.3.9 Timer*)
- **Service** - The service menu is open. (see *4.2.5.4.6 Service*)
- **Error** - The process sequence was cancelled automatically after an error.

4.2.5.3 Display program sequence

Display of a progress bar for the currently running sequence element, the name of the sequence element and the time duration.

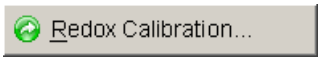
4.2.5.4 Buttons Calibration to Service

Starts the calibration sequence.
see *4.4.1.3.4 System – Calibration (Calibration seqence)*

Starts the cleaning sequence.
see *4.4.1.3.3 System – Cleaning sequence*

Opens the window of the display and input of the calibration factors, calibration concentrations and warning/alarm limits.
see *4.2.5.4.1 Input calibration factors, calibration concentrations and warning/alarm limits*

Opens the calibration window of the internal pH sensor after a password prompt.
see *4.2.5.4.2 Calibration pH sensor*



Opens the calibration window of the internal Redox sensor after a password prompt.
see *4.2.5.4.3 Calibration redox sensor*

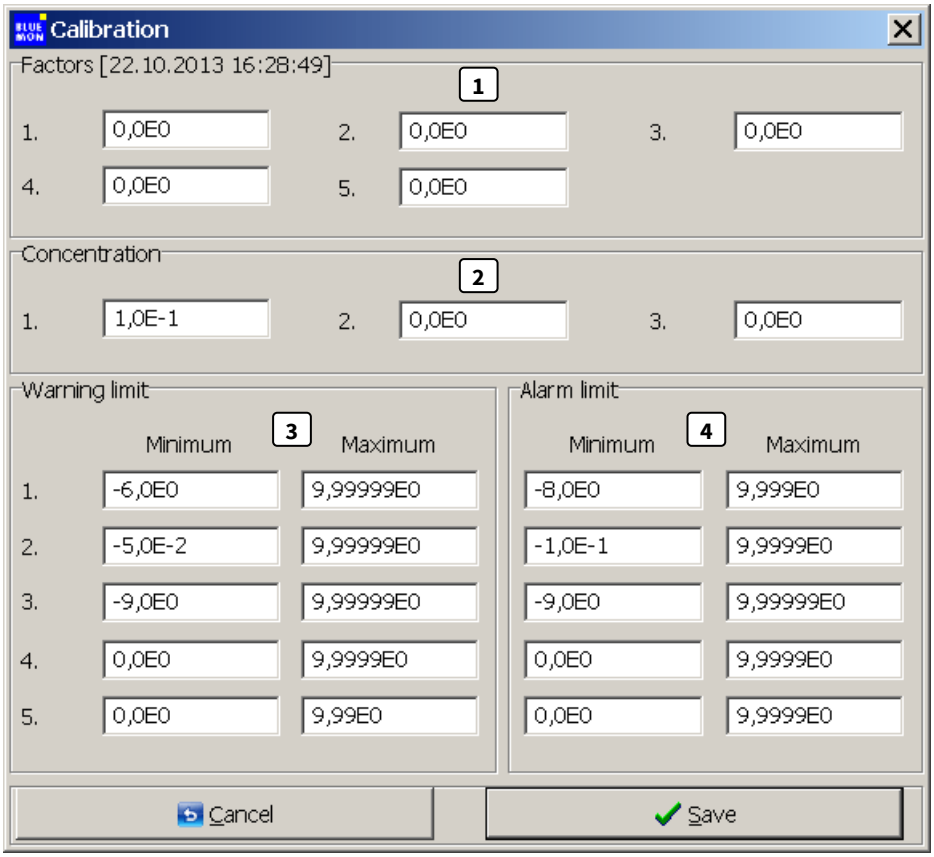
Opens the window of the spectrum diagrams.
see *4.2.5.4.4 Spectrum diagrams*

Opens the window of the titration log.
see *4.2.5.4.5 Titration log*

Opens the service window.
see *4.2.5.4.6 Service*

4.2.5.4.1 Input calibration factors, calibration concentrations and warning/alarm limits

Live Status window



[1] Factors - Calibration factors, calculation

[2] Calibration concentrations

For each calibration factor, there are two range tests.

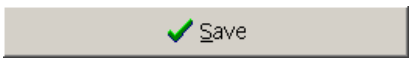
If a calibration factor exceeds or falls below the warning range, a warning message is displayed.

If a calibration factor exceeds or falls below the alarm range, the calibration is repeated.
If in the the repetition a calibration factor exceeds or falls below again, an alarm message is displayed and the measurement is stopped.

[3] Warning limit - Minimum and maximum values, if these values are underrun/overrun, a warning message is displayed.

[4] Alarm limit - Minimum and maximum values, if these values are underrun/overrun, an alarm message is displayed.

Closes the window without saving the values.



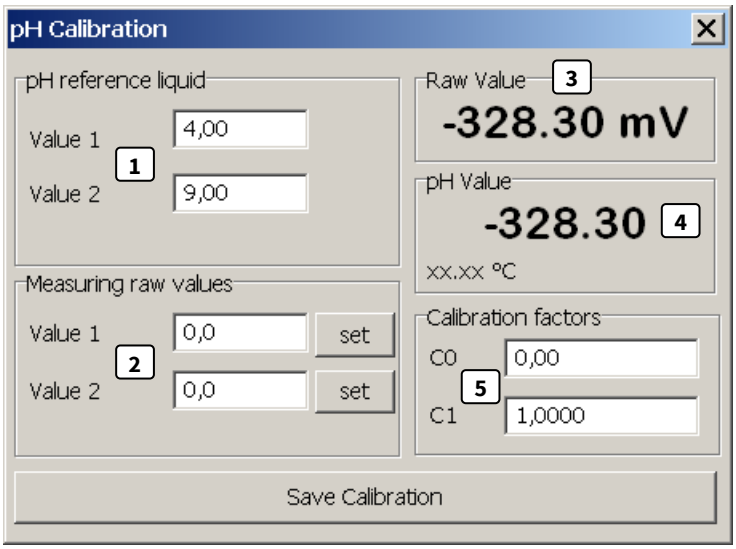
Saves the calibration and closes the window.

see also *4.4.1.3.4 System – Calibration (Calibration sequence)*

4.2.5.4.2 Calibration pH sensor

Live Status window

Opens the calibration window of the internal pH sensor after a password prompt.



[1] Input fields of the pH values of the reference liquids

[2] Input fields of the measured raw values of the both refence liquids

[3] Display raw values

[4] Display pH value

[5] Display-/Input fields of the calibration factors

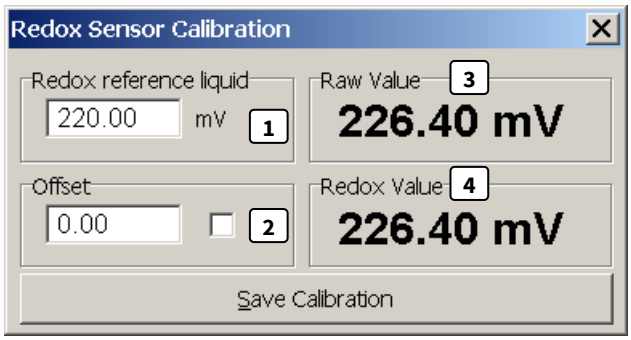
Computes the calibration factors with the current raw values.

Saves the calibration.

4.2.5.4.3 Calibration Redox sensor

Live Status window

Opens the calibration window of the internal Redox sensor after a password prompt.



[1] Input field of the redox value of the reference liquid

[2] Offset is ☑ active or ☐ not active.

[3] Display raw value

[4] Display raw value with Offset

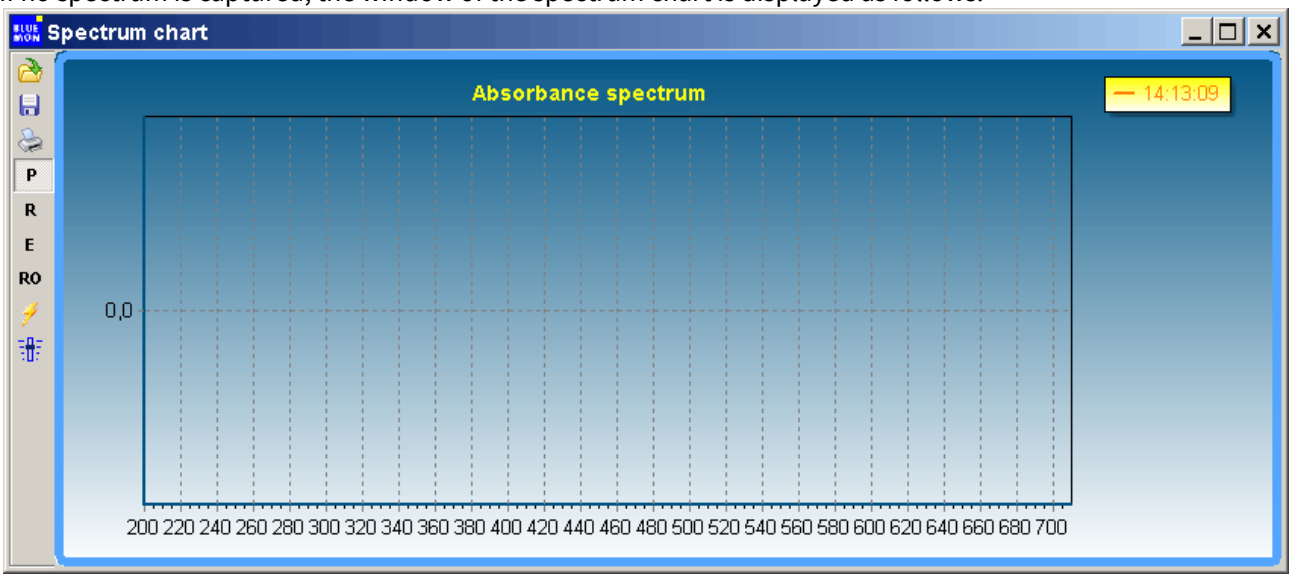
Saves the calibration.

4.2.5.4.4 Spectrum diagrams

Live Status window

Opens the spectrum chart window.

If no spectrum is captured, the window of the spectrum chart is displayed as follows:



Opens a window with the list of all spectra stored in the process sequence.

Saves the window graphic as .jpg, .bmp, .emf und .wmf.

Prints the current window graphic.

Opens the sample spectrum window.

Opens the reference spectrum window.

Opens the absorbance spectrum window.
The absorbance spectrum is a calculated spectrum from the last captured or saved sample spectrum and the last captured or saved reference spectrum.

Opens the raw spectrum window.

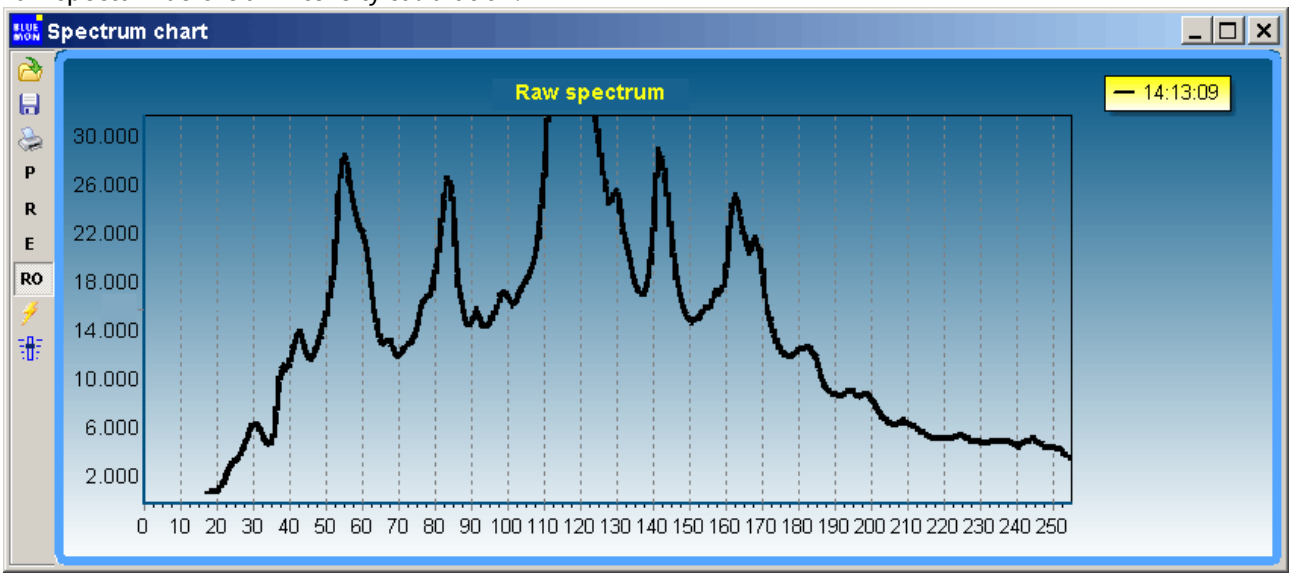
Captures a sample spectrum.

Performs an automatic intensity calibration.
The automatic intensity calibration can also be performed in a sequence program.

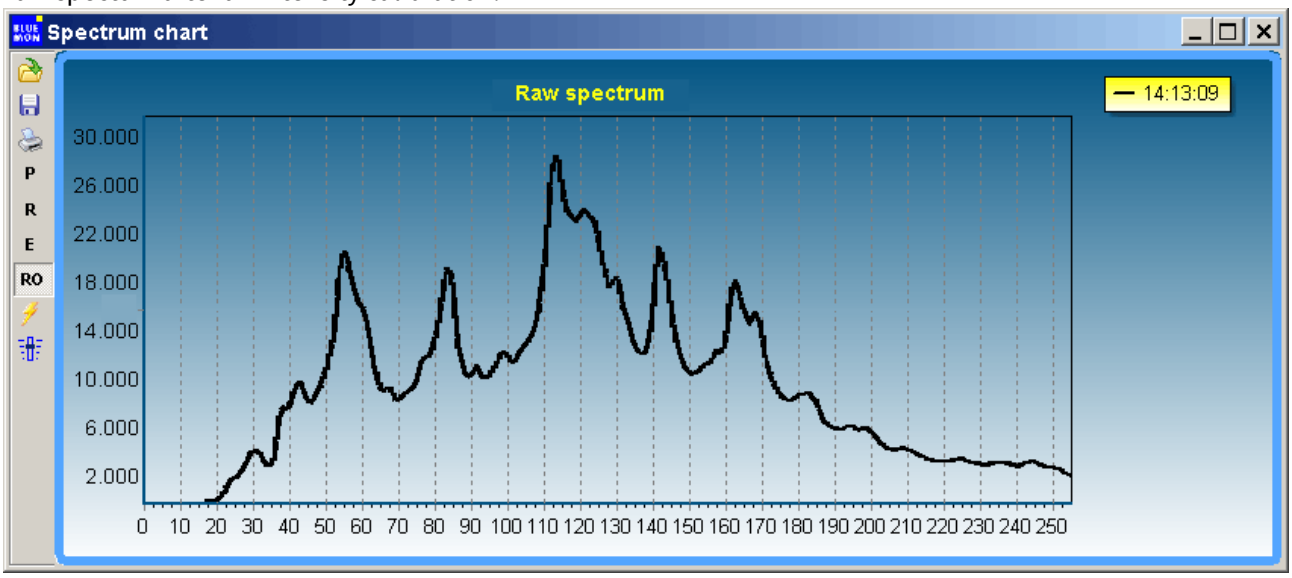
4.2.5.4.4.1 Automatic intensity calibration

The intensity calibration is for the optimal use of the measuring range. Here is an example of an overdriven spectrum, i.e. the intensity is too high. Click on the "perform intensity calibration" button and then "Yes" in the prompt window. The intensity is automatically adjusted by the integration time, i.e. the number of light flashes per single measurement.

Raw spectum before an intensity calibration:



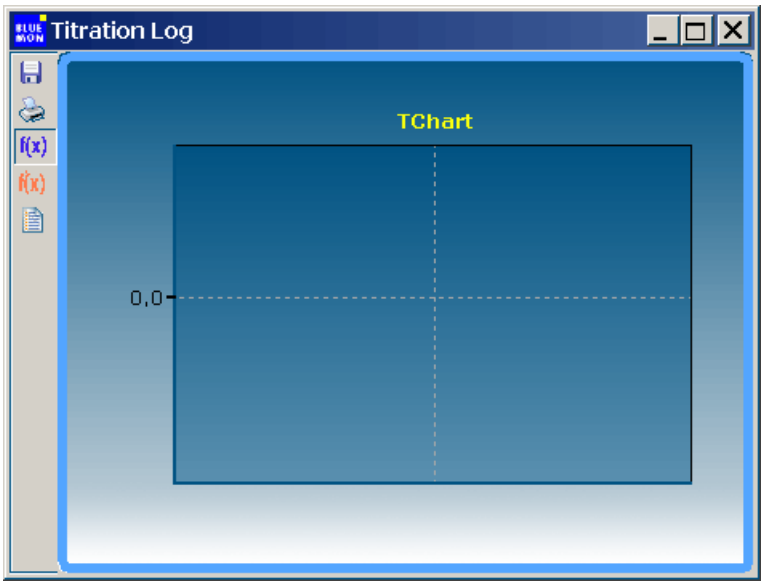
Raw spectum after an intensity calibration:



4.2.5.4.5 Titration log

Live Status window

Opens the window of the Titration log. ⇨ **function is in preparation**



Saves the titration log.

Opens the printer window.

Displays the first derivative of the titration curve .

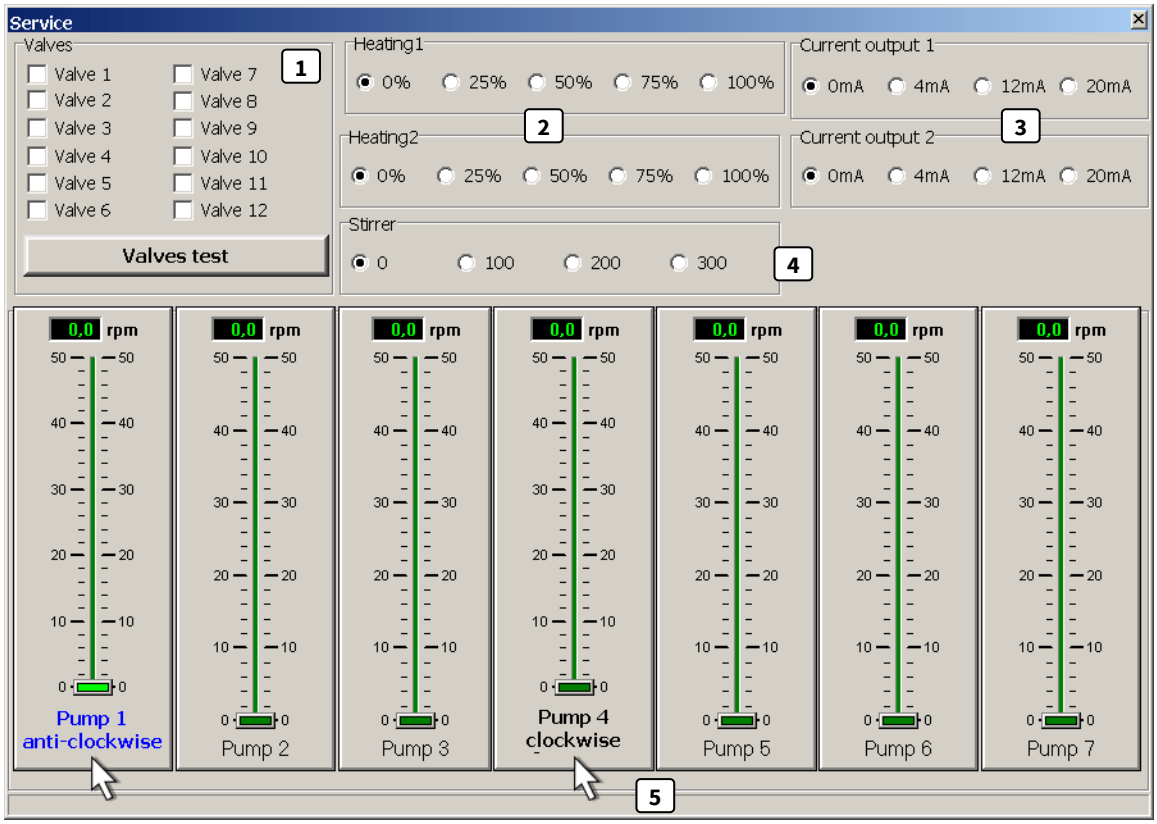
Displays the titration curve.

Opens a protocol list.

4.2.5.4.6 Service

Live Status window

Opens the sevice window after a password prompt.



In this window you have direct accesss to the BlueMon hardware.

[1] The BlueMon has 12 switched 24 V outputs (also called valve relay) for valve control.
Click on a valve check box switches the associated 24 V output.
☐ = Valve relay is open / ☑ = valve relay is switched

Switches and opens successively all valve relays, then all on, then opens all and then begins again.

Click again to stop the operation.

[2] Heating 1 and 2
Click on a radio button to set the heating power to the corresponding percentages.

[3] Current output 1 and 2
Click on a radio button to set the current output value to the corresponding mA values.

[4] Stirrer
Click on a radio button to set the rotational speed of the stirrer to the corresponding rpm values.

[5] Slider for adjusting the rotational speed of pump 1 to 7 in rpm
Pump 1 and pump 4 can also rotate to the left, change direction by clicking on either.
„**Pump 1|4 clockwise**“ or „**Pump 1|4 anti-clockwise**“

4.2.5.5 Heating

see also *4.4.1.3.5 System – Heater 1 - 2*

- **Off** - The heater does not heat.
- **Heating** - The heater heats.
- **Energy** - The heater is in power saving mode, i.e. the heater works only during measurement.
- **Overtemp** - Switched off after reaching upper limit value.
- **Shutdown** - Security stop and Emergency stop
  - Security stop (safety function): If the temperature is less than the set lower limit of the PID controller and in 60 s the temperature rises not more than +0.3 ° C, then the heater is turned on for 180 s.
  - Emergency stop: If the temperature is greater than the lower limit set in PID controller and the heating power is greater than 99% for 10 minutes, then the heating is switched off and the BlueMon enters into the error state.
- **Error** - Temperature sensor error.
- **Warm up** - The heater heats up.

4.2.5.6 Valve outputs | Digital inputs | Liquid detector

Valve outputs

- (grey circle) Valve relay is not switched.
- (red circle) Valve relay is switched.

Digital inputs

Digital 1 - 6

- (grey circle) Digital input is not switched.
- (red circle) Digital input is switched.

Leakage

- (grey circle) The system is leak-free.
- (red circle) The system has a leak.

Digestor 1 - 2

- (grey circle) Digestor is OK.
- (red circle) Digestor is damaged.

Liquid detector

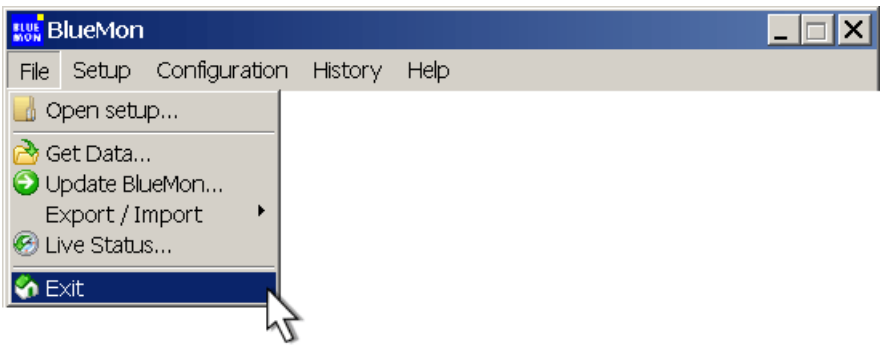
Sample

- (green circle) No bubbles detected in the sample fluid.
- (blue circle) Bubbles detected in the sample fluid.
- (red circle) Liquid detector error (Liquid detector is incorrectly adjusted or damaged.)

Rgt. 1 - 5

- (green circle) No bubbles detected in the reacting fluid.
- (blue circle) Bubbles detected in the reacting fluid.
- (red circle) Liquid detector error (Liquid detector is incorrectly adjusted or damaged.)

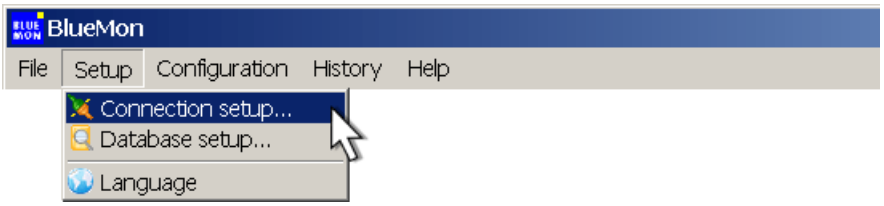
4.2.6 Close Program



Exits BlueMon SQL program.

4.3 Setup drop-down menu

4.3.1 Connection setup



[1] Drop-down menu selection of a BlueMon

[2] Serial number of the selected BlueMon

[3] Project name of the associated project (without spaces or special characters)

[4] Drop-down menu selection of a time zone

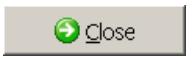
[5] Network setup of the selected BlueMon

[6] If the BlueMon will be accessed via gateway (e.g. through a UMTS-connection), the access data will be entered here (see 4.3.1.1 Setup of a new BlueMon).

Opens the window of the RAS setup.
(RAS configuration is only for modem connection), see *4.3.1.2*

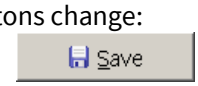
Goes to the setup of a new BlueMon, see next page.

Deletes the selected BlueMon from the list.



Closes the window.

Enter the new serial number or the new network-identification directly in the window.
The buttons change:



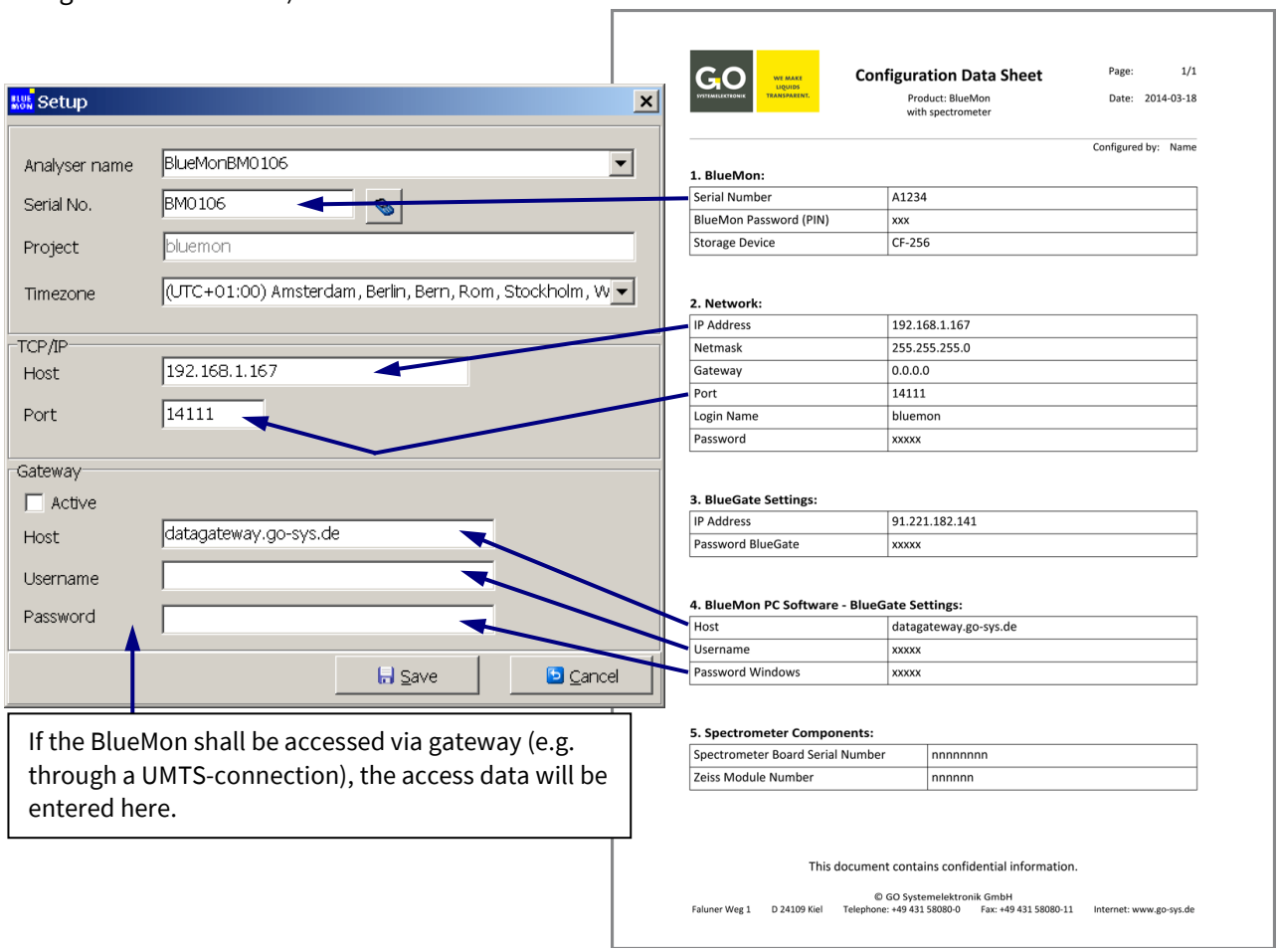
Saves the input.

Aborts the process, no saving.

4.3.1.1 Setup of a new BlueMon

New 4.3.1 Connection Setup

For the settings of a new BlueMon, please refer to the attached configuration data sheet (see Appendix A - The configuration data sheet).



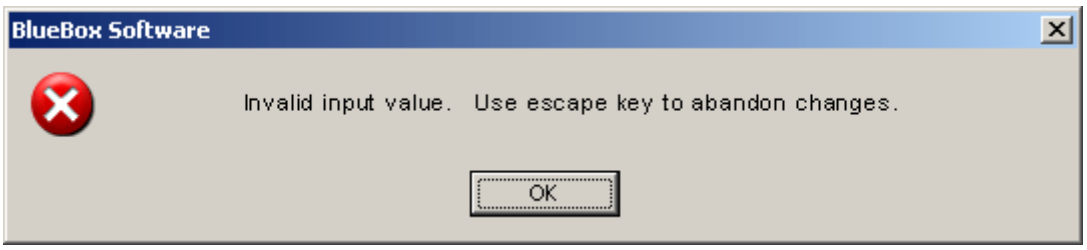
Enter the data of the new BlueMon at the input fields.

Save Setup of the new BlueMon.

Cancel Aborts the process, no setup of a new BlueMon.

Not saved inputs will be retracted by pressing of the Esc-key.

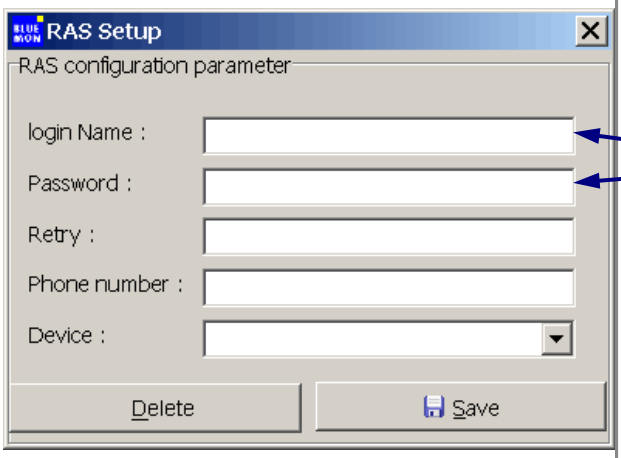
Invalid inputs won't be accepted.

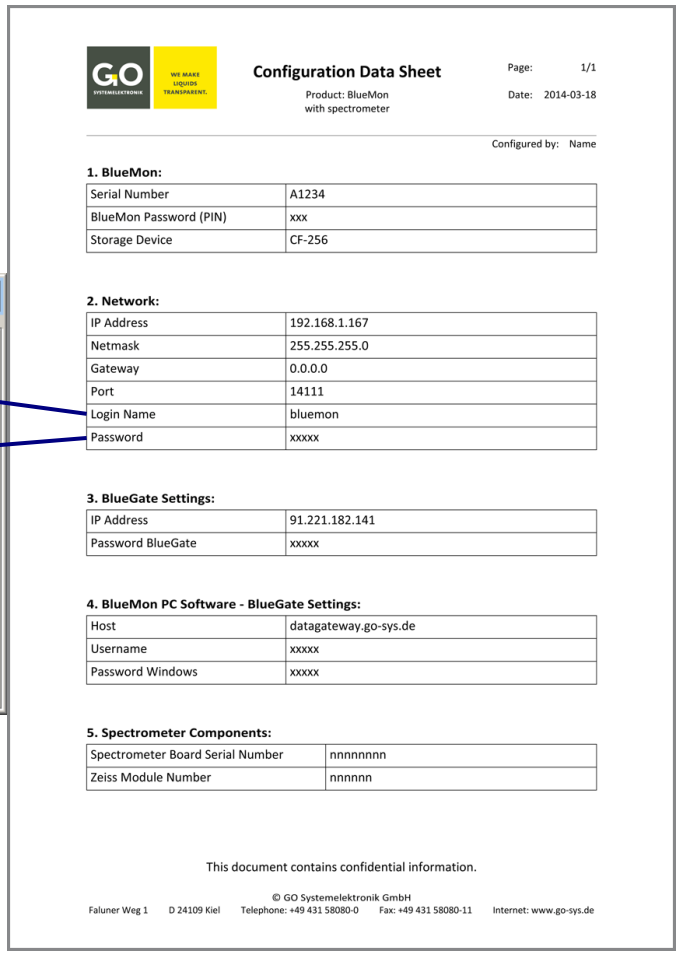


4.3.1.2 RAS setup (Modem configuration)

4.3.1 Connection Setup

In this window the access data to a modem connection has to be entered.





Configuration Data Sheet

Product: BlueMon with spectrometer

Page: 1/1

Date: 2014-03-18

Configured by: Name

1. BlueMon:

Serial Number	A1234
BlueMon Password (PIN)	xxx
Storage Device	CF-256

2. Network:

IP Address	192.168.1.167
Netmask	255.255.255.0
Gateway	0.0.0.0
Port	14111
Login Name	bluemon
Password	xxxxx

3. BlueGate Settings:

IP Address	91.221.182.141
Password BlueGate	xxxxx

4. BlueMon PC Software - BlueGate Settings:

Host	datagateway.go-sys.de
Username	xxxxx
Password Windows	xxxxx

5. Spectrometer Components:

Spectrometer Board Serial Number	nnnnnnnn
Zeiss Module Number	nnnnnn

This document contains confidential information.

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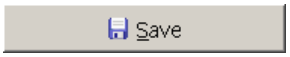
Faluner Weg 1 D 24109 Kiel Telephone: +49 431 58080-0 Fax: +49 431 58080-11 Internet: www.go-sys.de

The password and the login name of a BlueMon are documented in the enclosed configuration data sheet (see Appendix A - The configuration data sheet).

After entering login name, password and after it's confirmation in the text box "Retry", if a modem is installed, the phone number of the BlueMon modem is entered in the field "Phone number".
When entering the phone number, pay attention to the correct country code.

In the drop-down menu "Device" you have to select the connection type. Here all types of connections are shown that are available to the PC or notebook.

Deletes the settings.

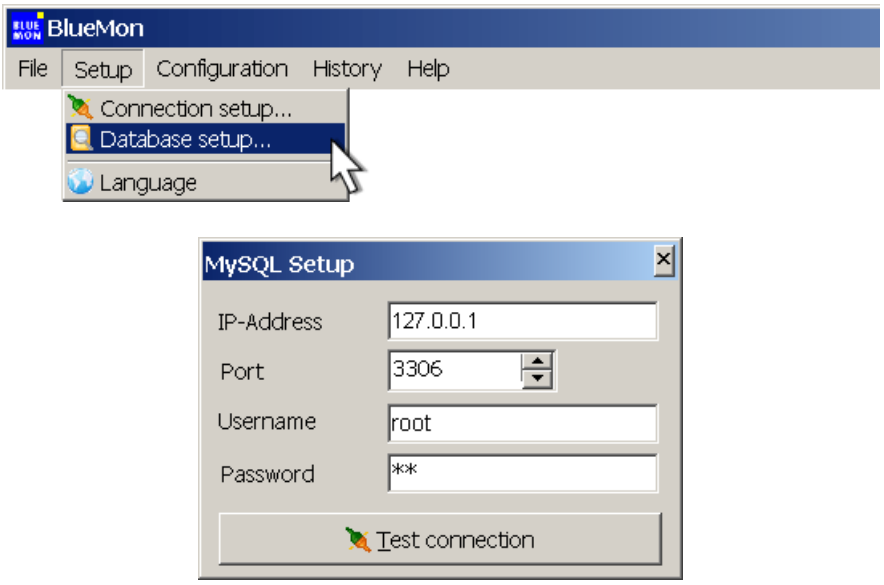


Saves the settings.

Please confirm the inputs with click on the save-button.
The password settings are completed now. You can close the window.

4.3.2 Database setup

Here you determine in which MySQL™ Server the data of the BlueMon will be stored.



IP-Address The IP address of your MySQL™ Server. If the server runs on the same PC as the BlueMon SQL Software, „localhost“ is entered here.

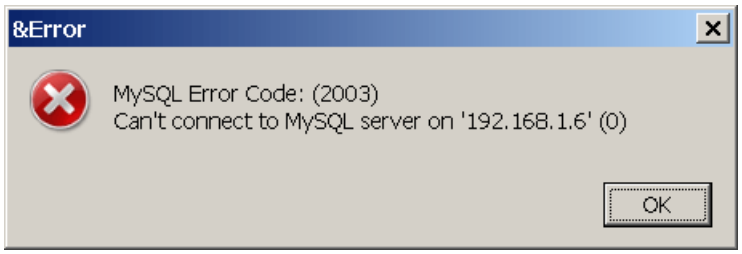
Port Default port address 3306 of the MySQL™ Server

Name Username of the MySQL™ Server, default name is „root“.

Password Password of the MySQL™ Server, set at the installation of the MySQL™ Server.

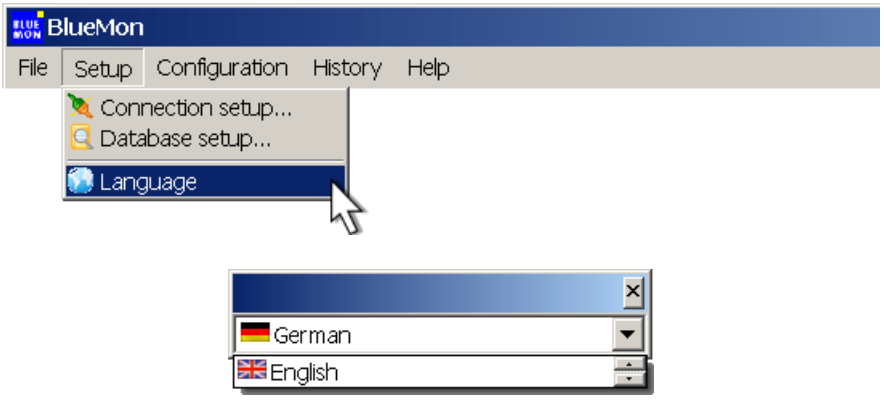
Tests the connection to the MySQL™ Server.

The connection exists. You can go on.



The connection does not exist. Check your settings.

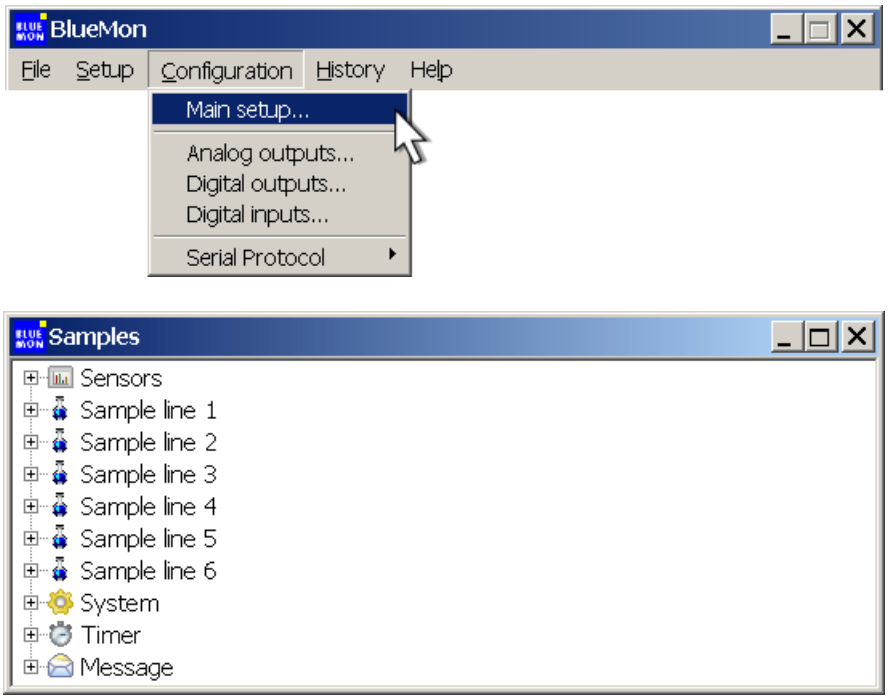
4.3.3 Language selection



The BlueMon PC Software offers the choice between German and English.
The menu navigation is identical in both cases.
This language selection defines also the menu language of the other programs.

4.4 Configuration drop-down menu

4.4.1 Main setup



Via the main setup window you parameterize and control the BlueMon.
In the following pages you see how the device control is set up.

Terminology:

A **Process Sequence** consists of **Sequence Elements**.

Sequence elements consist of

- **Waiting Times**

  and

- **Sequence Programs**.

A Sequence Program is

- an **Analysis Sequence**

  or

- a **Calibration Sequence**

  or

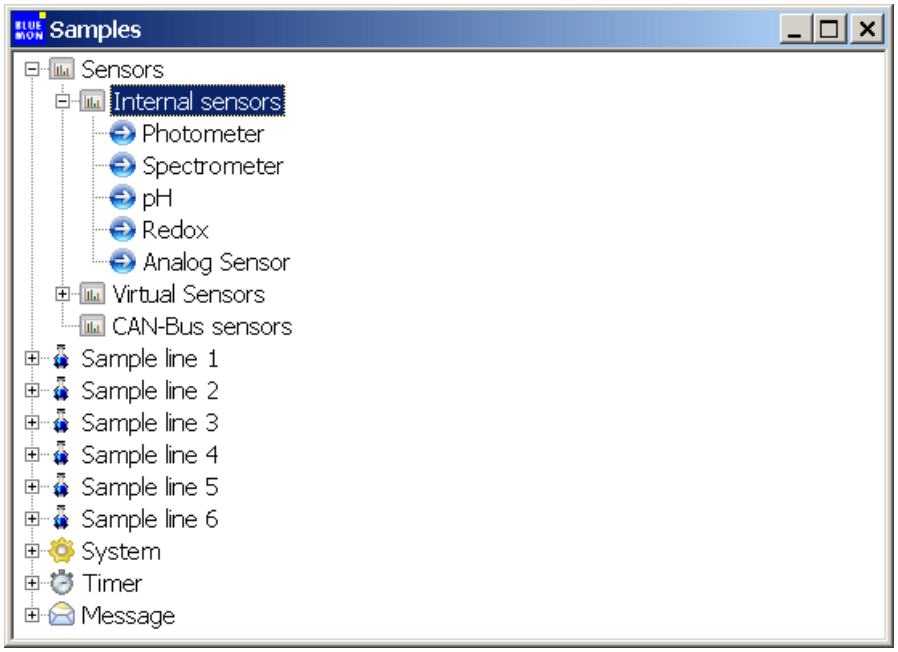
- a **Cleaning Sequence**.

separately: **Cancel Sequence**

4.4.1.1 Samples – Sensors

In this chapter there is decribed the setup of the internal sensors, the virtual (calculated) sensors and the CAN-bus sensors.

4.4.1.1.1 Sensors – Internal sensors

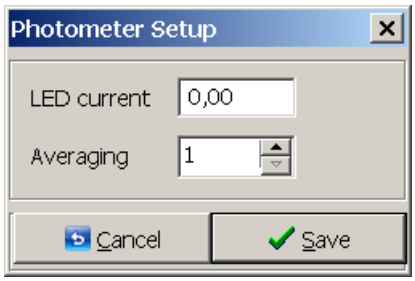


Photometer 36
Spectrometer 37
Measurement parameter 37
Zeiss data sheet 38
pH 39
Redox (ORP) 39
Analog Sensor 39

Available are a photometer*, a spectrometer*, a pH sensor, a Redox(ORP) sensor and a analog sensor (current input).
Double-click on a sensor icon opens a setup window.

* if existing

Photometer

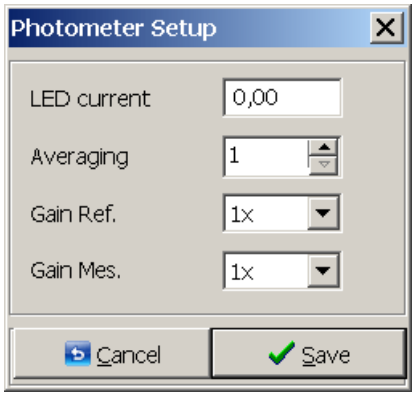


LED current determines the LED-current of the Photometers, and therefore the LED brightness.
Value range: [1 - 80 mA]

⚠	Mind the permitted maximum current of the LED.

Averaging determines the number of single measurements from which a floating average is calculated, this average is the recorded measurement value. Value range: 1 – 60

Photometer from Software Version 1.3.2.0



LED current determines the LED-current of the Photometers, and therefore the LED brightness.
Value range: [1 - 80 mA]

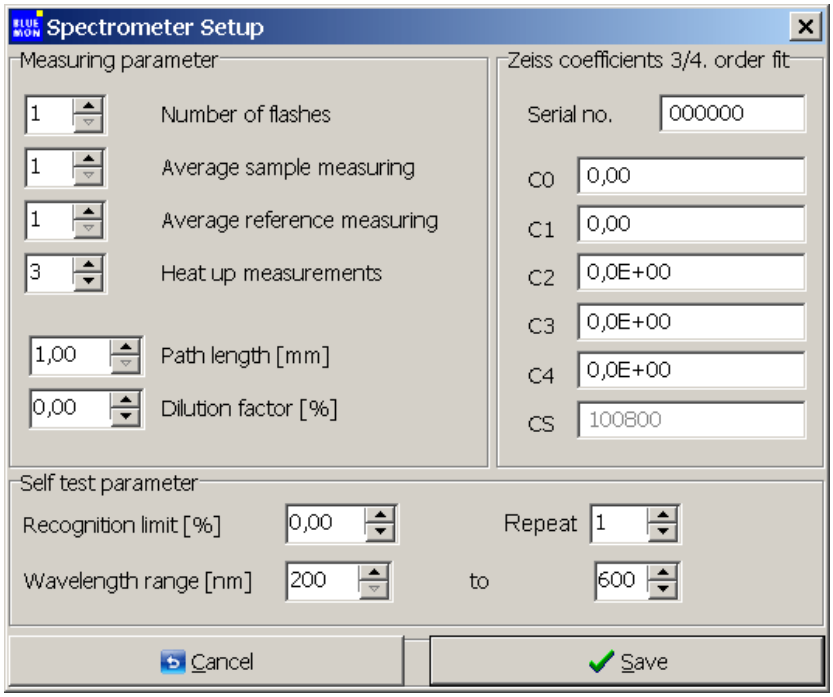
⚠	Mind the permitted maximum current of the LED.

Averaging determines the number of single measurements from which a floating average is calculated, this average is the recorded measurement value. Value range: 1 – 60

Gain Ref. determines the gain factor for the reference channel of the photometer.

Gain Mes. determines the gain factor for the measurement channel of the photometer.

Spectrometer Parametrisation of the spectrometer

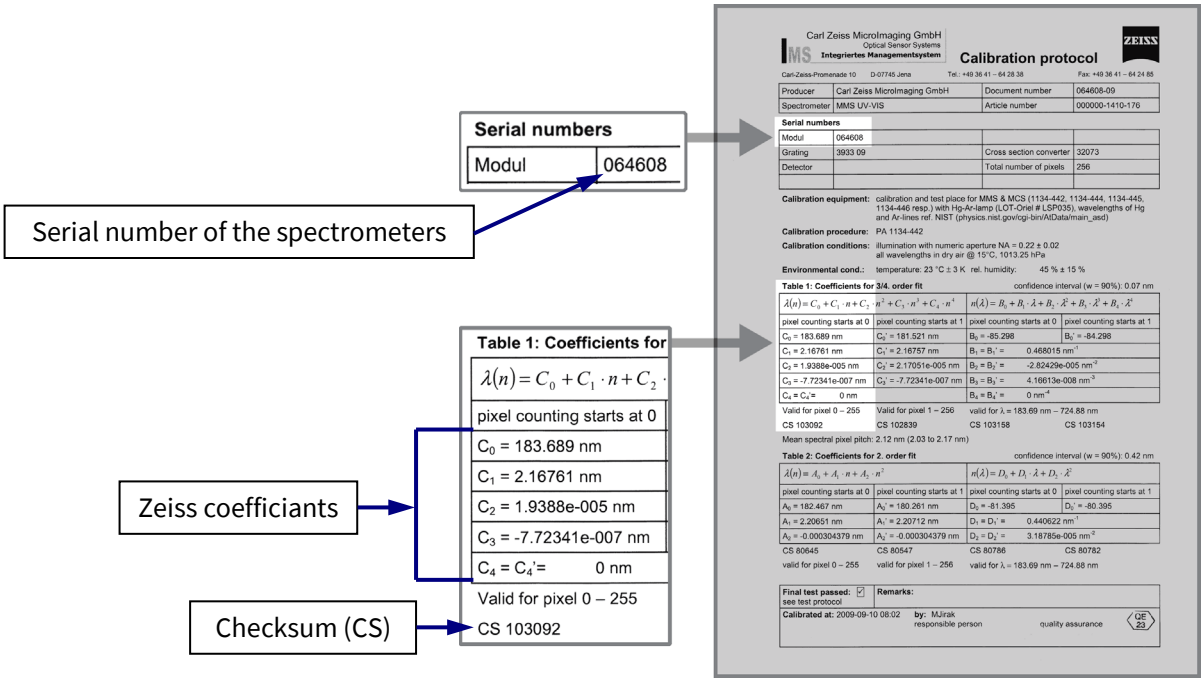


Measurement parameters

- **Number of flashes** - Number of light flashes per single measurement (intensity): results in a spectrum.
- **Average sample measurement** - Number of single measurements per sample measurement: The final measurement result is the arithmetic mean of the single measurements.
- **Average reference measurement**- Number of single measurements per reference measurement: The final measurement result is the arithmetic mean of the individual measurements.
- **Heat up measurements** - Number of light flashes to heat up the xenon lamp of the spectrometer
- **Path length [mm]** - Input of the measurement path length of the spectrometer
  Can be queried in formulas with **BM.ISA.PathLength**
- **Dilution factor [%]** - Solution dilution
  Can be queried in formulas with **BM.ISA.DilFactor**

Zeiss data sheet of the spectrometer

The Zeiss-coefficients and their associated checksum can be found on the Zeiss datasheet.
If the Zeiss-coefficients need to be changed, the checksum field serves to verify the inputted values.

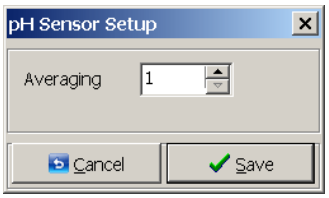


After entering the Zeiss coefficients the displayed checksum has to be the same as the checksum in the data sheet!

Selfe test parameter ⇨ in preparation

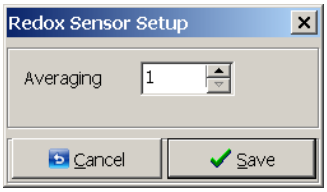
- **Recognition limit [%]**
- **Repeat**
- **Wave length range [nm]**

pH



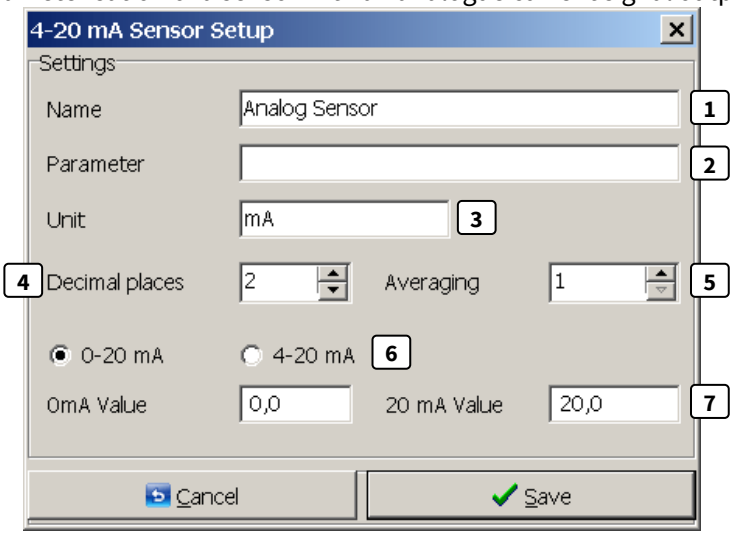
Averaging determines the number of single measurements from which a floating average is calculated, this average is the recorded measurement value..

Redox (ORP)



Averaging determines the number of single measurements from which a floating average is calculated, this average is the recorded measurement value..

Analog Sensor Parameterisation of a sensor with an analogue current signal output



[1] Name of the sensor

[2] Denotation of the measured parameter

[3] Unit of the measurement value

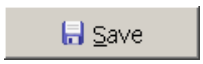
[4] Number of decimal places of the displayed measurement value

[5] Number of single measurements, the floating average is the measurement value.

[6] Selection of a current input range

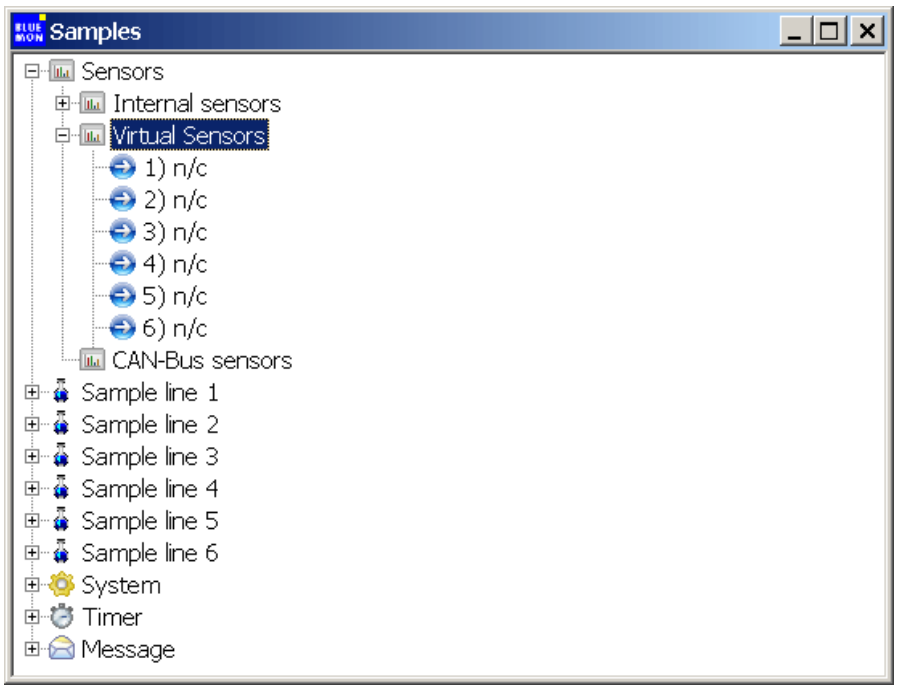
[7] Assignment of a measurement value range to the current input range
Example: 0 mA ≙ 0 mg | 20 mA ≙ 100 mg

Closes the window without saving the settings.



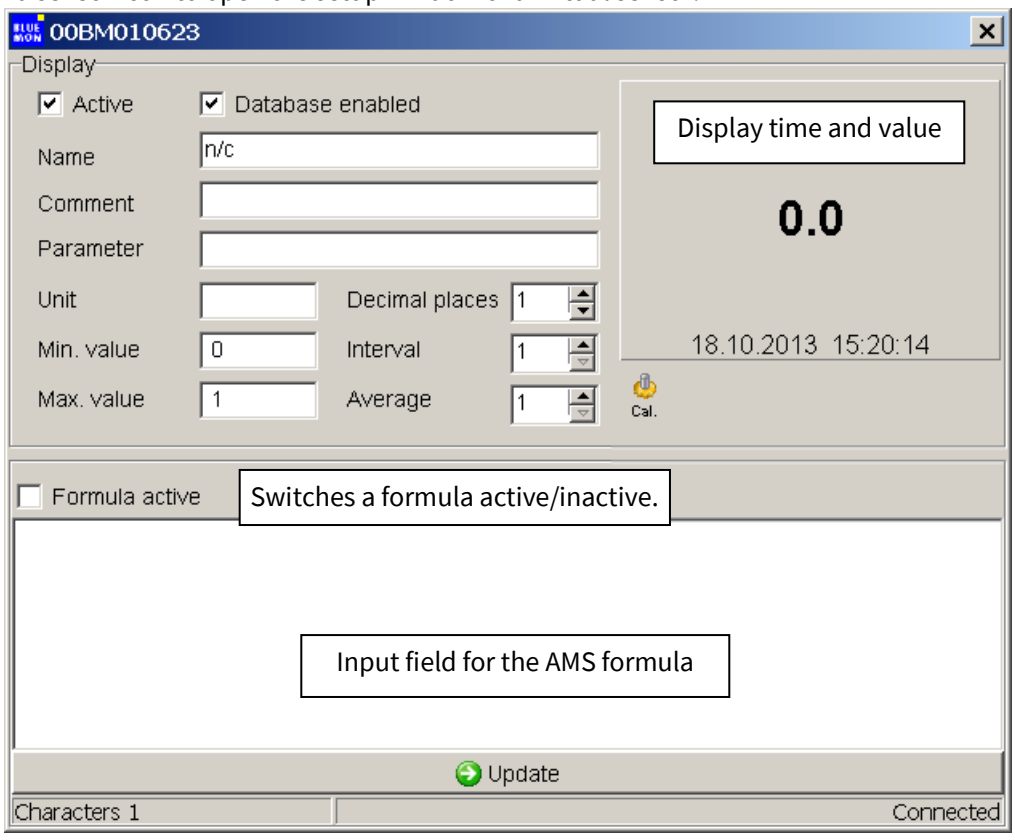
Saves the settings and closes the window.

4.4.1.1.2 Sensors – Virtual Sensors



Here you can setup virtual (calculated) sensors. The programming of virtual sensors is done with the formula language AMS formula.
see *4.4.1.2.4 Sample lines – Formula* | *Appendix G - AMS Formula* inter alia

Double-click a sensor icon to open the setup window of a virtual sensor.

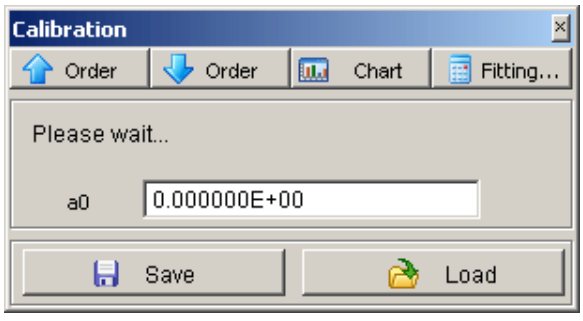


Transfers the sttings to the BlueMon.

☑ Active	The virtual sensor is active.
☐ Active	The virtual sensor is not active.
☑ Database enabled	The value of the virtual sensor is stored in the database.
☐ Database enabled	The value of the virtual sensor is not stored in the database.

Name	Name of the sensor, appears at query from other programs. Input “n/c” makes the sensor inactive.
Comment	Comment field
Parameter	Designation of the measured parameter
Unit	Unit of the measurement values
Decimal places	Number of decimal places of the displayed value
Interval	Measuring interval
Min. value	Smallest stored and displayed value
Max. value	Highest stored and displayed value
Average	If this value is greater than 1, the measured value is the average of n measurements (n = entered value).

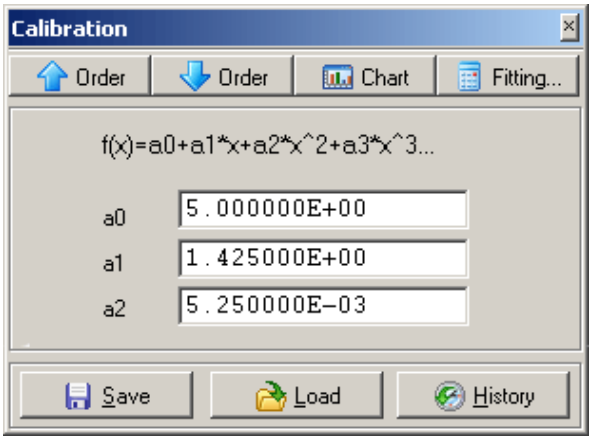
Opens a calibration window after a password prompt.



4.4.1.1.2.1 Multi-point calibration

Sensor setup window

Direct coefficient setting for the calibration polynomial (see also the next page).
Already existing coefficients are displayed.



Raises the number of calibration coefficients (max. 8).

Reduces the number of calibration coefficients.

Opens a window that displays the assignment of the raw values to the measured values graphically.

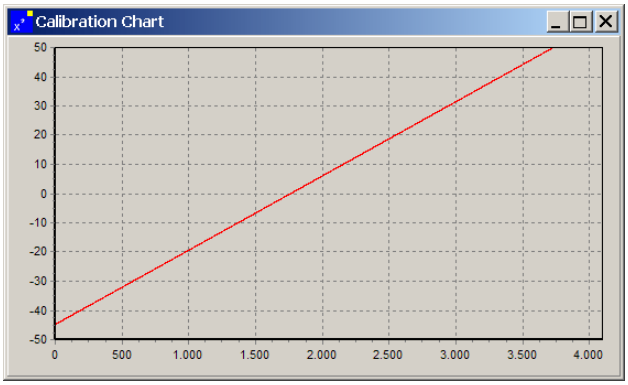
Opens the calibration fitting window (see next page).

Opens a window for choosing the file storage path.
Saves the calibration settings as .cal-file on the PC.

Opens a window for choosing the file storage path.
Already stored calibration settings are loaded from the PC.

Opens the calibration history.

Start window of the calibration



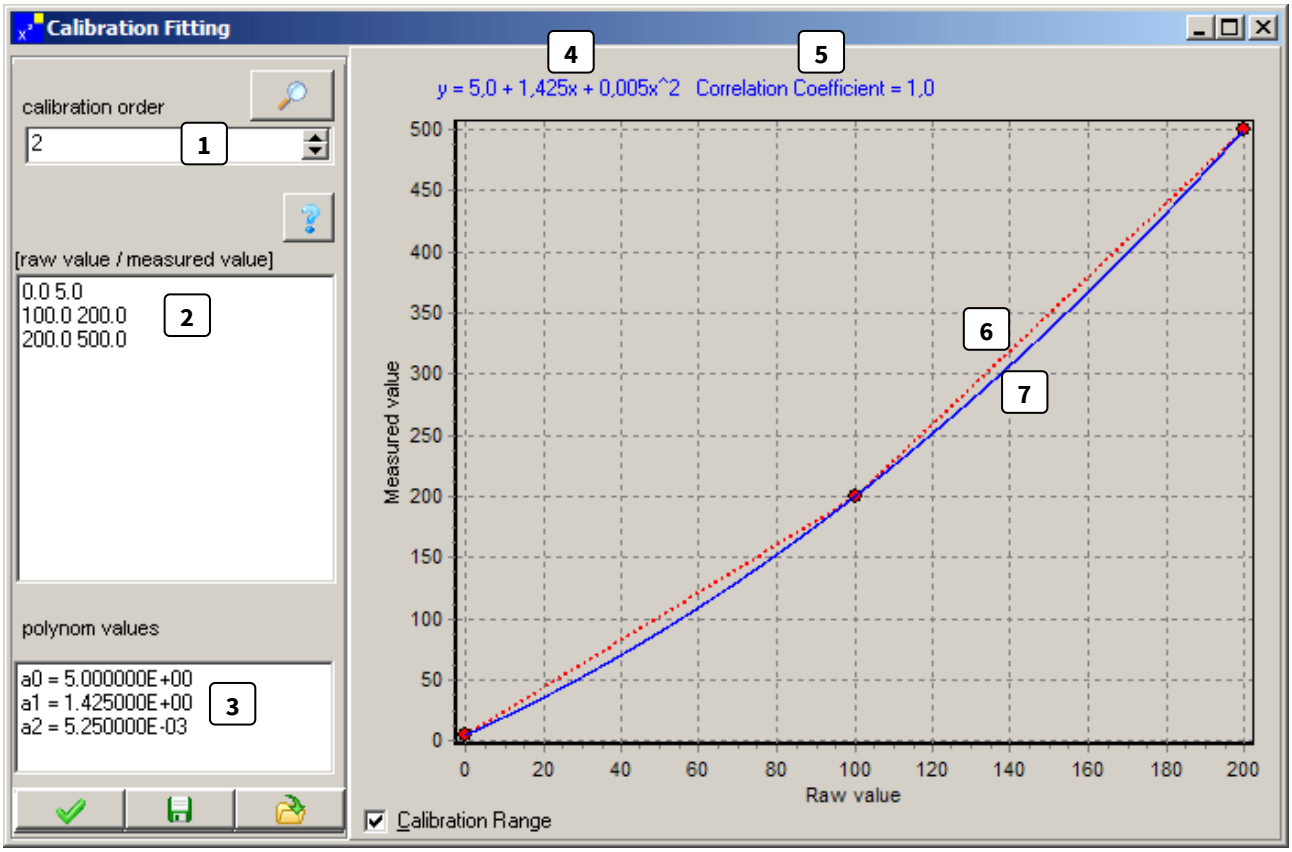
Assignment of the raw values (x-axis) to the measured values (y-axis)
Example of a degree 1 polynomial

Calibration Fitting

Start window of the calibration

A calibration generates, by a comparison with calibration mediums, value pairs out of sensor raw values and real values. These value pairs will be considered as points in a coordinate system.
Through these points a curve will be placed preferably exactly of a degree 1 up to a degree 8 polynomial, this is the **calibration polynomial**.

Example manual 3-point-calibration:



[1] Input **2** ⇒ The curve of calibration will be calculated with a degree 2 polynomial.

[2] Input **0.0 5.0 | 100.0 200.0 | 200.0 500.0** ⇒ value pairs of raw value and reference value
To each raw value of the sensor the actual value of a calibration medium or a reference instrument is allocated, here as example 3 value pairs. By changing the input 1 you can change the degree of the calibration polynimial to put the curve of the polynomial as accurately as possible along the coordinate points of the value pairs. In each line, the entry has to be confirmed by pressing the Enter key.

[3] the coefficients of the computed calibration polynomial

[4] the calibration polynomial

[5] Correlation Coefficient is the grade of approximation of the correction curve to the calibration value pairs, here as example 1, i.e. the curve of the calibration polynomial touches all coordinate points of the value pairs.*

[6] coordinate points of the value pairs (red) connected with straight lines (red)

[7] curve of calibration polynomial (blue)

* Describes the point correlation, not the curve in the region outside of the coordinate points of the value pairs.

Displays the actual raw value.

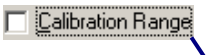
Opens a note window: Use CTRL-R to insert the actual raw value."

Transfers the calibration function to the sensor.

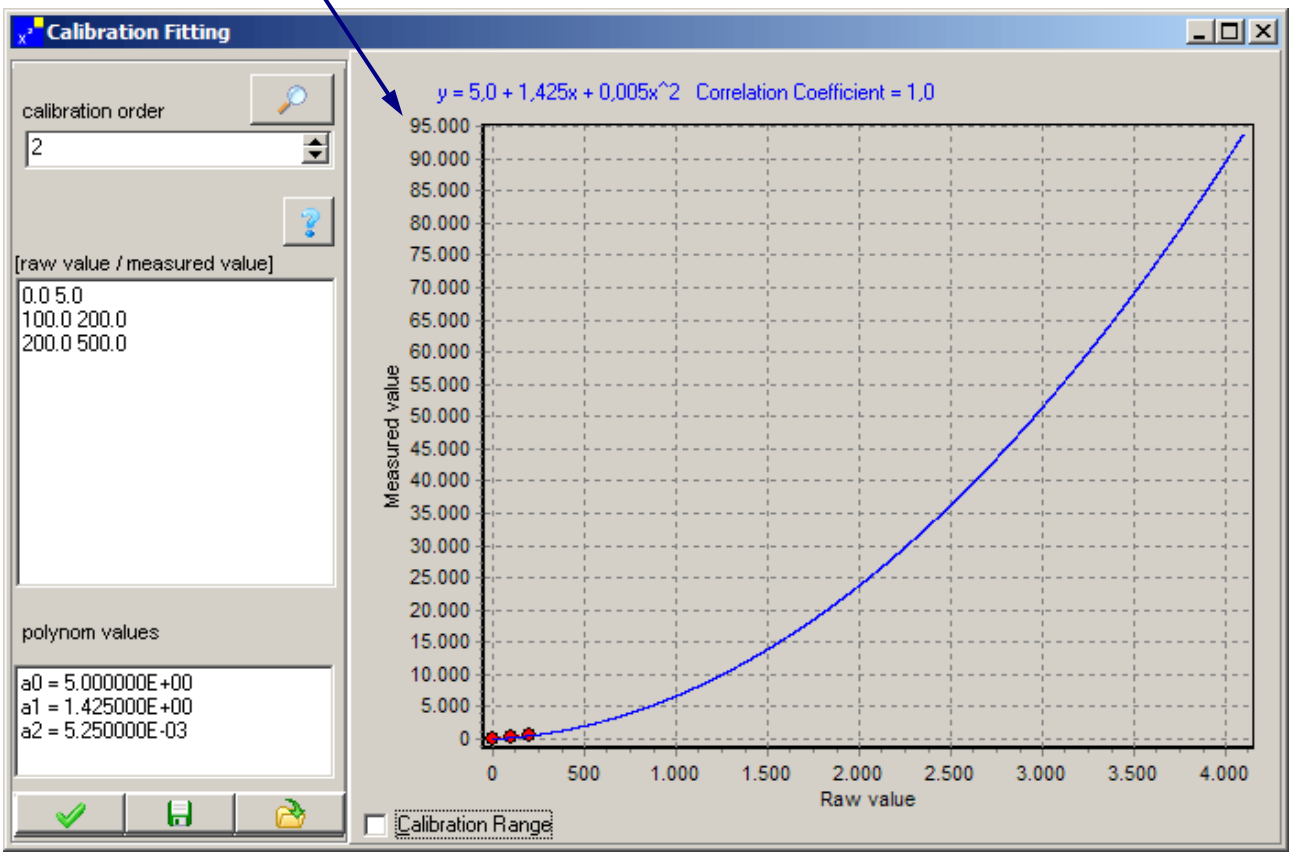
Saves the calibration values as .cal-file.

Loads an already existing .cal-file.

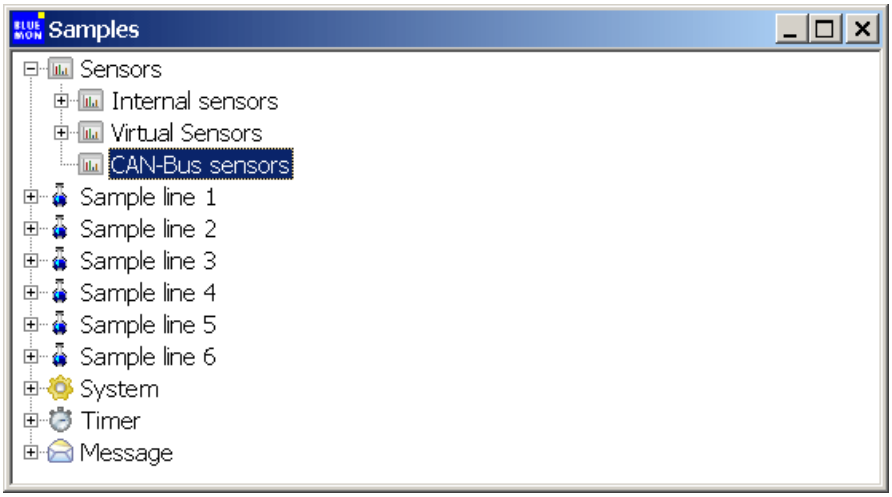
Displays only the range of coordinate points of the pairs of value.



Displays the whole range of measurement of the sensor.



4.4.1.1.3 Sensors – CAN-Bus sensors

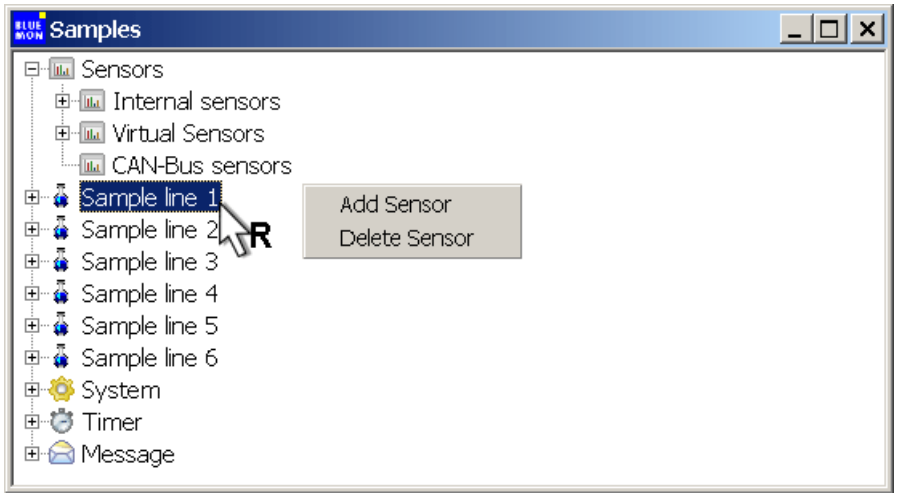


CAN-bus sensors are external sensors, connected via the CAN-bus connection of the BlueMon.
The displaying of the external CAN-bus sensors takes place after the transfer of the BlueMon data into the database of the MySQL ™ server (see 4.2.2 Open BlueMon > Get Data).

4.4.1.2 Samples – Sample lines

In the following windows you configure the sample lines.

4.4.1.2.1 Sample lines – Add and delete measurement value



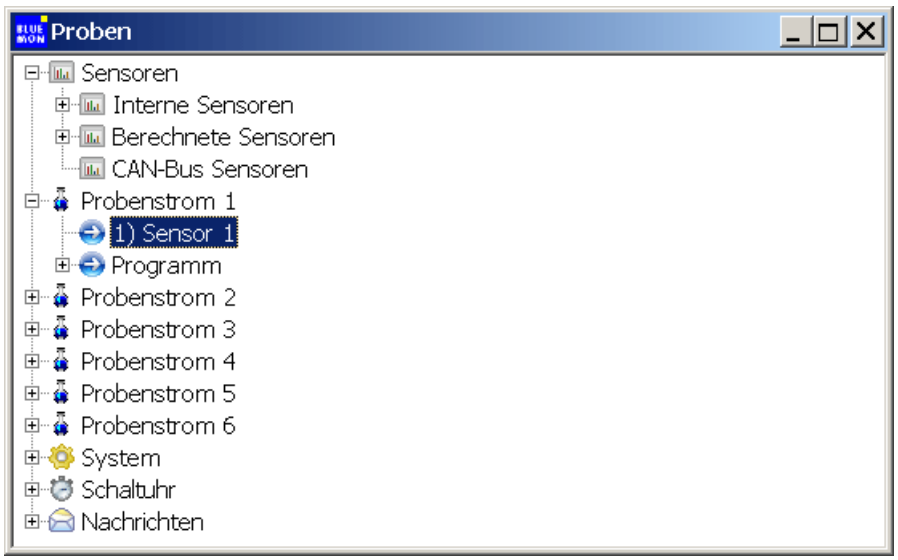
Click with the right mouse button opens a select menu.

The measurement values of a sample line are calculated as „Result1“, „Result2“ and „Result3“ in the formula window. These results are displayed in the LiveStaus window as sensor values.

Add Sensor adds a measurement value (here named sensor). max 3

Delete Sensor deletes a measurement value

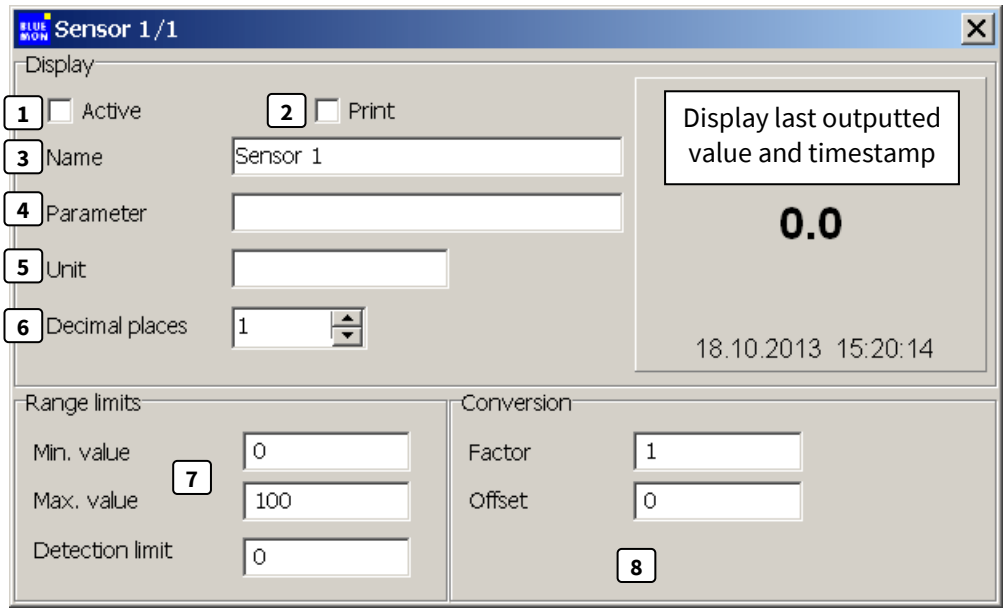
4.4.1.2.2 Sample lines – Sensor



Double click on 1) Sensor 1

Here you determine certain properties of the measurement value.

The output values of a measurement value are calculated as „Result1“, „Result2“ and „Result3“ in the formula window. These results are displayed in the LiveStaus window as sensor values.



[1] The measurement value is active or not.

[2] If a printer is connected, the measurement values are printed.

[3] Name of the sensor, appears in queries by other programs.
If the entry is "n / c" the sensor is inactive.

[4] Name of the parameter

[5] Unit of the measurement value

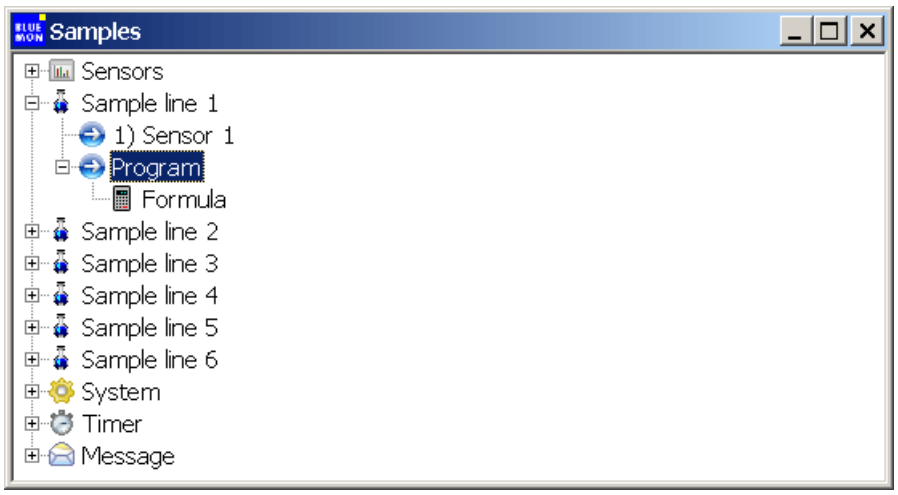
[6] Number of decimal places displayed

[7] Range limit of the measurement value

[8] Gain and offset of the measurement value
Result* = calculated value x Factor + Offset

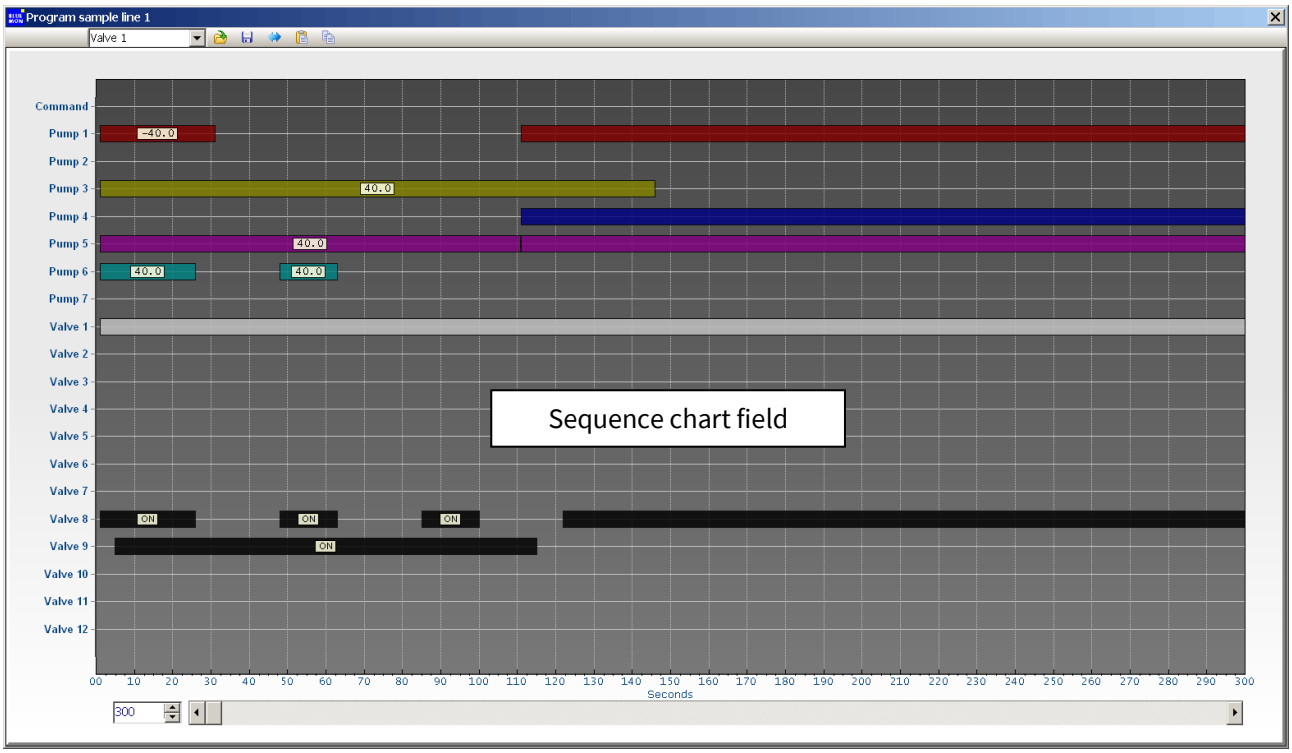
* e.g. for a unit conversion

4.4.1.2.3 Sample lines – Program (analysis sequence)



Double-click <Program >
Double-click on the program symbol opens the window of the sequence chart of the analysis sequence. Here you can schedule type, start time and duration of the sequence elements.

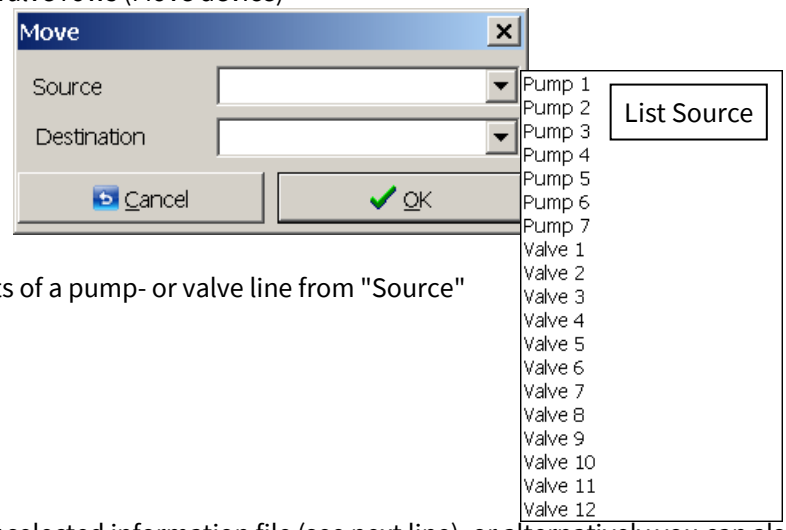
The sequence is displayed as Gantt chart.



Load sequence from file.
Opens an already saved analysis sequence as a .prg file.

Save sequence in file.
Saves the current analysis sequence as a .prg file.

Move pump- and valve rows (Move device)



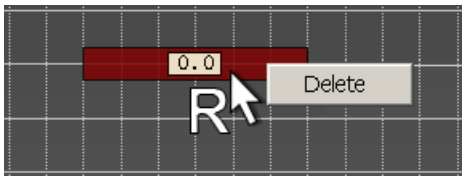
Moves all elements of a pump- or valve line from "Source" to "Destination".

Click opens a user selected information file (see next line), or alternatively you can also press the F1 key.
Possible formats: bmp, doc, jpg, pdf
If no file is selected, the button has no function, similarly the F1 key.

Click opens a window to select a user information file.
Possible formats: bmp, doc, jpg, pdf
You can only select one file.

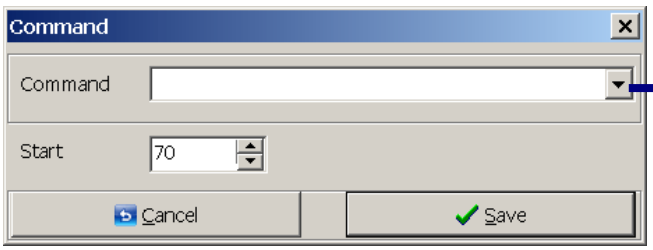
Determines the time period to view in seconds.

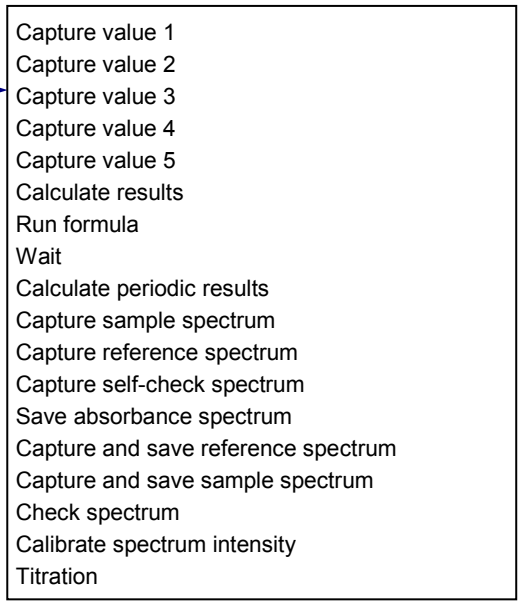
Right mouse button click on an element in the sequence chart field calls up a <Delete> button.



Click on the button deletes the element.

Double-click sequence chart field command line
Double-click on the command line or on an existing element opens the command window.





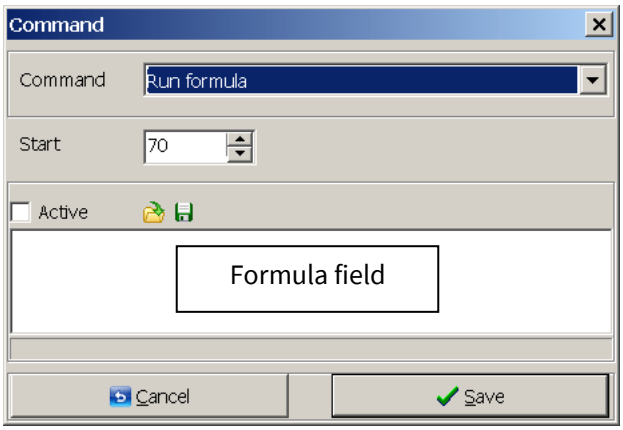
The command drop-down menu allows you to perform operations at desired time.
The displayed start time depends on the double-click position on the command line, but can also be set in the window of the single command.

Drop-down menu Command

1. **Capture value 1 - 5**
   Value Capture records the measurement values of all internal sensors (exeption spectrometer) in a list, list 1 (= Capture value 1) to list 5 (= Capture value 5). These list values can be queried in formulas.

2. **Calculate results**
   Executes the entry in the formula field of the command window (siehe *4.4.1.2.4 Sample lines – Formula*).

3. **Run formula**
   Executes the entry in the formula field of the command window.



The formula code* is written in the formula field and transferred to the BlueMon with the update function (see *4.2.2 Get Data*).

☐ The formula is inactive.

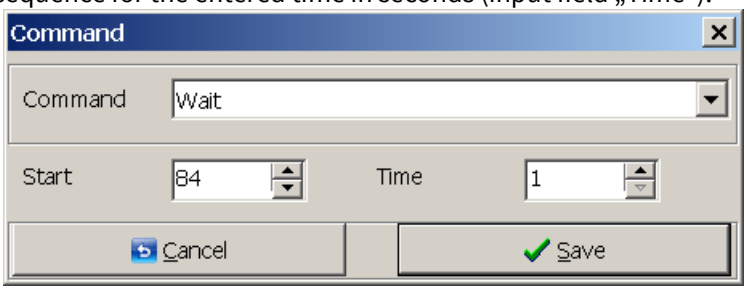
☑ The formula is active.

Saves a formula entry as .bf-file.

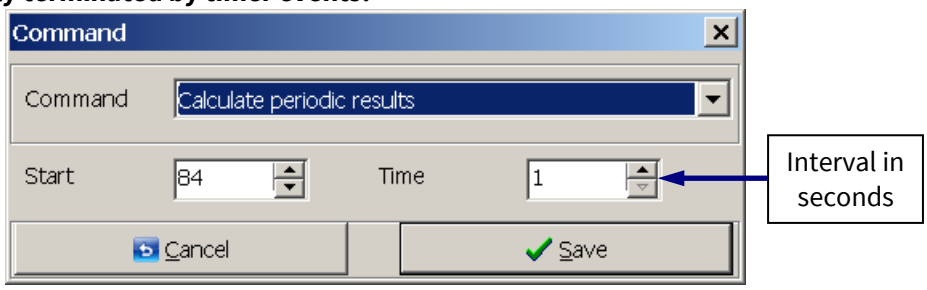
Opens a saved formula entry.

* Please read the corresponding chapters of this manual.

4. **Wait**
   Stops the analysis sequence for the entered time in seconds (input field „Time“).



5. **Calculate periodic results**
   Performs the entry in the formula field of the formula window periodically.
   see *4.4.1.2.4 Sample lines – Formula*
   The sequence program will be stopped at this point, all active pumps and valves remain active!
   This process is only terminated by timer events!

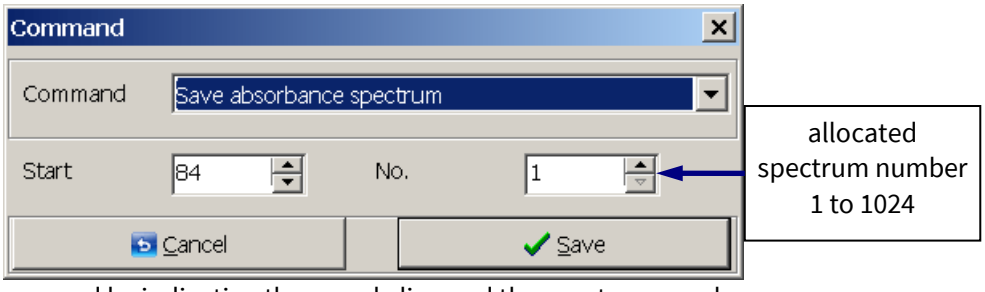


6. **Capture sample spectrum**
   Performs a sample measurement, i.e. the spectrometer detects a sample spectrum.
   Settings see *4.4.1.1.1 Sensors – Internal sensors*, there *Spectrometer*

7. **Capture reference spectrum**
   Performs a reference measurement, i.e. the spectrometer detects a reference spectrum.
   Settings see *4.4.1.1.1 Sensors – Internal sensors*, there *Spektrometer*

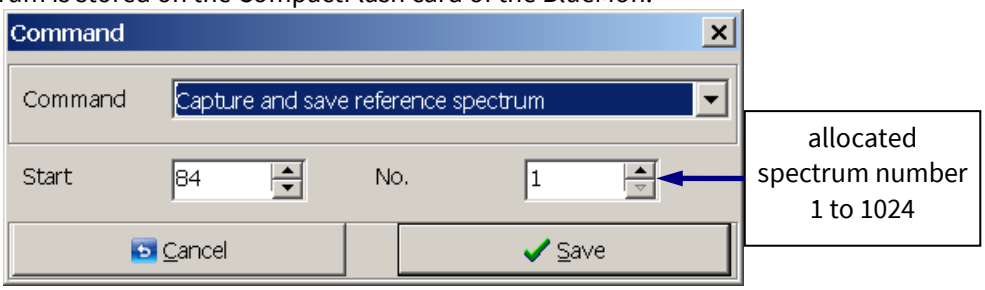
8. **Capture self-check spectrum**
   Performs a check spectrum measurement, i.e. the spectrometer detects a check spectrum.
   A check measurement is used for error control.

9. **Save absorbance spectrum**
   The absorbance is a calculated spectrum from the sample spectrum last recorded or loaded and the last recorded or loaded reference spectrum.
   The absorbance spectrum is stored on the Compact Flash Card of the BlueMon.
   The absorbance spectrum is the intended result of the measurement.



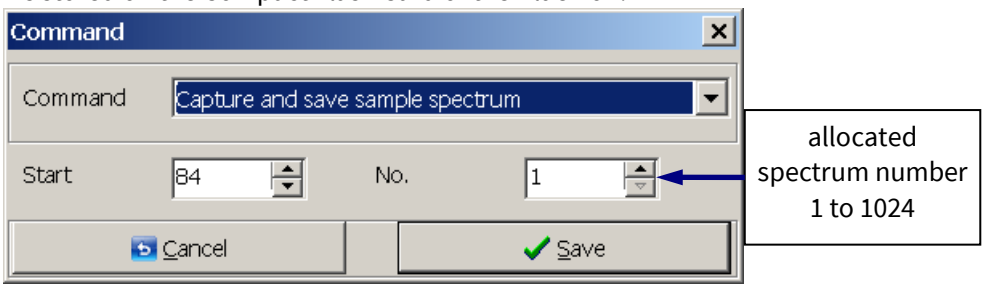
   The spectrum can be accessed by indicating the sample line and the spectrum number.

10. **Capture and save reference spectrum**
As 7. yet the the spectrum is stored on the CompactFlash card of the BlueMon.



The spectrum can be accessed by indicating the sample line and the spectrum number.

11. **Capture and save sample spectrum**
As 6. but the spectrum is stored on the Compact Flash Card of the BlueMon.

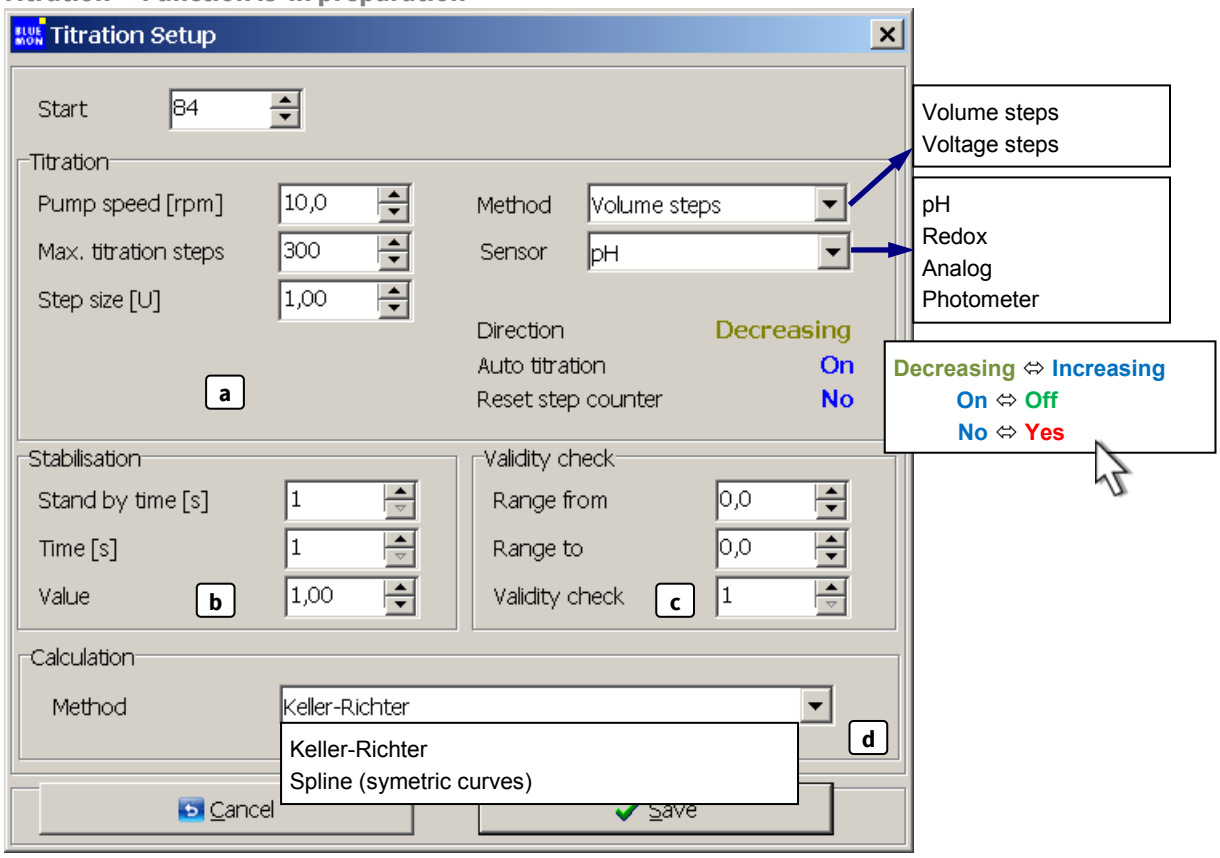


The spectrum can be accessed by indicating the sample line and the spectrum number.

12. **Self test with Check spectrum ⇨Function is in preparation**

13. **Calibrate spectrum intensity**
This function is for the automatic intensity calibration.

14. **Titration ⇨Function is in preparation**



a. Parameterization of the titration and sensor selection

b. Stabilisisation

c. Validity check

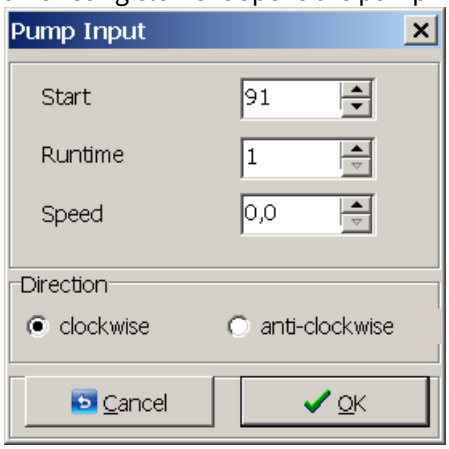
d. Calculation method
   - Keller-Richter
   - Spline (symetric curves)

Closes the window without saving the entries.

Saves the entries and closes the window.

Double-click sequence chart field, line Pump 1 - 7

Double-click on the pump line or on an existing element opens the pump input window.



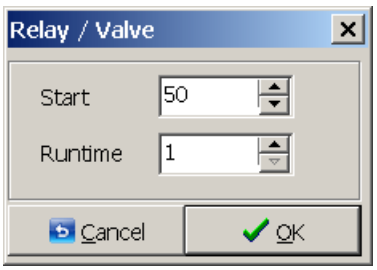
Start	Point of execution time, corresponds to the position of the double-click
Runtime	Duration of pumping
Speed	Pump speed in rpm
clockwise / anti-clockwise	Rotation direction of the pump

Closes the window without saving the entries.

Saves the entries and closes the window.

Double-click sequence chart field, line valve 1-6

Double-click on the valve line or on an existing element opens the relay/valve window.

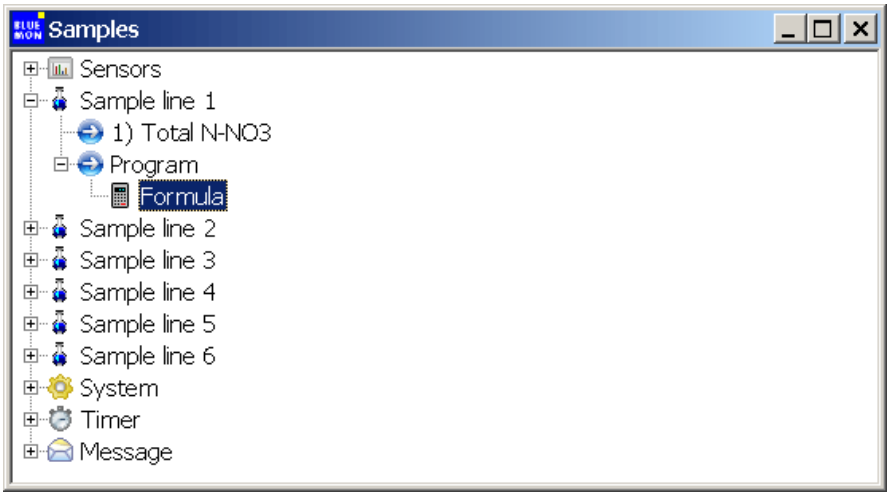


Start	Switching time point, corresponds to the position of the double-click
Runtime	Switching time in seconds

Closes the window without saving the entries.

Saves the entries and closes the window.

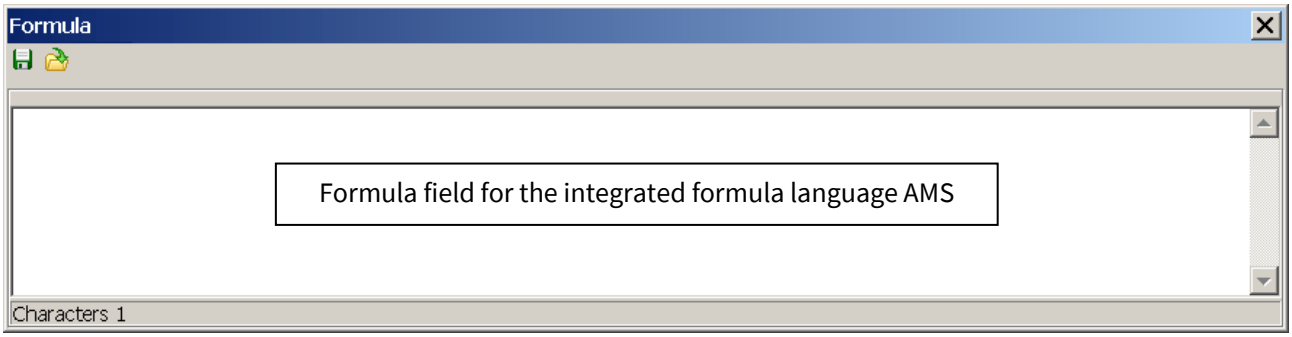
4.4.1.2.4 Sample lines – Formula



Double-click <Formula> opens the formula window of the particular sample line.

Here you can enter AMS formulas. You execute these formulas with the list entry <Calculate Result> in the command window.

The formula code is written in the formula field and transferred to the BlueMon with the update function (see *4.2.3 Update BlueMon*).

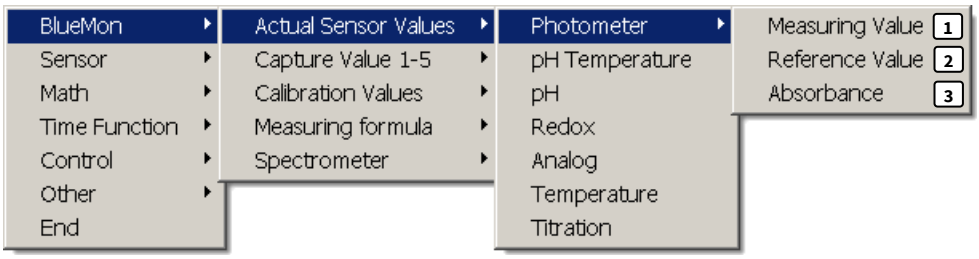


Saves a formula entry as .bf-file.

Opens a .bf-file.

One click with the right mouse button in the formula field opens the input assistance.
Click of an entry in the selective list leads forward correspondingly.
Here only the BlueMon specific formula elements are described.
The general formula elements are described in *Appendix E* and *Appendix F*.

Menu group Actual Sensor Values > Photometer:

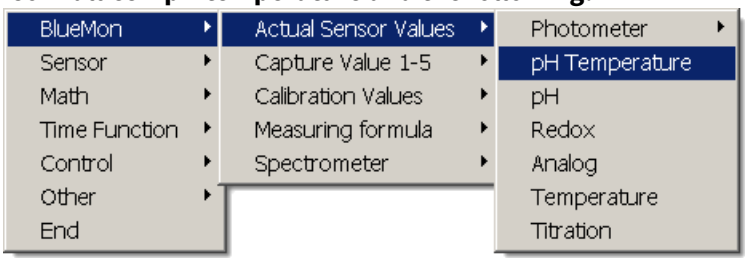


[1] current measurement value of the photometer — Formula entry ⇒ **BM.MES**

[2] current reference value of the photometer — Formula entry ⇒ **BM.REF**

[3] current absorbance value of the photometer — Formula entry ⇒ **BM.E**

Menu group Actual Sensor Values > pH temperature and the following:



current measurement value of the pH temperature sensor — Formula entry ⇒ **BM.PHTEMP**

current measurement value of the pH sensor — Formula entry ⇒ **BM.PH**

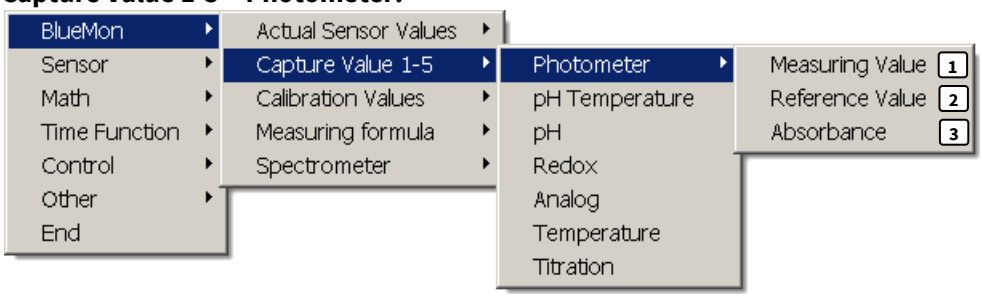
current measurement value of the Redox (ORP) sensor — Formula entry ⇒ **BM.REDOX**

current measurement value of the analog current input — Formula entry ⇒ **BM.ANALOG**

current measurement value of the temperature sensor — Formula entry ⇒ **BM.TEMP**

current measurement value of the titration sensor — Formula entry ⇒ **BM.TITRATION**

Menu group Capture Value 1-5 > Photometer:

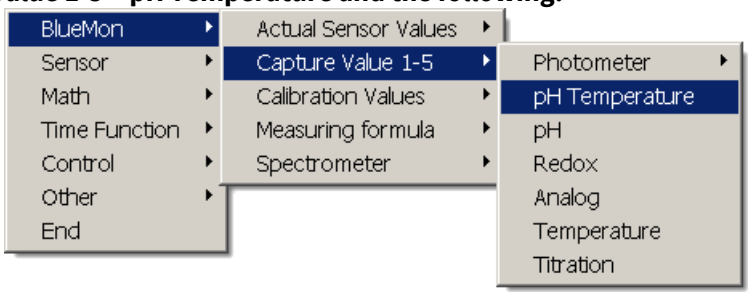


[1] Measurement value from photometer list 1 - 5 — Formula entry ⇒ **BM.MES***1-5*

[2] Reference value from photometer list 1 - 5 — Formula entry ⇒ **BM.REF***1-5*

[3] Absorbance value from photometer list 1 - 5 — Formula entry ⇒ **BM.E***1-5*

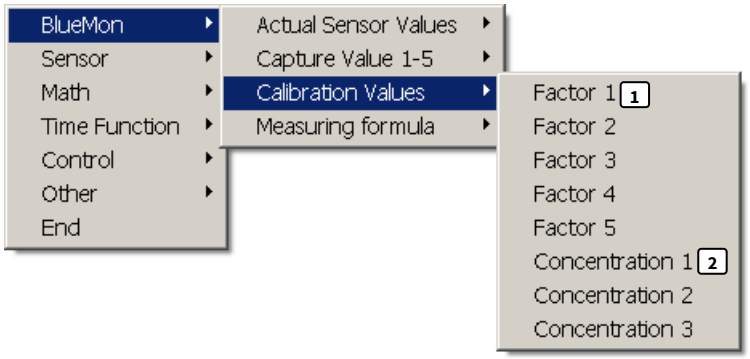
Menu group Capture Value 1-5 > pH Temperature and the following:



Measurement value from list 1 - 5 (= Capture Value 1 - 5):

pH temperature sensor	Formula entry ⇒ **BM.PHTEMP***1-5*
pH sensor	Formula entry ⇒ **BM.PH***1-5*
Redox (ORP) sensor	Formula entry ⇒ **BM.REDOX***1-5*
analog current input	Formula entry ⇒ **BM.ANALOG***1-5*
Temperature sensor	Formula entry ⇒ **BM.TEMP***1-5*
Titration sensor	Formula entry ⇒ **BM.TITRATION***1-5*

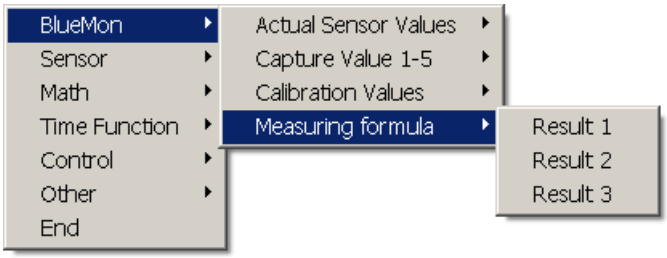
Menu group Calibration Values:



[1] Calibration factors	Formula entry ⇒ **BM_CAL***1-5*
[2] Calibration concentrations	Formula entry ⇒ **BM_C***1-3*

see *4.2.5.4.1 Input calibration factors, calibration concentrations and warning/alarm limits*

Menu group Measuring formula:

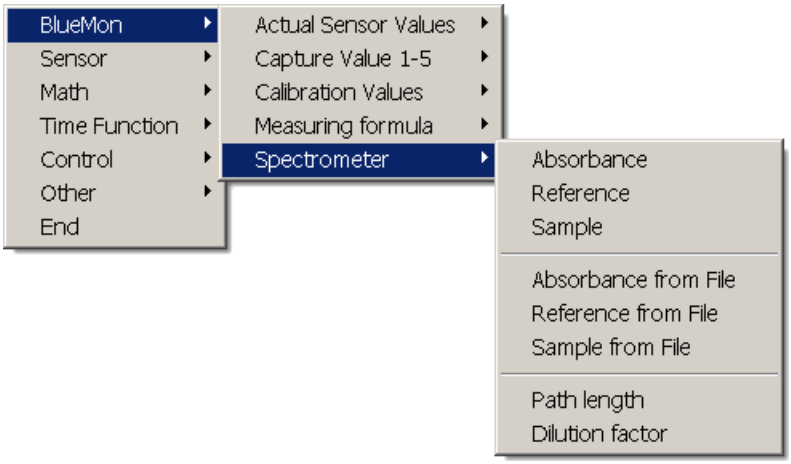


Result 1 - 3 (Result definition) Formula entry ⇒ **Result***1-3***=**

Formula example:
Result1 = (BM.PH1 + BM.PH2) / 2;

First measurement value of a sample line (Result1) = [(list entry of the pH value out of list Capture Value 1) + (list entry of the pH value out of list Capture Value 2) : 2]

Menu group Spectrometer



Spectra query

Absorbance value* of a newly calculated absorbance spectrum at wavelength n (n = 200 - 708) — Formula entry ⇒ **BM.ISA(*n*)**

This absorbance spectrum is a calculated spectrum from the last captured or loaded sample spectrum and the last captured or loaded reference spectrum.

Count (raw value) of the last captured or loaded reference spectrum at scanning point n (n = 0 - 255) — Formula entry ⇒ **BM.ISA0(*n*)**

Count (raw value) of the last captured or loaded sample spectrum at scanning point n (n = 0 - 255) — Formula entry ⇒ **BM.ISA1(*n*)**

---

* To each even wavelength from 200 nm to 708 nm there is an assigned calculated value. To uneven wavelengths there is assigned the value of the foregoing even wavelength.

Load and query saved absorbance spectra / Load stored reference spectra and raw spectra

- Spectra stored in the analysis sequence are loaded with "**Sample**".

  Absorbance value of a stored absorbance spectrum at wavelength n (n = 200 - 708) from sample line m (m = 1 - 6) with the allocated spectrum number k (k = 1 - 1024) — Formula entry ⇒ **BM.ISA_LOAD(*n*,"Sample*m*-*k*.abs")**

  Count (raw value) of a refence spectrum from sample line m (m = 1 - 6) with the allocated spectrum number k (k = 1 - 1024) — Formula entry ⇒ **BM.ISA_LOAD ("Sample*m*-*k*.ref")**

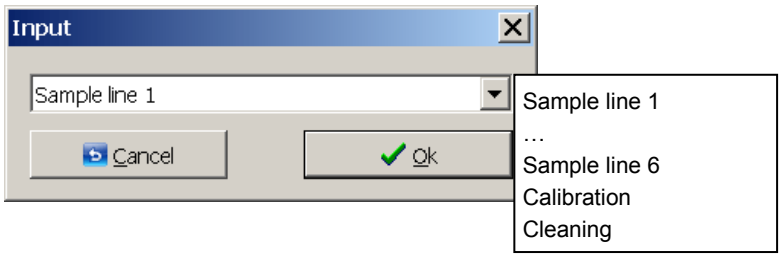
  Count (Rohwert) eines Probenspektrums from sample line m (m = 1 - 6) with the allocated spectrum number k (k = 1 - 1024) — Formula entry ⇒ **BM.ISA_LOAD ("Sample*m*-*k*.smp")**

- Spectra stored in the calibration sequence are loaded with "**Calibration**".

  Formula entry ⇒ **BM.ISA_LOAD(*n*"Calibration-*k*.abs")**
  ⇒ **BM.ISA_LOAD ("Calibration-*k*.ref")**
  ⇒ **BM.ISA_LOAD ("Calibration-*k*.smp")**

- Spectra stored in the cleaning sequence are loaded with "**Cleaning**".

  Formula entry ⇒ **BM.ISA_LOAD(*n*"Cleaning-*k*.abs")**
  ⇒ **BM.ISA_LOAD ("Cleaning-*k*.ref")**
  ⇒ **BM.ISA_LOAD ("Cleaning-*k*.smp")**

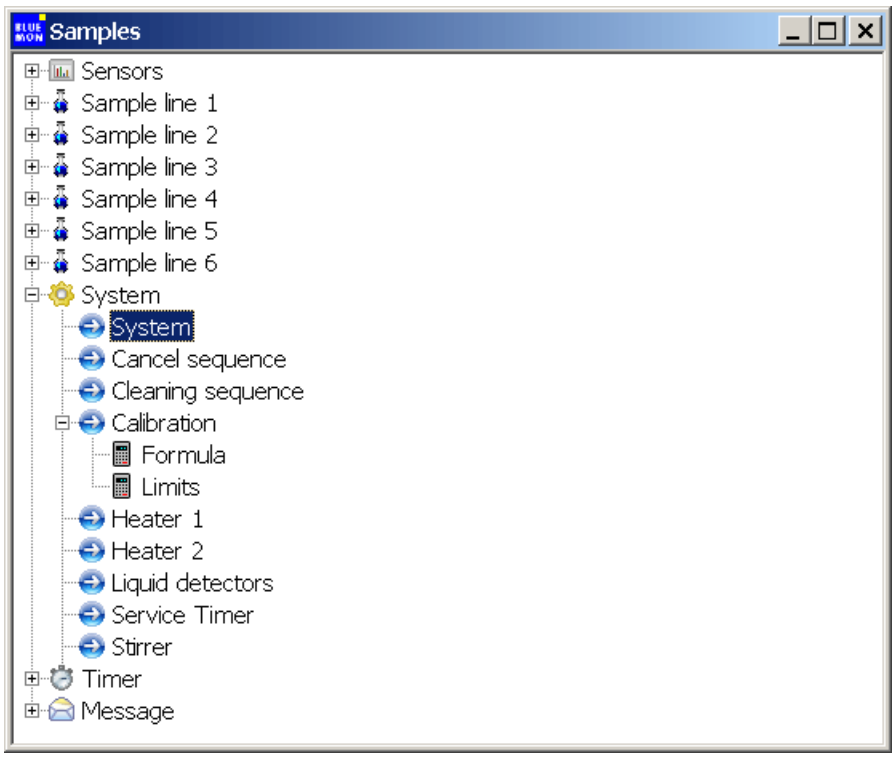


Output of the measurement path length* of the spectrometer — Formula entry ⇒ **BM.ISA.PathLength**

Output of the degree of dilution* of the solution — Formula entry ⇒ **BM.ISA.DilFactor**

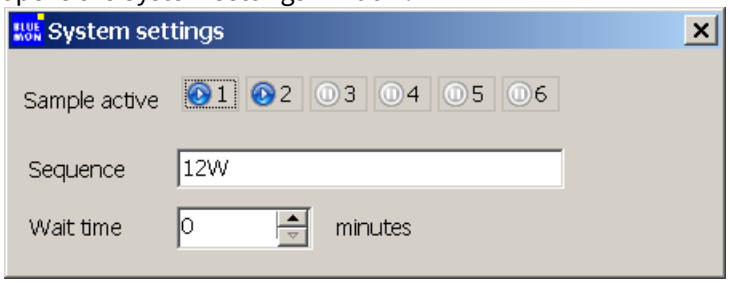
* see spectromter settings *4.4.1.1.1 Sensors – Internal sensors*, there *Spectrometer*

4.4.1.3 Samples – System



4.4.1.3.1 System – System settings

Double-click on System opens the System settings window.



Here you can activate or deactivate the 6 analysis sequences and determine the process sequence. Deactivated analysis sequences are skipped in the process sequence.

With the process sequence you determine the order in which the sequence elements are executed.

- 1 to 6 stands for the analysis sequences of the each sample line
- * (asterisk) stands for a cleaning sequence
- C stands for a calibration sequence
- W stands for a waiting period, which is determined in the input field "Wait time".

4.4.1.3.2 System – Cancel sequence

Double-click <Cancel sequence>
Double-click on cancel sequence opens the program window of cancel sequence.
This program window is identical to the program window of the analysis sequence
(see *4.4.1.2.3 Sample lines – Program (analysis sequence*).

The cancel sequence is executed at a process abortion by the user in the Live Status screen (see *4.2.5 Live Status*) or at an error-related automatic abortion.

4.4.1.3.3 System – Cleaning sequence

Double-click <Cleaning sequence >
Double-click on cleaning sequence opens the program window of cleaning sequence.
This program window is identical to the program window of the analysis sequence
(see *4.4.1.2.3 Sample lines – Program (analysis sequence*).

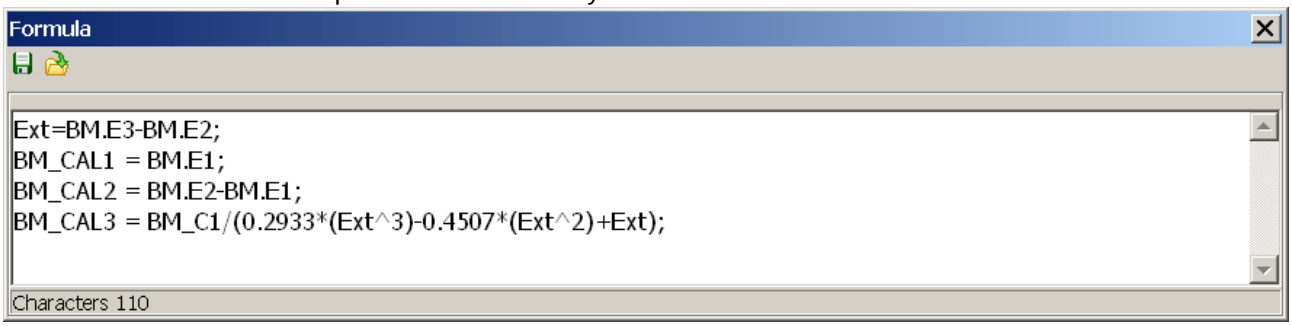
The cleaning sequence is started by the user in the Live Status screen (see *4.2.5 Live Status*, Start cleaning) or via the process sequence (see *4.4.1.3.1 System – System settings*).

4.4.1.3.4 System – Calibration (Calibration sequence)

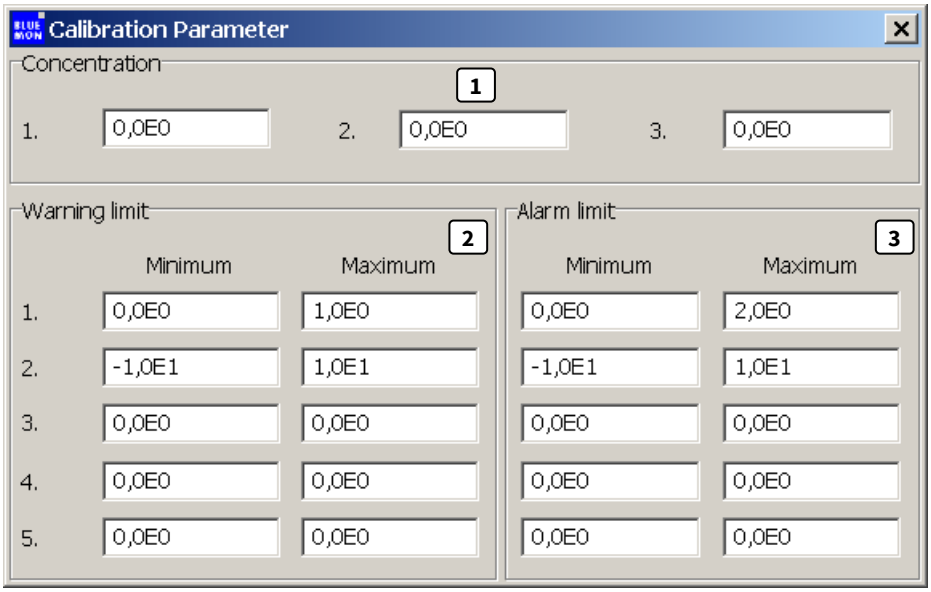
Double-click <Calibration>
Double-click on calibration opens the program window of the calibration sequence.
This program window is identical to the program window of the analysis sequence
(see *4.4.1.2.3 Sample lines – Program (analysis sequence*).

The calibration sequence is started by the user in the Live Status screen (see *4.2.5 Live Status*, Start calibration) or via the process sequence (see *4.4.1.3.1 System – System settings*).

Double-click <Formula>
Double-click on <Formula> opens the formula entry window for the calculation of the calibration factors.



Double-click <Limits>
Double-click on <Limits> opens the window of the calibration concentrations and the warning and alarm limits of the calibration factors.



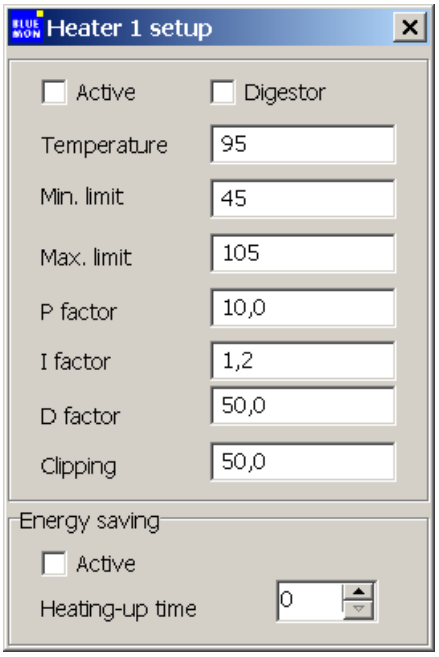
[1] Input concentration of each refence liquid (calibration concentrations)

[2] Input of the minimal/maximal values of each of the 5 calibration factors, when the values are underrunned/overrunned there will be a warning message.

[3] Input of minimal/maximal values of each of the 5 calibration factors, when the values are underrunned/overrunned there will be an alarm message.

4.4.1.3.5 System – Heater 1 - 2

Double-click on Heater opens the setup window of the heater.

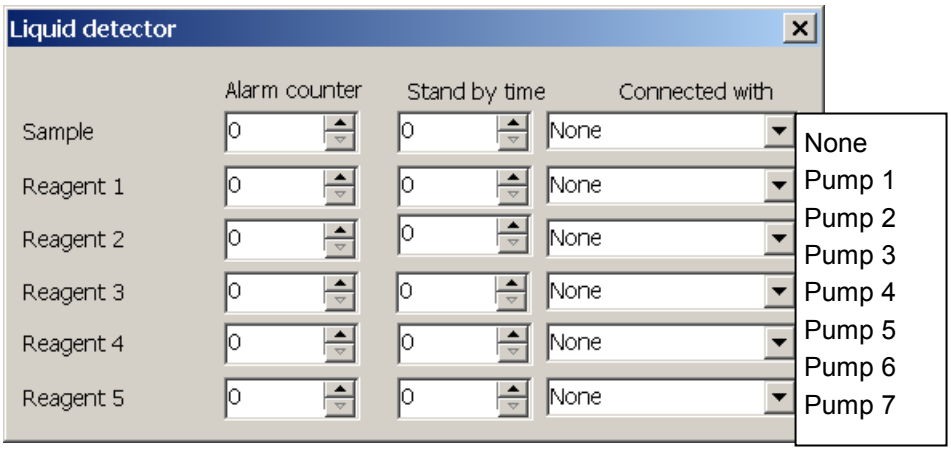


Active	The heater is active or not.
Digestor	UV-Digestor is active or not
Temperature	Nominal temperature
Min. limit	Lower limit
Max. limit	Upper limit
PID	Factors of the PID controller
Clipping	Limitation of the integral of the PID controller
Energy saving	Heating is only running while measuring.
Heating-up time	Minimum heating time

Emergency stop:
If the temperature is greater than the lower limit set in PID controller and the heating power is greater than 99% for 10 minutes, then the heating is switched off and the BlueMon enters into the error state.

4.4.1.3.6 System – Liquid detectors

Double-click on Liquid detectors opens the setup window of the liquid detectors.
In this window you can set the parameters of the bubble detection.

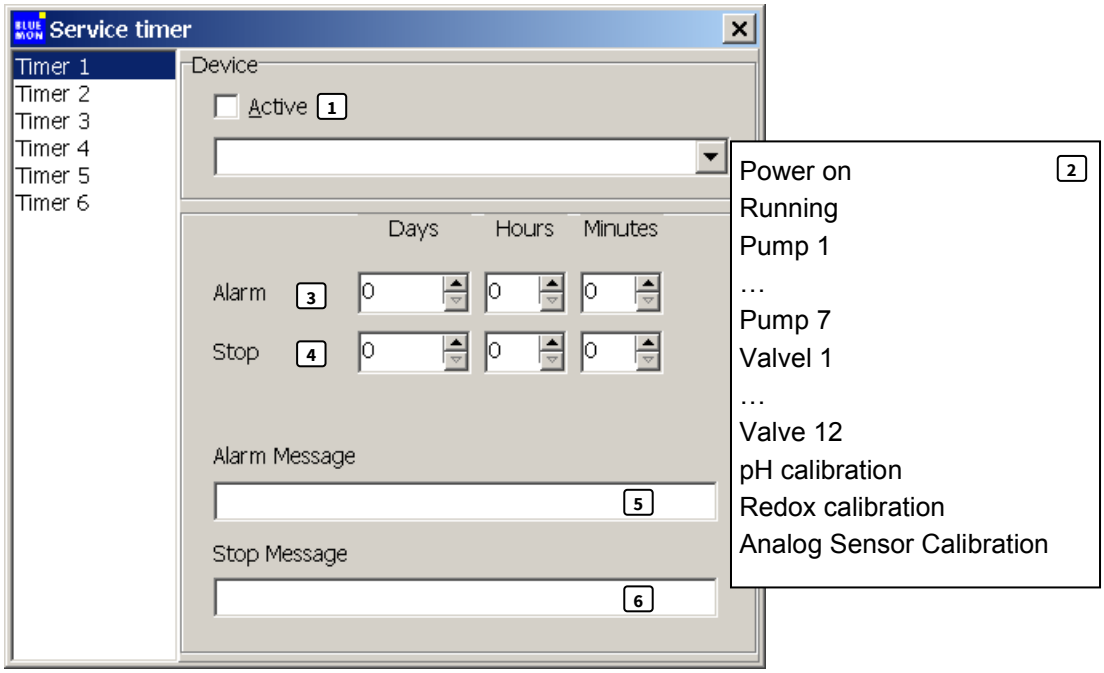


Sample	Bubble detection in the measurement liquid
Reagent 1 - 5	Bubble detection in the reagent liquid
Alarm counter	The alarm counter defines the number of bubbles that must be recognized before an error message is issued.
Stand by time	The stand by time is the time in seconds that the pump runs before the bubble detection starts.
Connected with	active pump

4.4.1.3.7 System – Service Timer

From this window you can set, after a set period of a selected device activity, trigger alerts and stop the system automatically. For calibrations the time is the time elapsed since the last calibration.

Up to 6 service timers can be defined.



[1] Service timer is active or not

[2] Drop-down list for a selection of a device activity

[3] Time period until the alarm message starts

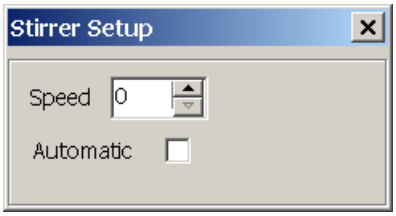
[4] Time period until the system stops automatically

[5] Input field of the text of the alarm message

[6] Input field of the text of a message that appears at an automatic system stop

4.4.1.3.8 System – Stirrer setup

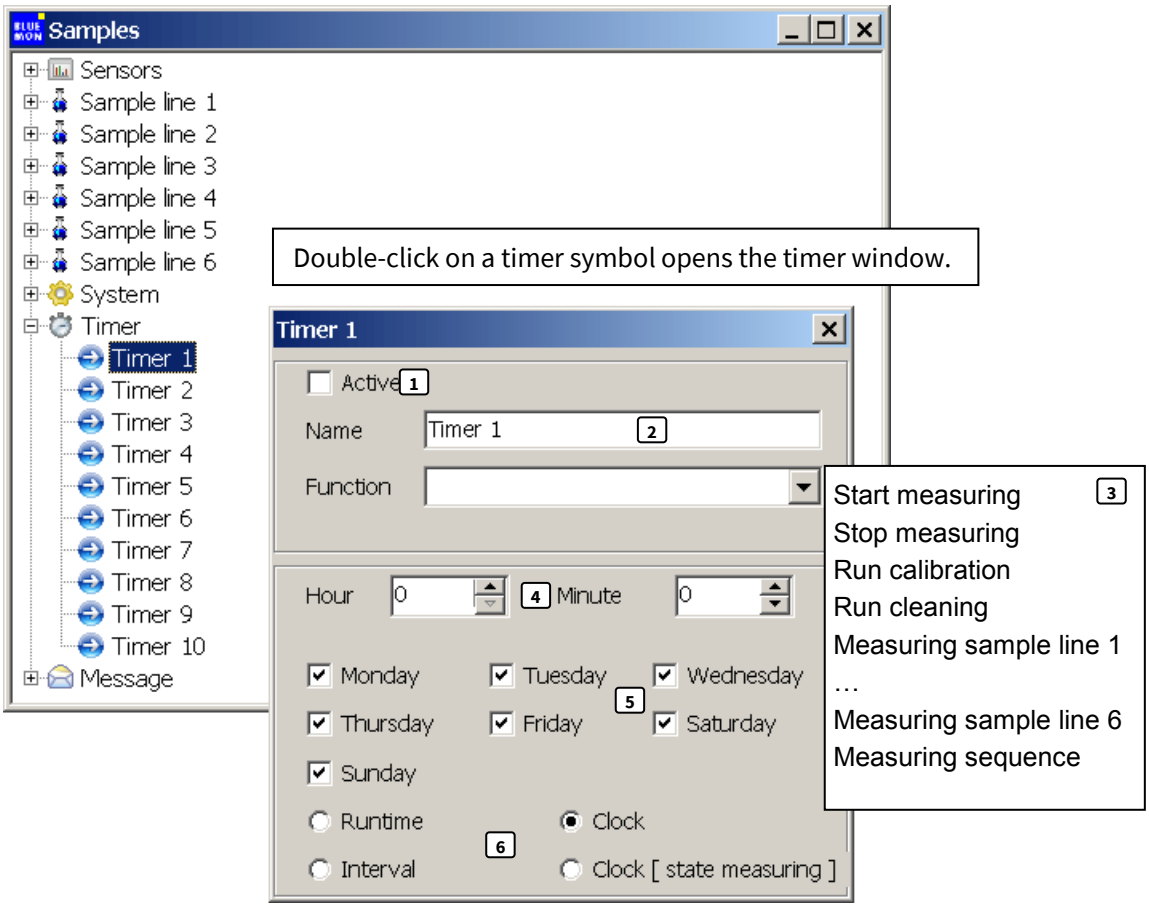
Setting of the number of rotations of the stirrer in revolutions per minute [1/min]
and
stirrer automatic on/off



4.4.1.3.9 Timer

From this window, you can trigger scheduled device activities.

Up to 10 timers can be defined.



[1] Timer is active or not

[2] Input field timer name

[3] Drop-down list function selection

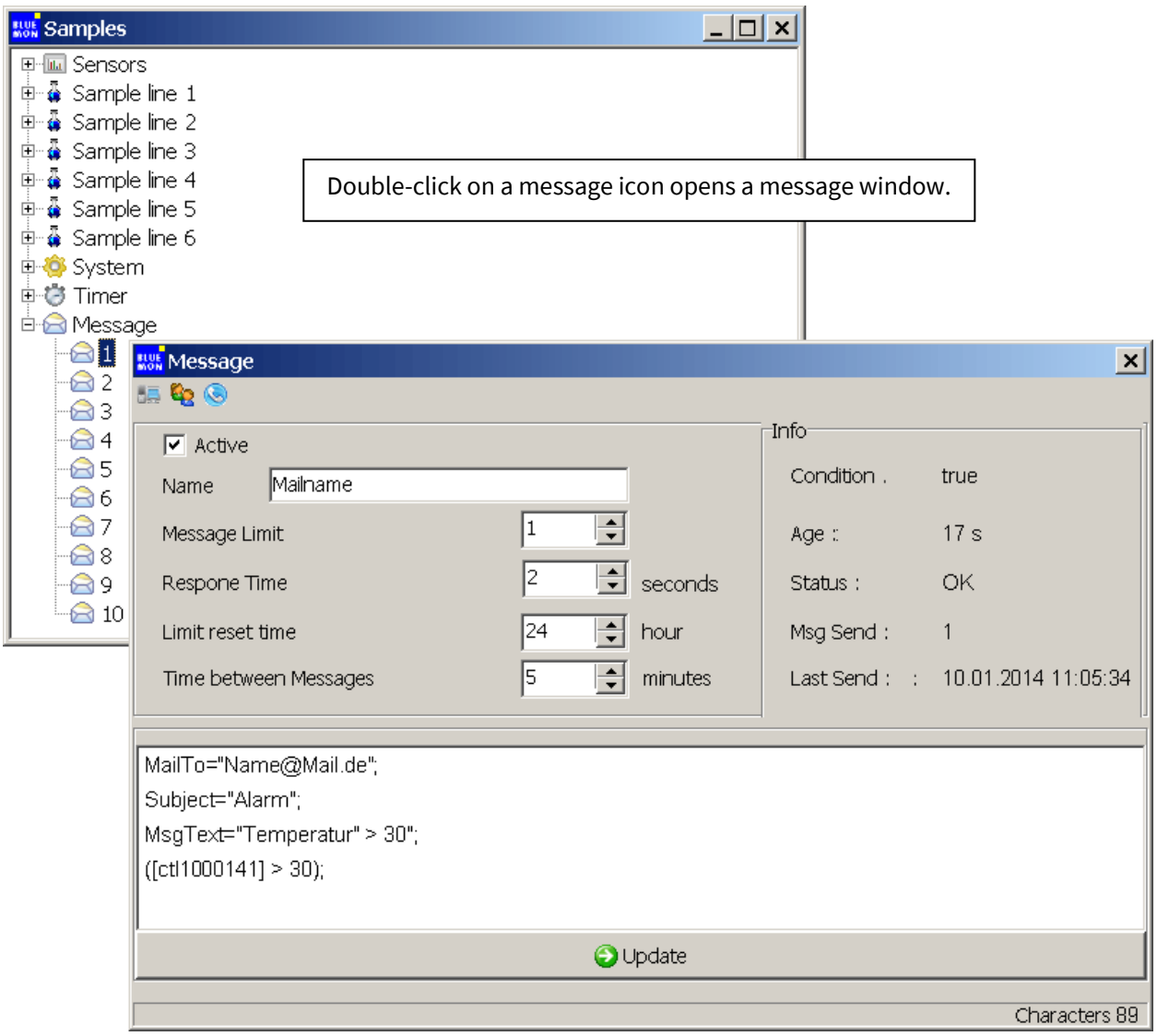
[4] Input field time of day

[5] Selection field day of week

[6] Selection field time definition

- Runtime: operation duration of the system
  The selected function is e.g. triggered after each hour of operation.
- Clock: time of day and day of week
  The selected function is activated at a certain time on certain days.
- Interval: Interval duration
  The selected function is e.g. activated every hour from now.
- Clock [state measuring]
  The selected function is only executed only if a measurement is running.

4.4.1.3.10 Messages

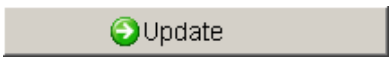


From this menu, you can send an E-mail or send a SMS message upon fulfillment of a condition.

Calls up menu mailserver settings.

Calls up menu E-mail addresses list.

Calls up menu SMS address list (telephone numbers list).



Transfers the formula to the BlueMon.

Example: Sending an E-mail if there is an exceeding of a measured value

☑ Active	The Formula is enabled.
☐ Active	The Formula is disabled.

Name		Name or description of the message
MessageLimit	6	Maximum number of messages which can be transmitted in the Limit reset Time.
Response Time	2	Time period from the appearance of the message condition (here temperature > 30) till the sending of the message. If the condition changes in the response time, the message won't be transmitted.
Limit reset time	5	During this time, no more messages can be sent, than defined above in Message Limit.
Time between Messages	15	Duration before sending the next message if the condition is fullfilled (true).
Condition:	true	true: The condition for sending of the message is fulfilled. false: The condition for sending of the message is not fulfilled.
Age:	17s	Duration in s since the condition for the message has been fullfilled.
Status:	OK	After transfer OK: The formula is syntactic error-free. Calc Error: The formula has one syntax error at least.
Msg Send:	1	Number of previously sent messages
Last Send:	10.03…	Date and time of the last message sent

Mailto="Name@Mail.de"; or **Mailto="nnn";**	⇒	Target mail address or Reference to an entry in the E-mail addresses list
Subject"Alarm";	⇒	Mail subject*
MsgText="Temperatur > 30";	⇒	Mail text*
[ct1000141] > 30;	⇒	Condition for sending a mail: The measured value of the sensor ct1000141 is greater than 30.

- If an E-mail cannot be sent, the system tries to send this E-mail again after 120 s.
- If an E-mail cannot be sent within 12 hours, this E-mail will be deleted.

* The E-Mail must have a subject and text.

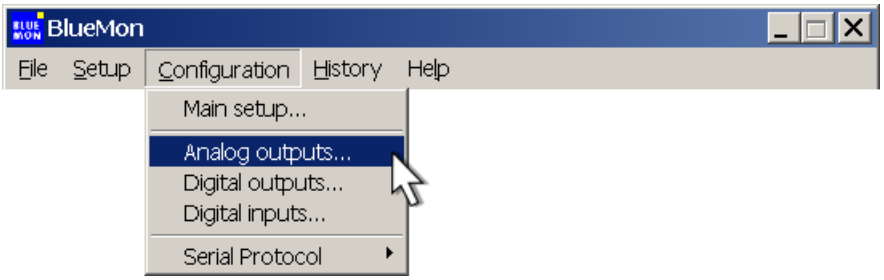
The corresponding entry for the sending of a SMS-message is:

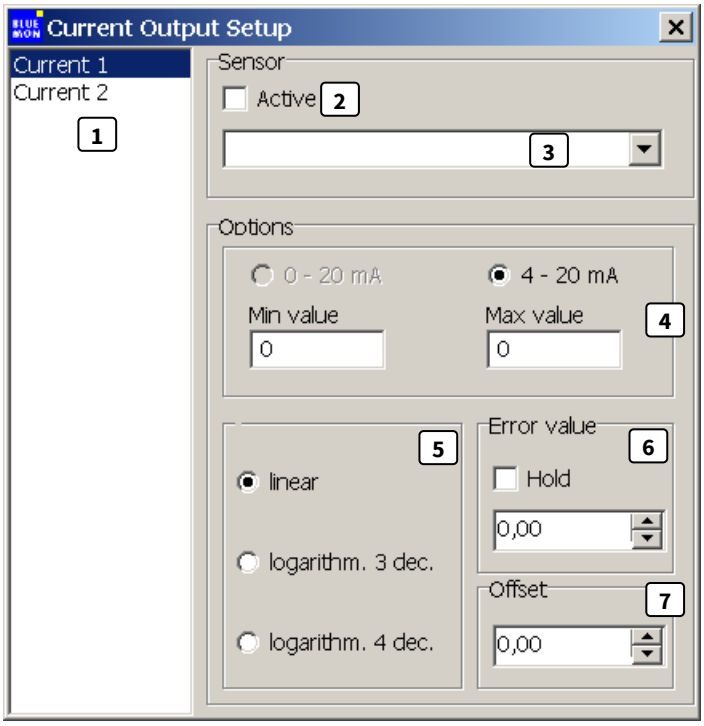
PhoneNo="nnn",	⇒	Telephone number or reference to an entry in the phone list Here you can enter phone numbers in the international format without plus signs (+). The phone number from GO-Systemelektronik entered in the footer will be entered as 49431580800.
MsgText="Temperatur > 30";	⇒	SMS text
[ct1000141] > 30;	⇒	Condition for sending a SMS: The measured value of the sensor ct1000141 is greater than 30.

- If the receipt of an SMS-message is confirmed, no further message will be transmitted.
- Sending an SMS is only possible if the BlueMon has a GSM modem.

4.4.2 Analog outputs (current output settings)

Here you can parameterize the two current outputs of the BlueMon.





[1] Selection current output

[2] The current output is active or not.

[3] Drop-down list selection of:

- internal sensors
- measurement values of the sample lines 1- 6
- virtual sensors
- all CAN-bus sensors

[4] Current value assignment and current value limiter

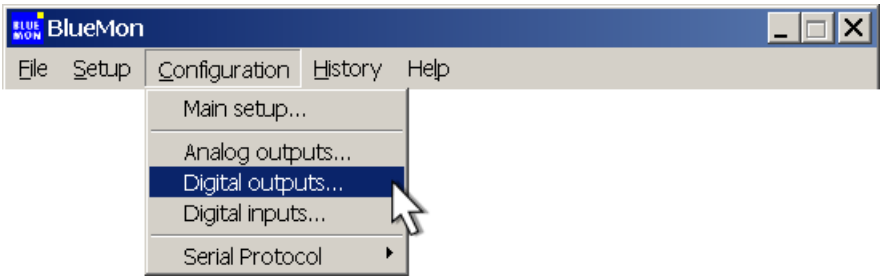
[5] Output scale (linear, logarithmic over 3 decades, logarithmic over 4 decades)

[6] Definition error output values in mA
If "Hold" is activated, the output is the last value before the error occurred.

[7] Input offset value

4.4.3 Digital outputs (relay setup)

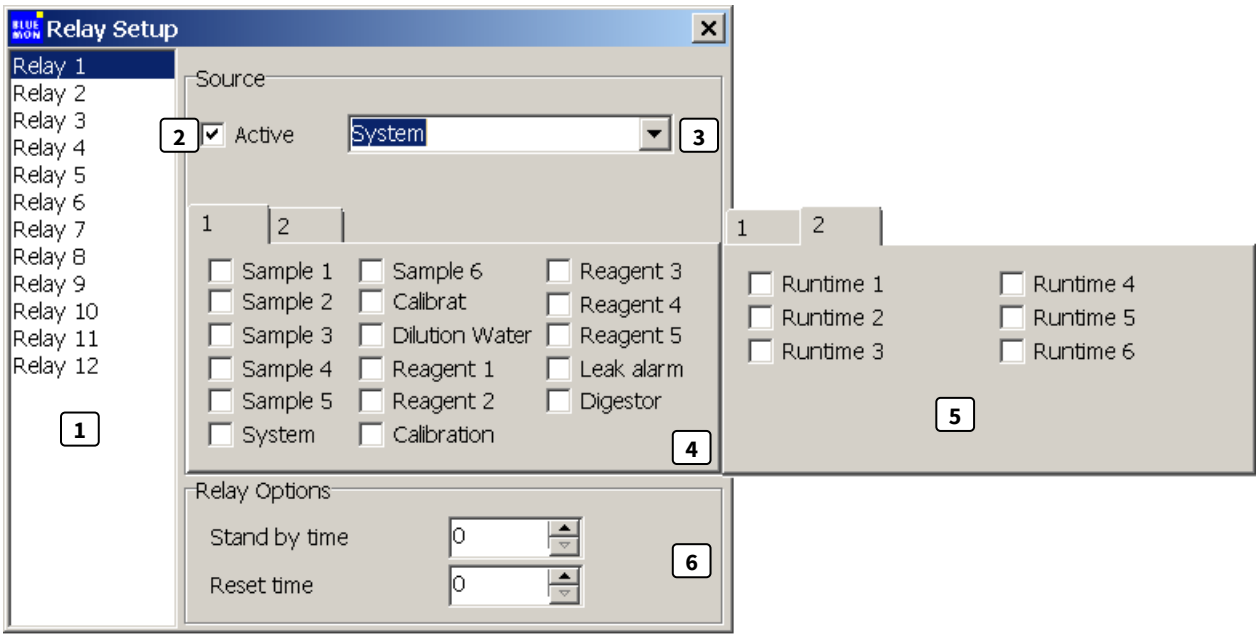
Here you parameterize the switching of the 12 relays.



4.4.3.1 Digital outputs (relay setup) - System

Assignment of relay switchings at

- Lack of liquid and error in certain components or the entire system
- Alarm messages as set in *4.4.1.3.7 System – Service Timer*.



[1] Selection relay

[2] Settings are active or not

[3] Drop-down list selection System Setup or Sensor Setup

[4] Selection field:

- Lack of liquid
  Sample* 1 to Sample* 5, entire system, calibration liquid,
  dilution water, reagent liquid, leakage
- Error
  wrong calibration factors, lamp defect in the UV digestor

[5] Selection field runtime occurence, see Timer 1 - 6 in *4.4.1.3.7 System – Service Timer*

[6] Relay switching options

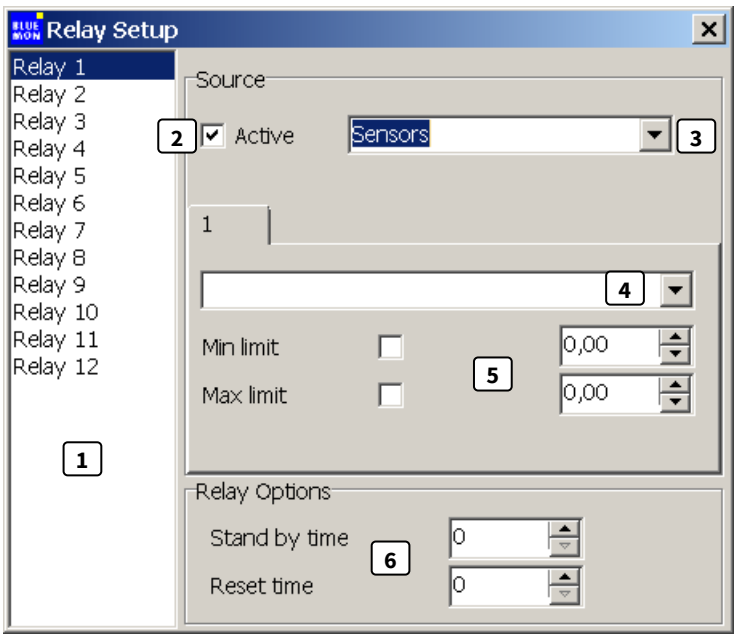
Stand by time: Time of the occurrence of the switching condition to the switching operation in seconds. If the the condition changes in the waiting time, the relay does not switch.

Reset time: Time in which the relay is switched back.

* means sample line

4.4.3.2 Digital outputs (relay setup) - Sensors

Assignment of the relay switching with limit values of certain measuring points



[1] Selection relay

[2] Settings are active or not

[3] Drop-down list selection System Setup or Sensor Setup

[4] Drop-down list selection of:

- internal sensores
- measurement values of the sample lines 1- 6
- virtual sensors
- all CAN-bus sensors

[5] Activation and input of lower and upper switching limits

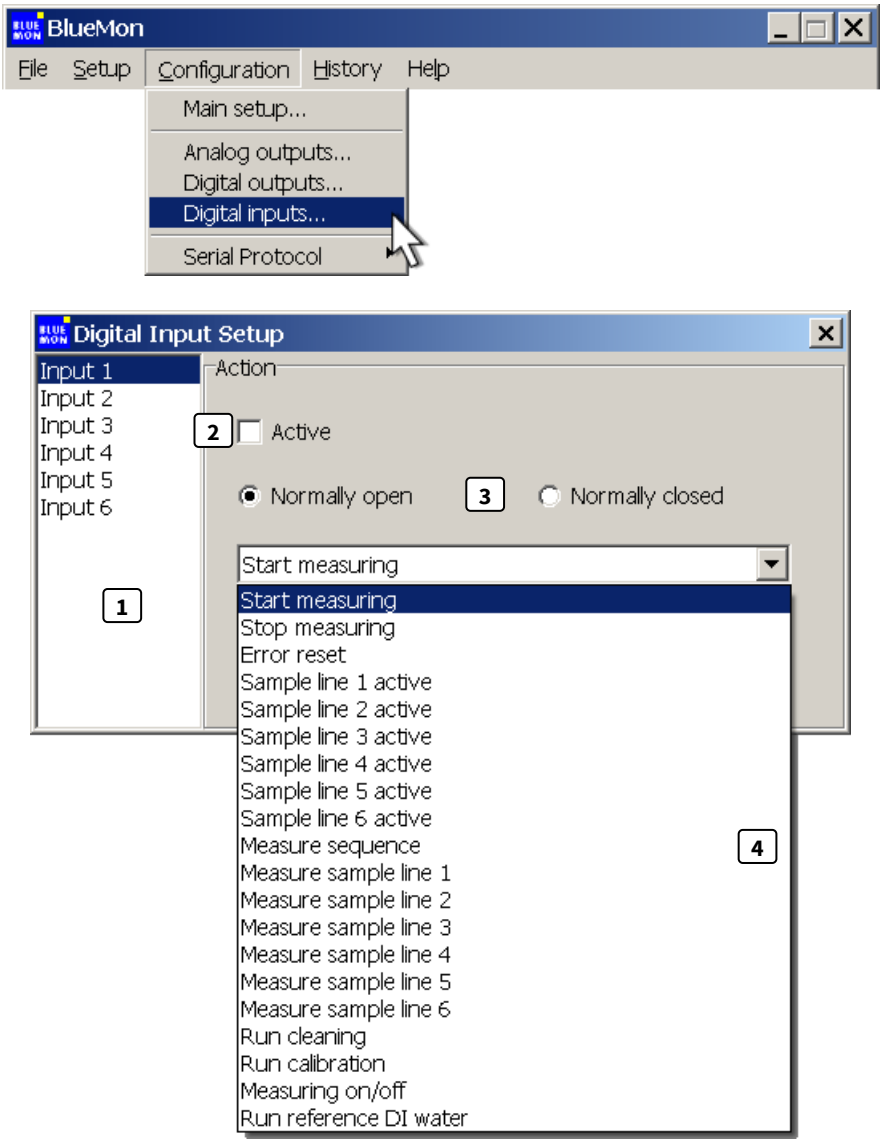
[6] Relay switching options

Stand by time: Time of the occurrence of the switching condition to the switching operation in seconds. If the the condition changes in the waiting time, the relay does not switch.

Reset time: Time in which the relay is switched back.

4.4.4 Digital inputs

Assignment of actions to the digital inputs



[1] Selection digital input

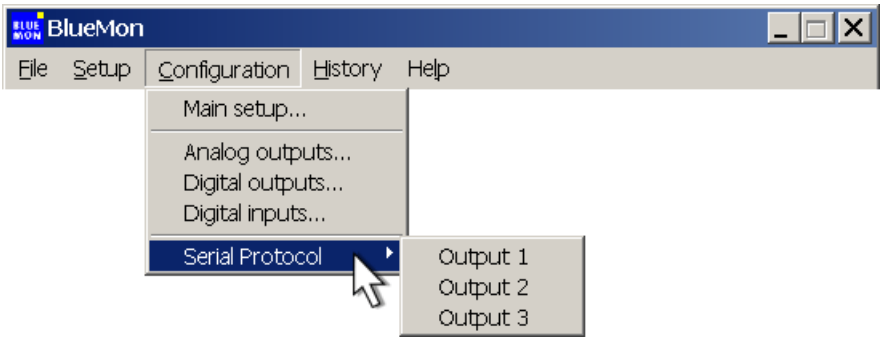
[2] Selection is active or not

[3] A mouse click on the text toggles between **Normaly open** and **Normaly closed**.

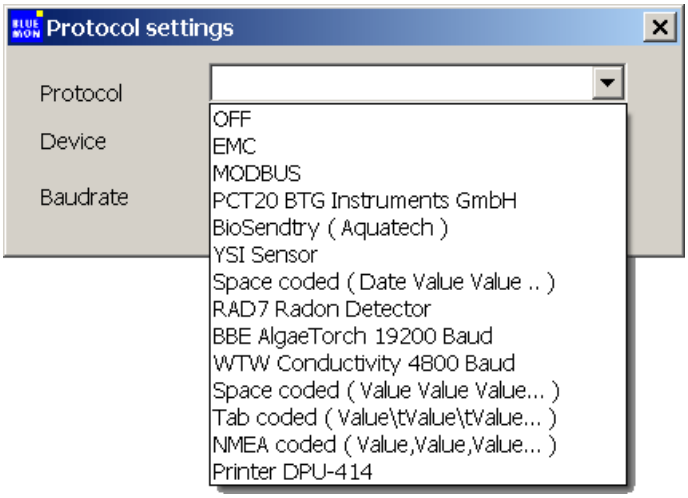
[4] Drop-down list selection of actions

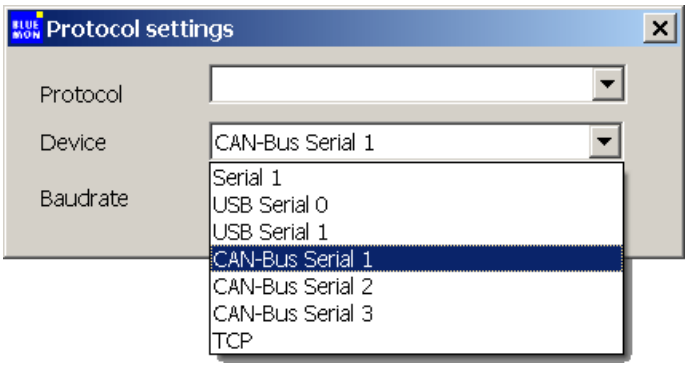
4.4.5 Serial Protocol

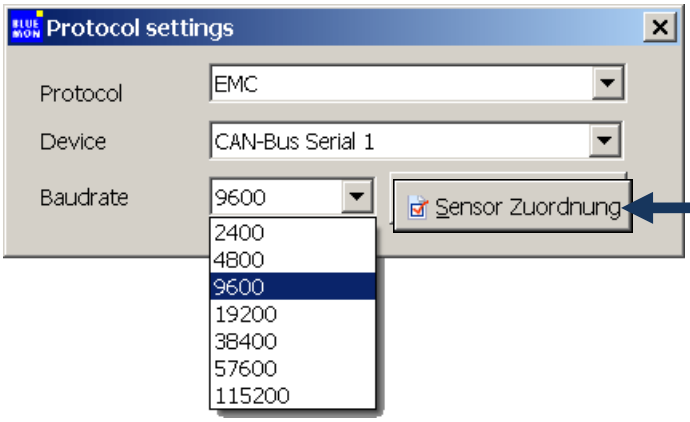
Assignment of protocols, devices and transmission rates for the three internal serial protocols (Output 1-3) of the BlueMon.



With these settings external sensors can be connected (eg via the CAN-Bus Serial module from GO Systemelektronik).
After a protocol change the BlueMon must be restarted!
After an interface change the BlueMon must be restarted!





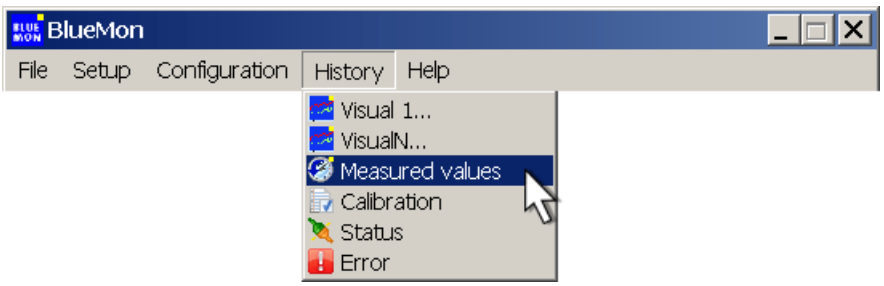


When an EMC- or Modbus protocol is selected, this button opens a menu for sensor allocation.

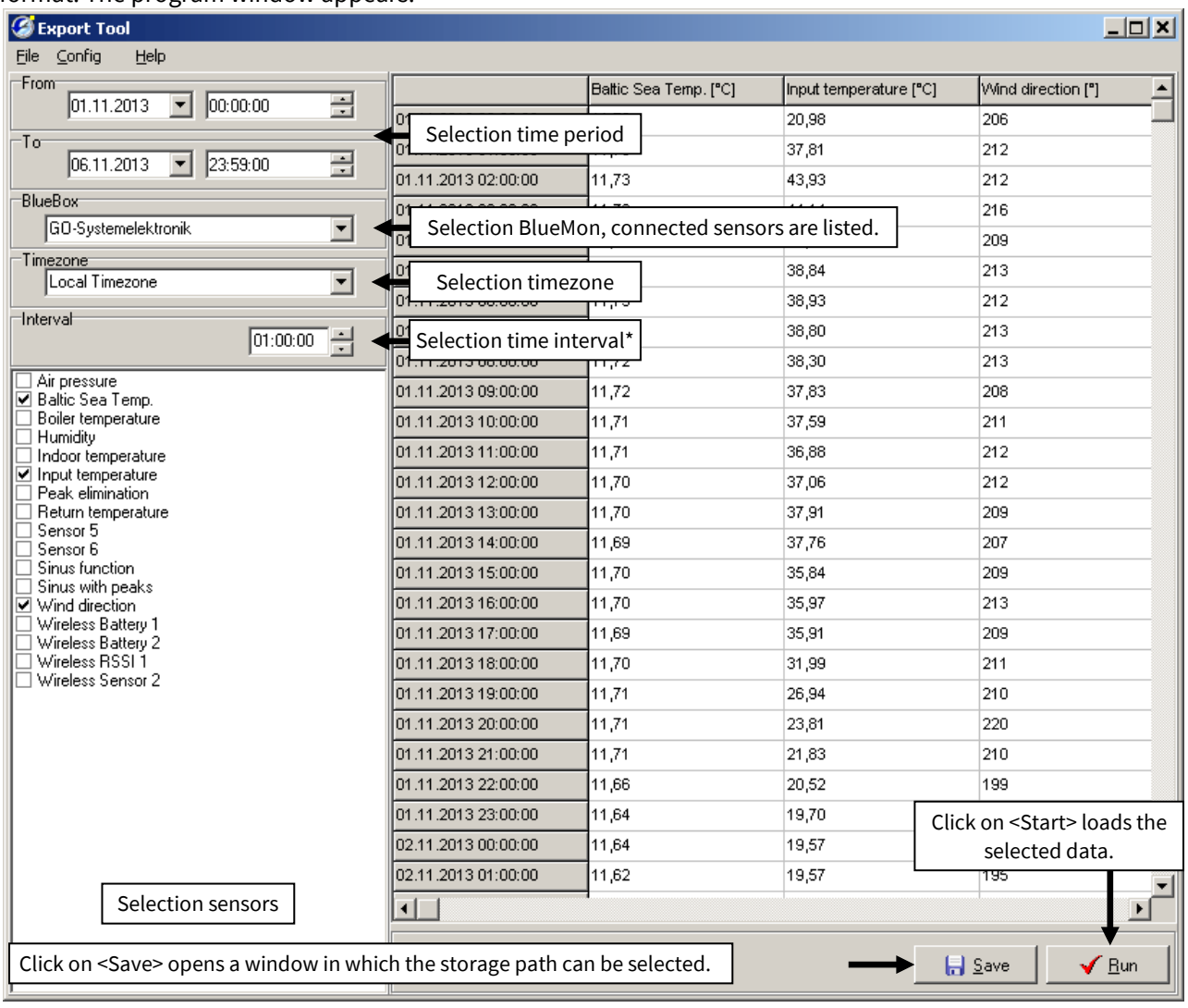
4.5 History drop-down menu

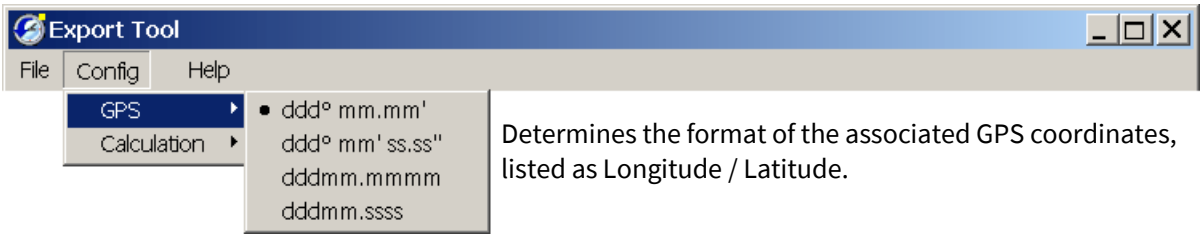
Visual 1 and Visual N see *5 Programs for data display and visualisation*

4.5.1 Measured values



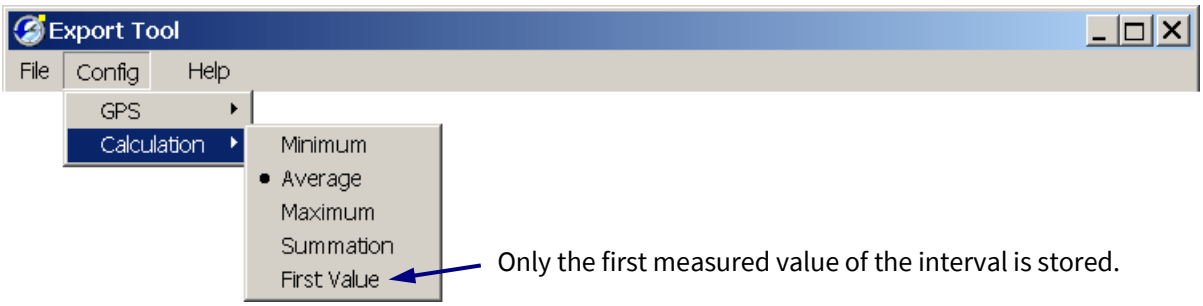
Click on „Measured Values“ calls up the program Export Tool.exe (program version: 3.6.6.0).
The program ExportTool.exe exports selected measured values from the database in the .txt- and .csv-file format. The program window appears:



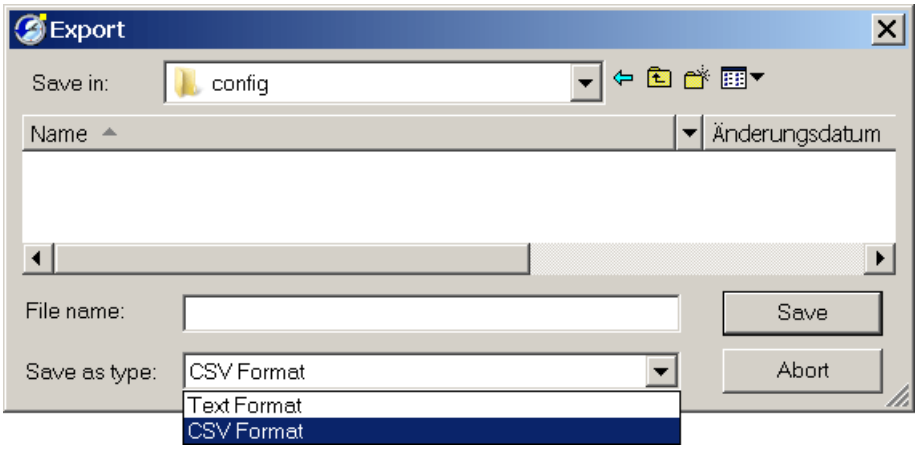


Determines the format of the associated GPS coordinates, listed as Longitude / Latitude.

* Period for the included measurement values (see next page)



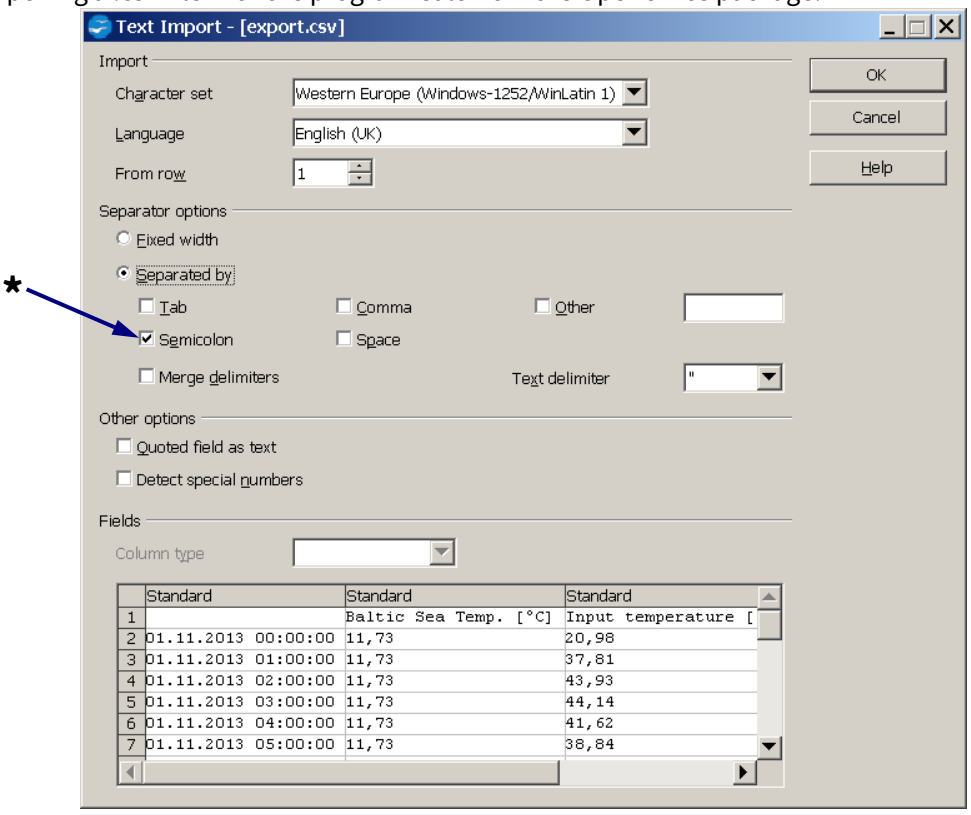
Determines the method of calculating of the values collected in the time interval.



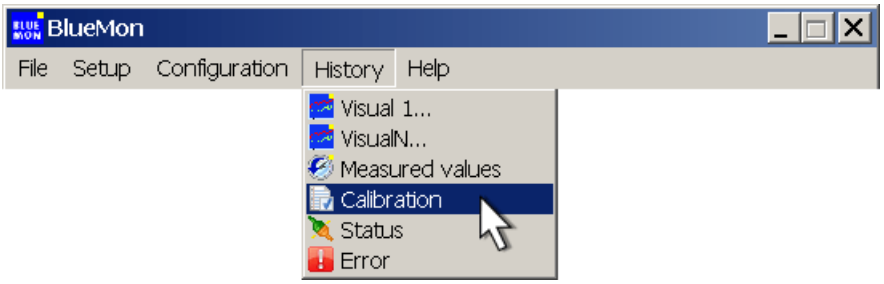
You can save the data as .txt or .csv file.

In this .csv or .txt file the individual values are separated with a **semicolon***. It is recommended to open these files with a program that displays the data in a clearly arranged way.

Example: Opening a .csv-file with the program Calc from the OpenOffice package.



4.5.2 Calibration history

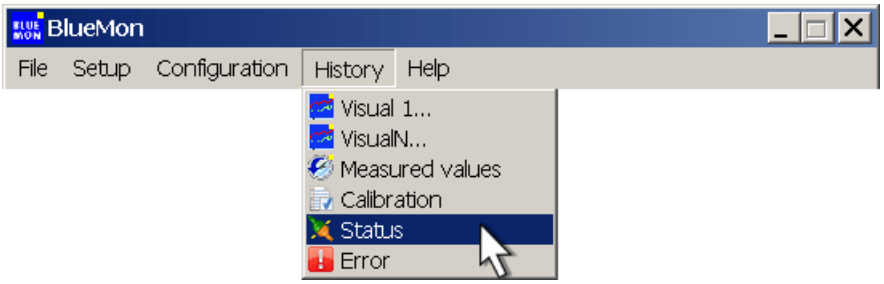


History of the results of the performed calibrations

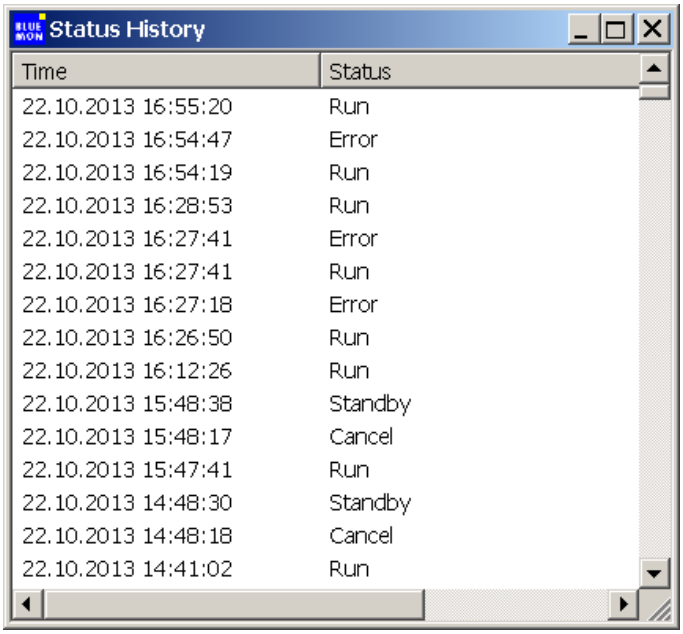
Calibration History

Time	Sensor	C1	C2	C3	C4
22.10.2013 16:28:49	BlueMon	0,0E+0			
23.09.2013 14:34:05	BlueMon	1,305E+1	1,3025E+1	1,30167E+1	
23.09.2013 12:34:04	BlueMon	1,104E+1	1,102E+1	1,10133E+1	
23.09.2013 10:34:03	BlueMon	9,03E+0	9,015E+0	9,01E+0	
23.09.2013 08:34:02	BlueMon	7,02E+0	7,01E+0	7,00667E+0	
23.09.2013 06:34:01	BlueMon	5,01E+0	5,005E+0	5,00333E+0	
23.09.2013 04:34:00	BlueMon	3,0E+0	3,0E+0	3,0E+0	
23.09.2013 02:34:20	BlueMon	1,2E+0	1,1E+0	1,06667E+0	
23.09.2013 00:34:19	BlueMon	2,319E+1	2,3095E+1	2,30633E+1	
22.09.2013 22:34:18	BlueMon	2,118E+1	2,109E+1	2,106E+1	
22.09.2013 20:34:17	BlueMon	1,917E+1	1,9085E+1	1,90567E+1	
22.09.2013 18:34:16	BlueMon	1,716E+1	1,708E+1	1,70533E+1	
22.09.2013 16:34:15	BlueMon	1,515E+1	1,5075E+1	1,505E+1	
22.09.2013 14:34:14	BlueMon	1,314E+1	1,307E+1	1,30467E+1	

4.5.3 Status history



Protocol of the status messages

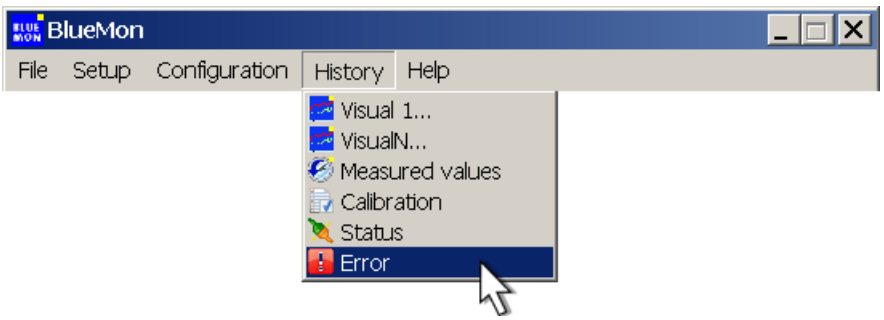


Corresponds to the state display in the LiveStatus window. (see *4.2.5.2 Area State*)

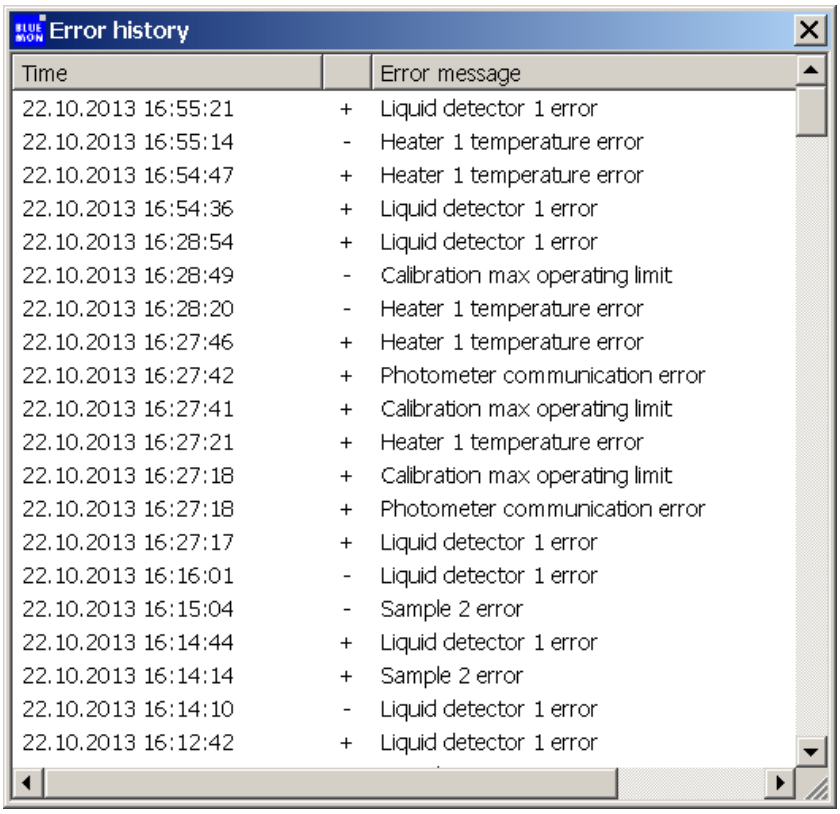
Status	System staus
Standby	• Ready
Run	• Measurement is running
Stop	• Measurement stopped
Cancel	• Measurement canceled
Service	• Service
Error	• Error

The state ◉ Timer has no status.

4.5.4 Error history



Protocol of the warning- and error messages



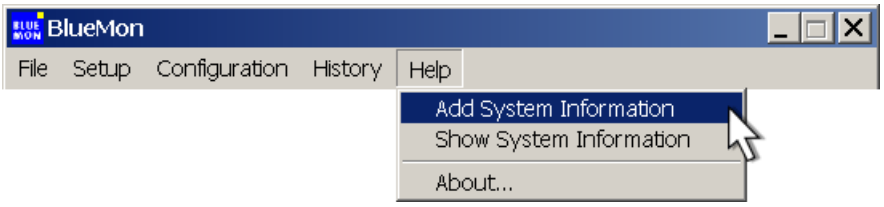
+ ⇒ Error has been occured.

- ⇒ Error has been corrected.

For a complete list of warnings and error messages, refer to *Appendix F - Warning and error messages*.

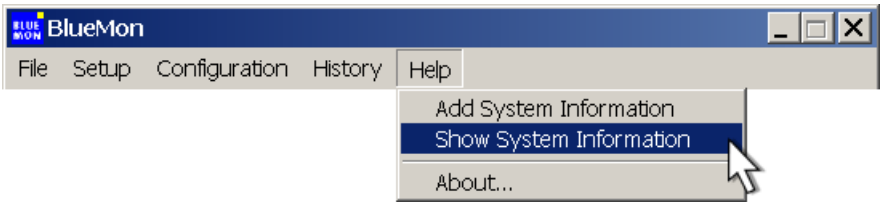
4.6 Help drop-down menu

4.6.1 Add System Information



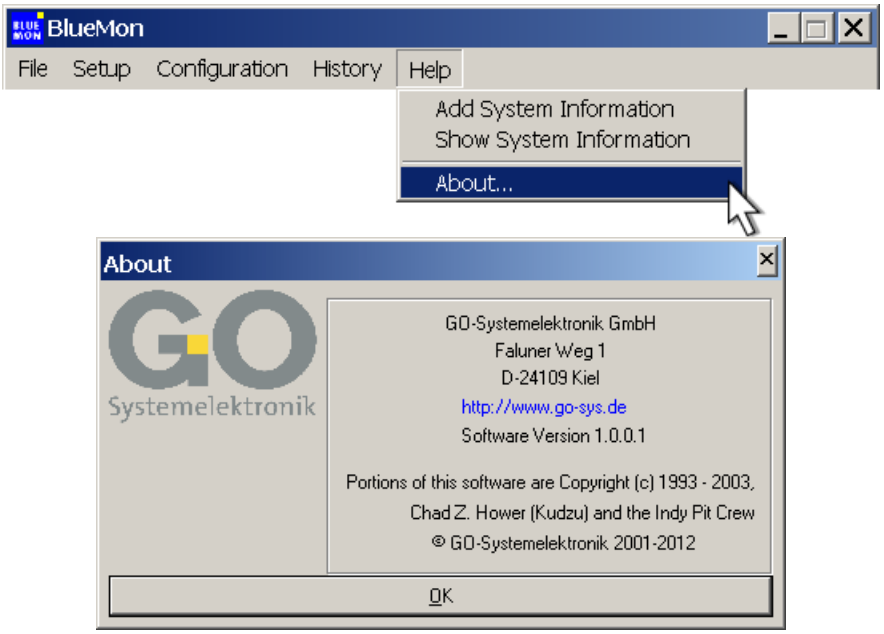
Opens a window to select a user information file.
Possible formats: bmp, doc, jpg, pdf
You can only select one information file.

4.6.2 Show System Information



Click opens a user selected information file (see 4.5.1 Add Help), or alternatively you can also press the F1 key.
Possible formats: bmp, doc, jpg, pdf
If no file is selected, the button has no function, similarly the F1 key.

4.6.3 About



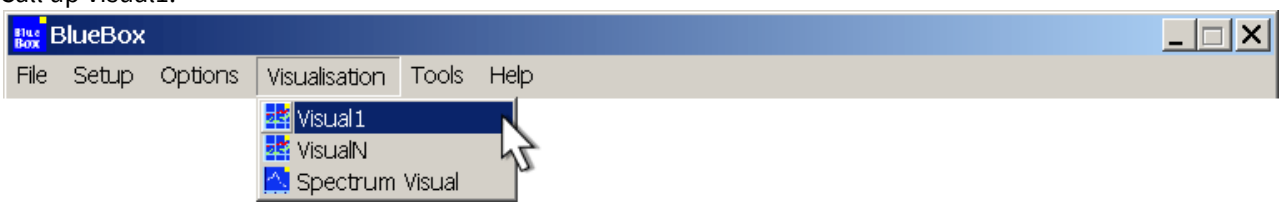
5 Programs for data display and visualisation

5.1 Visual 1

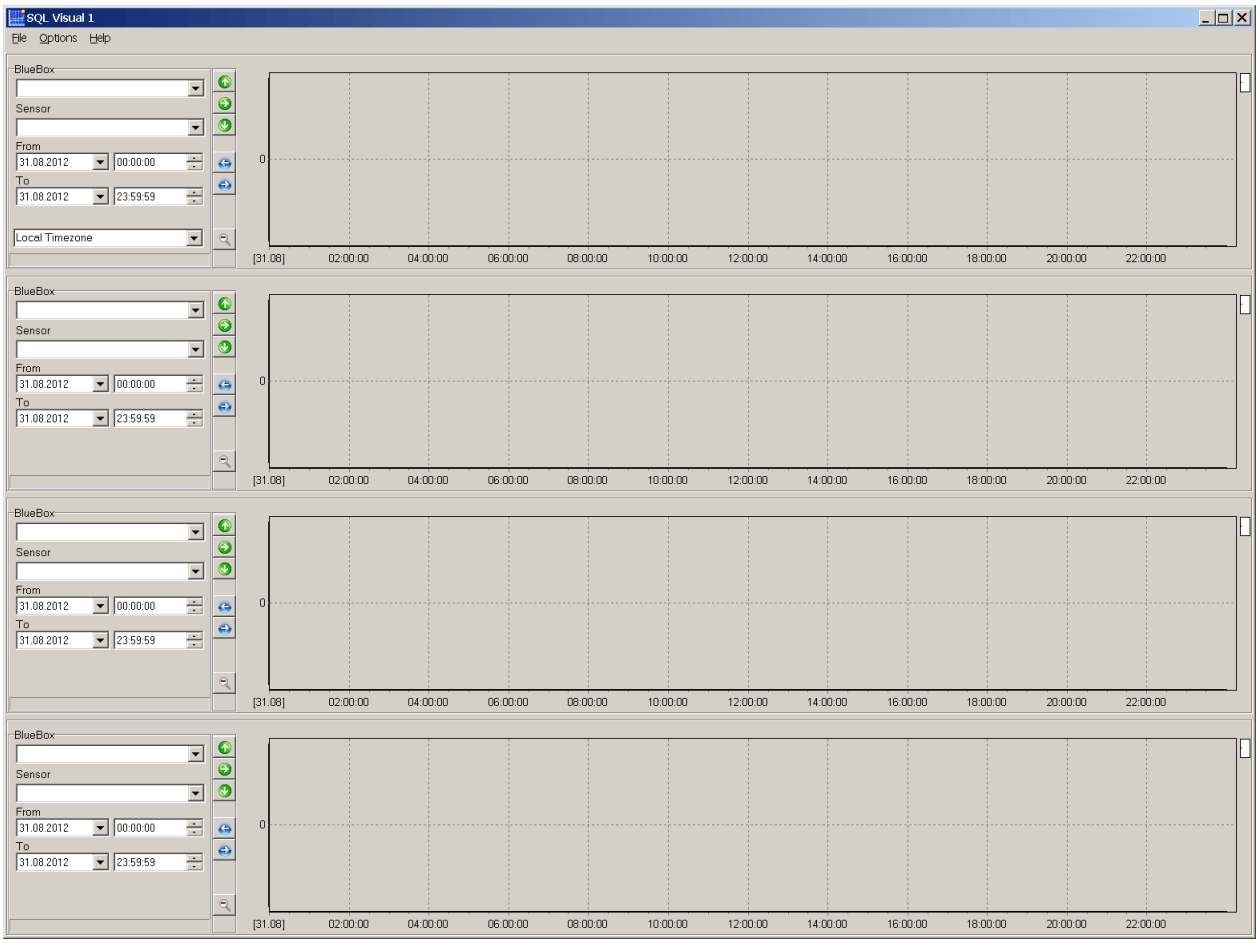
Version: 3.4.0.0

Visual1 features the display of the measured values from four different sensors at the same time. These sensors can be connected to several BlueMon-Systems. In the following the menu items of this visualisation will be described.

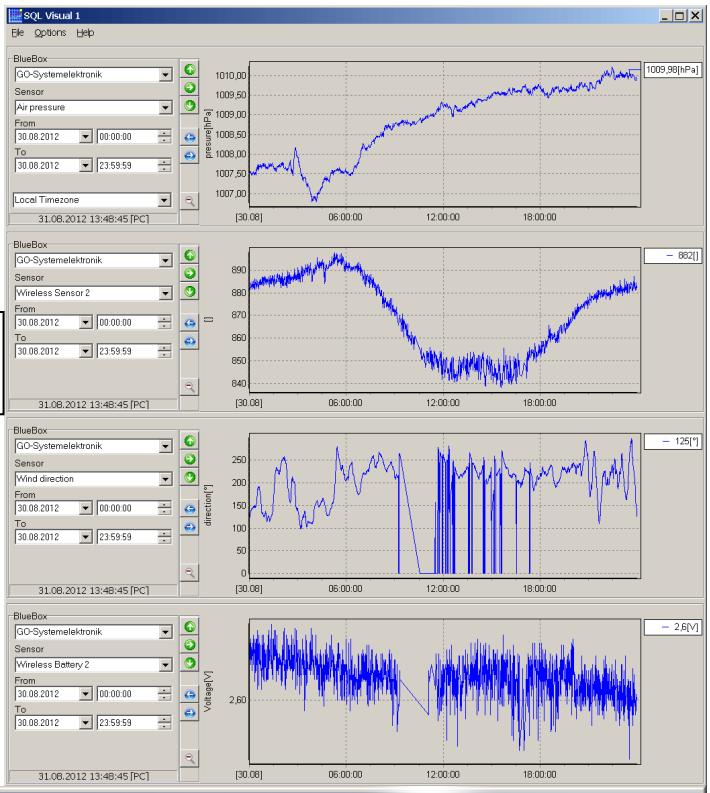
Call up Visual1:

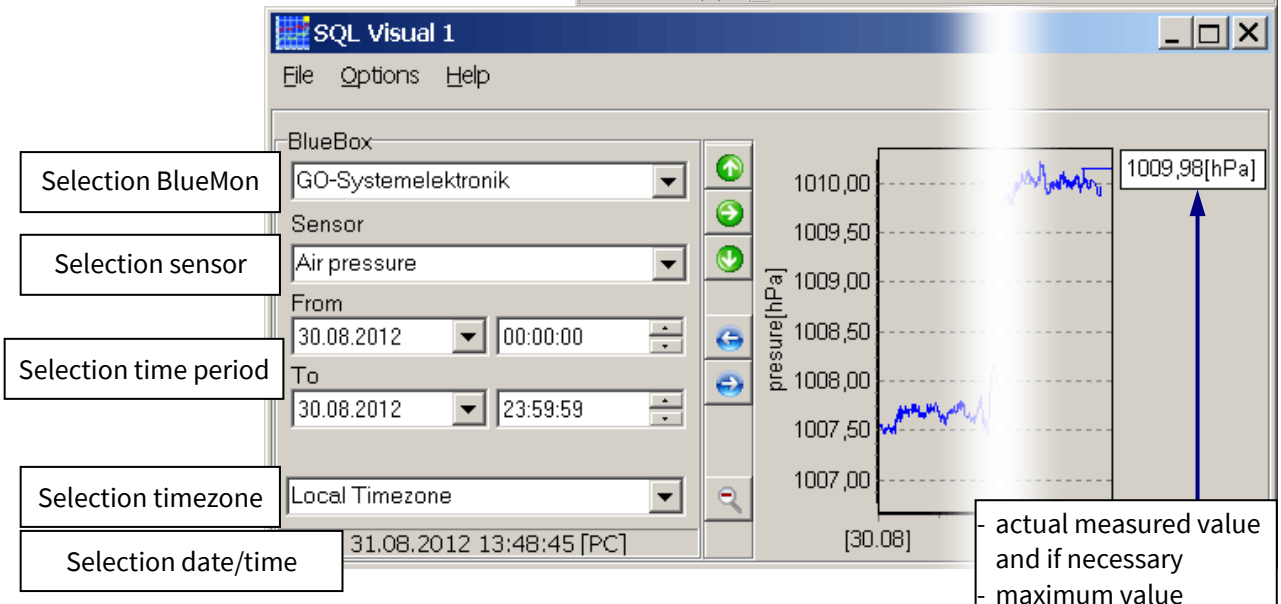


The following window opens:



Here you can select 4 sensors from different BlueMon-Systems.





Selection BlueMon

Selection sensor

Selection time period

Selection timezone

Selection date/time

- actual measured value and if necessary
- maximum value
- mean value
- minimum value

The maximum value measured in the selected period will be shown as (red) curve.

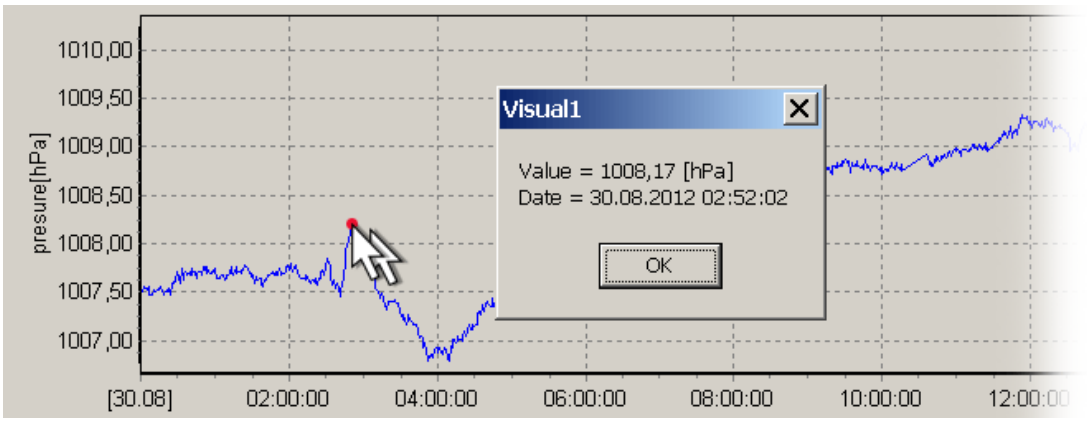
The mean value measured in the selected period will be shown as (blue) curve.

The minimum value measured in the selected period will be shown as (yellow) curve.

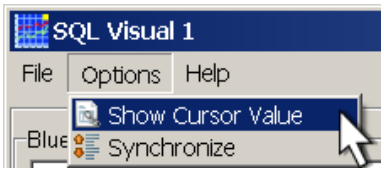
Sets the display period back by one day.

Sets the display period forward by one day.

Resets the zoom value to 1.

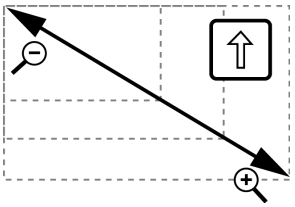


The red point stands on the spot of graph which is nearest the cursor. Double-click opens a window with the value, the date and the time (at using GPS also the position data) of the measured values underlying the red point.

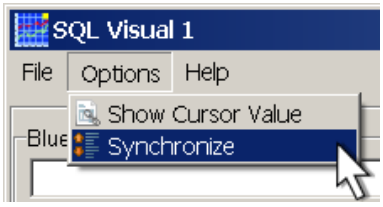


Is „show cursor value“ activated, this data will be shown permanently beside the graph on the right.

You can zoom or reduce the diagram by pressing the shift-key and the left mouse-key to raise a rectangle to the right or the left.



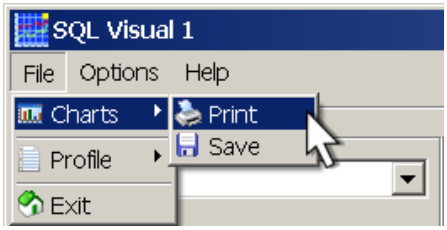
With the right mouse button down, you move the timeline.



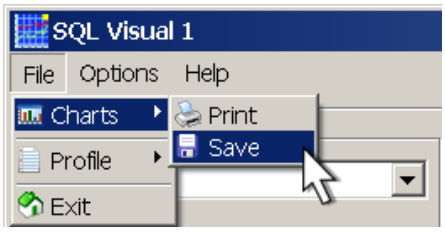
It is recommended to synchronize the four graphs chronologically for comparing these graphs better. Decisive therefore are the timing settings within the first graph.

The time-based synchronization of the four graphs takes place by choosing „synchronize” under “Options”..

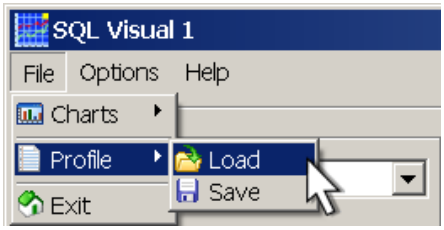
The subsequent graphs will be adapted according to the period of the first graph.



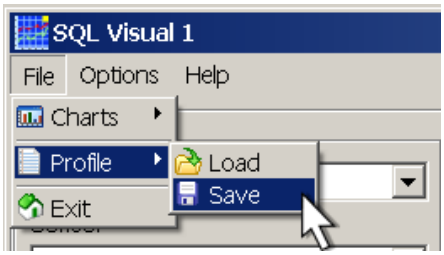
Opens the standard-printer-menu and prints all diagrams.



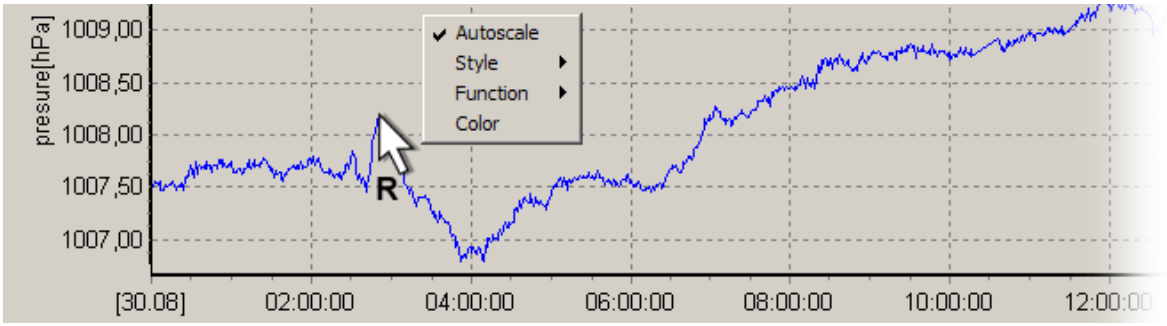
Saves every diagram separately in popular graphic format.



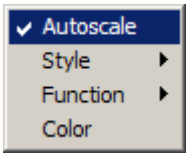
Loads a previously saved setting-profile.



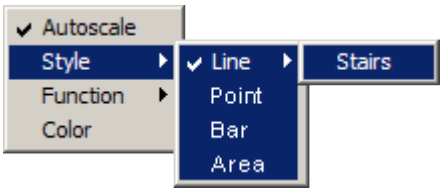
Saves the settings of this window as .vp1-file.



Right-click in the diagram-display opens a selection dialog for setting of the diagram-display.



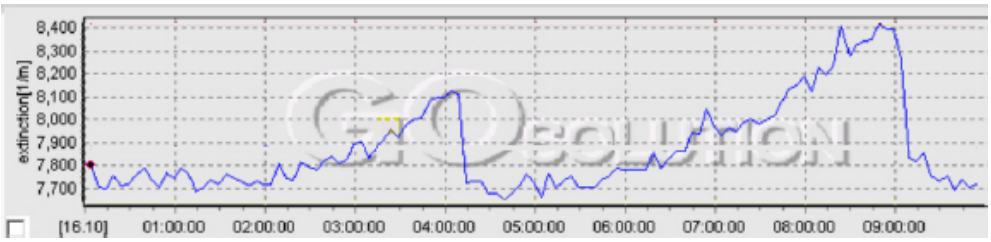
If Autoscale is enabled (default), the y-axis will be scaled in reference to the diplayed measured values, otherwise the y-axis will be scaled in reference to the measuring range of the sensor.



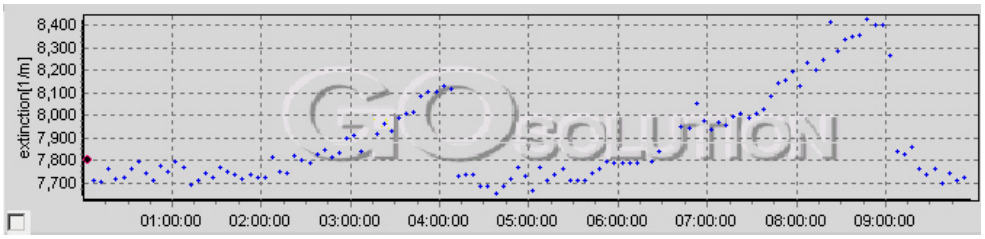
The step diagram presents the switching points better:

The different display formats of a graph:

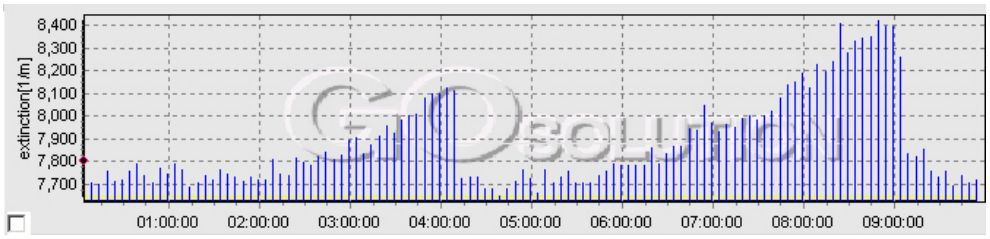
curve:



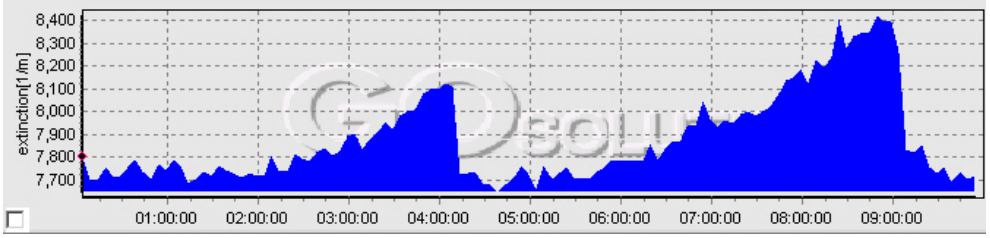
point:

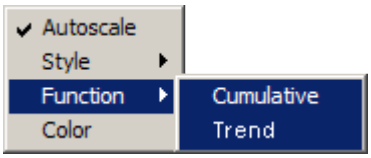


bar:



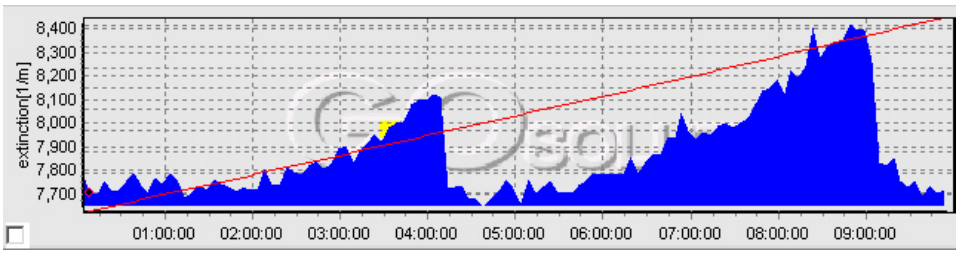
plane:



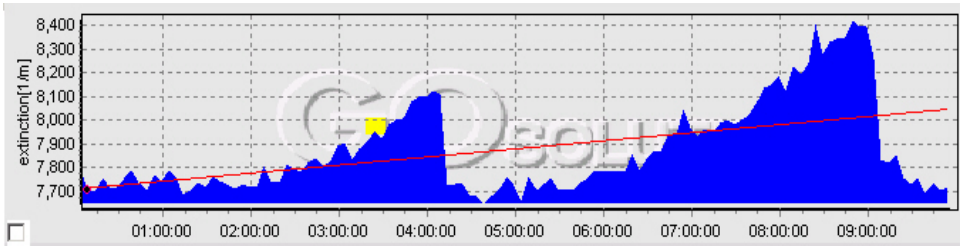


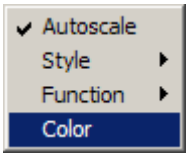
Setting with which functions will be attached to the graph.
Available are the representation of cumulative value („**summate**“) and the tendency value („**trend**“). For both functions graphs will be pictured in the diagram.

Cumulative value **summate**:



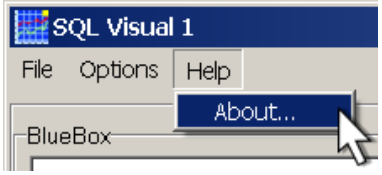
Tendency **trend**:



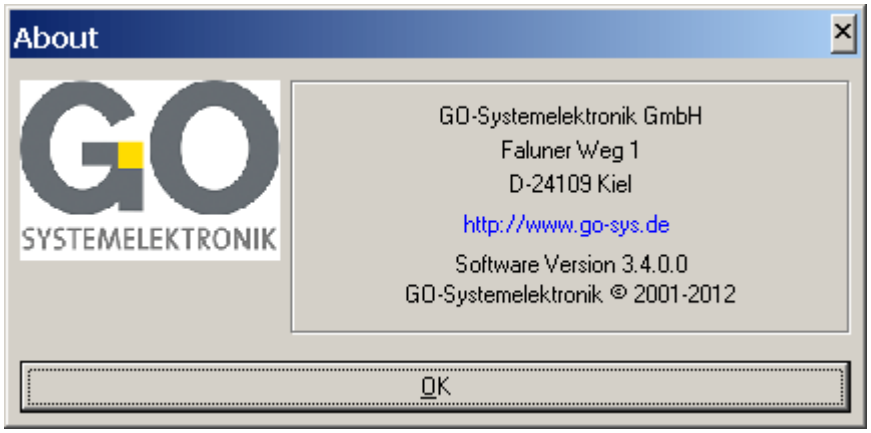


Choice of colour of a graph. After choice by click with the left mouse-key the selection screen will be shown.

After selection of colour please confirm with „OK“, the graph will be shown in the colour selected.



When contacting GO Systemelektronik, always specify the software version number indicated here.

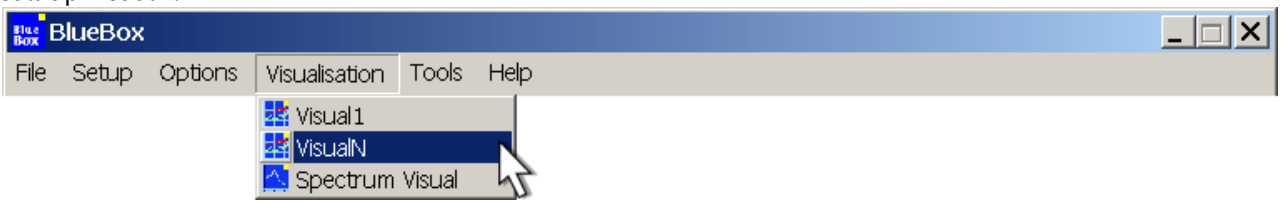


5.2 VisualN

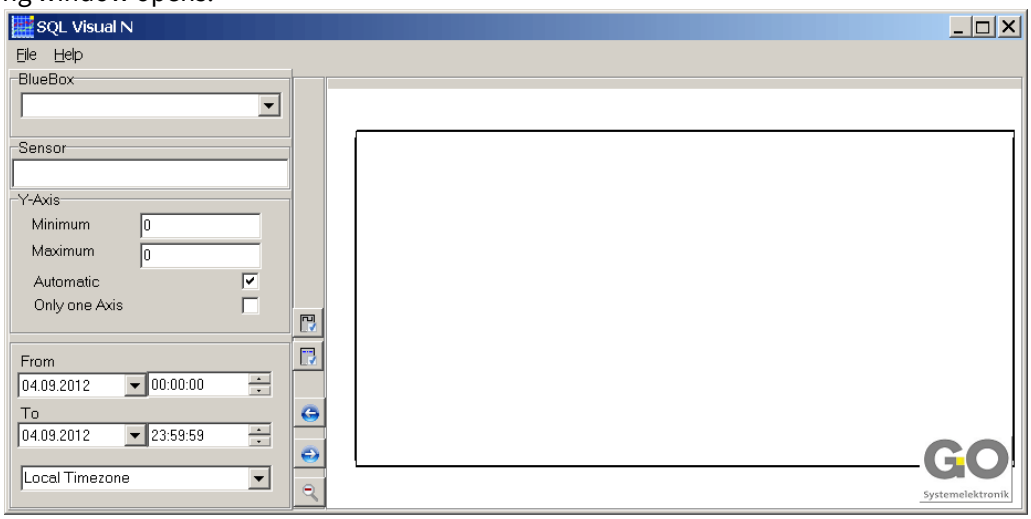
Version: 3.4.0.0

VisualN features the possibility to display the measured values from several different sensors of a BlueMon at the same time. In contrast to Visual1 shows VisualN the graphs of measured values only in one diagram. Each sensor will be shown with a different-coloured graph. Graph, chart and the legend of a sensor have the same colour.

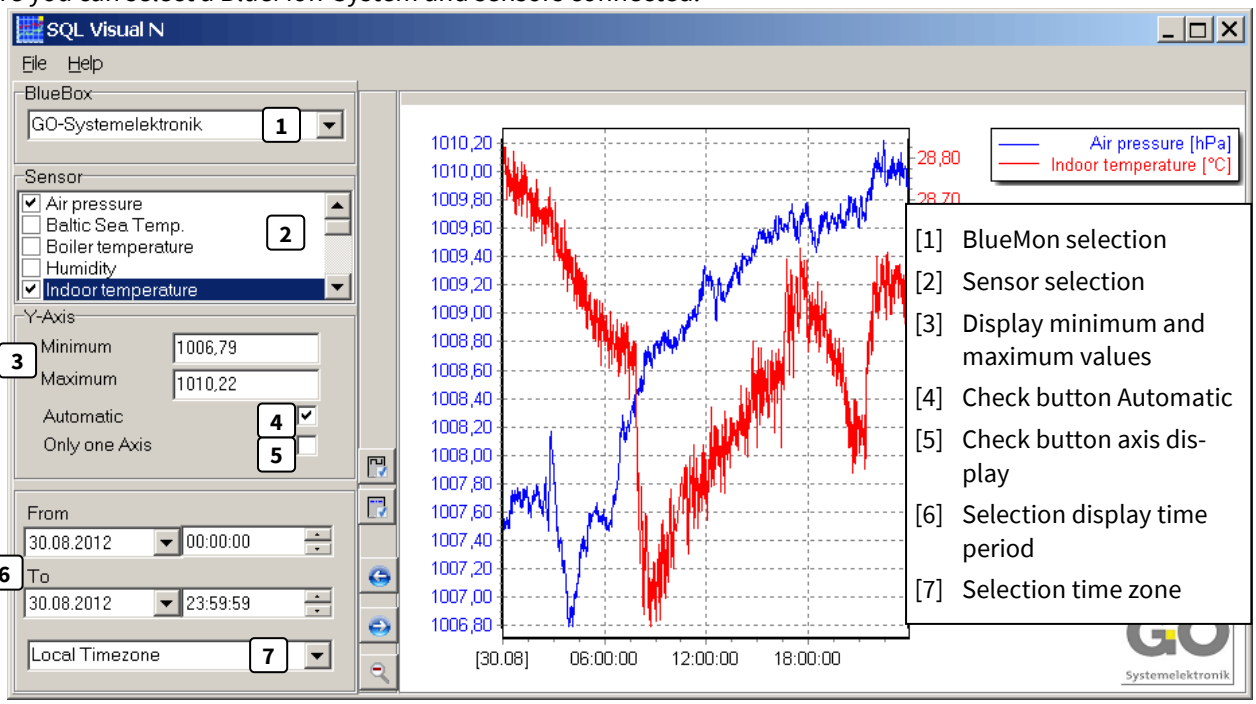
Call-up VisualN:



The following window opens:



Here you can select a BlueMon-System and sensors connected.



Graph representation with diagonal/straight lines

Graph representation continuous/dashed

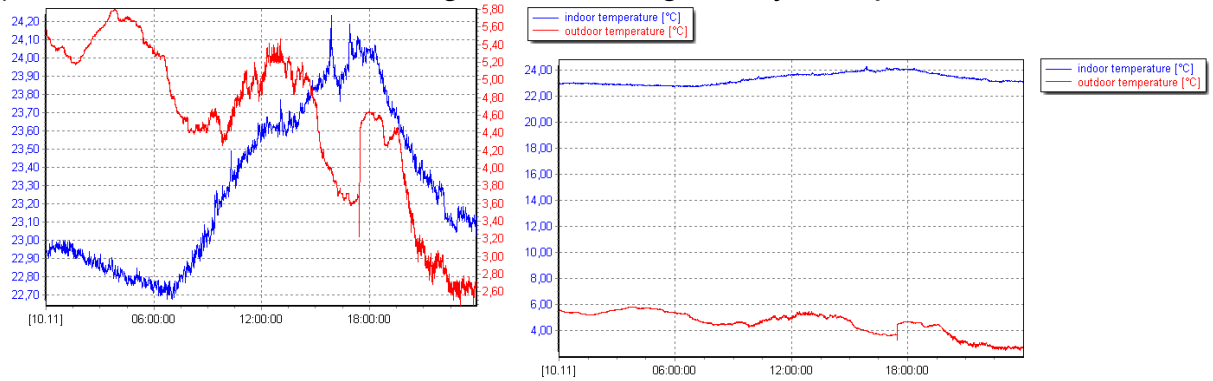
Sets the display period back by one day.

Sets the display period forward by one day.

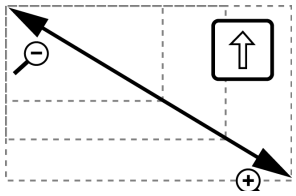
Resets the zoom value to 1.

Automatic	☐	Automatic scaling of the vertical axis: Off
Automatic	☑	Automatic scaling of the vertical axis: On
Only one Axis	☐	Each sensor graph has its own y-axis.
Only one Axis	☑	The sensor values are scaled to one y-axis.

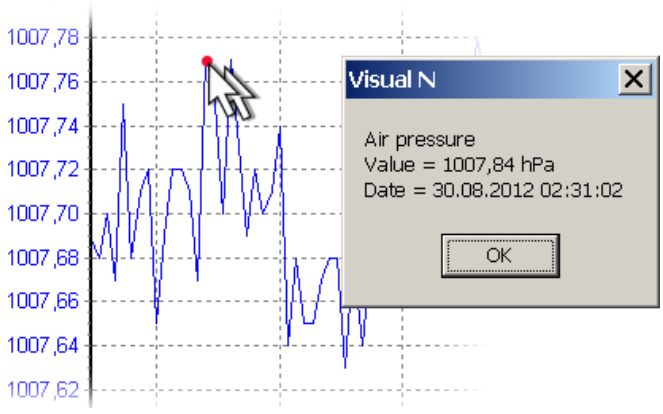
Because of the better comparability it is recommended to select “just one axis” if several sensors of the same parameter should be shown in the diagram. Then the diagram has just one y-axis.

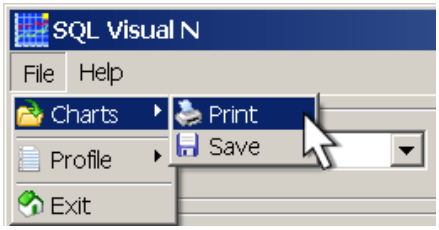


You can zoom or reduce the diagram by pressing the shift-key and the left mouse-key to raise a rectangle to the right or the left.

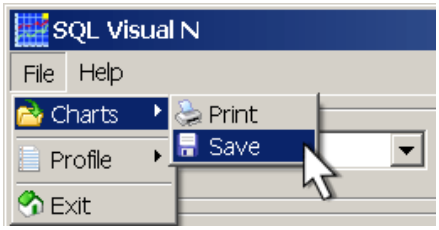


The red point stands on the point of a graph selected (selection with click on the graph), which is nearest to the cursor.
Double click opens a window with the value, the date and the time (with GPS also the position data) of the measured value underlying the red point.

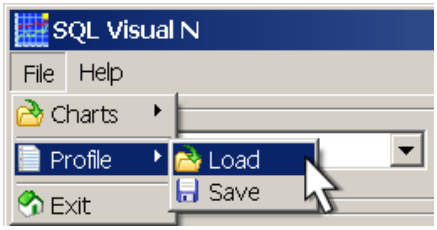




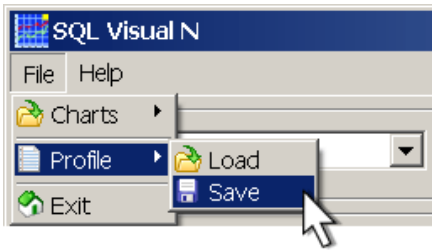
Opens the standard-printer-menu and prints the diagram.



Saves every diagram separately in popular graphic format.



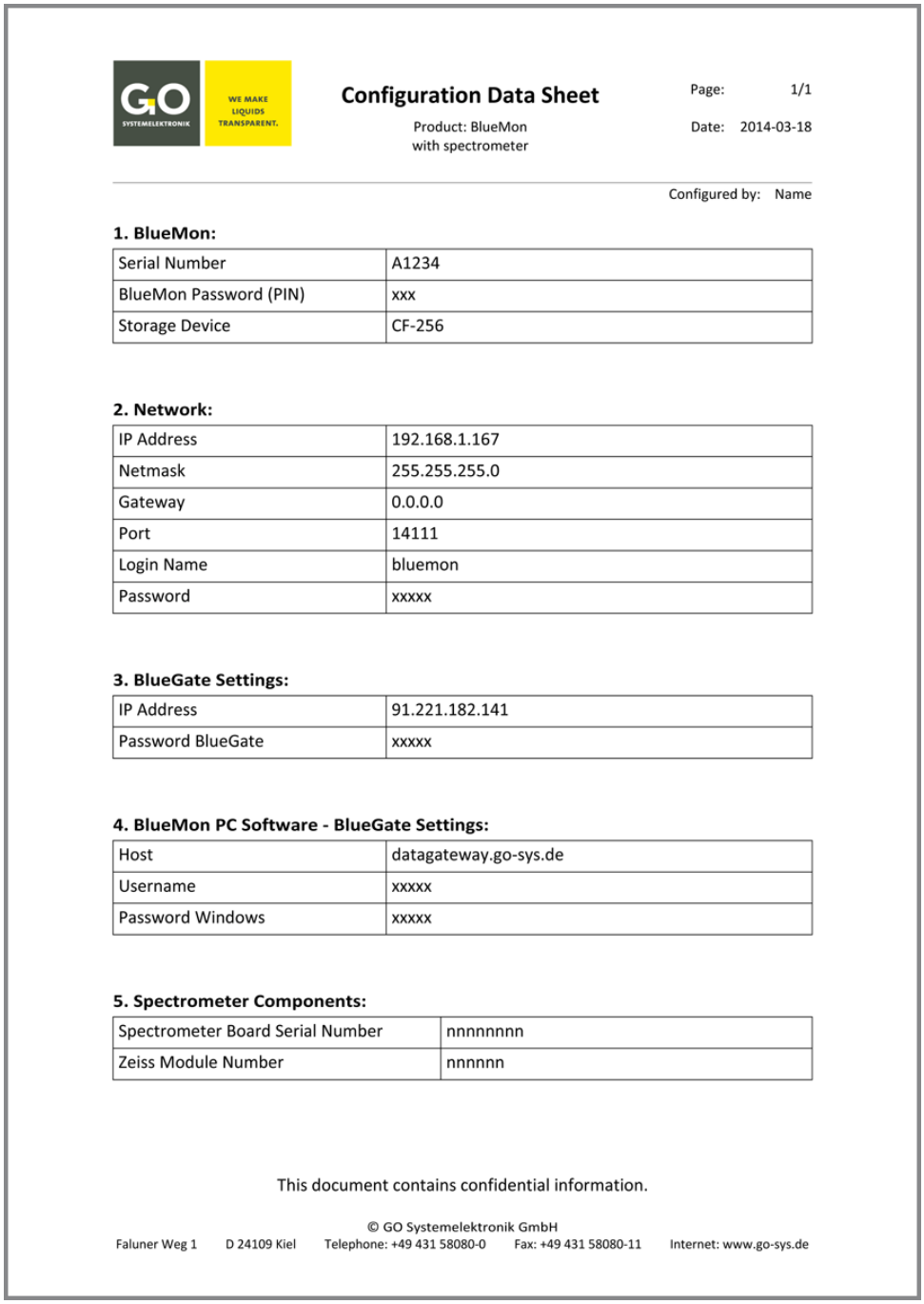
Loads a previously saved setting-profile.



Saves the settings of this window as .vpn-file.

Appendix A - The configuration data sheet

The configuration data sheet contains the necessary settings to run the BlueMon.
Example:



Configuration Data Sheet

Page: 1/1

Product: BlueMon with spectrometer

Date: 2014-03-18

Configured by: Name

1. BlueMon:

Serial Number	A1234
BlueMon Password (PIN)	xxx
Storage Device	CF-256

2. Network:

IP Address	192.168.1.167
Netmask	255.255.255.0
Gateway	0.0.0.0
Port	14111
Login Name	bluemon
Password	xxxxx

3. BlueGate Settings:

IP Address	91.221.182.141
Password BlueGate	xxxxx

4. BlueMon PC Software - BlueGate Settings:

Host	datagateway.go-sys.de
Username	xxxxx
Password Windows	xxxxx

5. Spectrometer Components:

Spectrometer Board Serial Number	nnnnnnnn
Zeiss Module Number	nnnnnn

This document contains confidential information.

© GO Systemelektronik GmbH

Faluner Weg 1 D 24109 Kiel Telephone: +49 431 58080-0 Fax: +49 431 58080-11 Internet: www.go-sys.de

1. BlueMon:

Serial Number	A1234
BlueMon Password (PIN)	xxxxx
Storage Device	CF-256

Serial Number Serial number of the BlueMon
With this serial number the BlueMon is identified by the BlueMon SQL Software.
⇨ set at the factory, not changeable

BlueMon Password (PIN) Password of the BlueMon
Is required to change the BlueMon system settings.
⇨ set at the factory, not changeable

Storage Device Model and size of the internal memory of the BlueMon, here CF-256 (CF = Compact Flash, 256 = 256 MB)
⇨ set at the factory, changeable by replacing

2. Network:

IP Address	192.168.1.167
Netmask	255.255.255.0
Gateway	0.0.0.0
Port	14111
Login Name	bluemon
Password	xxxxx

IP Address IP address of the BlueMon
At this address, the BlueMon is addressed on the network.
⇨ set at the factory, changeable

Netmask Netmask of the BlueMon
⇨ set at the factory, changeable

Gateway Default gateway of the Blue Box
⇨ set at the factory, changeable

Port network Port of the BlueMon
⇨ set at the factory*, not changeable

Login Name User name for a modem connection
⇨ set at the factory, not changeable
see *4.3.1.2 RAS setup (Modem configuration)*

Password Network password of the BlueMon
Is needed to access the BlueMon via the AMS software.
⇨ set at the factory, not changeable

* 14111 / or when encryption is enabled 14110

3. BlueGate Settings:

IP	91.221.182.141[1]
Password BlueGate	xxxxx

IP IP address of an Internet Gateway
⇨ can be configured at the factory, changeable

Password BlueGate Password of an Internet Gateway
⇨ can be configured at the factory, changeable[2]

4. BlueMon PC Software - BlueGate Settings:

Host	datagateway.go-sys.de
Username	xxxxx
Password Windows	xxxxx

If the BlueMon is accessed via a gateway (e.g. a UMTS connection), you have to enter these access data in the BlueMon SQL software.
see *4.3.1.1 Setup of a new BlueMon*

Only for BlueMon with inbuilt spectrometer

5. Spectrometer Components:

Spectrometer Board Serial Number	nnnnnnnn
Zeiss Module Number	nnnnnn

Spectrometer Board Serial Number Serial number of the spectrometer board
⇨ set at the factory, not changeable

Zeiss Module Number Serial number of the Zeiss spectrometer module
⇨ set at the factory, not changeable

[1] IP-Address of the GO webserver (default address)
[2] changeable only at the default address

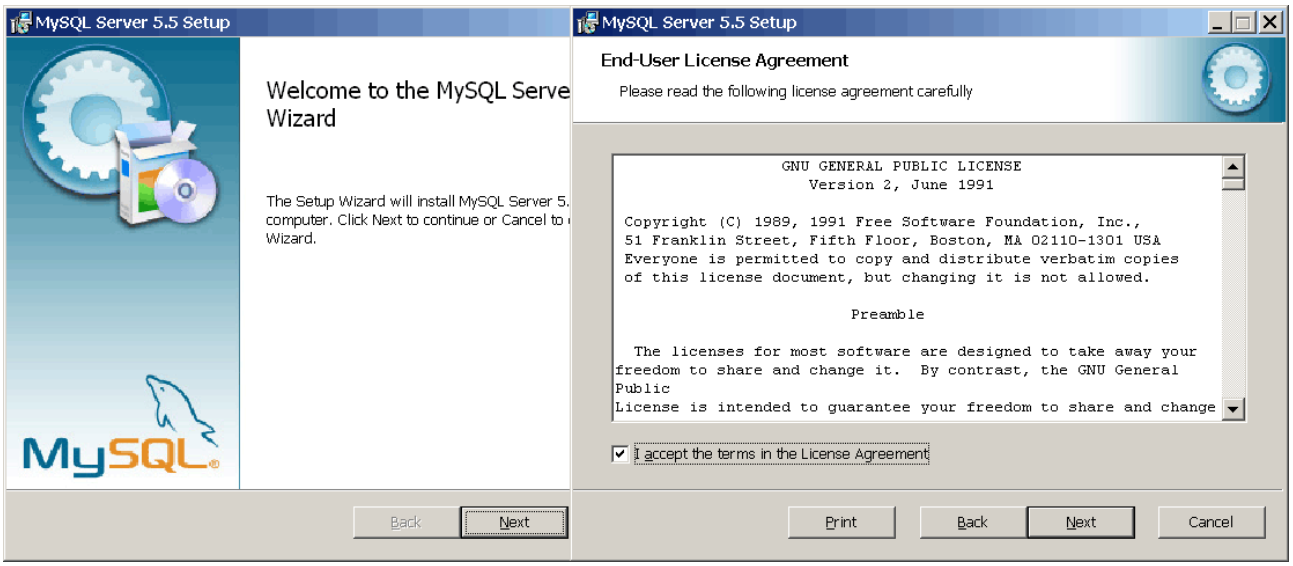
Appendix B - Installation MySQL™ Server

1 Preparation installation MySQL Server

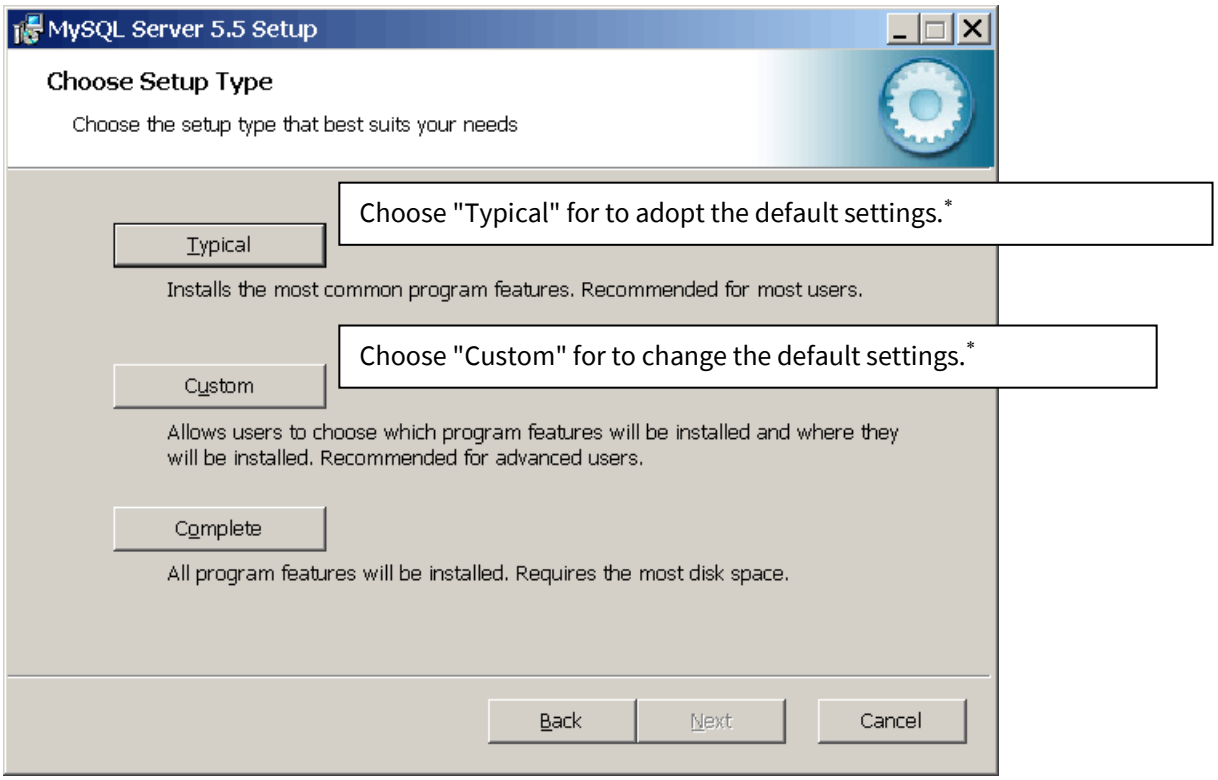
The installer for the MySQL server is stored on the USB memory stick:

- BlueMon Install\1. MySQL Server Installation\mysql-5.5.8-win32.msi (32-bit-version)
  or
- BlueMon Install\1. MySQL Server Installation\mysql-5.5.9-winx64.msi (64-bit-version)

Start the installation program and follow the instructions.



Klick auf Next

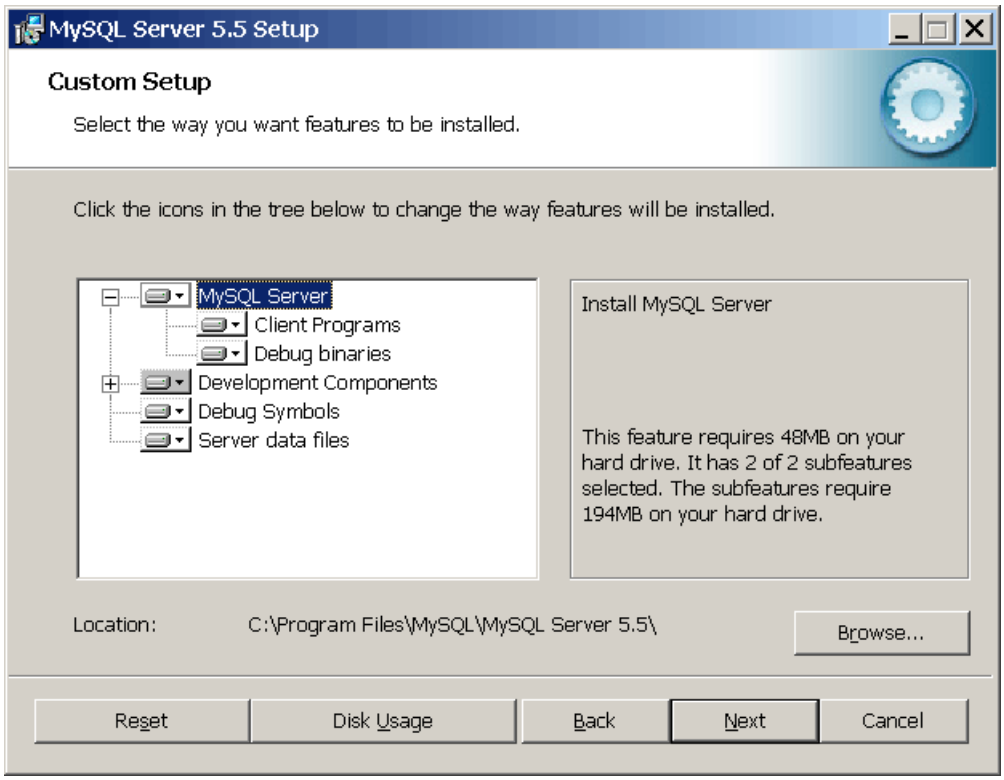


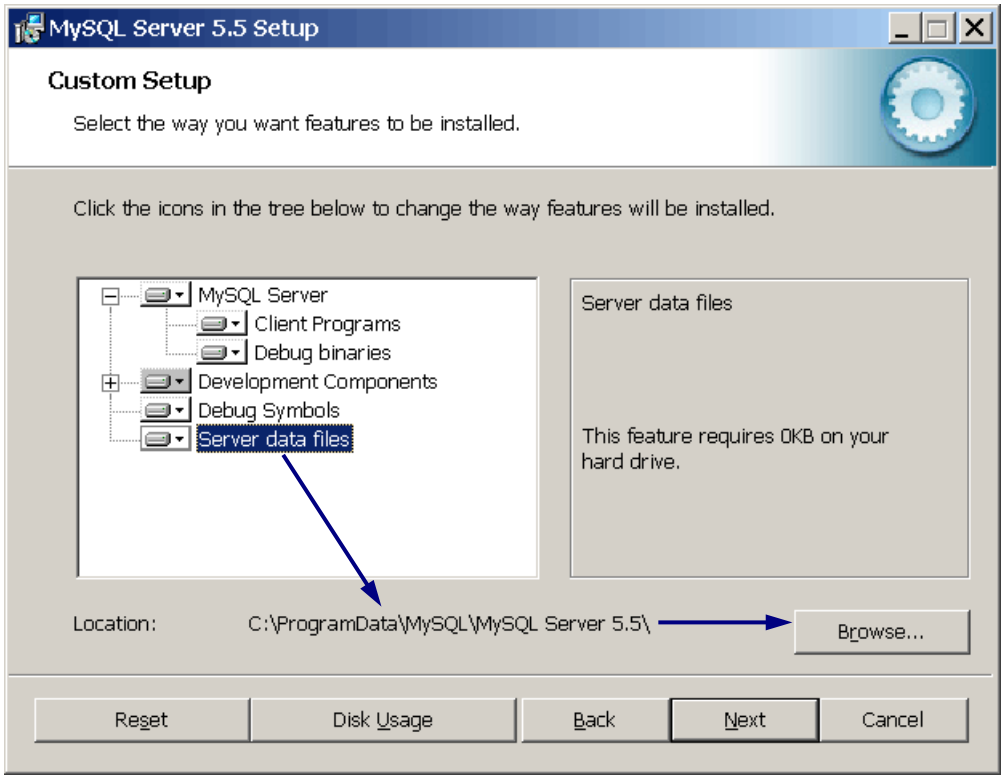
1.1 Typical selection leads to **2 Installing MySQL Server**.

* GO Systemelektronik recommends the default settings (see next page) up from Windows Vista.

1.2 Custom Setup

Here you can determine the storage pathes.



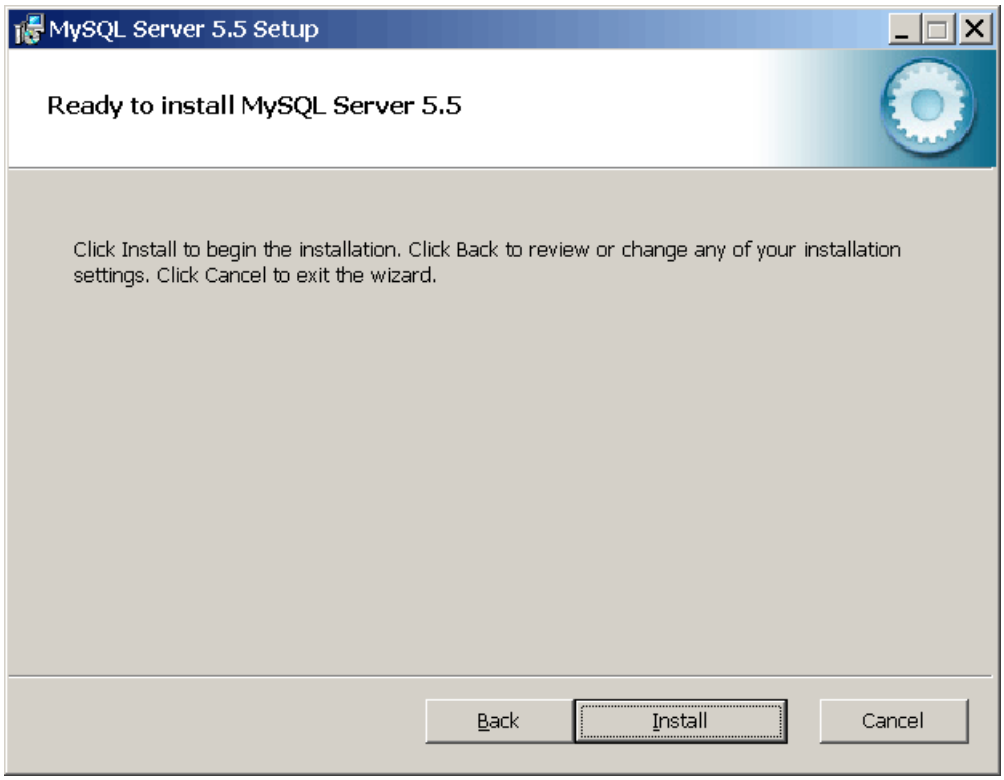


From Windows Vista onwards the database is created by default in a hidden directory. To access it with Windows Explorer, you may need to change the Windows folder options.
It may be helpful to note the location.

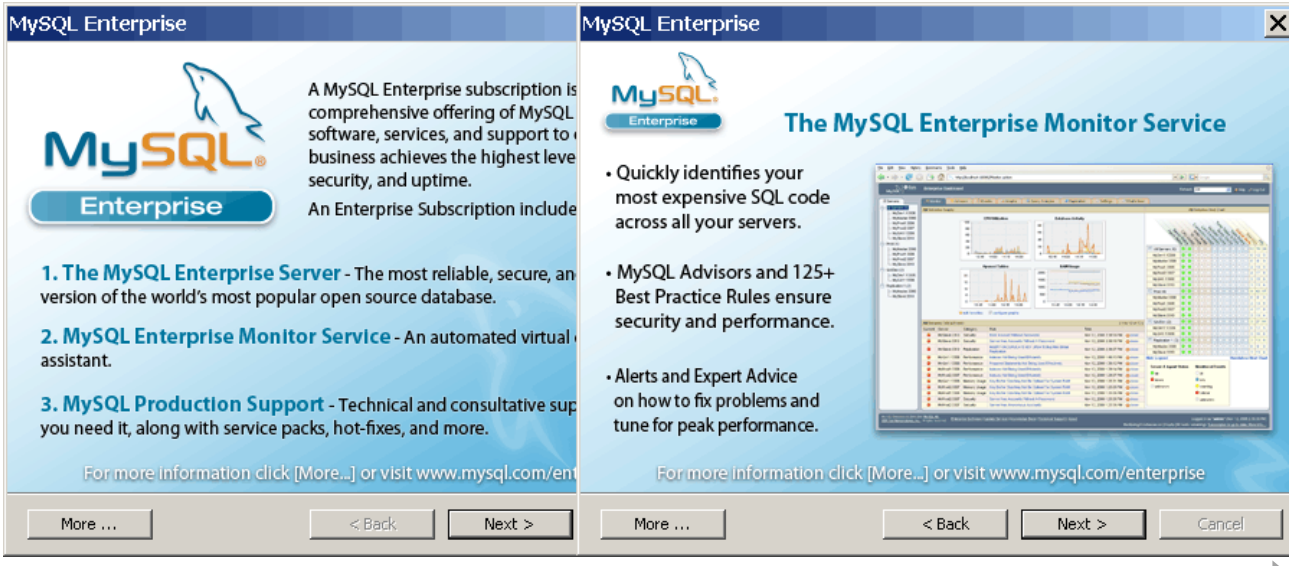
It is recommended to create the database in a different and accessible directory.

Click on Next leads to **2 Installation MySQL Server**.

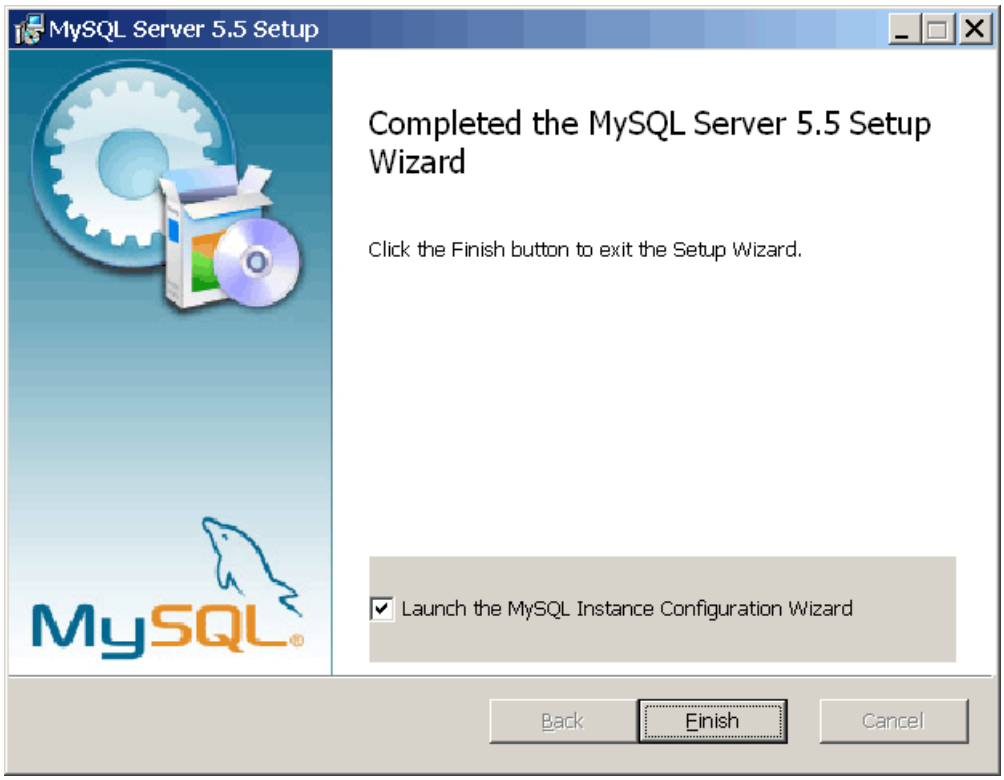
2 Installation MySQL Server



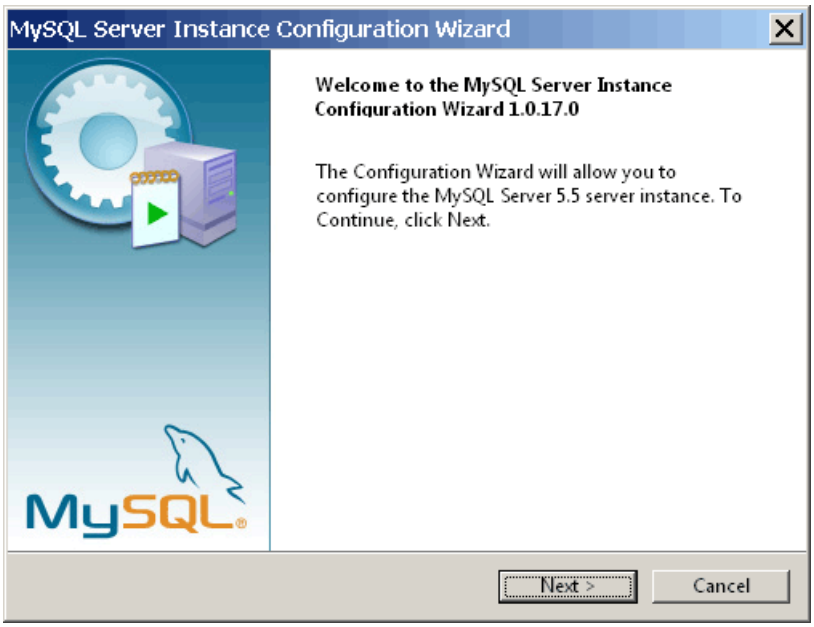
Click on Install



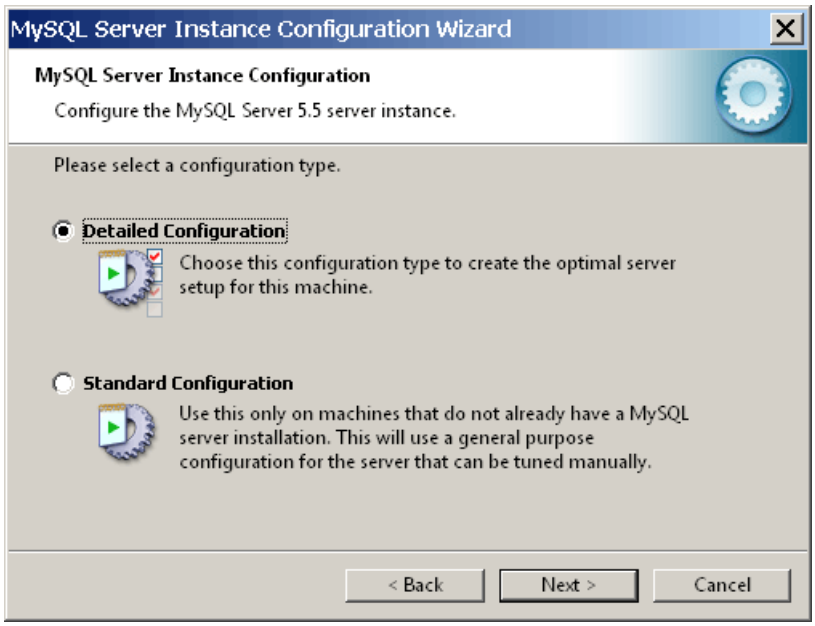
Click on Next

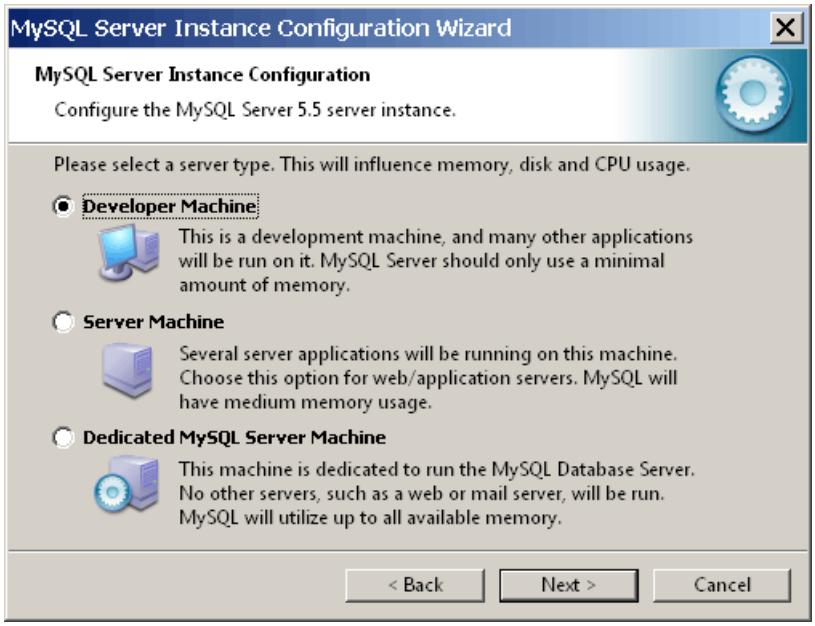


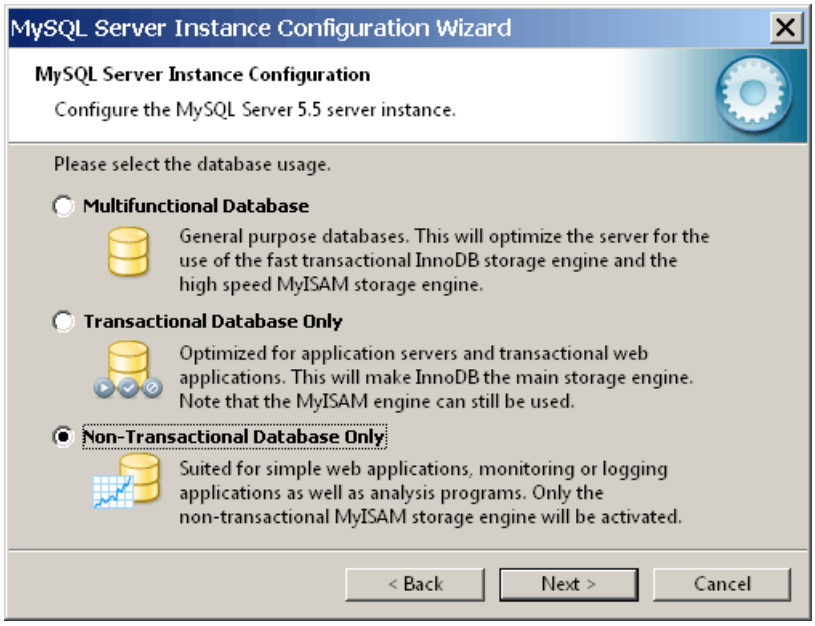
Click on Finish



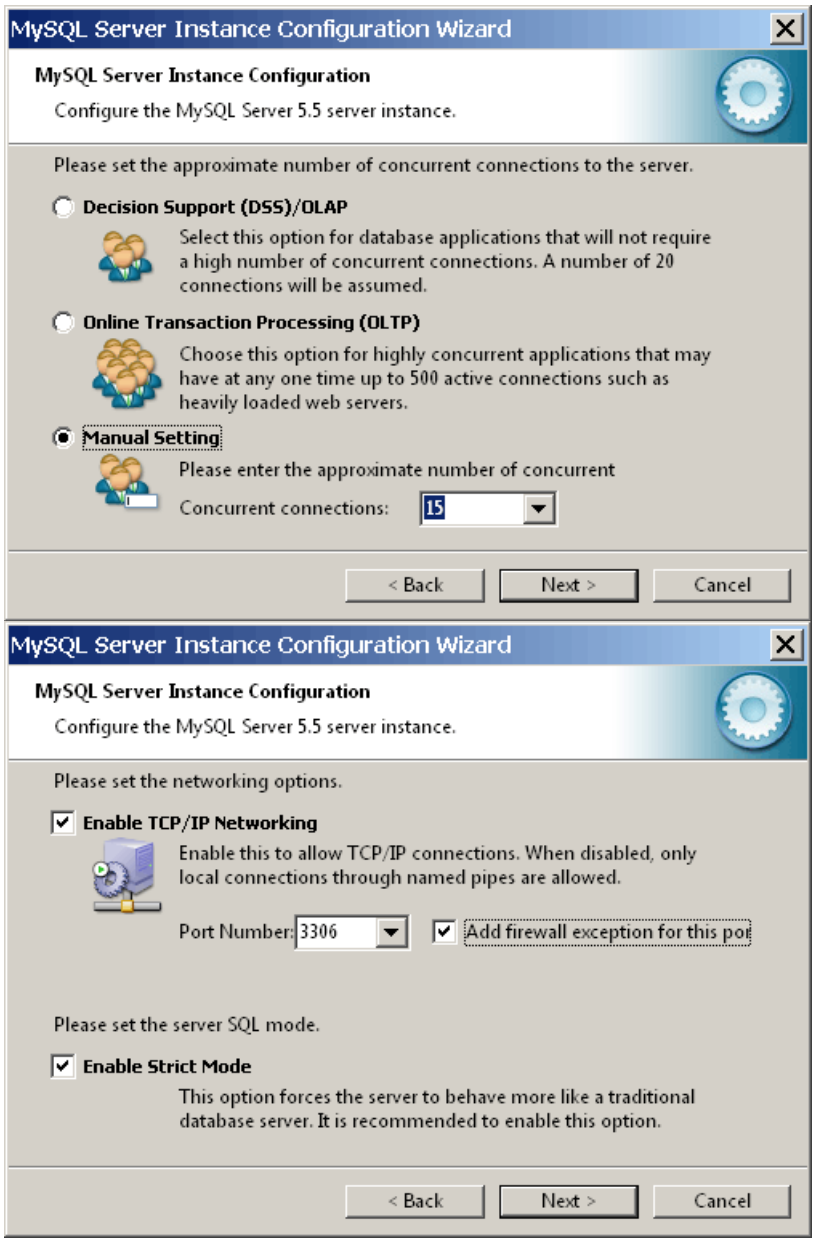
Click on Next



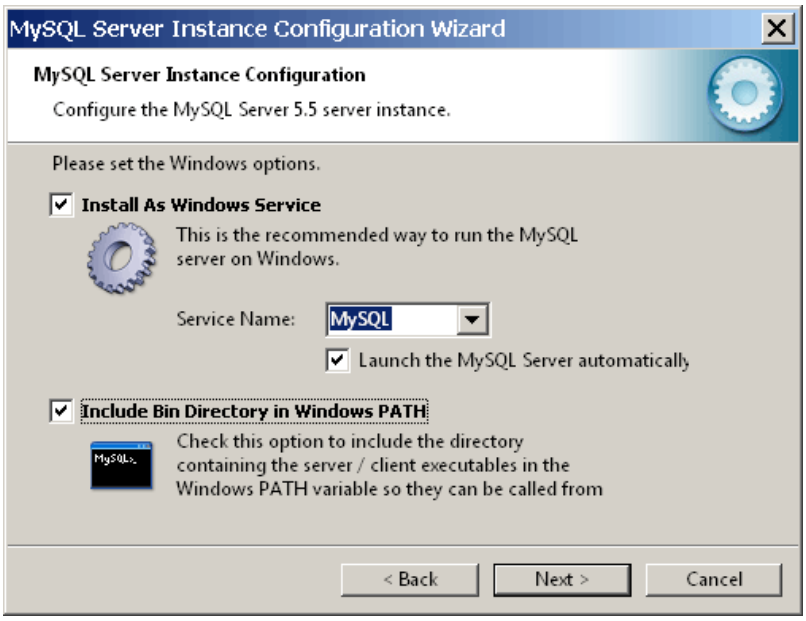




Click on Next



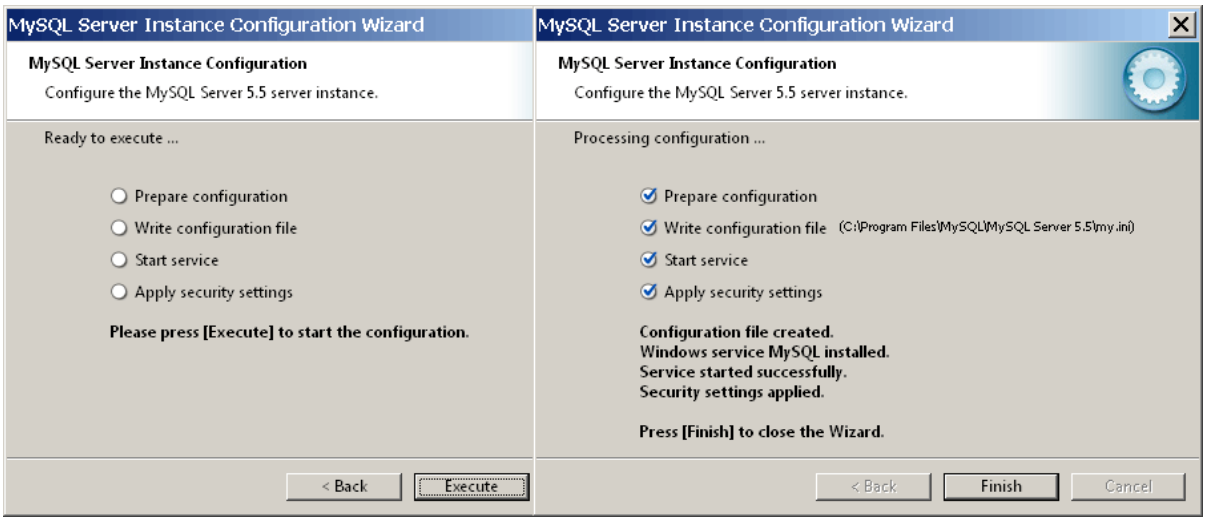
Click on Next



Click on Next

Click on Next

The entered password is needed at the BlueMon Software installation. Please note the password.



Click on Execute

Click on Finish finishes the installation.

Appendix C - Installation BlueMon PC Software

The BlueMon PC software can be installed on Windows 2000, Windows XP, Windows Vista and Windows 7.

A MySQL™ Server is mandatory necessary for the running of the BlueMon PC Software, see Appendix A - Installation MySQL™ Server.

Programs of the BlueMon PC Software:

- BlueMon SQL Software
- Visual1
- VisualN

Software protection against unauthorized use:

- CodeMeter Software

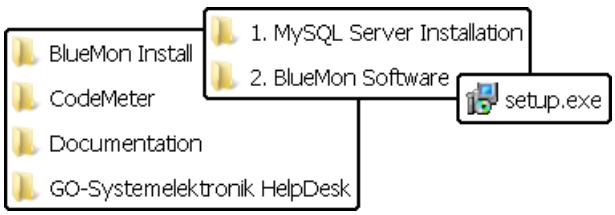
You need the USB memory stick from GO Systemelektronik and the dongle stick from GO Systemelektronik. The USB-Dongle and the CodeMeter Software work together to protect the BlueMon PC Software against unauthorized use.

USB memory stick

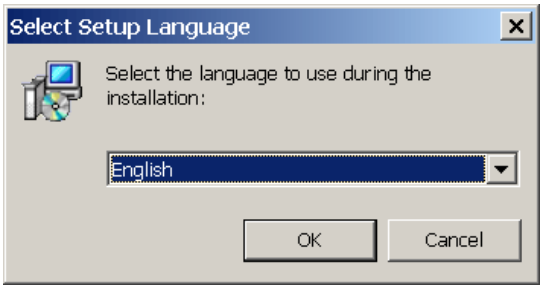
USB-Dongle

The USB memory stick contains the program data.
To operate the software, you need the USB dongle.
Put the USB memory stick into a USB slot of your PC. Open the USB memory stick

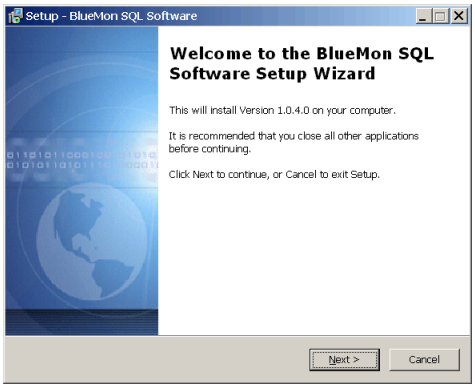
Double-click “setup.exe”.

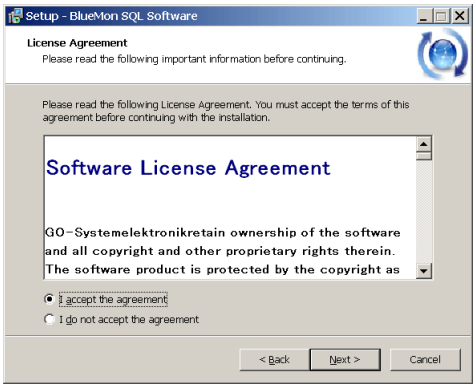


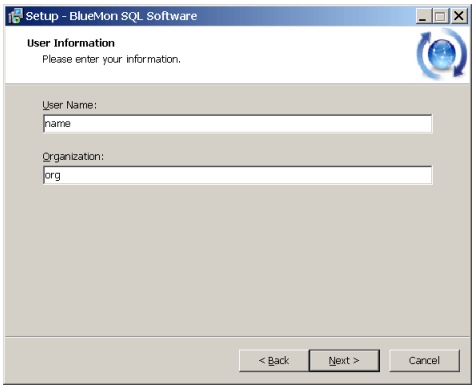
Choose your language.

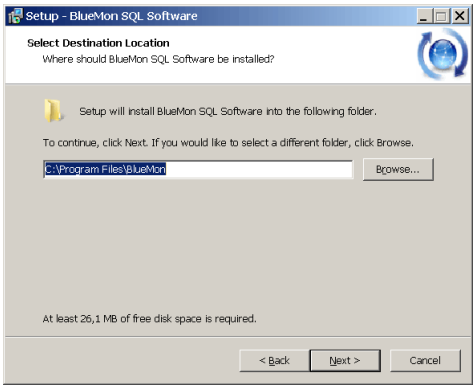


Click <OK>

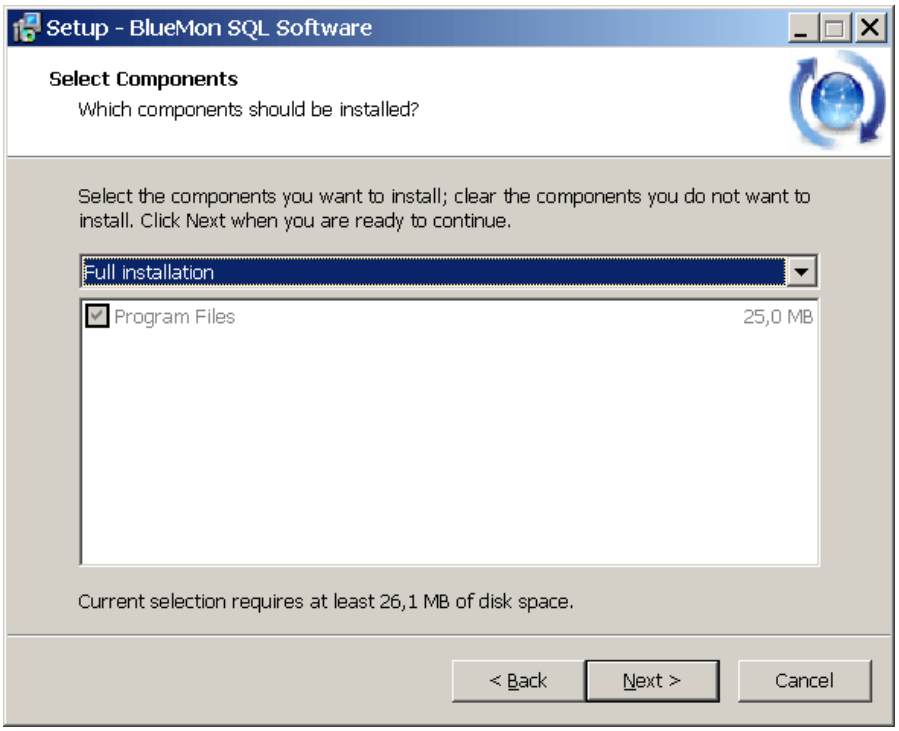






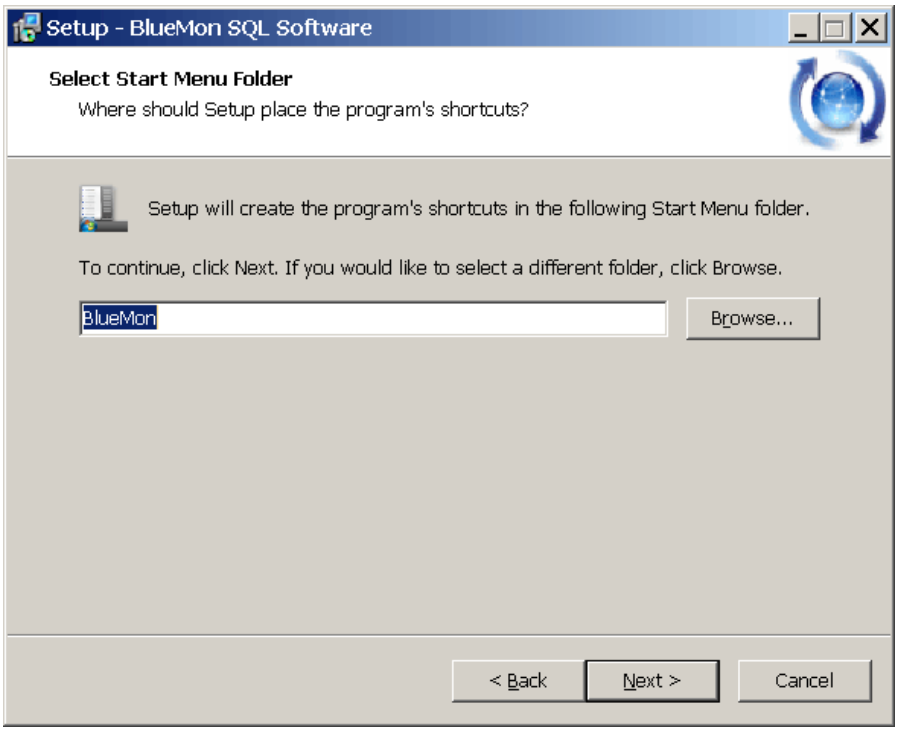


Click <Next >

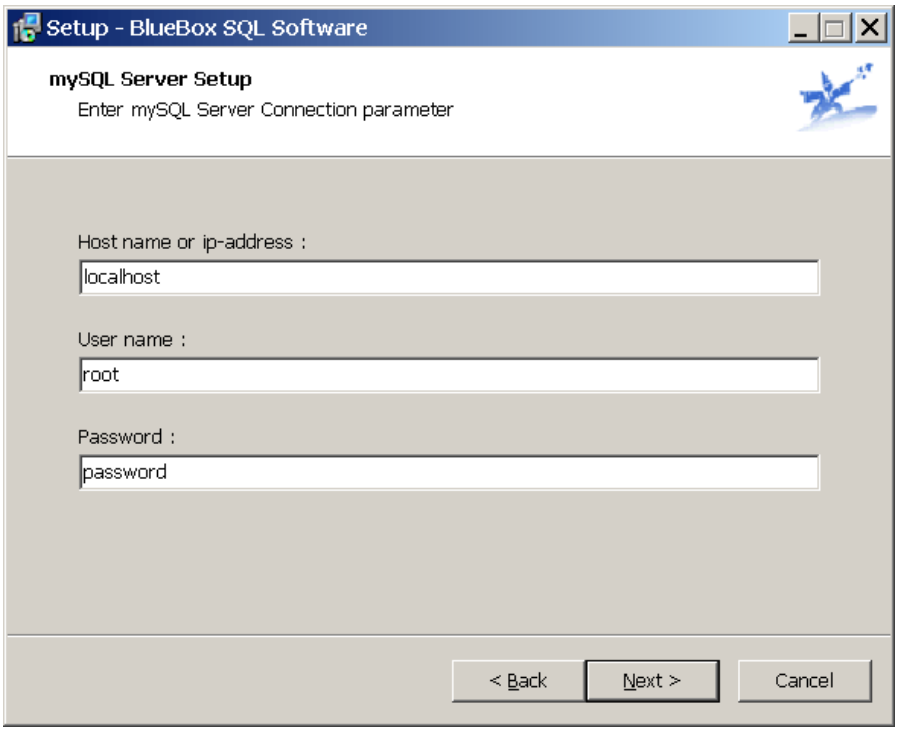


“Program Files” is always activated and installs the BlueMon PC Software. Even if the BlueMon PC Software is already installed, new software versions will be installed.
Depending on customer requirements here other programs can be selected for installation

Click <Next >



Click <Next >

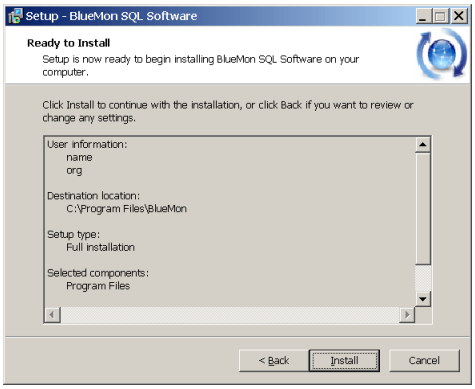


Host name or ip-address: The IP-address of your MySQL™ Server. If the server runs on the present PC you have to enter „localhost“.

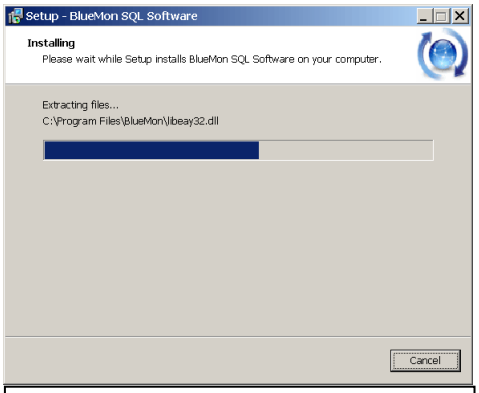
User name: Root name of the MySQL™ Server, here the standard name „root“.

Password: Password of the MySQL™ Server, was assigned during the installation of the server.

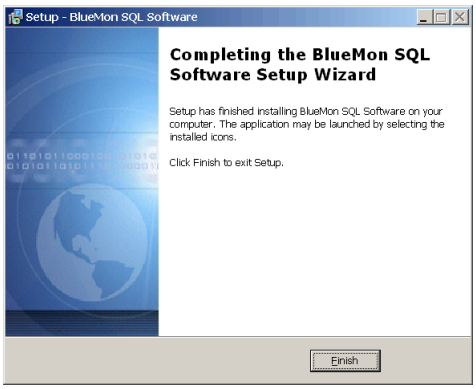
Click <Next >



Click <Install >



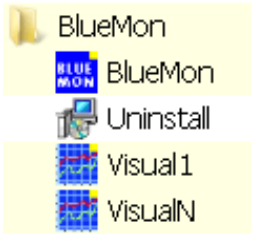
If the Codemeter software is not installed on your PC, the Codemeter installer will run now .



Click on <Finish>

The installation is completed.

Open the program menu of the taskbar.



From here you can start the programs Visual1 and VisualN.*

Before starting the software, put the USB-Dongle into a USB slot of your PC.
The USB-Dongle protects the BlueMon PC Software against unauthorized use.

USB-Dongle

* In general these programs are started from the BlueMon SQL main program.

Appendix D - BlueMon SQL in server operation

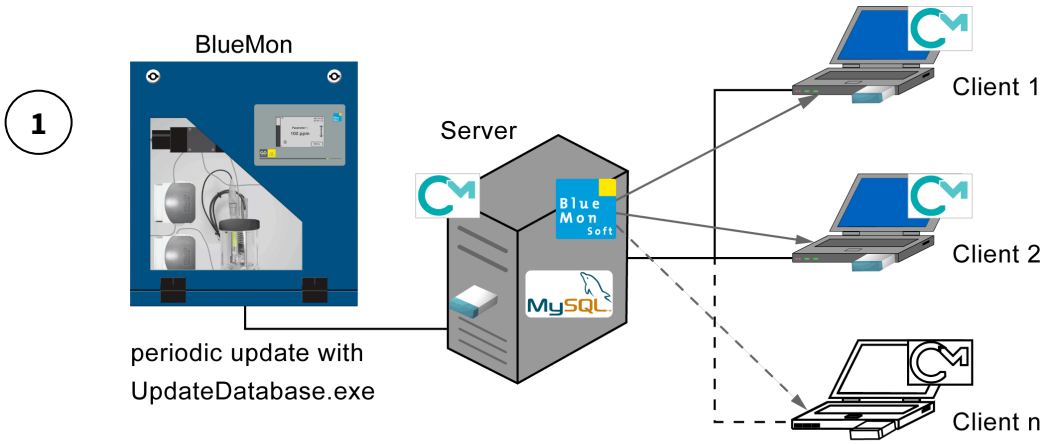
1 Overview

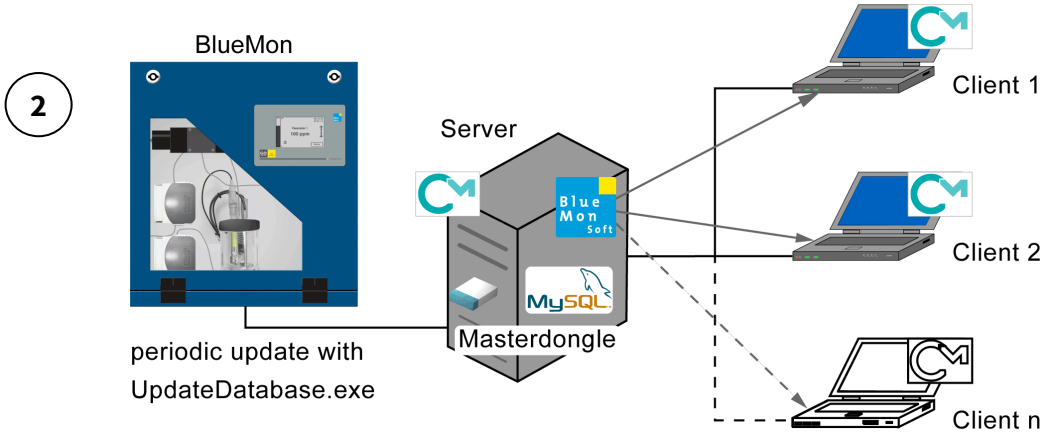
The BlueMon can be connected with clients via a server in two ways.

1. The server and each client have a dongle, the number of connected clients is unlimited.
2. The server has a masterdongle, the number of connected clients depends on the license.

Without dongle you can visualize data already existing on the PC with Visual1 and VisualN.

The SQL server must be installed on the server.
The CodeMeter software must be installed on the server and on each client.
The BlueMon-Software must be installed on the server. It could be installed on each client, generally you apply a link to the BlueMon software at the server.





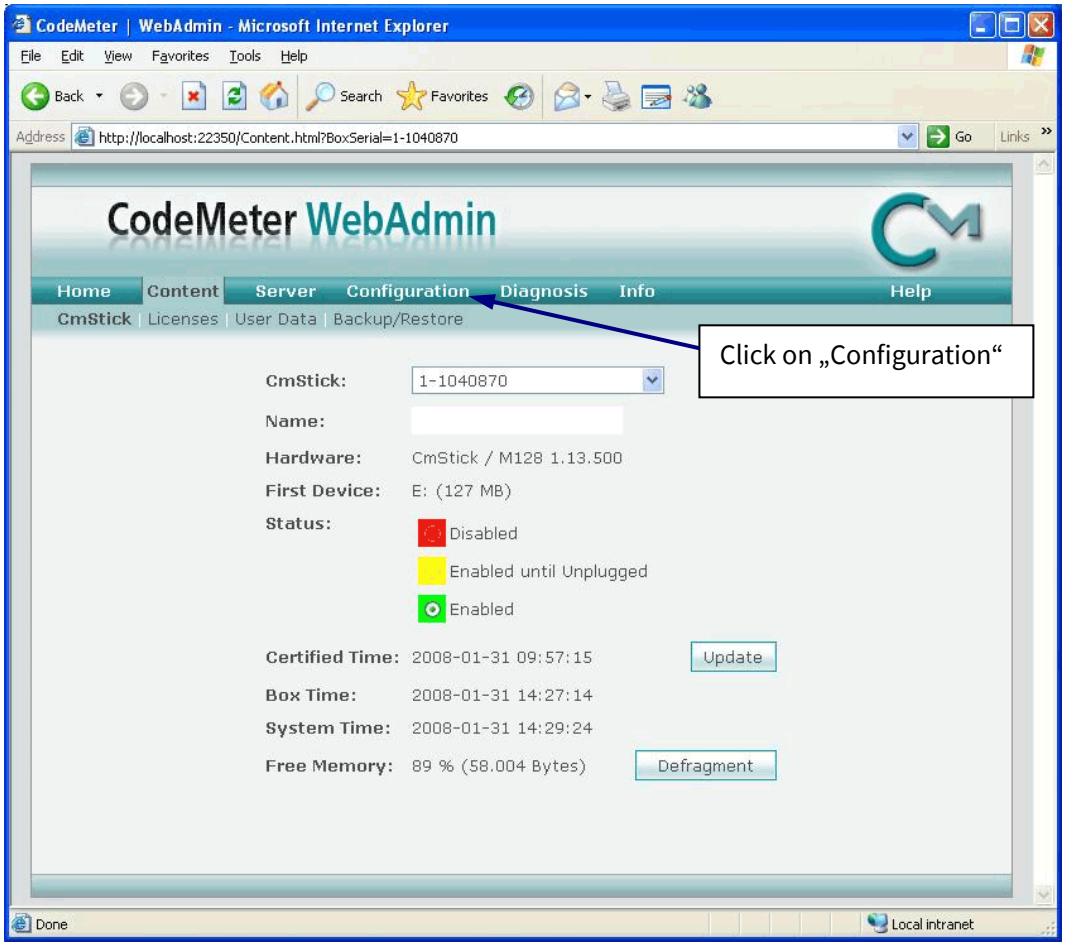
The periodic update of the SQL database with the data of the BlueMon take place with the program **Update-Database.exe**.

2 Settings of the CodeMeter Software for operation with Masterdongle

So that the clients can use the master dongle, the following settings of the CodeMeter Software at the server* have to be done.

Click with the right mouse button on the CodeMeter symbol in the taskbar.

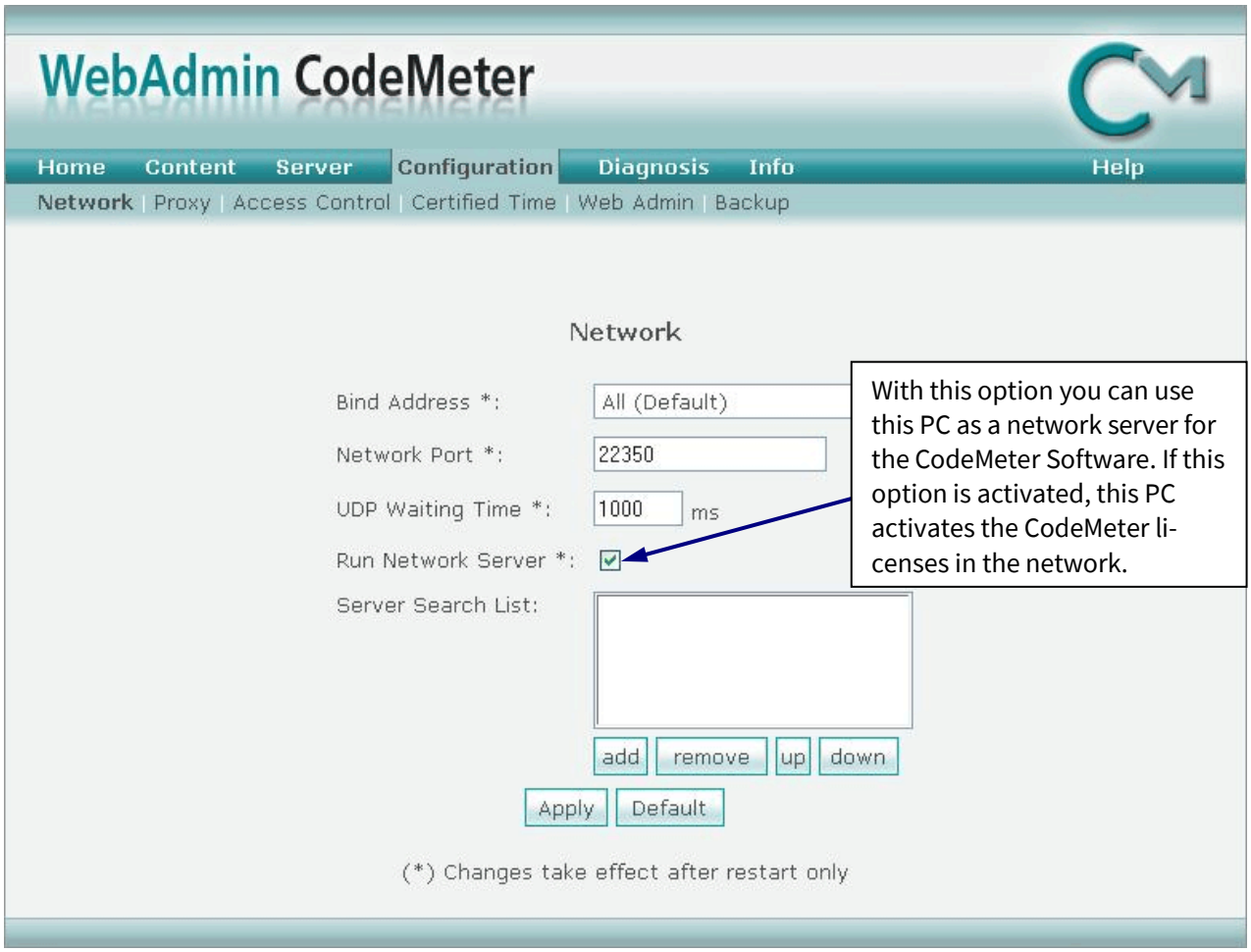
It opens the CodeMeter Webadmin interface with your default browser.



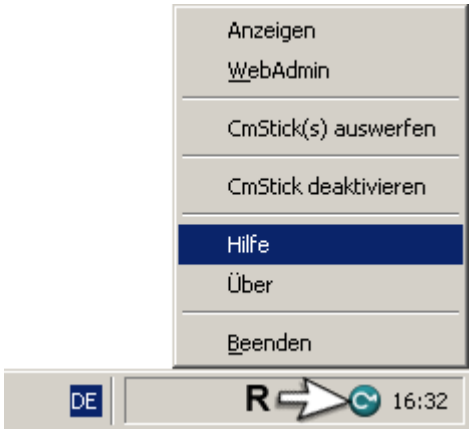
Now the input mask of the configuration opens in your default browser.

* The masterdongle can be plugged even into any client, then the described server settings have to be made at this client.

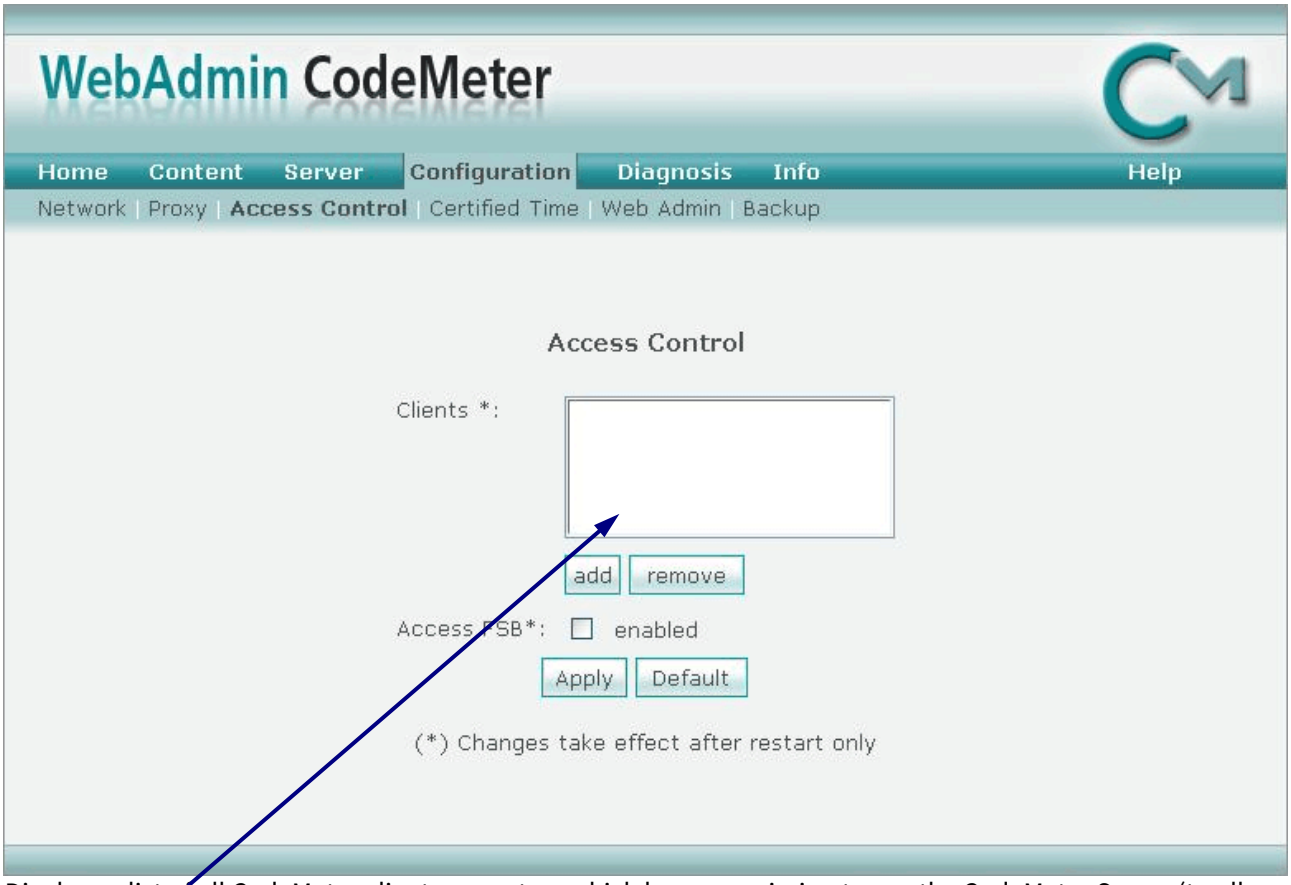
2.1 Settings of the CodeMeter Software at the server



A documentation of the CodeMeter Webadmin surface you will find here:
Click “Help”.

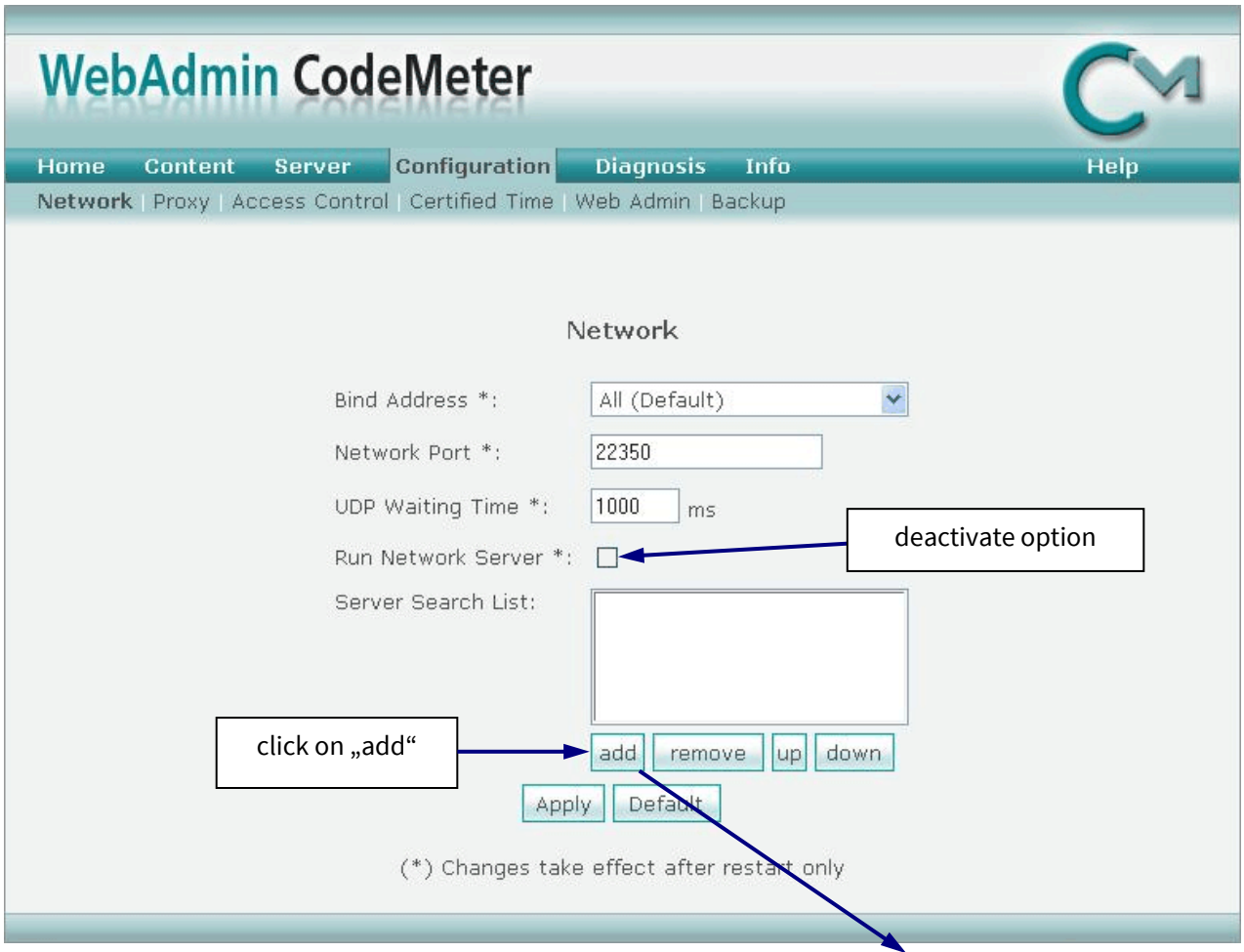


Remark:
If there are connection problems, check the input mask „Access Control“ the server.

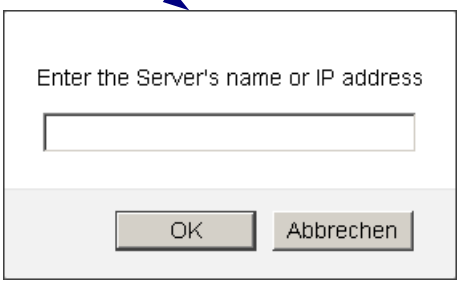


Displays a list of all CodeMeter client computers which have permission to use the CodeMeter Server (to allocate a license).
If this list is empty (default setting), all CodeMeter clients are allowed to use the CodeMeter Server.

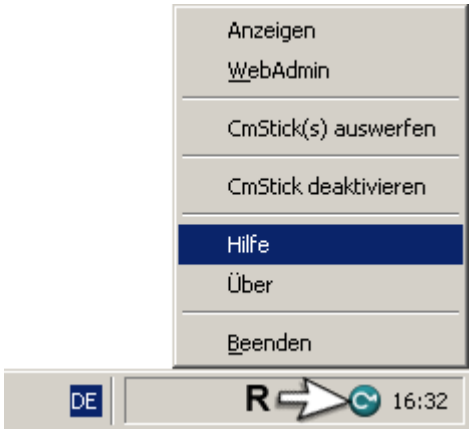
2.2 Settings of the CodeMeter Software at the client



Write the name of the server or its IP address into this window.
Click on „OK“ stores it into the Server Search List.



A documentation of the CodeMeter Webadmin surface you will find here:
Click “Help”.



Appendix E - Requesting a dongle upgrade for a license upgrade

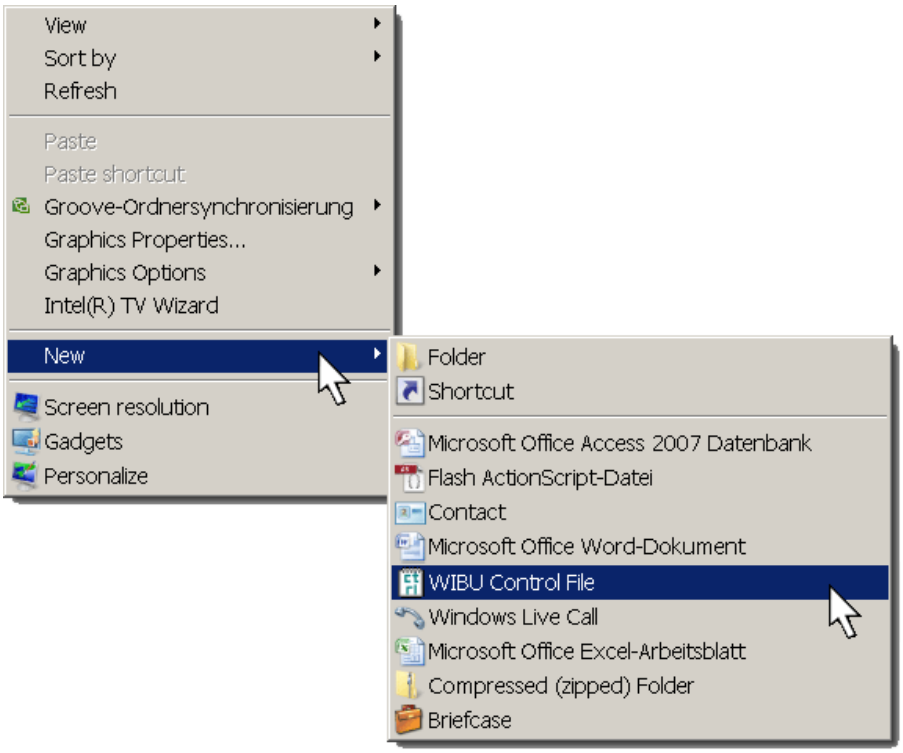
Precondition:

- inserted USB-Dongle from GO Systemelektronik
- installed Codemeter Software

Both are included in scope of delivery of BlueMon PC Software.

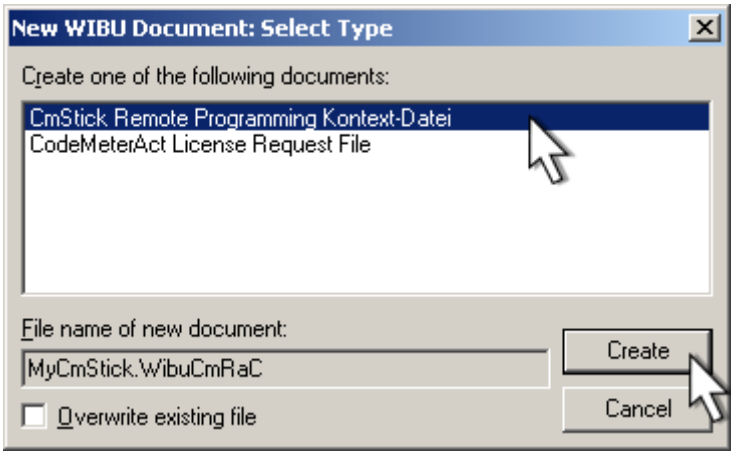
1. Call up of „WIBU Control File“

Click with the right mouse button on the background of the Windows desktops. Select “New“ and then „WIBU Control File“.



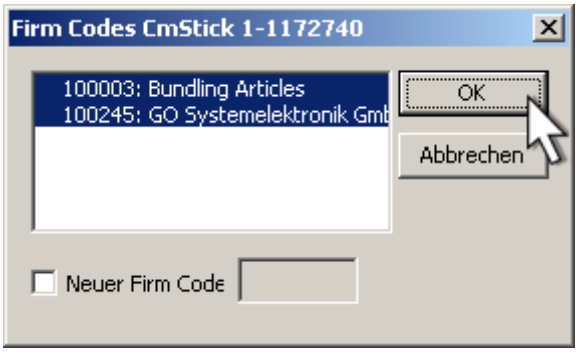
2. Document selection

Select the entry „CM Stick Remote Programming Kontext-Datei“. „CM Stick Remote Programming Kontext-Datei“ denotes a license file. Click on „Create“.



3. Creating a context file

Select both entries in the list field. Click on “OK“.



Click on “OK“. The program creates the file “MyCmStick.WibuCmRaC“ on the desktop.

4. File sending

Send the license file “MyCmStick.WibuCmRaC“ to GO Systemelektronik: **info@go-sys.de**

5. License extension

Within short time you will get a new license file back. Open this file with a double-click. The license will be extended automatically.

Appendix F - Warning and error messages

There are warning messages and error messages.

A warning message is displayed and the program continues, if necessary program routines are repeated (e.g. at a calibration) to ensure the program continuance.

An error leads to the termination of the current program.

The messages are displayed in the Live Status window (see *4.2.5 Live Status*).

warning messages are yellow

error messages are red

All messages are also displayed on the BlueMon display.

message type: 0 = warning message | 1 = error message

No.	Type	Message
0	1	Config error
1	1	CAN-bus error
2	1	Out of memory error
3	1	Extention card communication error
4	1	Read program error
5	1	Photometer error reference beam
6	1	Photometer error measuring beam
7	1	Photometer communication error
8	0	Heater 1 safety stop
9	1	Heater 1 emergency stop
10	1	Heater 1 temperature to high
11	0	Heater 1 temperature to low
12	1	Heater 1 temperature error
13	0	UV digestor 1 error
14	0	Heater 2 safety stop
15	1	Heater 2 emergency stop
16	1	Heater 2 temperature to high
17	0	Heater 2 temperature to low
18	1	Heater 2 temperature error
19	0	UV digestor 2 error
20	1	Leackage error
21	0	Sample 1 error
22	0	Sample 2 error
23	0	Sample 3 error
24	0	Sample 4 error
25	0	Sample 5 error
26	0	Sample 6 error
27	1	Calibrat error
28	1	Dilution water error
29	1	Reagent 1 error
30	1	Reagent 2 error
31	1	Reagent 3 error
32	1	Reagent 4 error

33	1	Reagent 5 error
34	0	Alarm runtime 1
35	1	Stop runtime 1
36	0	Alarm runtime 2
37	1	Stop runtime 2
38	0	Alarm runtime 3
39	1	Stop runtime 3
40	0	Alarm runtime 4
41	1	Stop runtime 4
42	0	Alarm runtime 5
43	1	Stop runtime 5
44	0	Alarm runtime 6
45	1	Stop runtime 6
46	0	Calibration fault
47	0	Calibration min warning limit
48	0	Calibration max warning limit
49	1	Calibration min operating limit
50	1	Calibration max operating limit
51	1	Spectrometer failed
52	1	Spectrometer AD values
53	0	Spectrometer selftest
54	1	Spectrum load
55	1	Spectrum save
56	1	Titration config load
57	1	Titration sensor error
58	0	Inflection point 1 not found
59	0	Inflection point 2 not found
60	0	Inflection point 3 not found
61	0	Inflection point 4 not found
62	0	Inflection point 5 not found
63	0	Titration interpolation error
64	0	Liquid detector 1 error
65	0	Liquid detector 2 error
66	0	Liquid detector 3 error
67	0	Liquid detector 4 error
68	0	Liquid detector 5 error
69	0	Liquid detector 6 error

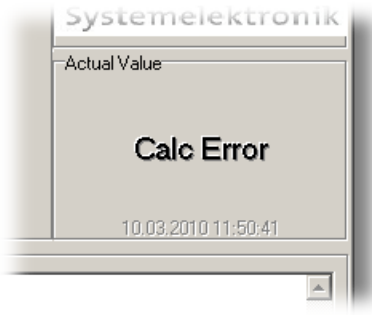
The Liquid detector is for bubble detection.

Appendix G - AMS Formula

AMS Formula offers the manipulation of sensor data and actuators, set up of virtual (calculated) sensors (unlike real sensors) and sending messages via E-mail and SMS. The formula code is written into the formula input field and transferred to the BlueMon.

If an offset value is entered in the formula input field of a sensor and this offset shall be removed, it must be ensured that the formula field must be completely empty. Spaces must also be deleted.

Error message of a formula error
Faulty formulas will be displayed at their processing as **Calc Error** with the number of the error line.



Note: After transferring the contents of a formula field on the BlueMon this content will only be permanently stored on the CompactFlash card after 30 seconds. So the BlueMon can be safely booted after a formula related crash.

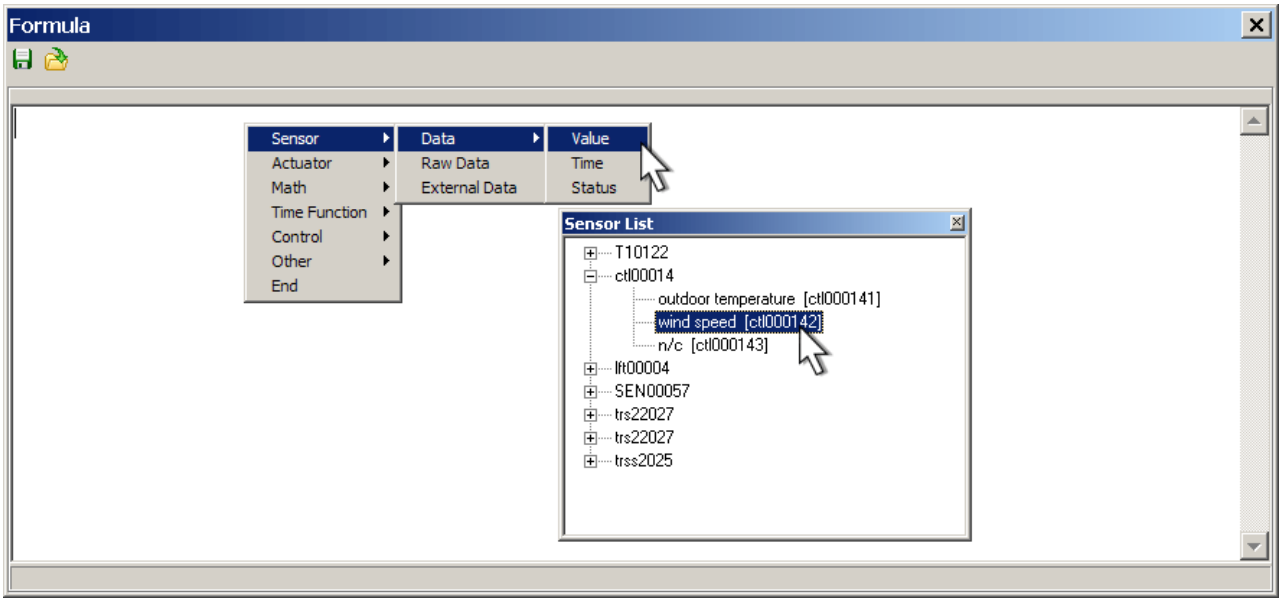
1 Formula structure

- The **formula syntax** is defined by lines.
  Skip functions do not exist, the formula is executed line by line sequentially.
- Uppercase and lowercase letters are differentiated (case sensitive).
- **; (Semicolon)** marks the end of a statement.
- **#** marks the following characters of the line as a comment.
- The argument of a function will be included through **round brackets**.
  In calculation formulas round brackets express a priority of an arithmetic operation over other in the arithmetic sequence. Multiple interleaving is allowed.
- A block of statements will be started with an opening **curly bracket {** and will be ended through a closing curly bracket **}** .
  In conditional statements, you must define statement blocks when more than one statement has to be execute. That means: **if (**condition**) {**statement1**;**statement2**;**...**;**statementn**;}**
- **Variables**
  - Can only contain floating point numbers up to 64 bits long (float double), therefore the largest decimal number is 2^{65}-1 = 36,893,488,147,419,103,231
  - Variables have by definition the start value 0.
  - Variables are global.
- **Variable names**
  - Only consist of ASCII letters and ASCII digits.
  - The first character must be a letter.
  - Uppercase and lowercase letters are differentiated in the variable name (case sensitive).
  - The maximum length is 30 characters.
  - Can not begin with the character string of AMS formula elements.*
- **Variable types**
  There are three types of variables:
  - **Standard Variables**, the content will be deleted with the shutdown of the BlueMon and set on restart to 0 (zero).
  - **Permanently Stored Variables** Variables are stored every 10 minutes on the BlueMon permanently, they are marked by a preceding underscore (example: _Name).
  - **At BlueMon Adjustable Permanently Stored Variables** can be changed on the display of a BlueMon, they are marked by a preceded dollar sign (example: $name).
    The suffix ". MIN", ".MAX" or ".RESOLUTION" limits the adjustable value and determines the changing steps. Example: $Name.MIN = -5; $Name.MAX = 10; $Name.RESOLUTION = 0.01;

* Also here uppercase and lowercase letters are differentiated.

2 The AMS Formula input assistant

Example: sensor value



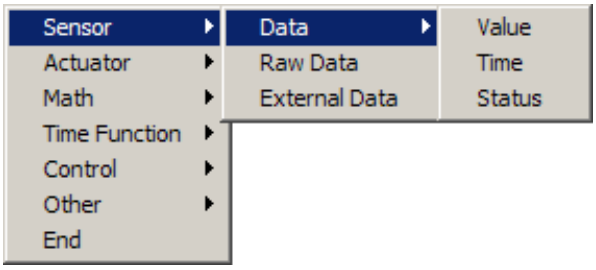
A click with the right mouse button in the formula input field opens the input assistance.
Click of an entry in the selection list leads forward correspondingly.
Double click on a sensor in the sensor list of inserts the sensor identification into the formula input field.

For the specific input help for the BlueMon see *4.4.1.2.3 Sample lines – Program (analysis sequence)*.

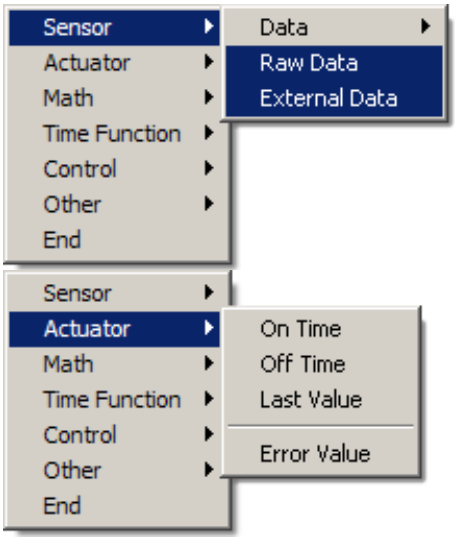
2.1 Formula elements of the input assistant

For a complete list of the AMS Formula elements, see: Appendix H - List of the AMS Formula elements

A click with the right mouse button in the formula input field opens the input assistant.
Click on an entry in the list continues accordingly..



Value
Indicator on the measured value of the selected sensor.
Example [lft000044]
Time
Indicator on the measurement time of the measured value.
Example [lft000044.TIME]
Status
Indicator on the status of the selected sensor.
Example [lft000044.STATUS]

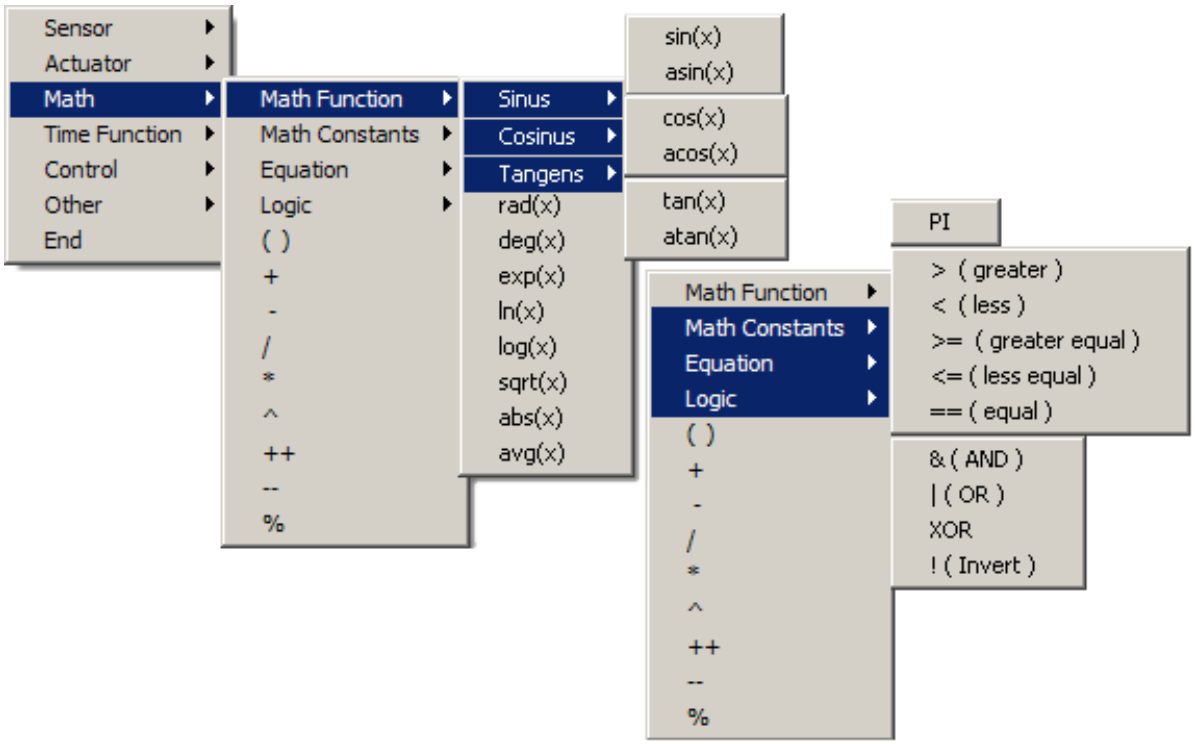


Raw Data
Indicator on the raw value of the selected sensor.
Example [!lft000044] Identifiable at exclamation mark.
External Data Measured value from another BlueMon
Indicator on the measured value of a with DAM-ID + sensor number selected sensor. [**DAM-ID + Sensor number*] Identifiable at asterisk.

On Time
Time in seconds since the actor is switched-on.
Off Time
Time in seconds since the actor is switched-off.
Last Value
Last measured value
>0.5 actor switched-on, <0.5 actor switched-off
Error Value*
Defines if an actor will be switched on or off at an incorrect calculation (e.g. breakdown of a sensor).

ERRORVALUE=1 Actor will be switched-on.
ERRORVALUE=0 Actor will be switched-off.

* If this value is used, it should be entered in the first line of the formula input field!



In order to calculate a formula, various mathematical operators, functions etc. are available.
Most items listed are likely to be known, to better understand these they are listed here in their order:

trigonometric functions

sinus	sinus function sin(x)
cosine	cosine function cos (x)
tangent	tangent function tan(x)

inverse trigonometric functions

asin(x)	Arcus sinus
acos(x)	Arcus cosine
atan(x)	Arcus tangent

angular dimensions

rad(x)	radian measure, also: radian (e.g.: 60° is π/3 rad, i.e. circa 1.0472 rad)
deg(x)	degree, conversion from radian to degree (rad -> grad)

exponential function

exp(x) exponential function, whose basis is the Euler's number e: e^x

logarithm function

Logarithm are the inverse function of the exponential function.

ln(x)	logarithm naturalism, log (x)
log(x)	log10 (x)

root function

sqrt(x) square root of x

absolute value

abs(x) value of x. When calculating this value positive real digits and the zero will be unchanged, at negative real numbers the leading sign will be switched to + .

arithmetical mean value

avg(x) AVG(1,10,[sensor number]);

1 number of the averaging; may occur just one time within one BlueMon

10 number of values from which the mean value will be computed

[*sensor number*] the sensor number of the sensor

constant

Pi π=3,14159265

comparing operators

In particular comparing operators are necessary for settings of switching points for sensors.

> greater than

< less than

>= greater or equal

<= less or equal

== equal

logic operations

For the setting of switching points for sensors logic operations can be used also:

& and

| or

XOR exclusive or

! Bit-inverting,

truth table of the above mentioned logic operations

OR			XOR			AND		
a	b	y	a	b	y	a	b	y
0	0	0	0	0	0	0	0	0
0	1	1	0	1	1	0	1	0
1	0	1	1	0	1	1	0	0
1	1	1	1	1	0	1	1	1

arithmetic operators

( ) preferred transaction of the in brackets-setted basic-calculating-operation

+ addition

- subtraction

/ division

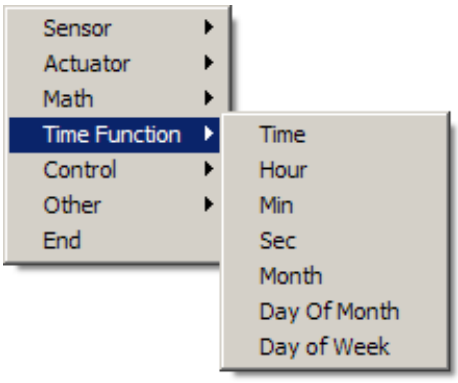
* multiplication

^ potency, a notation for the repeated multiplication of a real number with oneself, a^n

++ addition of 1 (+1)

-- subtraction of 1 (-1)

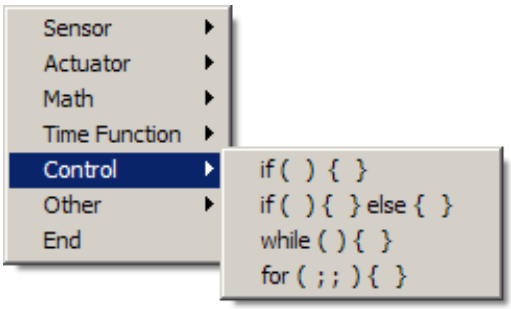
% modulo-operator, rest of an integer division



The information refer to the time of the BlueMon.

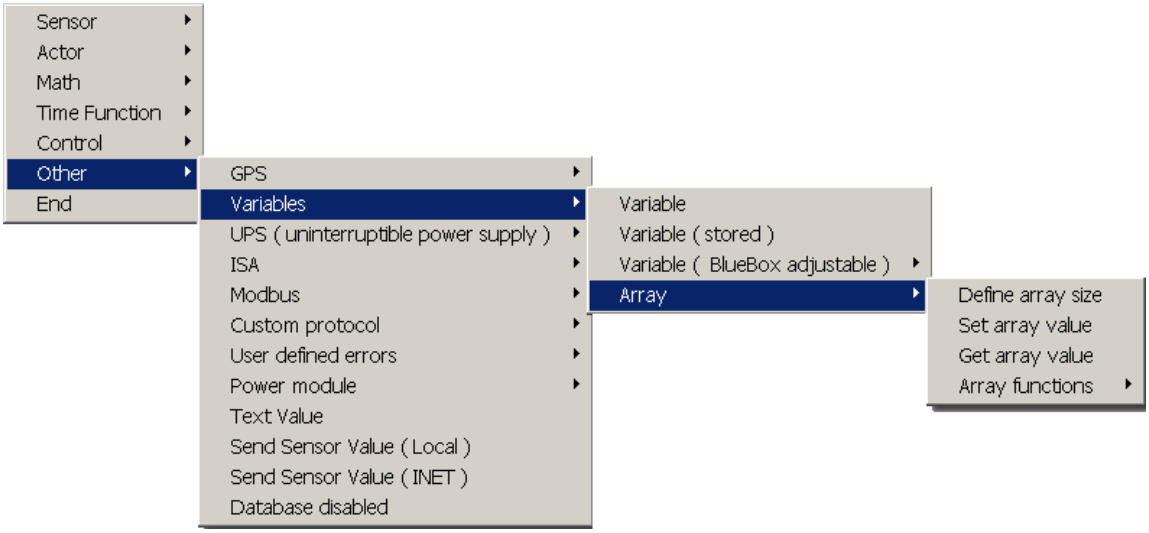
Time	TIME	current time (Local time)
Hour	HOUR	current hour
Min	MIN	current minute
Sec	SEC	current second
Month	MONTH	current month
Day of Month	DAYOFMONTH	current day of month
Day of Week	DAYOFWEEK	current day of week

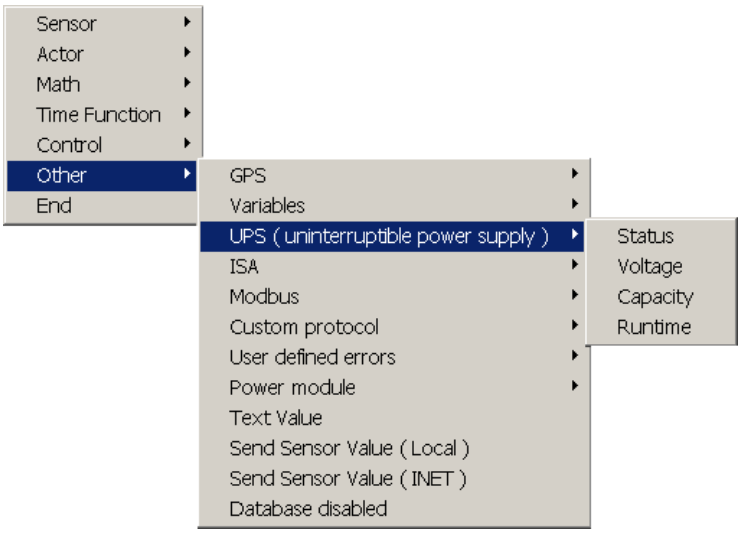
0 corresponds Sunday
1 corresponds Monday,
2 Tuesday
etc.

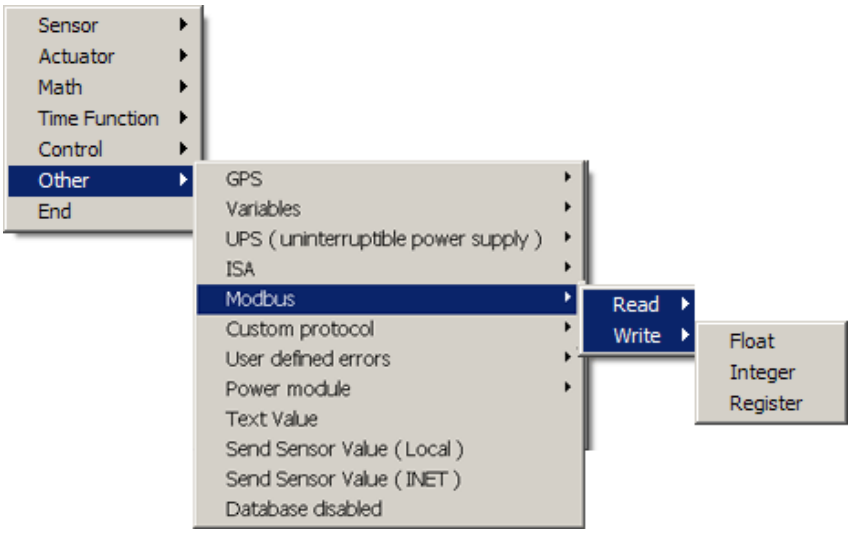


Conditional statements

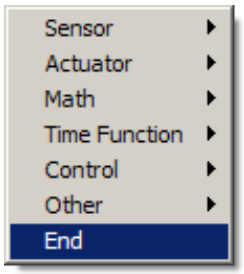
other elements







Reads values out of the Modbus-Register. Writes values into the Modbus-Register.



A complete list of the AMS Formula elements you see at: Appendix H - List of the AMS Formula elements

Appendix H - List of the AMS Formula elements

Specific formula elements of the BlueMon

BlueMon - current values	Description
BM.MES	current measured value of the photometer
BM.REF	current reference value of the photometer
BM.E	current absorbance value of the photometer
BM.PHTEMP	current measured value of the pH temperature sensor
BM.PH	current measured value of the pH sensor
BM.REDOX	current measured value of the Redox sensor
BM.ANALOG	current measured value of the analogue current input
BM.TEMP	current measured value of the temperature sensor
BM.TITRATION	current measured value of the titration sensor

BlueMon - measured value variable	Description
Result*n*	Variable for a measured value of a sample line (n = 1 - 3)

BlueMon - captured values	Description
BM.MES*n*	measured value from list 1 - 5 of the photometer (n = 1 - 5)
BM.REF*n*	reference value from list 1 - 5 of the photometer (n = 1 - 5)
BM.E*n*	absorbance value from list 1 - 5 of the photometer (n = 1 - 5)
BM.PHTEMP*n*	temperature value of the pH temperature sensor from list 1 - 5 (n = 1 - 5)
BM.PH*n*	pH value or voltage from listl 1 - 5 (n = 1 - 5)
BM.REDOX*n*	Redox value from list 1 - 5 (n = 1 - 5)
BM.ANALOG*n*	measured value analogue current input from list 1 - 5 (n = 1 - 5)
BM.TEMP*n*	temperature value heating from liste 1 - 5 (n = 1 - 5)
BM.TITRATION*n*	measured value of the titration sensor from list 1 - 5 (n = 1 - 5)

BlueMon - calibration values	Description	
BM_CAL *n*	calibration factors[1]	(1 ≤ n ≤ 5)
BM_C*n*	calibration concentrations[1]	(1 ≤ n ≤ 5)

BlueMon - spectrometer	Description
BM.ISA(*n***)**	absorbance value at wavelength n (n = 200 - 708) of a newly calculated absorbance spectrum
BM.ISA0(*n*)	count (raw value) at the scanning point n (n = 0 - 255) of the last captured or loaded reference spectrum
BM.ISA1(*n*)	count (raw value) at the scanning point n (n = 0 - 255) of the last captured or loaded sample spectrum
BM.ISA(*n***,"Sample***m*-*k***.abs")**	absorbance value of a captured absorbance spectrum at wavelength n (n = 200 - 708) of sample line m (m = 1 - 6) with the assigned spectrum number k (k = 1 - 1024)
BM.ISA_LOAD(*n***"Calibration-***k***.abs")**	absorbance value of a absorbance spectrum from the calibration program at wavelength n (n = 200 - 708) of sample line m (m = 1 - 6) with the assigned spectrum number k (k = 1 - 1024)
BM.ISA_LOAD(*n***"Cleaning - *k*.abs")**	absorbance value of a absorbance spectrum from the cleanig sequence at wavelength n (n = 200 - 708) of sample line m (m = 1 - 6) with the assigned spectrum number k (k = 1 - 1024)
BM.ISA_LOAD ("Sample*m*-*k***.ref")**	count (raw value) of a captured reference spectrum of sample line m (m = 1 - 6) with the assigned spectrum number k (k = 1 - 1024)
BM.ISA_LOAD ("Calibration-*k***.ref")**	count (raw value) of a reference spectrum from the calibration program with the assigned spectrum number k (k = 1 - 1024)
BM.ISA_LOAD ("Cleaning-*k***.ref")**	count (raw value) of a reference spectrum from the cleaning sequence with the assigned spectrum number k (k = 1 - 1024)
BM.ISA_LOAD ("Sample*m*-*k***.smp")**	count (raw value) of a captured sample spectrum of sample line m (m = 1 - 6) with the assigned spectrum number k (k = 1 - 1024)
BM.ISA_LOAD ("Calibration-*k***.smp")**	count (raw value) of a sample spectrum from the calibration program with the assigned spectrum number k (k = 1 - 1024)
BM.ISA_LOAD ("Cleaning-*k***.smp")**	count (raw value) of a sample spectrum from the cleaning sequence with the assigned spectrum number k (k = 1 - 1024)
BM.ISA.PathLength	measuring path length of the spectrometer sensor head[2]
BM.ISA.DilFactor	dilution factor of the dilution in the spectrometer[2]

[1] see *4.2.5.4.1 Input calibration factors, calibration concentrations and warning/alarm limits*
[2] see spectrometer settings *4.4.1.1.1 Sensors – Internal sensors*, there *Spectrometer*

Common formula elements

also valid for the **BlueBox** systems of GO Systemelektronik

Code marking	Description
;	Marks the end of a statement, e.g. Var=1;
#	Marks the following characters of the line as a comment.

Sensors	Description
[*Sensor-ID*]	Measured value of a sensor or state of an actuator
[**!***Sensor-ID*]	Measured value of a sensor without offset
[*****Sensor-ID*]	Measured value of a sensor on another BlueBox (transmitted via UDPSEND)
[**%***n*]	Measured value of the sensor of the n-th sensor in the DAM related to this formula, [% 1] would be the first sensor and so on
[*SensorID*.**STATUS**]	**status** / **description** 0 sensor sends data (OK) 1 sensor sends no data (No Data) 2 new sensor 3 sensor-ID assigned 4 sensor alert (used by ISA-spectrometer for the outlier-recognition) 5 measurement value under the detection limit 6 sensor calibration failure (only BlueMon) 30 formular failure 31 unknown sensor is used in the formula 32 measurement value is not been saved 33 calculation time of the formula is overrun 50 minimal measurement value underrun (formula) 51 maximal measurement value overrun (formula) 52 COM Error (failure of the serial data transfer, ISA) 53 MIN ADC Limit (lower limit of the AD-transducer) 54 MAX ADC Limit (upper limit of the AD-transducer) 55 Dev Error 56 sensor reaches lower alarm limit 57 sensor reaches upper alarm limit
[*SensorID*.**TIME**]	Time of day of the last value of this sensor
[*Sensor-ID*.**VAL**]	Measured value of the sensor without considering the status of this sensor
[*Sensor-ID*.**SEC**]	Time in seconds since last measured value
[*Sensor-ID*.**RSSI**]	Receiving power of a radio sensor, 0 - 255
[*Sensor-ID*.**LQI**]	Receiving quality of a radio sensor, 0 - 255
[*Sensor-ID*.**BAT**]	Battery voltage of a radio sensor, 2 V bis 3.5 V
	Combinations possible, e.g. [!%1.VAL]

Reserved words/characters	Description
AND respectively &	Logic operation AND
OR respectively |	Logic operation OR
XOR	Logic operation exclusive OR
!	Inversion
==	Comparison: is equal
!=	Comparison: is not equal
<	Comparison: is less
<=	Comparison: less than or equal
>	Vergleich: greater
>=	Comparison: greater than or equal
++	Variable plus 1
--	Variable minus 1
+=	Variable plus x, test += 5; is the same as test = test + 5;
-=	Variable minus x, test -= 5; is the same as test = test - 5;
***=**	Variable multiplied with x, test *= 5; is the same as test = test * 5;
/=	Variable divided with x, test /= 5; is the same as test = test / 5;

Mathematical functions	Description
sqrt(*x*)	Square root of x
sin(*x*)	Sine x
asin(*x*)	Arcsine x
cos(*x*)	Cosine x
acos(*x*)	Arc cosine
tan	Tangent
atan	Arctangent
rad	Converts degrees to radians
deg	Converts radians to degrees
pi	Pi, π=3.1415

ln(*x*)	log
log(*x*)	log10(x)
exp(*x*)	exp(x)
%	Modulo Operation (remainder of division)
abs(*x*)	Absolute value of x
^	Exponent , e.g. 10^3=1000

Arrays	**Description**
ARRAY_SIZE(*n*)=*x*	Defining the array size. Array n can take x measured values (n = 0 to 9) (x = 1 to 10000).
ARRAY_SIZE(*n*,*s*)=*x*	Defining the array size and the storage behavior Array n (n = 0 to 9) can take x (x = 1 to 10000) measured values. If s = 1, the array is saved* on the BlueBox beyond a restart. If s = 0, the array is initialized with a restart at 0.
ARRAY(*n*,*x*)	Query respectively storage of measured values in Array n (n = 0 to 9) at position (x= 0 to 9999)
STAT_MEAN(*n*,*x*)	Arithmetic mean of the first x (x = 1 to 10000) measured values of array n (n = 0 to 9)
STAT_VARIANCE(*n*,*x*)	Variance of the first x (x = 1 to 10000) measured values of array n (n = 0 to 9)
STAT_SD(*n*,*x*)	Standard deviation of the first x (x = 1 to 10000) measured values of array n (n = 0 to 9)
STAT_SORT(*n*)	Sorting the array n (n = 0 to 9) on the size of the value, downwards

Conditional statements	**Description**
if (*Condition***) {***Statement1***;***Statement2***;…;***Statement1N***;}**	if request
if ( ) { } else { }	if else request
while ( ) { }	while loop
for(i=*a***;i<***b***;i++) { }**	for loop, i++ → jump by 1, i+=x → jump by x, - is also possible

* storage interval 2 min

Time	Description
TIME	Current time of day as a value, 131014 for 13:10:14 (Localtime of the BlueBox)
HOUR	Current hour, e.g. 13
MIN	Current minute, e.g. 10
SEC	Current second, e.g. 14
MONTH	Current month 0= January 1=February etc.
DAYOFMONTH	Current day of the month (1-31)
DAYOFWEEK	Current day of the week (days since sunday) Sun= 0, Mon=1, Tue=2 etc.
'13:10:14'	is converted into 131014, if (TIME == '13:10:14')

Modbus	Description
MODF(*x***)**	Modbus measured value (float) read respectively write (0 ≤ x < 200)
MODR(*x***)**	Modbus Register (2-Byte) auslesen bzw. schreiben (0 ≤ x < 400)
MODI(*x***)**	Modbus Integer (4-Byte) read respectively write (0 ≤ x < 200)
	Can be accessed via Modbus using the commands READ_HOLDING_REGISTER(3), WRITE_SINGLE_REGISTER(6) and WRITE_MULTIPLE_REGISTER

Actuator specific	Description
ERRORVALUE=*Value*	When a formula error respectively a sensor error occurs, this value is passed to the actuator. If this value will be used, it should be entered in the first line of the formula field!
ONTIME	Time in seconds since the relay is on
OFFTIME	Time in seconds since the relay is off
LASTVALUE	State of the relay at the last calculation
TEXT="*Text***"**	At the display of the BlueBox the measured value is not shown, instead this text is shown, e.g. if (temp> 20) {TEXT = "WARM";}
NMEA("000000001")	At a RS-232 module (NMEA) a NMEA string with the format $BBMVA,HHMMSS,YYMMDD,000000001,,,,,measured value,status,*XX is released.
FSEND("*a***,***b***,***c***,***d***")**	At a RS-232 module (NMEA) a string with the format „01,aa.aa,bb.bb,cc.cc,dd.dd,\r" is released.
FIX("000000001")	At a RS-232 module (NMEA) a string with the format „01 17.44 0 FF" is released. FF is a checksum.

Uninterruptible Power Supply (UPS) Article-No. 48 806 J00 00 A1	**Description**
UPS.STATUS	Status of a connected UPS, -2 ≙ UPS error, -1 ≙ UPS not detected, 0 ≙ UPS online, 1 ≙ UPS on Battery, 2 ≙ UPS search, 10 ≙ UPS change battery respectively error
UPS.VOLTAGE	Battery voltage of a connected UPS in Volt
UPS.CAPACITY	Residual capacity of a connected UPS in in %
UPS.TIME	Remaining operation time of a connected UPS, normal in seconds

Hardware BlueBox	**Description**
$CPU	PC104 CPU temperature
$MAIN	PC104 mainboard temperature
$CURRENT	Current consumption of a BlueBox Power up module
$VOLTAGE	Voltage BlueBox Power up module
$STATE	Switch state BlueBox Power up module
$SHUTDOWN(“*nn***:***nn***“)**	BlueBox shutdown and restart, e.g. at 10:30 Uhr

GPS (NMEA 183) Artikelnr. 380 1000	**Beschreibung**
LONGITUDE	current GPS position longitude (GPS sensor needed with output $GPGGA)
LATITUDE	current GPS position latitude (GPS sensor needed with output $GPGGA)
GROUNDSPEED	current speed over ground in m/s (GPS sensor needed with output $GPVTG)
TRUECOURSE	current course in ° (GPS sensor needed with output $GPVTG)
MAGCOURSE	current magnetic course in ° (GPS sensor needed with output $GPVTG)

Averaging	**Description**
AVG(*N***)**	current value of averaging with the number N (0 to 9999)
AVG(*N***,***b***,***c***)**	running average, N = identification number, b = number of averaged measured values, c = measured value
AVG(*N***,***b***,***c***,***d***)**	running average; N = identification number; b = number of averaged measured values; c = measured value; d = minimal measuring interval

PID controller*	Description
PID(*N***)**	current value of the PID controler N
PID(*N***,***Value***,***SollValue***,***P***,***I***,***D***)**	PID controller N= controller number, Value = measured value, SollValue = nominal value, PID = controler parameters
PID(*N***,***Value***,***SollValue***,***P***,***I***,***D***,***Intervall***)**	PID controller N= controller number, Value = measured value, SollValue = nominal value, PID = controler parameters, Intervall=minimal controler interval
PID_RESET(*N***)**	PID controler reset, Integral reset
PID_RESET(*N***,***x***)**	sets the integral of the PID controler N to x

Error	Description
SET_ERROR(*x***)**	Puts error x (1 ≤ x ≤ 100) from the AMS error list
CLEAR_ERROR(*x***)**	Deletes error x (1 ≤ x ≤ 100) from the AMS error list
GET_ERROR(*x***)**	Control whether error is set, 0 = no, 1 = yes
ERROR_COUNT()	Number of errors that are set
ERROR_COUNT(*x***)**	Number of errors that are set whose error number is > = x

Network	Description
UDPSEND()	Sends a measured value as a network broadcast
UDPSEND(“*a.b.c.d***“)**	Sends a measured value to the IP address a.b.c.d
UDPSENDV(“*var***“)**	Sends the variable „var“ as a network broadcast
UDPSENDV(“*var***“,“***a.b.c.d***“)**	Sends the variable „var“ to the IP address a.b.c.d
GPSSEND()	Sends the current GPS position as a network broadcast
GPSSEND(“*a.b.c.d***“)**	Sends the current GPS position to the IP address a.b.c.d

System	Description
NOSAVE()	Disables the recording of measured values
NOSTATUS()	Resets the error status of a formula Warning, error control must be programmed then!
IGNORE()	Disables the output of measured values (virtual sensor)

* The data of the PID controller is permanently stored on the BlueBox (storage interval 2 min). After a reboot, the controller picks up where it left off.

E-Mail/SMS	Description
MsgText="*Text***"**	Message text of an E-mail or an SMS
PhoneNo="*telephone number***"**	international phone number without 0; the phone number of GO Systemelektronik would be 4943158080
PhoneNo="*1*"	telephone list No. 1 etc.
MailTo="*Mailaddress***"**	E-mail address
MailTo="*1*"	E-mail address list No. 1 etc.
Subject="*Text***"**	Subject of a E-mail

User protocol	Description
CUSTOM[*x*]	x-th measurement in the string which has been received from the customer protocol 1. Protocol "Space codes" receives the string "14.4 17.5 19:33 20.1". The command CUSTOM [2] would return the value 17.5.
CUSTOM1[*x*]	x-th measured value which was received via the customer protocol 1
CUSTOM2[*x*]	x-th measured value which was received via the customer protocol 2
CUSTOM3[*x*]	x-th measured value which was received via the customer protocol 3

ISA	Description
ISA(*x***)**	ISA extinction at wave length x ($200 \leq x \leq 708$)
ISA'(*x***)**	ISA extinction first derivation of wave length (x)
ISA0(*x***)**	ISA raw value of pixel x ($0 \leq x \leq 255$)
ISAFP(*x***)**	ISA extinction at wave length x , the reference is the fingerprint spectrum and not the clear the water spectrum
ISA_CAL()	Performs a clear water calibration e.g. if (TIME == 170000) ISA_CAL (); performs a clear water calibration at 17:00 or at the first measurement after 17:00.