MONI LOG® Sensor network

INSTRUCTION MANUAL

For

MONI LOG® **data link sensor**

(GPS receiver & GSM/UMTS transmission unit)

and

MONI LOG® **sensor module**

(universal data logger)

Edition 04/2015

PRODUCT CERTIFICATION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Modifications not expressly approved by this company could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a **Class A digital device**, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Son fonctionnement est sujet aux deux conditions suivantes: (1) le dispositif ne doit pas produire de brouillage préjudiciable, et (2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

This EXPERTISE is issued in accordance with the Directive 1999/5/EC of the European Parliament and Council on radio equipment and telecommunications terminal equipment and mutual recognition of their conformity dated 9th March 1999 and is only valid in conjunction with following annex: -1- (2 pages)

MONI LOG® Sensor network

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This device has been designed to operate with the antennas listed below (see 2. Technical Parameters). Antennas not included in this list are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

Cet appareil a été conçu pour fonctionner avec les antennes énumérées ci-dessous (voir 2. Paramètres techniques). Les antennes n'étant pas énumérées dans cette liste sont strictement interdites pour une utilisation en combinaison avec cet appareil. L'impédance de l'antenne requise est de 50 ohms.

Afin de réduire les interférences radio potentielles pour les autres utilisateurs, le type d'antenne doit être choisi afin que la puissance isotrope équivalente (e.i.r.p.) ne soit pas supérieure à celle permise pour réaliser une communication stable.

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1. INTRODUCTION

1.1 SCOPE OF DELIVERY

<div align="center">

Thank you

for having chosen the MONI LOG® sensor network.

</div>

Scope of delivery[1] (standard):

- MONI LOG® data link sensor, incl. 4 x R14, alkaline or lithium batteries according to your requirement
- MONI LOG® sensor module, incl. 1 x R6 lithium battery (number of devices depends on the order stipulations)
- Installation CD
    - Configuration software "Sensor network Vx.xx" with integrated software help
    - Driver for USB interface
    - Operating instruction in electronic form (PDF)
- Hard copy of the operating instruction
- USB 2.0 interface cable (type A ↔ type Mini AB)
- Antennas
    - GPS antenna
    - QUAD Band GSM/UMTS antenna
    - Bluetooth antenna

<div align="center">

In order to be able to further optimise our products for the respective applications, we are always open to suggestions and change requests on your part.

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1) The scope of delivery can deviate from the standard due to special contract agreements!

1.2 FUNCTIONALITY

The MONI LOG® **sensor network** consists of the UMTS/GSM transmission unit incl. GPS receiver MONI LOG® data link sensor and up to 8 universal MONI LOG® sensor module data loggers.
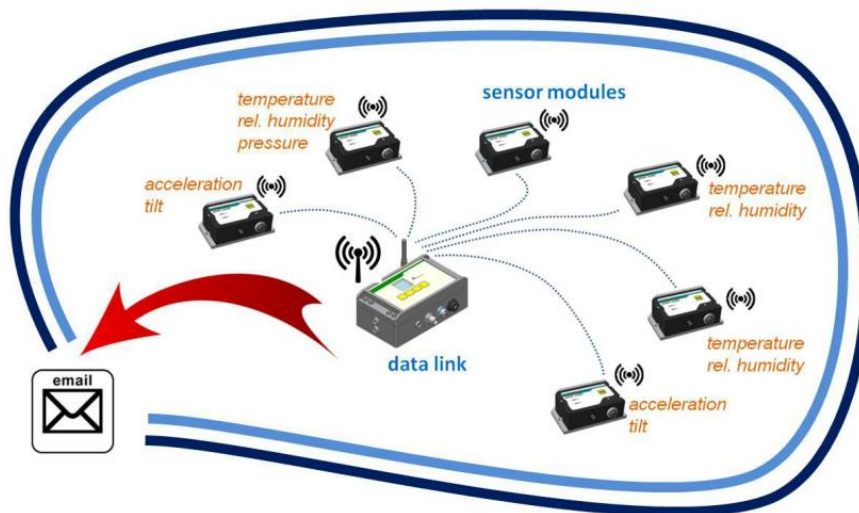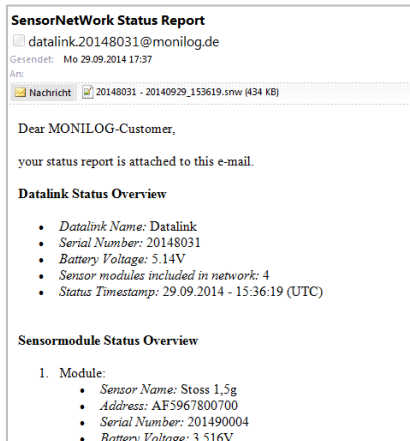

The MONI LOG® **data link sensor** forms the central unit in the sensor network. It detects all sensor modules situated within range and automatically connects with them for the data exchange via a Bluetooth 4.0 LE radio interface.

The compact and energy-efficient MONI LOG® **sensor modules** form the measurement nodes of the sensor network. Developed for long-term measuring applications, the sensor modules are ideally suitable for the monitoring of transport goods and critical environments.

The integrated sensor system for the detection of shock events and for the measurement of temperature, humidity, air pressure, inclination and incident light metering enables a wide range of different measuring applications.

Configured alarm thresholds ensure the reliable detection of exceedances of limit values and the associated immediate sending of **alarm messages** to the MONI LOG® data link sensor. It subsequently initiates the recording of the current GPS position and the immediate sending of alarm emails.

This way a location-independent and permanent monitoring (time- & event-controlled) as well as an effective danger assessment /prevention during transport are rendered possible.

SensorNetWork Status Report
☐ datalink.20148031@monilog.de
Gesendet: Mo 29.09.2014 17:37
An:
📎 Nachricht 📄 20148031 - 20140929_153619.snw (434 KB)

Dear MONILOG-Customer,

your status report is attached to this e-mail.

Datalink Status Overview

- *Datalink Name: Datalink*
- *Serial Number: 20148031*
- *Battery Voltage: 5.14V*
- *Sensor modules included in network: 4*
- *Status Timestamp: 29.09.2014 - 15:36:19 (UTC)*

Sensormodule Status Overview

1. Module:
   - *Sensor Name: Stoss 1,5g*
   - *Address: AF5967800700*
   - *Serial Number: 201490004*
   - *Battery Voltage: 3.516V*

The MONI LOG® **data link sensor** sends the data received by the sensor modules in the set intervals in the **GSM (2G), GPRS (2.5G), UMTS (3G) or HSPA (3.5G) network** worldwide as an email to definable email recipients.

If an UMTS connection should be impossible, an automatic switchover in an alternatively available GPRS connection takes place.

As a further function the MONI LOG® data link sensor also offers a **route tracking**. For this, all GPS coordinates, including speed, direction, etc. are saved. The recorded route data can be imported and evaluated afterwards in Google Earth.

GPS-Position 24:
[51.0511104, 14.701152]
Date/Time: 10.09.2014 09:00:29
Speed: 79,2 km/h

Event: Tracking

Route: Hier hin - Von hier

The **compact and network-independent design** enables simple fixing on or in transport goods and transport devices.
The cases of the devices protect against dust and splash water (**degree of protection IP 65**) and thus are also suitable for the exterior use. Thanks to this, the MONI LOG® sensor network can be universally used as an almost invisible goods companion in the international transport of goods, in storage rooms, at reloading points and during transport by rail, by roads as well as by water and by air.

The **power supply** is realised by customary, exchangeable alkaline or lithium batteries. Due to very low current consumption and associated very long, maintenance-free operating time the MONI LOG® sensor network is ideally suitable for self-sufficient long-term applications. Energy-optimised operating settings render possible a self-sufficient operational life of up to 2 years under rough ambient conditions.

The **licence-free configuration programme** enables a simple and intuitive configuration of the devices. It offers a comprehensive adjustment of the device functions to your application-specific requirements. Besides the detailed evaluation of the device data in measured value tables and graphs the programme also provides export functions for external applications (e.g., Microsoft Excel).
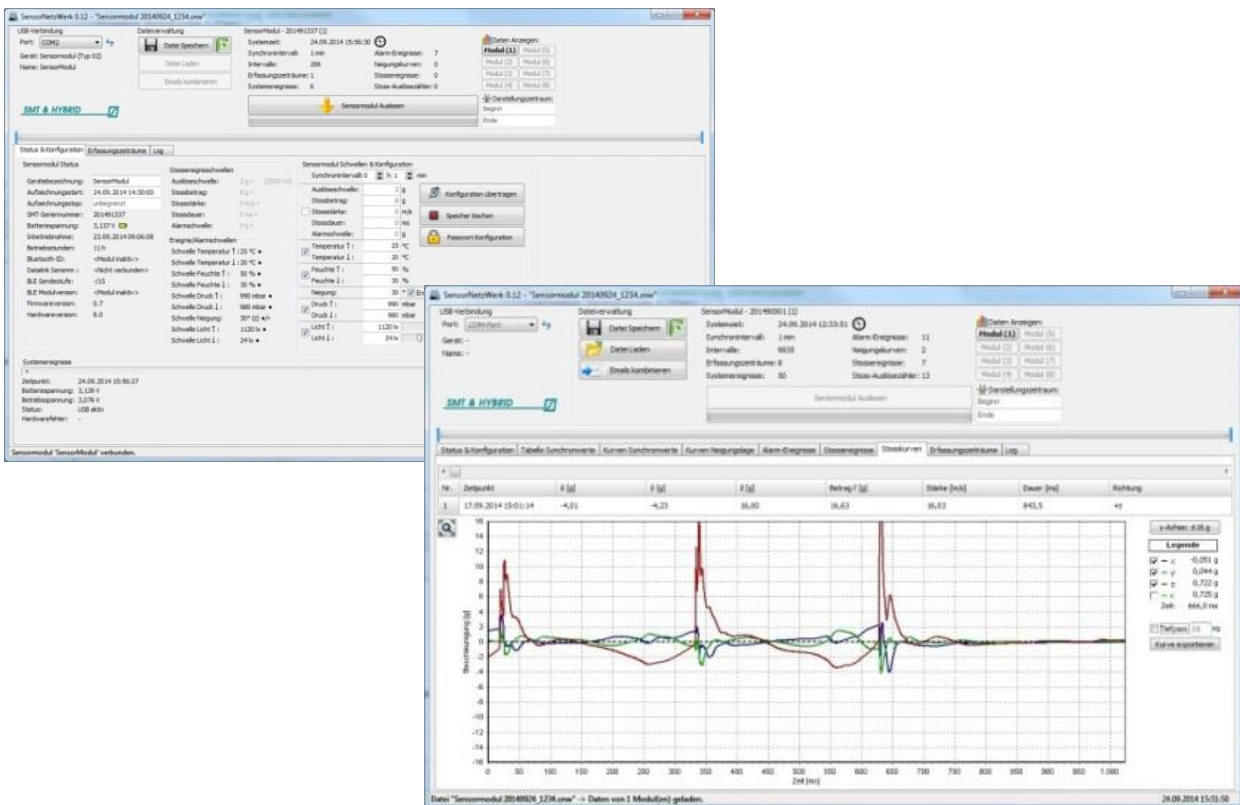
1.3 ENVIRONMENTAL AND SAFETY INSTRUCTIONS

Environment & Disposal

The MONI LOG® data link sensor and the MONI LOG® sensor module contain, except the internal batteries, no corrosive or environmentally damaging substances.

Used batteries must be immediately removed from the device and afterwards disposed of in an environmentally friendly manner, according to the applicable legislation. Lithium batteries are hazardous waste.

Battery operation

The power supply is ensured in the MONI LOG® data link sensor by means of 4 exchangeable alkaline or lithium batteries (type C|R14) and in the MONI LOG® sensor module by means of 1 lithium battery (type AA|R6). They can be bought in the specialist shop according to the specification stated in the instruction manual.

When lithium batteries are used, the MONI LOG® data link sensor and the MONI LOG® sensor module must be labelled as hazardous material of class 9 according to the hazardous materials law (Germany). The transport conditions resulting due to this must be taken into account!

Please take into account that when using alternative battery types the functionality of the device cannot be guaranteed in the entire specified temperature range from -40 to 85°C.

ATTENTION!
Use only intrinsically safe batteries.
In case of non-compliance with the national regulations/laws applicable in the handling of lithium batteries, any liability and warranty claim becomes void!

External power supply

For the external power supply and the switching outputs, only current sources
of limited power must be used according to EN 60950-1, point 2.5.

Decommissioning

In case of decommissioning the devices must be properly switched off and all batteries must be removed from the cases.

2. TECHNICAL PARAMETERS

2.1 MONI LOG® DATA LINK SENSOR

Case	
Case material	Aluminium, coated
Degree of protection	IP65
Weight	1.15 kg (incl. batteries)
Dimensions (H/W/D)	160 x 90 x 60 mm³
Mounting type	Surface mounting (screw fixing recommended), alternatively magnetic base mounting (upon request)
Application conditions	
Operating and storage conditions	▪ -20 °C to +70°C with alkaline batteries ▪ -40°C to +85°C with lithium batteries (labelling obligation!)
Voltage supply	

Internal	▪ 5-15 V (max. 3 A)
	▪ 4 batteries of type C or R14 (exchangeable)
	    o alkaline batteries (1.5 V each)
	    o lithium batteries (3.6 V each)
	▪ Service life: up to 1 year (in case of email interval of 24 h)

External	▪ 5-15 V (max. 3 A) **No charging function for internal batteries!**
External interfaces	
RS232	▪ 1 socket for MONI LOG® ShockDisplay Curve or MONI LOG® EndalCurve ▪ 1 socket for an external satellite modem
Digital inputs and outputs	▪ 2 switching inputs and 2 switching outputs (M12 connector)
USB	▪ USB 2.0 Client (Mini-USB AB)
Indicating and operating elements	
Display	Bistable monochrome display (96x96 pixel)
LED	Status LED (red/green)
Keys	4 control keys for menu navigation and user entries

| GPS	
Channels	22
Antenna	SMA socket for the connection of an external active antenna 50 Ω (3-30 mA / 3 V / rod or cable antenna)
Mobile radio communication	
Frequency ranges	▪ Quad Band EGSM/GPRS (850 / 900 / 1800 / 1900 MHz) ▪ Triple Band UMTS / HSPA (850 / 1900 / 2100 MHz)
SIM card	Slot for 1.8 V or 3 V SIM card ▪ Standard SIM ▪ Micro SIM (upon request)
Approved antenna	
Taoglas	
Typ	TG 22.0111
Gain / Impedance	2.14 dBi / 50 Ω
Device approval	CE, IC, FCC
Socket	SMA
Bluetooth	
Version	Bluetooth 4.0 Low Energy (master role)
Encryption	AES-128
Radio communication	Simultaneous radio communication to up to 8 MONI LOG® sensor modules (for data synchronisation and cordless device configuration)
Approved antenna	
Taoglas	
Typ	GW.15.2113
Gain / Impedance	2 dBi / 50 Ω
Device approval	CE, IC, FCC
Socket	SMA
Data memory	
Data retention	minimum 10 years (independent of battery condition)
Memory type/size	▪ 512 MB flash data memory ▪ 128 kB FRAM parameter memory

2.2 MONI LOG® SENSOR MODULES

Case	
Case material	PVC + aluminium
Degree of protection	IP65
Weight	0.40 kg (incl. batteries)
Dimensions (H/B/T)	120 x 70 x 40 mm³
Mounting type	Surface mounting (screw fixing recommended), alternatively magnetic base mounting (upon request)
Application conditions	
Operating and storage conditions	▪ -40°C to +85°C with lithium batteries (labelling obligation!)
Voltage supply	
Internal	▪ 1 battery of type AA or R6 (exchangeable) o lithium battery (3.6 V; 2250 mAh) ▪ Service life: 2 years (in case of synchronous interval of 10 min)
External interfaces	
USB	▪ USB 2.0 Client (Mini-USB AB)
Indicating and operating elements	
LED	1 green activity LED + 1 red status LED
Keys	1 control key
Bluetooth	
Version	Bluetooth 4.0 Low Energy (slave role)
Encryption	AES-128
Radio communication	Radio communication to MONI LOG® data link sensor

Approved antenna	
ACX	
Typ	TG 22.0111
Gain / Impedance	0.5 dBi / 50 Ω
Device approval	CE, IC
Socket	SMA
RF Solutions	
Typ	ANT-24G-S21P
Gain / Impedance	0.0 dBi / 50 Ω
Device approval	CE, IC, FCC
Socket	SMA

Data memory	
Data retention	minimum 10 years (independent of battery condition)
Memory type/size	▪ 256 Mbit flash parameter and data memory
Device sensors		
Measuring quantity	**Measuring range**	**Tolerance**
Acceleration/shock (only shock sensor modules)	**+/- 16 g (3 axes)** Upon exceedance of a recording threshold a shock curve (2kHz, 1sec) is recorded. The 256 largest shock curves are saved. (optional: 100g/400g; 1kHz)	+/- 50 mg (+/- 200 mg)
Temperature	-40 °C – 85 °C	+/- 0.3 °C
Relative air humidity	0 % - 100 %	+/- 2 %
Air pressure	260 – 1260 mbar (optional: 10 – 2000 mbar)	+/- 2 mbar (+/- 4 mbar)
Light	0 lx – 188000 lx	+/- 10%
Inclination	Inclination calculation from static acceleration Upon exceedance of an inclination threshold an inclination curve (25Hz, 3 sec) is recorded. Up to 320 inclination curves are saved.	+/- 5 degrees

3. DEVICE DESCRIPTION OF MONI LOG® DATA LINK SENSOR

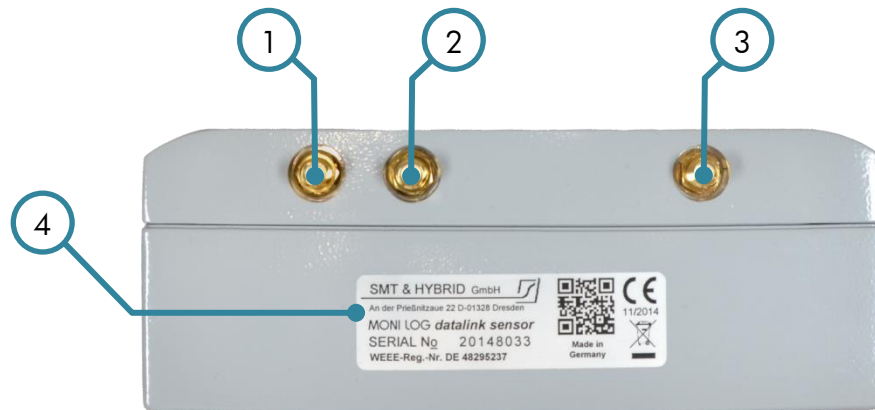### 3.1 DEVICE SETUP / DEVICE VIEW

Top view:
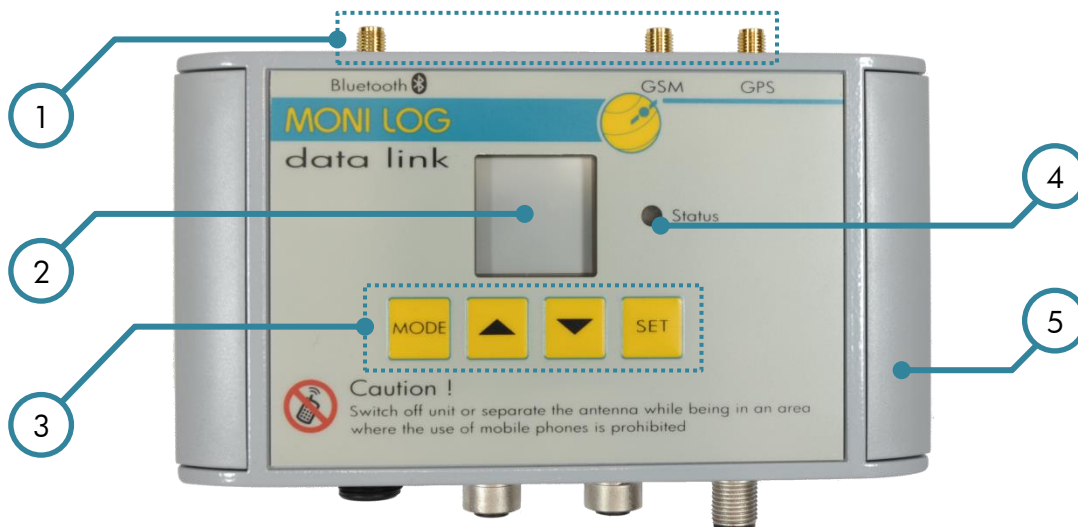
1	Antenna terminals	**4**	Status LED
2	Display	**5**	Protective covers for case screws
3	Keyboard		

Front view:
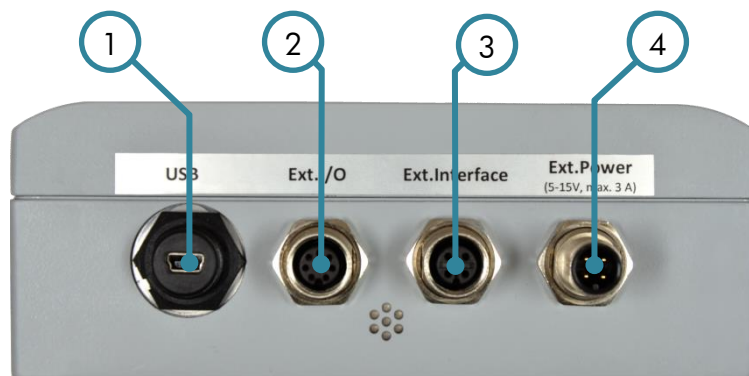
1	USB port	**3**	Port for external satellite modem
2	Switching inputs and outputs	**4**	External power supply

Rear view:

1 Port for GPS antenna

2 Port for UMTS/GSM- antenna

3 Port for Bluetooth antenna

4 Name plate incl. serial number

Side view:

Interface for external
MONI LOG® transport data logger
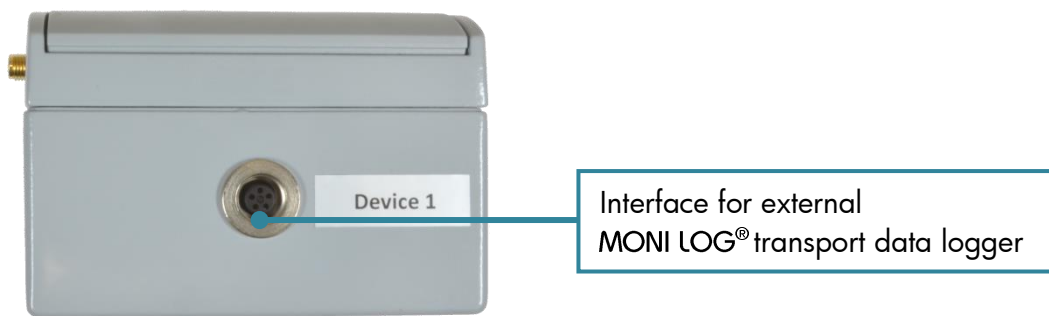
3.2 OPERATION AND MENU NAVIGATION

3.2.1 Keyboard

The operation (incl. switching on and off) of the MONI LOG® data link sensor is carried out by means of 4 keys of the keyboard on the device top side. The keys are assigned with the following functions:
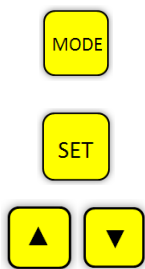
- Switching on of the MONI LOG® data link sensor
- Menu selection

- Confirm password/ parameter

- Selection of parameter signs
- Input / Change of parameters

3.2.2 Menu structure
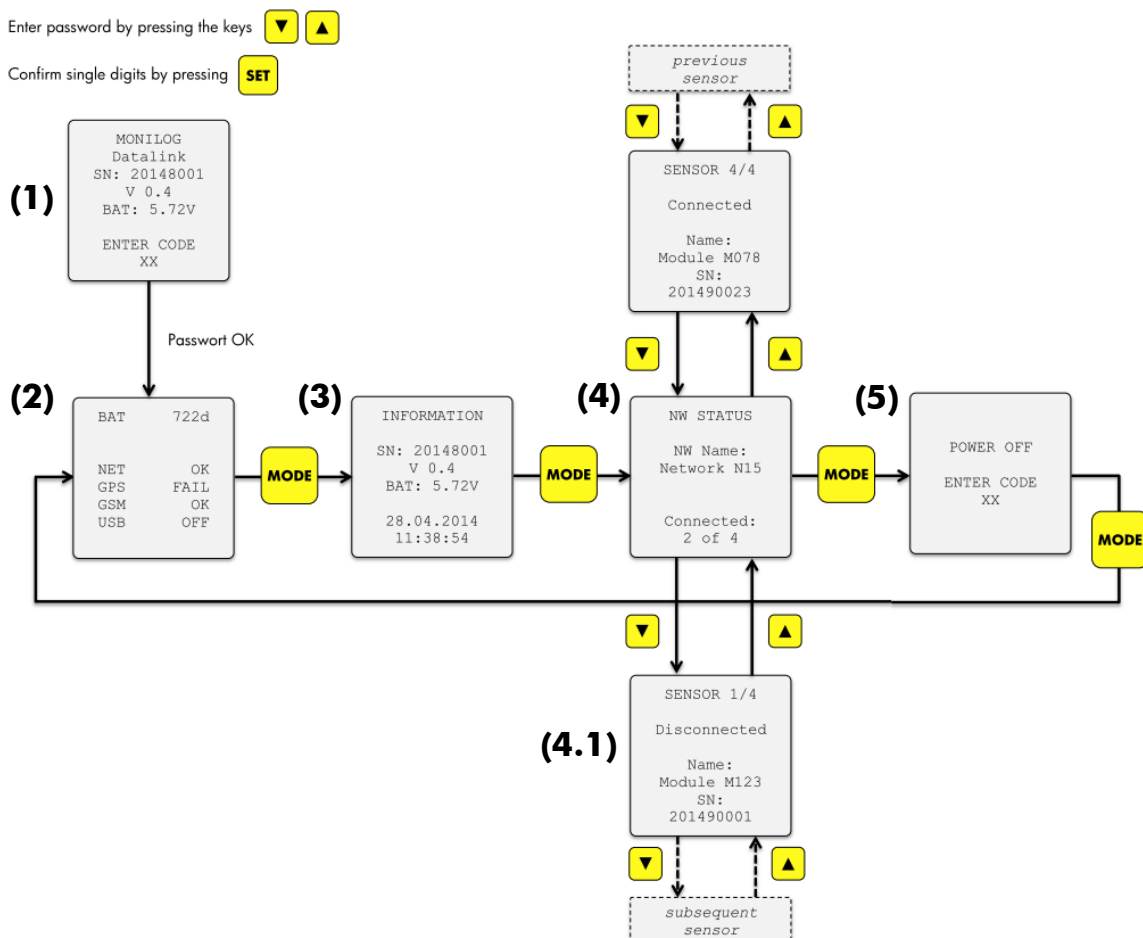
1) Switching on device:

The device is switched on by the key MODE.

Afterwards in the start screen (1) a request is made to enter an On/Off code. Using the keys ▲ or ▼ the individual figures of the password can be selected. Every set figure must be

confirmed by means of the key SET.

After the input of the correct On/Off code the display switches over into the screen view (2).

With the help of the key MODE one can switch over between the following screen views.

Note:

If no On/Off code is configured, this menu is skipped and the display
will immediately show screen view (2).

---

2) Status:

The screen view (2) shows additionally to the charging status of the batteries (in %) a status overview for the individual device components. This includes:

- Sensor network (NET)

- GPS

- Mobile radio communication interface (GSM)

- USB connection status

They can assume the following status states:

OK　　　　→ Function in order
FAIL　　　 → A failure occurred
ON　　　　→ Function is active (only USB)
OFF　　　 → Function is inactive (only for GSM and USB)
POS　　　 → A GPS position is being searched for (only for GPS)
SCN　　　 → The MONI LOG® data link sensor scans for sensor modules (only for NET)
CUR　　　 → A sensor module currently sends a shock or inclination curve
　　　　　　　to the MONI LOG® data link sensor (only for NET)

- **"FAIL" in GPS**

  No GPS position could be found. Check the GPS antenna alignment and, if necessary, whether the antenna is shielded by unfavourable fastening or position. Bad weather conditions and thick cloud covers can also lead to poor GPS reception.

- **"FAIL" in GSM**

  The email sending was prematurely interrupted. Reasons for this can be faulty email settings or a too poor signal quality between the MONI LOG® data link sensor and mobile communications system. Check, if necessary, your email settings and, when using the device abroad, the network coverage and contract conditions of your mobile communications provider.

- **"FAIL" in NET**

  The radio interface could not be initiated correctly. Please restart the MONI LOG® data link sensor. If errors continue to occur, please contact the manufacturer.

3) **Device information**:

   The screen view (3) shows the device serial number (SN), the firmware version (V x.y), current battery voltage and device time of the MONI LOG® data link sensor. The indication of time is carried out in coordinated universal time (UTC).

4) **Sensor network status (NW status)**:

   The screen view (4) shows the sensor network name and the number of the sensor modules currently connected via radio. By pressing the keys "arrow up" or "arrow down" the status states of the individual sensor modules located in the network can be retrieved.

4.1) **Sensor module status overview:**

   The overview for the respective sensor modules includes the current radio communication state, the device name and the serial number of the sensor module. By means of the key "MODE" a switchover to the screen view (5) is carried out, using the arrow keys the subsequent or preceding sensor is selected.

5) **Switching off device:**

   In the "Power Off" menu the device can be switched off. This is carried out by entering the On/Off code (analogue to step 1) "Switching on device"). If no On/Off code is configured, the device can be switched off by pressing the key "Set" (observe display indication).

3.3 COMMISSIONING

3.3.1 Behaviour of the MONI LOG® data link sensor after the switching on

After the switching on of the MONI LOG® data link sensor and, if configured, after the input of the On/Off code, the operation of the device starts. At first, a brief diagnostics of the mobile communications module and the Bluetooth radio unit is carried out. After successful diagnostics the GPS positioning and, with a delay of 90 seconds, the email sending are started, if these options are activated.

During the initial commissioning the GPS positioning and the email sending are deactivated as a standard, as the settings necessary for the operation (see for this chapter 5.3) are still to be configured.

If an error is determined during the mobile communications module diagnostics (e.g., no SIM card inserted, faulty SIM PIN or a hardware error), an error message is shown in the display and afterwards the sending of emails is deactivated (shown by "GSM Off"). If necessary, contact the manufacturer to obtain more detailed instructions for troubleshooting.

If the diagnostics of the Bluetooth radio unit fails and in the display the indication "NET FAIL" appears, restart the MONI LOG® data link sensor. If the error continues to occur, please contact the manufacturer.

Setup of the radio communication to the sensor modules

If at the turning-on sensor modules are included in the sensor network, in case of successful Bluetooth diagnostics the MONI LOG® data link sensor immediately starts the search (scanning) for the corresponding modules (display indication "NET   SCN").

For energy reasons the scanning is not carried out on an ongoing basis, the process is performed in intervals according to:

90 second scanning → 15 minutes scanning pause → 90 seconds scanning → etc.

If within 90-second scanning time a radio communication to a sensor module is set up, the scanning time is reset to the full 90 seconds, if radio communications to further sensor modules must be set up.

During a scanning pause the scanning is started immediately, if a connection to a sensor module is lost in order to render possible a fast re-establishment of the connection.

During the time period, if the MONI LOG® data link sensor is connected via USB with the PC, the scanning is carried out on an ongoing basis, if not all sensor modules should already be connected with the MONI LOG® data link sensor. After unplugging the USB cable from the device, a restart of the scanning cycle occurs starting with a scanning pause.

3.3.2 Battery change

Prior to a battery change the MONI LOG® data link sensor must be properly switched off, otherwise the data loss of the device cannot be excluded.

Attention:

During a change all batteries must always be replaced by the new ones. Only batteries of the same type and manufacturer may be used in the same device.
Ensure the correct polarity when inserting the batteries!

Remove the lateral protective covers to reach the case screws located under them. The protective covers can be easily detached using a flat-blade screwdriver or by hand. Afterwards the case cover is opened by loosening four cover screws by means of a Phillips screwdriver (5x0.8).
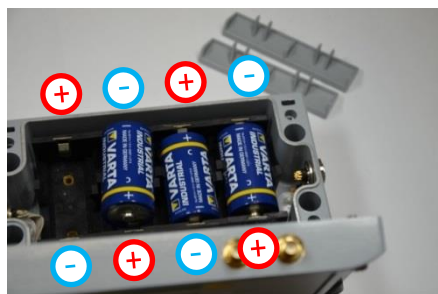
Image 1: Polarity of the batteries in the device
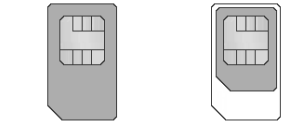
Carefully open the case cover in order not to damage the connecting cable. Remove the batteries situated in the device by means of the battery removal strap. Afterwards the batteries can be replaced according to the preset polarity (see Image 1).

Finally, the device can be closed again in reverse order.

3.3.3 SIM card

For the setup of an internet connection the integrated mobile communications module requires a functional SIM card. The device has a 3 V standard SIM card holder as a standard and can be also equipped with a Micro SIM holder upon request.

Please remove the SIM card from the MONI LOG® data link sensor, if you do not use it for a longer period of time.

SIM card	
Type	Slot for 1.8 V Micro or 3 V standard SIM card Standard-SIM Micro-SIM

SIM card change

1) Open the case (see 3.3.1) and unlock the SIM holder.

2) Swing open the SIM holder carefully and pull out the SIM card.
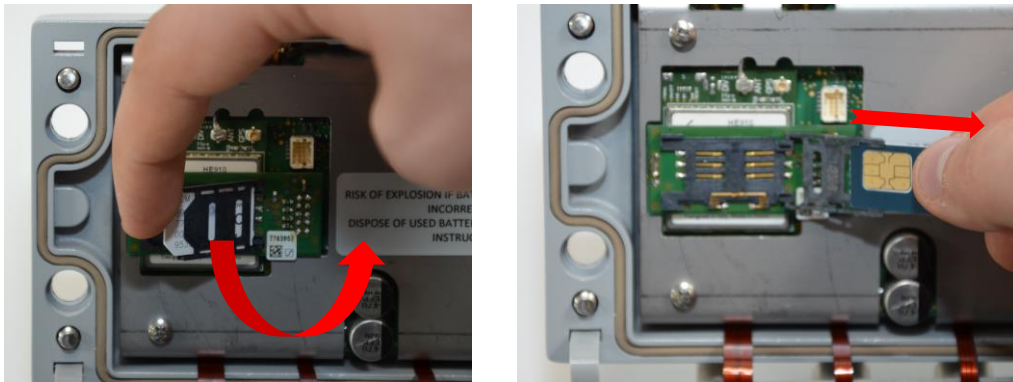
3) Finally, the new SIM card can be inserted in reverse order and the case can be closed.

3.3.4 Mounting information

The device can be attached on the transported goods by means of 4 fastening screws, according to the marked mounting holes. Optionally magnetic base mounting is also possible.

During the mounting of the MONI LOG® data link sensor the following conditions must be observed:

- The GPS antenna requires an approximately direct and uncovered alignment to the sky.
- Metallic surfaces reduce the sending and reception characteristics of the mobile communication and Bluetooth antenna, thus they should be shielded metallically as little as possible.

If the conditions cannot be fulfilled, the appropriate aerial lead-ins must be ensured and appropriate cable antennas including extensions must be used.

In order to be able to ensure an optimal fastening on the transported goods, we recommend a different screw length depending on the ground.

Effective screw length:

- Metal (aluminium, steel, etc.):   length > 8 mm
- Wood: length > 15 mm

Side view:
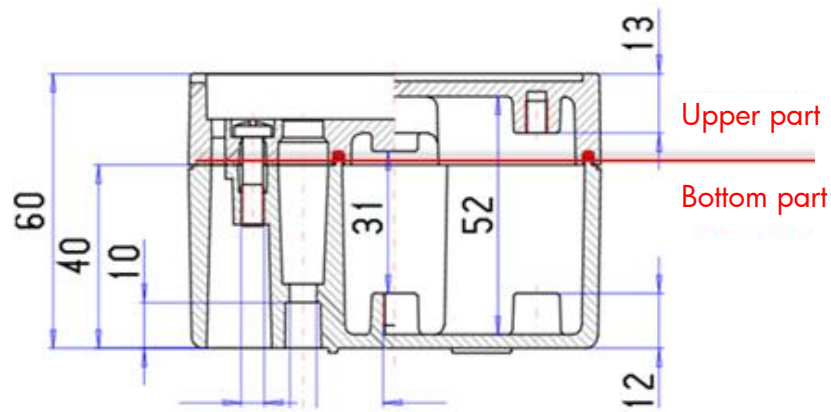
Image 2: Side view of the MONI LOG® data link sensor (dimensions in mm)

Top view:
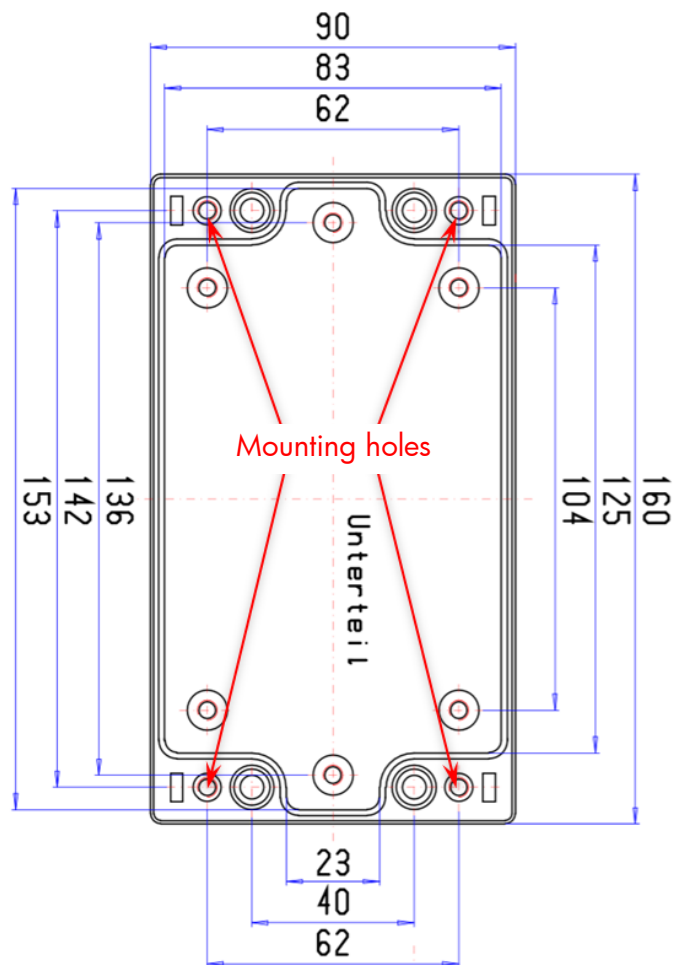
Image 3: Top view of the MONI LOG® data link sensor (dimensions in mm)

3.4 OPERATION TIME OF THE DEVICE

The operation time of the **MONI LOG**® data link sensor is primarily defined by the number of the emails to be transferred (time- and event-controlled) in the time of use. Additionally the interval of GPS position determination and the number of connected **MONI LOG**® sensor modules have also influence on the resulting operation time of the device.

The longer the email interval is set, the longer the device can be operated. Therefore, when defining the email interval, you should always take account of the resulting operation time, which can be derived from the following diagram (Image 4):

Operation Time Diagram

(GPS postition determination every 4 hours; 5 connected sensor modules; 1 Alarm-Email per Week;
5x Alarm-GPS position determinations per week; 1 email retry every 3 days)
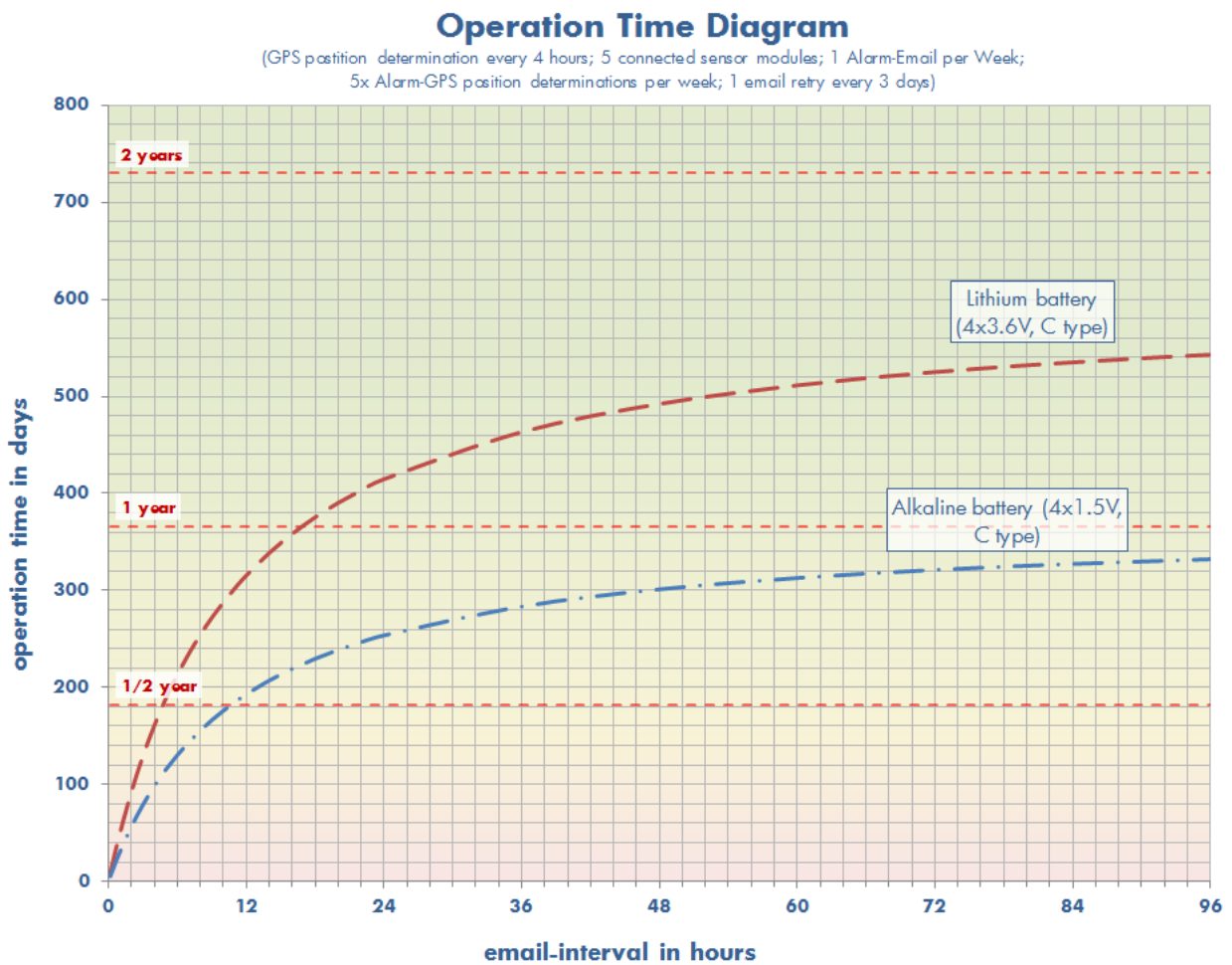
Image 4: Operation time of the **MONI LOG**® *data link sensor*

4. DEVICE DESCRIPTION OF MONI LOG® SENSOR MODULE

4.1 DEVICE SETUP / DEVICE VIEW

Top view:

Front view:
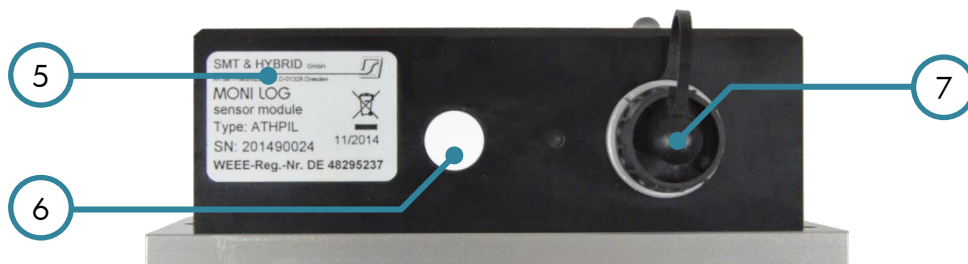
1	Battery cover	**5**	Name plate
2	Activity and status LEDs	**6**	Temperature/Humidity sensor
3	*Control* key	**7**	USB port
4	Light sensor		

4.2 OPERATION OF THE SENSOR MODULE

For the operation of the device there is a key *"control"* which function is essentially limited to switching on and off of the device. For the indication of the states a green LED *"active"* and a red LED *"status"* are used.

Checking the device on-state

To determine whether the sensor module is switched on or off, press **briefly** the *control* key:

green LED does **not** light up → the device is **OFF**

green LED lights up **briefly** → the device is **ON**

Switching on device

For the switching on of the sensor module press the *control* key (~1 second) until the **green** LED goes on. Release then the key.

Switching off device

To switch off the sensor module, continue to press the *control* key until the **red** LED stops to flash and goes on permanently. As long as the **red** LED flashes, there is a possibility to release the key. The device does not switch off in this case (can be recognised on a brief lighting up of the **green** LED).

4.3 MEANING OF THE LED STATES

LED	What?	How?	When?	2nd LED?	Meaning
Green (active)	Illuminated	~ 1 second	Switching on	-	Device switched on
Green (active)	Illuminated	1x briefly flash up	Keypress briefly	-	Device is on
Green (active)	Illuminated	~ 1 second	USB active	-	USB connected/ disconnected
Green (active)	Illuminated	irregularly	USB active	-	USB data transmission

Green (active)	Illuminated	1 second	Device active	-	ongoing shock recording
Green (active)	Illuminated	0.2 seconds	Device active	-	Synchronous recording
Green (active)	Illuminated	0.1 seconds	Device active	-	Event recording
Green (active)	Flickering (quickly)	~ 3 seconds in total	Device active	-	Recording of inclination curves
Green & **Red**	Illuminated	4 seconds permanently	USB configuration	**Green** & **Red**	Memory is erased
Red (status)	Flashing	4x briefly	Keypress longer than 2s	-	Device is being switched off
Red (status)	Illuminated	As long as key is being pressed	Keypress longer than 2s	-	Device is switched off (LED goes off when release key)
Red (status)	Flashing	Up to 4x briefly	Keypress longer than 2s → then released	**Green** flashes up briefly	Device remains on
Red (status)	Flashing	3x briefly, 3x for long, 3x briefly (SOS)	Switching on	**Green**	Hardware error in the memory
Red (status)	Flashing	3x briefly, 3x for long, 3x briefly (SOS)	Switching on	-	Battery empty, device switches off again
Red (status)	Flashing	5x briefly	Switching on or USB configuration	**Green**	Main position could not be determined → inclination event inactive
Red (status)	Flashing	Prolonged with 1 Hz	Switching on	-	Update mode active or no valid firmware found

4.4 BATTERY CHANGE

Prior to the battery change the MONI LOG® sensor module must be properly switched off, otherwise a data loss of the device cannot be excluded.

Attention:

Ensure the correct polarity when inserting the batteries!

For the change of the batteries proceed as follows:

1) Remove the battery cover by loosening the fastening screws by means of a screw driver. Afterwards, you can pull out the battery out of the battery holder using the battery removal strap.
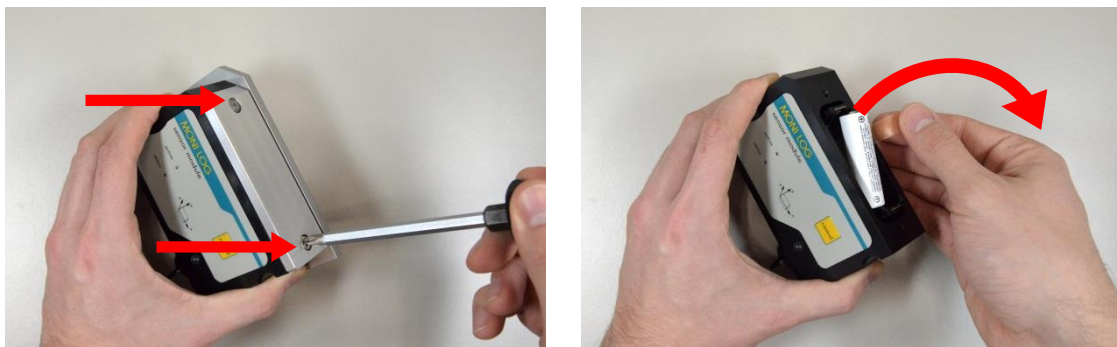
2) Now, insert the new battery according to the specified polarity into the device. Ensure that the battery removal strap is located under the battery again. This simplifies the removal of the battery during the next battery change.

3) In a last step, screw again the battery cover onto the sensor module.

4.5 MOUNTING INFORMATION

The device can be attached by means of 3 fastening screws (see Image 5) on the transported goods according to the marked mounting holes. Optionally magnetic base mounting is also possible.

During the mounting of the MONI LOG® sensor module it must be ensured that metallic surfaces reduce the sending and reception characteristics of the radio transmission. Therefore, the device should be shielded metallically as little as possible.
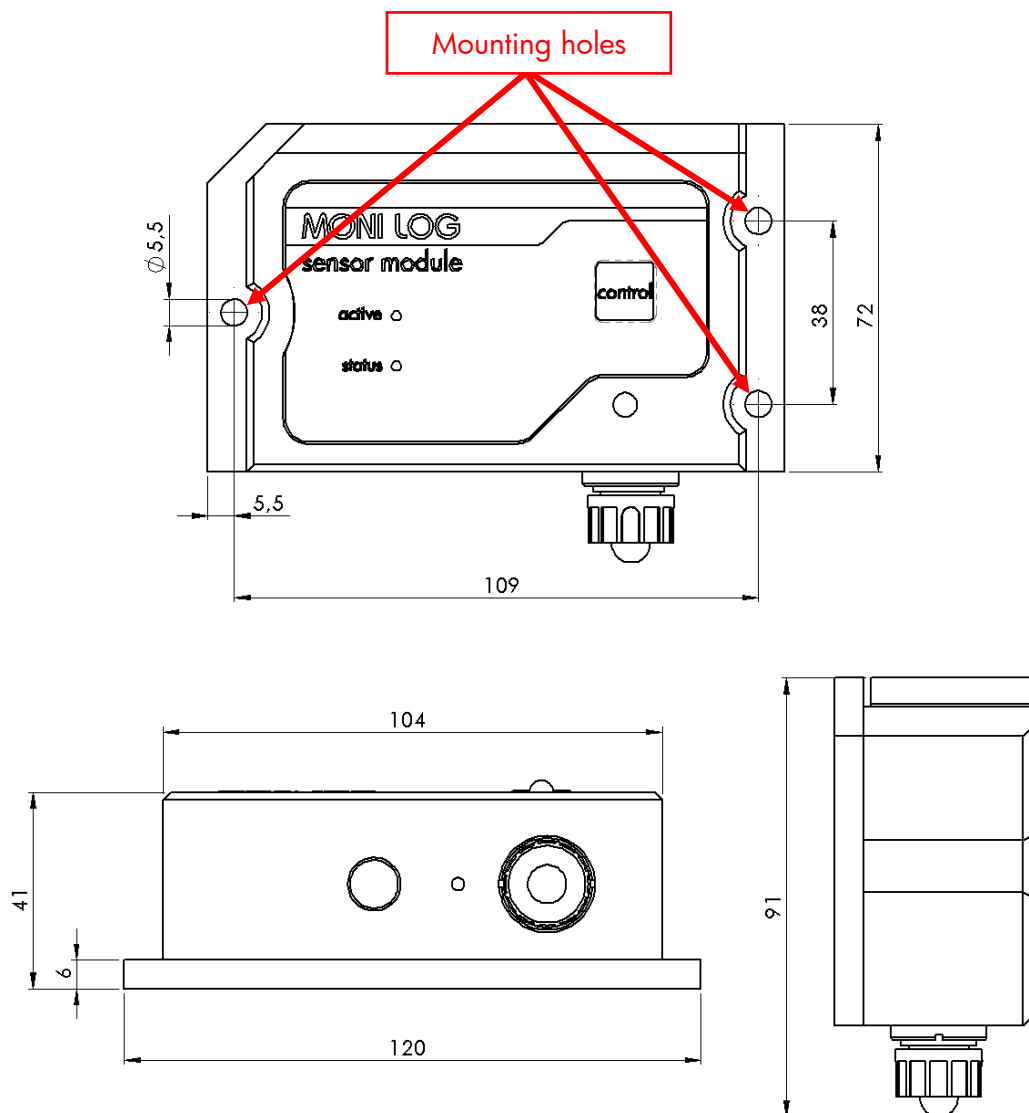
Image 5: Dimensions and mounting information of the sensor module (dimensions in mm)

5. PC SOFTWARE

The evaluation programme can be used both for the readout and configuration of the MONI LOG® data link sensor and the MONI LOG® sensor module. It is intended for the display and analysis of the recorded data in tabular/graphic form. Furthermore, data sets can be saved locally on your PC or loaded from your PC.

5.1 INSTALLATION

5.1.1 USB driver

Note:

When connecting the devices for the first time, the installation of the device driver on your PC can be necessary. Use for this the included driver file "EFM32-Cdc.inf"!

For the installation of the USB driver the following points must be observed:

- You need administrator rights to update a driver.
- The images can differentiate from the view of your device manager.
- There can be a deviating system language.
- The driver must be set up only once on your computer in case of successful installation.

Installation process

1. Connect the MONI LOG® data link sensor or the MONI LOG® sensor module by means of the included USB cable with your PC.
   A data link device signals the USB readiness by the indication "USB active" and "USB ON" (in the status overview).
   In the sensor module after plugging of the USB cable the green LED ("active") lights up. After the LED has gone off, the USB is ready.

2. Open the device manager. The interface is listed under the node "Other devices" as *"EFM32GG CDC Device"* or *"Monilog - USB serial port device."*
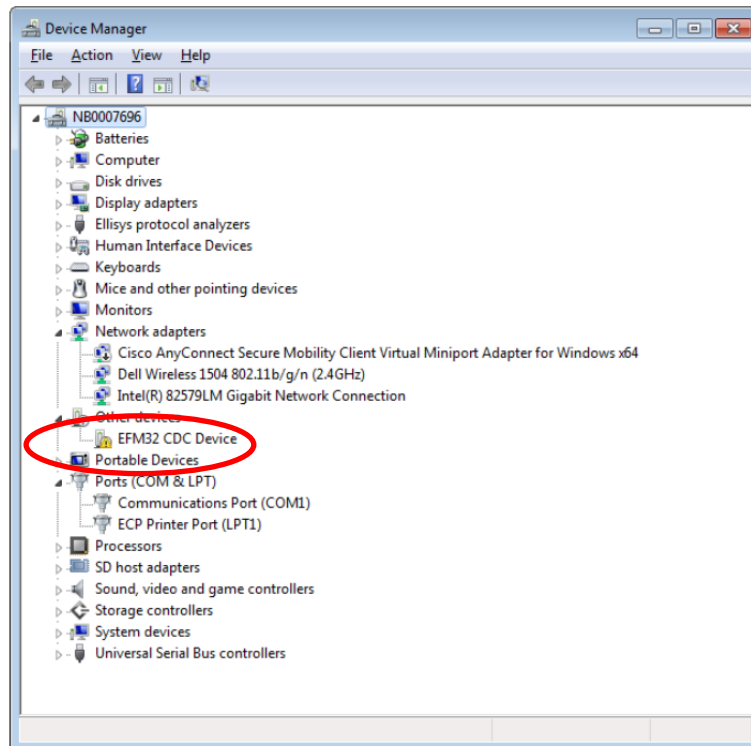
3. After a right click on the undefined interface "*EFM32GG CDC Device*" select the option "Update Driver Software…"
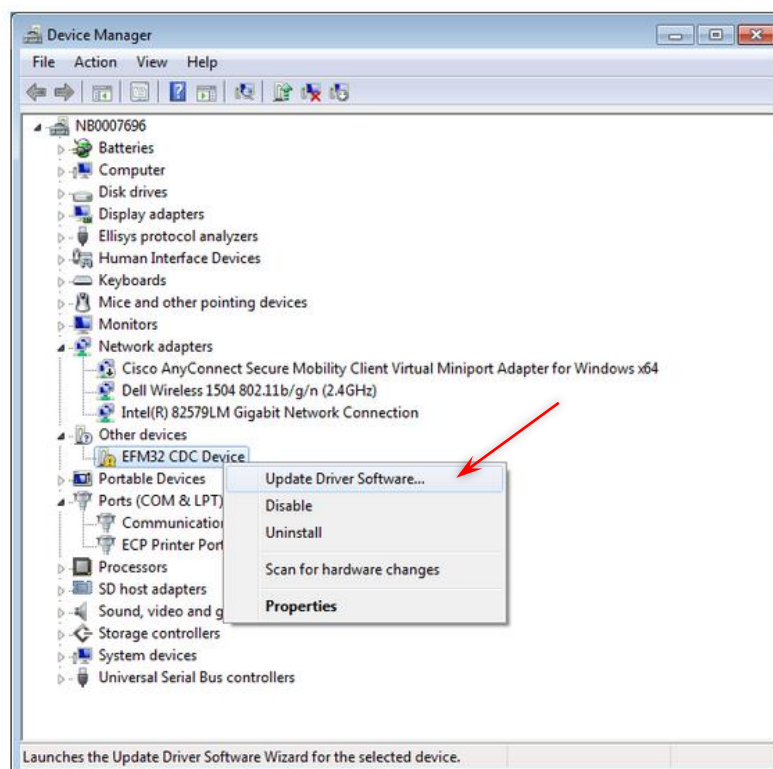
4. Select "Browse my computer for driver software".
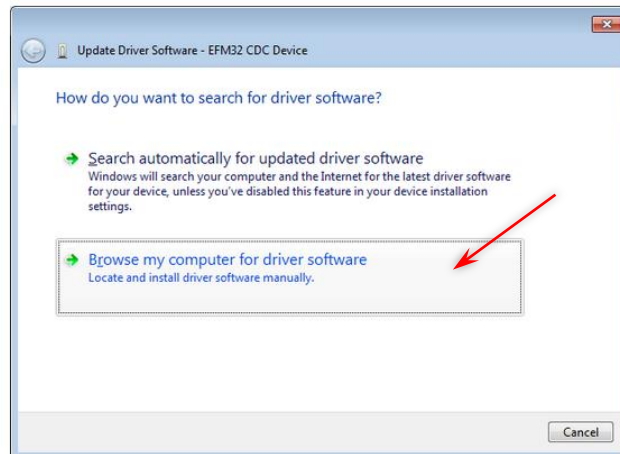
5. Select the required USB driver (EFM32-Cdc.inf). It is located on the included CD.
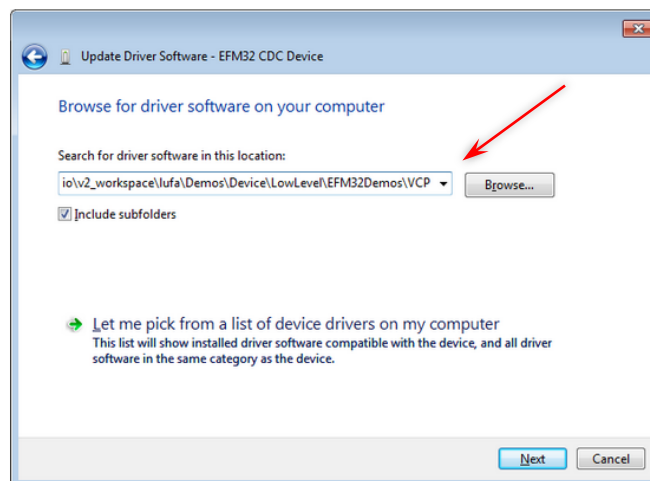
6. Windows will show you a warning message. Please select "Install driver software". In case of successful installation the driver is listed under ports (COM&LPT) with the corresponding COM number.
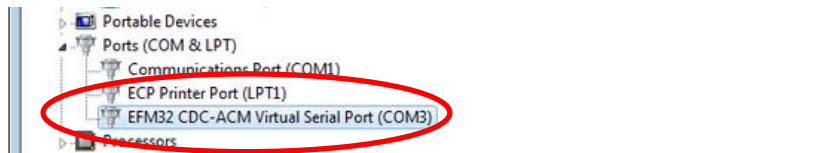
7. The driver installation is completed, the USB interface can now be used.

5.2 GENERAL USE OF PC SOFTWARE

5.2.1 Establishing a device connection

If the device driver is installed, the connection, as a rule, will be automatically established upon the start of the evaluation software, if a device is connected via USB.

If the evaluation programme has already been active before the plugging of the device, move the mouse in the area [COM-Port]. The connection is automatically established. If you would like to connect a device at another COM-Port, select it in the selection window (see for this Image 6).
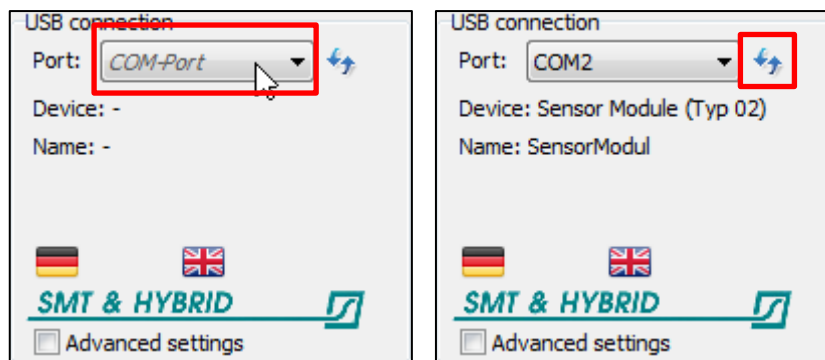
Image 6: USB connection window: left) no connection; right) connection established

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In case of connection problems:

If the USB connection is not initiated correctly select the
Refresh button (**blue** double arrow), disconnect the USB cable from the device
and reconnect it.

5.2.2 File area

Read out data can be saved and loaded again. Partial files from emails can be compiled into one complete file (future function). The firmware for the device and Bluetooth module is also updated by means of the Bootloader functions. For this, the device must be started in the update mode (see for this chapter 6 "Firmware Update".
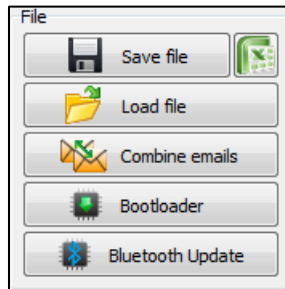
Image 7: File area

The data read out from a sensor module can be saved as a file. A click on the button "Save file" opens the memory dialogue. A click on the button with the Excel symbol exports the read out data in an Excel file.

The data saved or received by email can be loaded again into the PC programme. The button "Load file" opens the corresponding dialogue for the selection of the needed file.

Note:
Some functions are not available in full yet.

Merging of split email files

The files received by email can contain in part not all recorded data due to email file size limitation. In order to merge the partial data volumes into one single file, the needed files can be selected by a click on "Combine emails". The PC programme collects afterwards all data of the selected emails. A "complete file" can be created by renewed saving of the data.

Attention!
Files of different MONI LOG® data link sensor devices cannot be merged.
This similarly applies to a mixed selection of sensor module and data link files.

5.2.3 Message window (log)

The message window, which can be found as a programme tab "Log", renders possible an overview on the actions performed by means of the programme or the status changes of the sensor network during the established USB connection. Error messages and notes, e.g., for performance of configuration commands, connection setup to devices, saving of data, etc. are listed here.
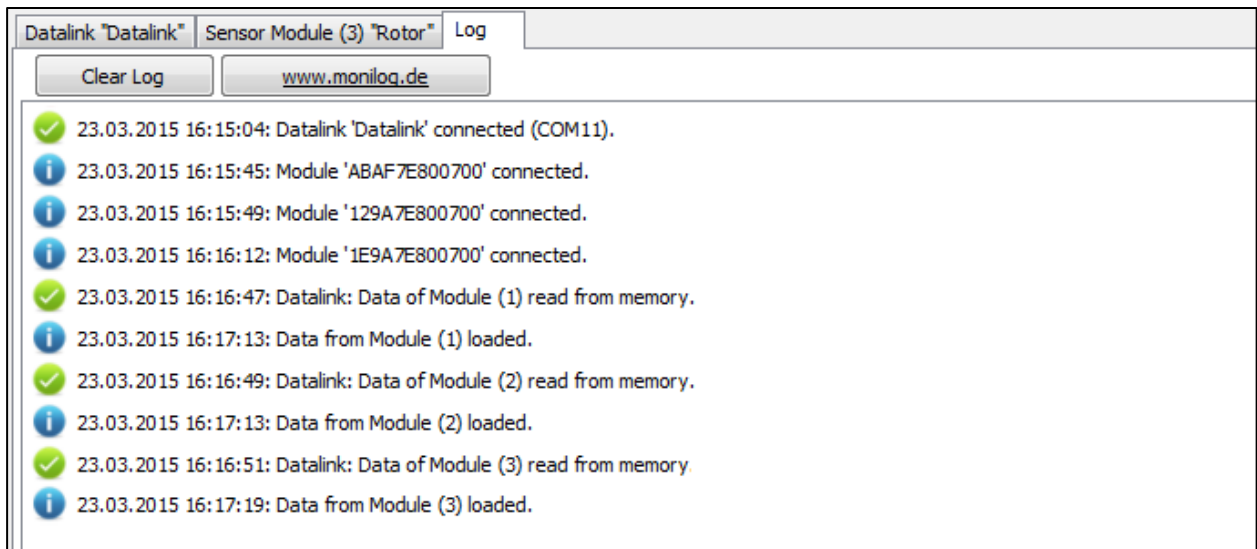
Image 8: Log window

5.2.4 View of measurement data

Graphs

In a graph it is possible to zoom in. For this, draw up a selection window using the mouse (see Image 9). The view can be shifted using the held right mouse button ⊕. By moving the mouse wheel up/down concentric zooming is carried out. The standard zoom is restored by a double click on the graph or using the button 🔍.
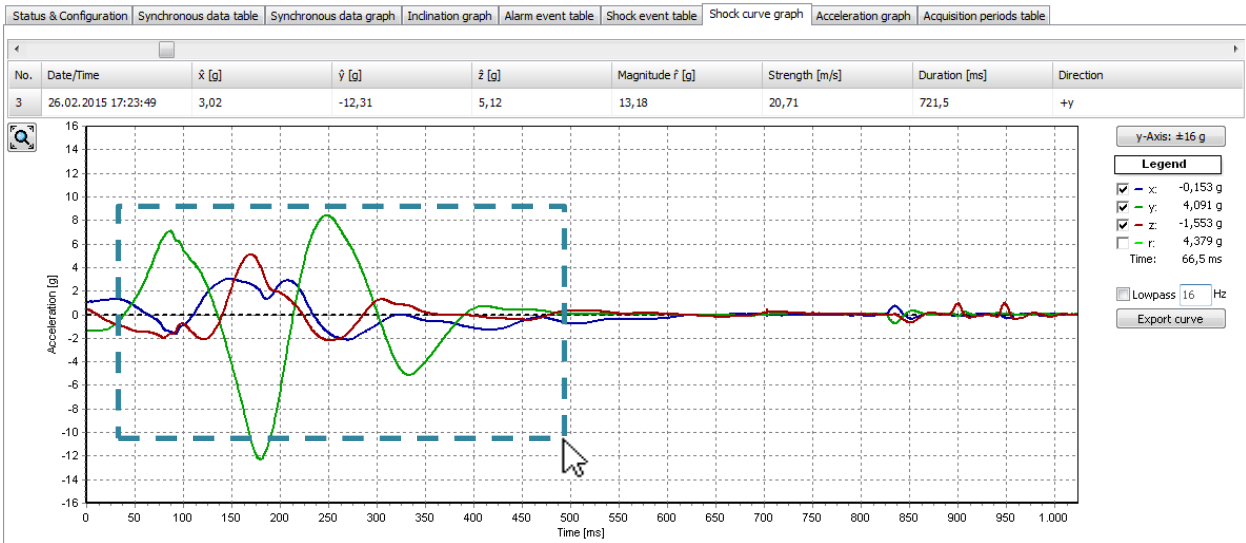
Image 9: Zoom selection window

Sorting function in tables

For tables a sorting function is available. This is carried out by clicking on the respective column in the table header. This facilitates the finding of maximum/minimum values. The sorting is made alternately in ascending and descending order. The data sets remain unchanged by this.

Image 10: Sorting table columns

5.3 MONI LOG® DATA LINK SENSOR

5.3.1 General configuration

Change of device name

The device name of the MONI LOG® data link sensor can be changed in the programme tab "Data link configuration" in the input field "Device name" (see Image 11). For this, 16 signs are available at most. By pressing the Enter key of your keyboard or by clicking on the button "Send configuration" the new device name is transferred to the MONI LOG® data link sensor.
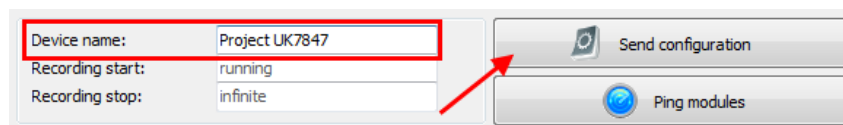
Image 11: Change of device name

Setting of device time

The device time can be set by a click on the clock symbol in the programme tab "Status & Configuration" (see Image 12). The synchronisation is carried out based on the system time of your PC.

The indication of all time data is carried out in the PC programme according to the time zone setting of your PC, the indication of the time in the display of the device is carried out in coordinated universal time (UTC).
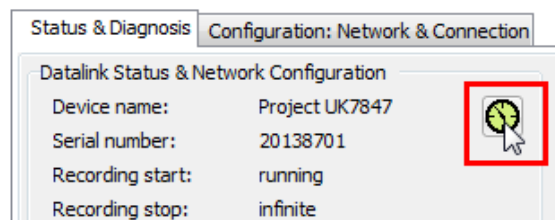
Image 12: Setting of device time

During the operation the device time is always synchronised by GPS, if the GPS positioning is carried out by the activity of the GPS tracking, the email sending or by the occurrence of alarm events of the sensor modules.

5.3.2 Email configuration

General information for the email sending

In adjustable intervals by means of the MONI LOG® data link sensor the dial-up in any mobile communications network available on site and the sending of an email with all received measurement data as a file attachment take place.

The sender address of the MONI LOG® data link sensor results from the serial number of the device according to *"datalink.<serial number>@monilog.de"* (e.g., datalink.20148030@monilog.de).

During the email sending there is no radio communication to the sensor modules. Therefore, for this time period no data of the modules can be received. After completion of the email sending the radio communication to the sensor modules is re-established automatically. Furthermore, during the email sending the navigation through the menu structure of the MONI LOG® data link sensor is deactivated.

Note:

Pressing of the key "Mode" leads to the manual interruption of the email sending!
If retry attempts are configured, sending retries are carried out according to the settings!

Email settings

The parameters for the email sending are explained below (s. Image 13).
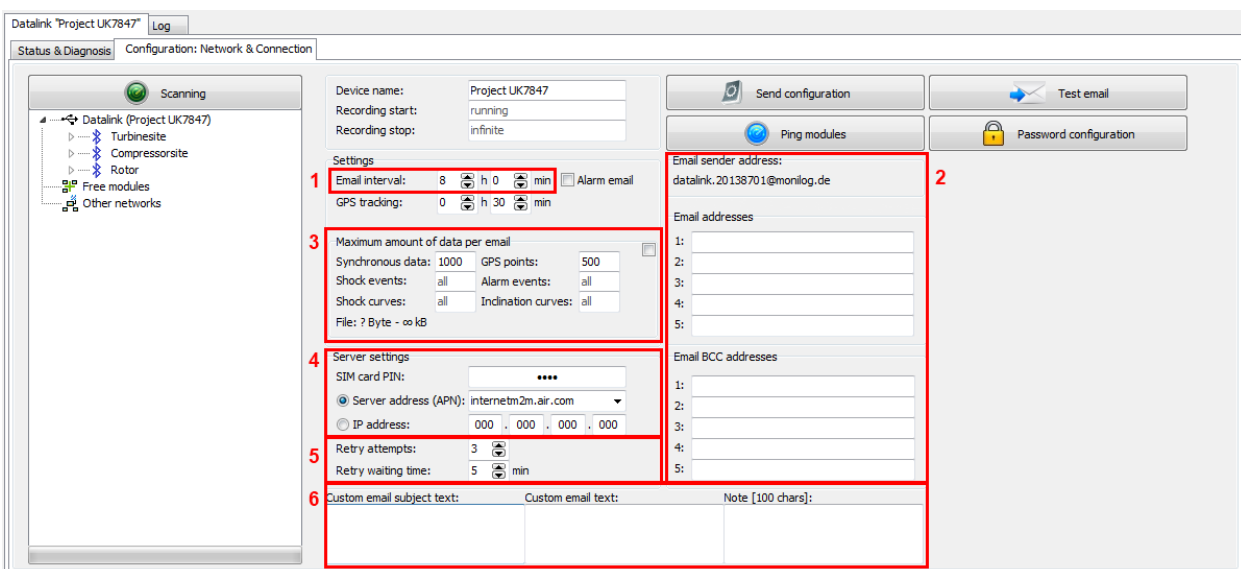
Image 13: Configuration view of the MONI LOG® data link sensor

1) Email interval

In this interval the dial-up into the mobile communications network and the sending of status emails take place. The sending of alarm emails is not affected by this setting.

If the email interval has been changed in comparison to the previous setting, the next email sending time is set to "the current time + 30 seconds". This means that directly after the completion of the configuration and unplugging of the USB connector from the MONI LOG® data link sensor the email sending is initiated, if the time is within the recording period.

2) Email recipient addresses

In these windows up to 5 email recipient addresses can be specified (per line only one recipient).

In the area "Email blind copy addresses" up to 5 blind copy (BCC) recipient addresses can be additionally set (per line only one recipient).

3) Maximum number of data sets per sensor module in measurement data file

In these input fields, the maximum number of data sets per data type of one sensor module und additionally the maximum number of the GPS data recorded by the MONI LOG® data link sensor can be defined. This way, the file size of the measurement data file can be limited to a corresponding maximum.

For the sending of all available measurement data no number is entered into the input field or the field content is erased. The field is automatically marked afterwards with "all".

If a data type shall not be integrated into the measurement data file, "0" (zero) must be entered into the field.

Note:

The defined number corresponds to the maximum data set number **per** sensor module!

---

4) Server settings & SIM PIN

Into the field "SIM card PIN" the PIN of your SIM card must be entered.

For the dial-up into the mobile communications network the access point (APN) is required additionally. It can be entered in text form or alternatively, if the APN is not known in text form, in IP notation.

Please find the SIM PIN and the accordingly required APN in you mobile communications contract.

5) Retry attempts

If the sending fails due to absent mobile communications connection, network malfunction, or the like, these settings enable the retry of the email sending.

The input field "Retry attempts" defines the maximum number of retry attempts after a failure of a regular status email or an alarm email.

The input field "Retry waiting time" defines the time period that should be waited after a failure of an email sending until the initiation of the retry attempt.

Note:

Retries are only initiated, if the time interval until the next regular email interval is more than 10 minutes!

---

6) User-defined email subject, email text and device note

The field "Email subject text" enables the defining of an own subject text for status emails (maximum 64 signs). The subject text for alarm emails and test emails cannot be changed.

The field "User email text" enables the defining of a user text which is written additionally to the standard text in the email (maximum 100 signs).

The notes field enables the storing of user-defined additional information in the MONI LOG® data link sensor (maximum 100 signs). This text is not displayed in the email text, but is included in the file located in the attachment.

Activation of alarm emails

Alarm emails enable the immediate notification of the user on detected alarm events of the sensor modules.

The sending of alarm emails is configured in the settings window by activation /deactivation of the option "Alarm email" (see Image 14).

Afterwards, after the detection of alarm events of the sensor modules located in the sensor network the sending of an alarm email is initiated. In order to also integrate possible further alarm events occurring directly after the first alarm event into the alarm email, the email sending is started 3 minutes after the occurrence of the first alarm event.

In order to prevent an excessive sending of alarm emails, the renewed sending of an alarm email is carried out not earlier than in one hour after the sending of the previous alarm email. All alarm events detected by the MONI LOG® data link sensor until then are buffered.

Note:

In order that alarm emails are sent, at least in one of the sensor modules
alarm thresholds must be defined!
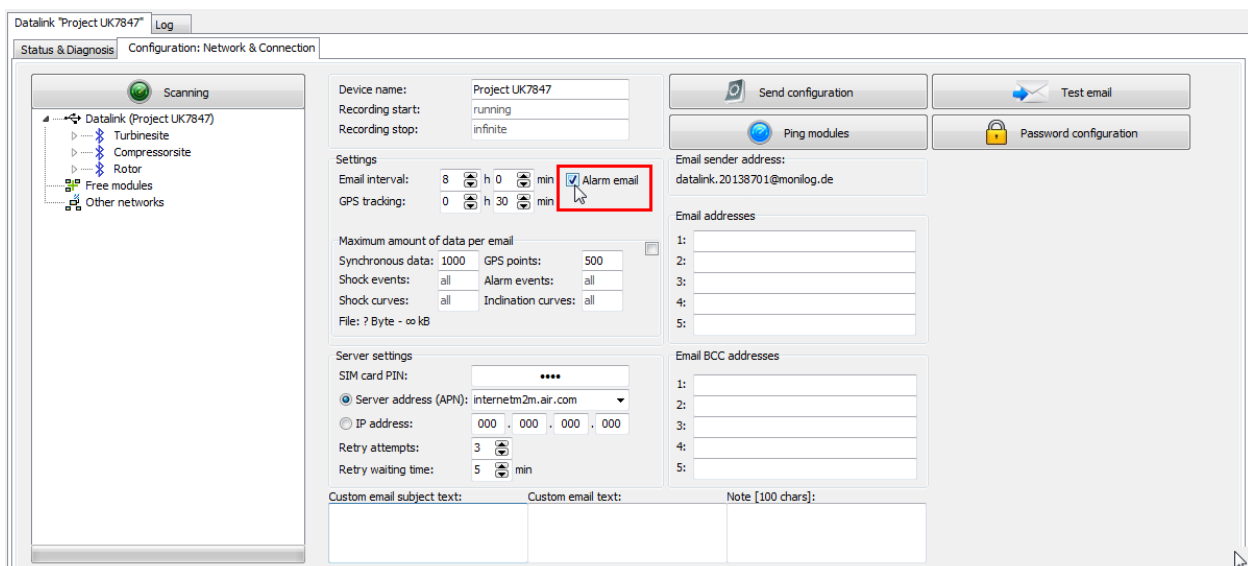
Image 14: Activation of alarm emails

Sending of a test email

To be able to check performed email settings (email addresses, server APN, SIM PIN) for their correct configuration, the button "Send test mail" enables the sending of a short test email (see Image 15).

Note:

Prior to the initiation of the test email sending ensure that at least 1 email recipient and the server address including SIM PIN are set and by means of the button "Send configuration" are transferred to the MONI LOG® data link sensor! Furthermore, pay attention to possible error message in the PC programme.
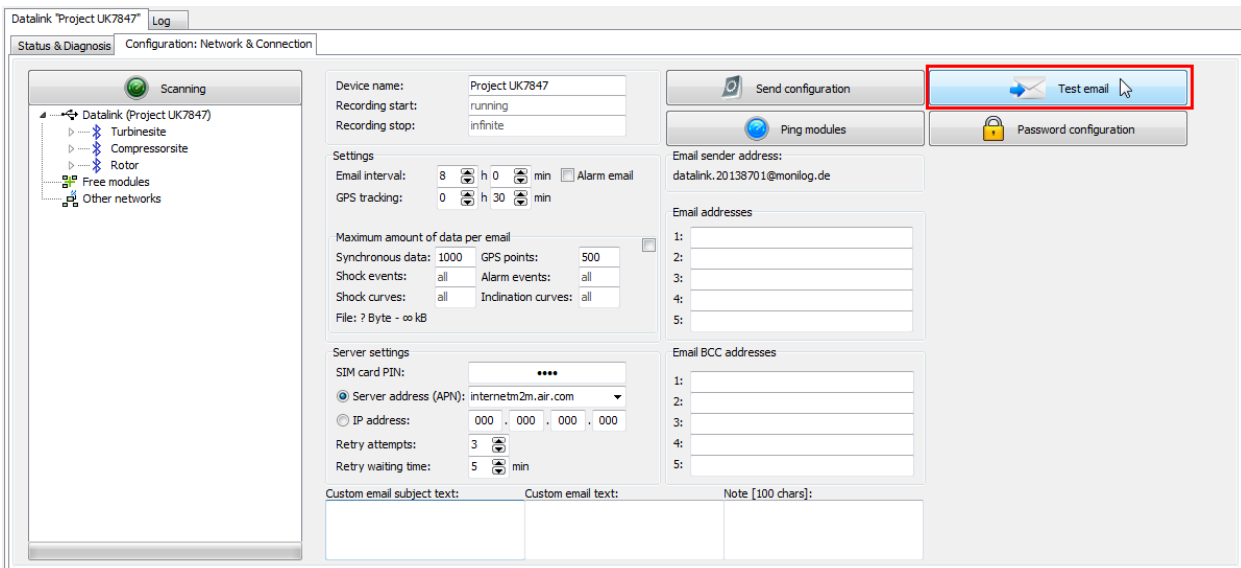
Image 15: Sending of a test email

After the clicking on the button please exit the PC programme and remove the USB cable from the MONI LOG® data link sensor. As long as the USB cable is plugged, the sending of the email will not be initiated. Afterwards, the email sending begins automatically.

In case of correct configuration after completion of the email sending a corresponding email should be in your set email recipient's mailbox. If the sending, however, fails, check your settings and pay attention to the display output on the MONI LOG® data link sensor. For test emails no sending retry is initiated in case of an error!

After the completion of the email sending the MONI LOG® data link sensor can be connected again with the PC programme via the USB interface for possible further configurations.

5.3.3 GPS position determination

The MONI LOG® data link sensor renders possible the determination of the current GPS position in settable intervals (tracking function), before the sending of emails and during detection of alarm events.

Configuration of the GPS tracking

The GPS tracking interval can be specified in the field "GPS tracking" (see Image 16). If no GPS tracking is carried out, the interval must be set to "0 h" and "0 min".
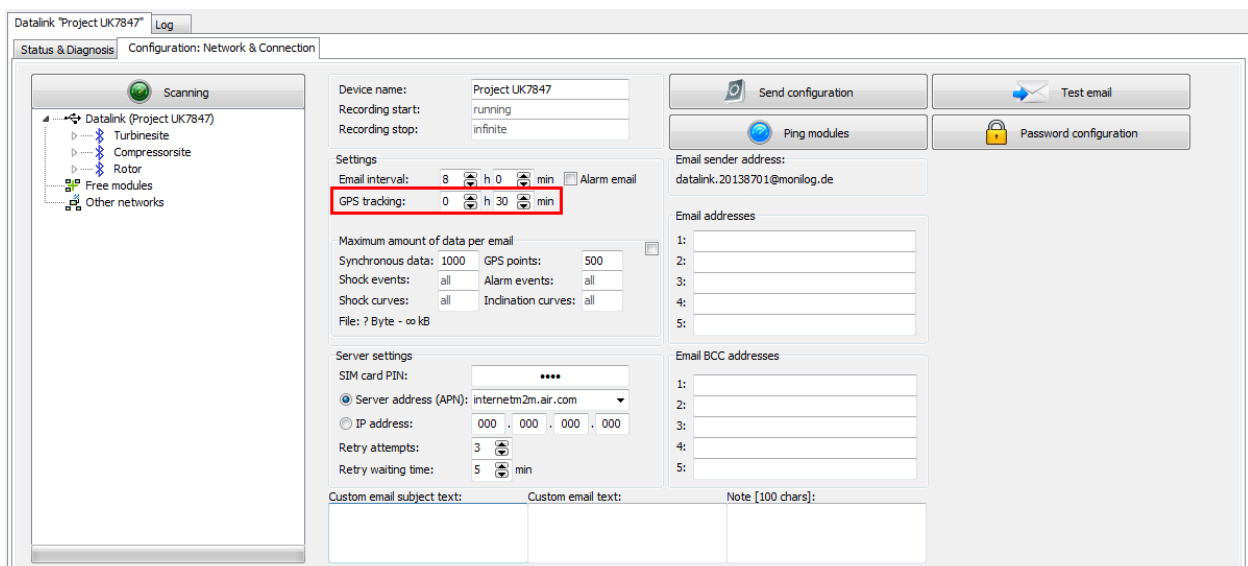
Image 16: Configuration of the GPS tracking

Export and representation of the GPS recording in Google Earth

The recorded GPS data can be view by means of Google Earth. In order to create a corresponding .kml file, click in the menu tab "Status & Configuration" on the button "GPS" (see Image 17). The figure represented in brackets corresponds to the number of the recorded GPS data sets.
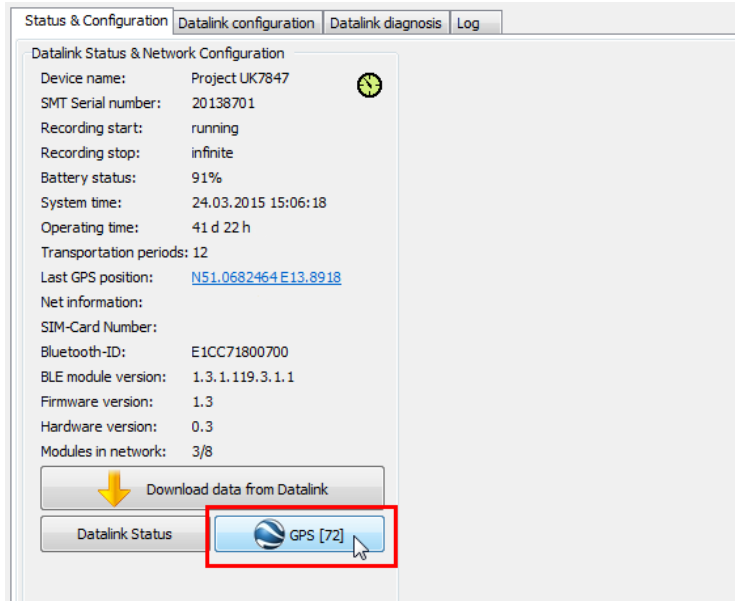
Image 17: Readout of the recorded GPS data

The message box appearing after that (see Image 18) enables additional saving of the created .kml file in any directory by a click on "Yes". A click on "No" does not carry out any additional saving of the file.
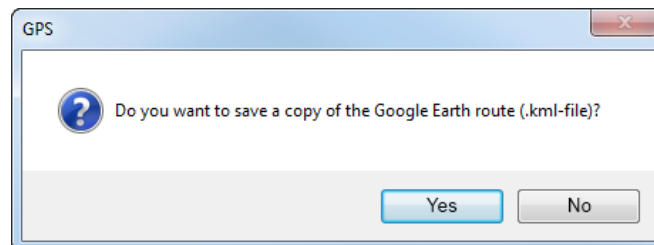
Image 18: Additional saving of the created .kml file at a user-defined memory location

If Google Earth is installed on your PC, now the automatic start-up of Google Earth occurs. Image 19 shows an example view of the GPS data in Google Earth.
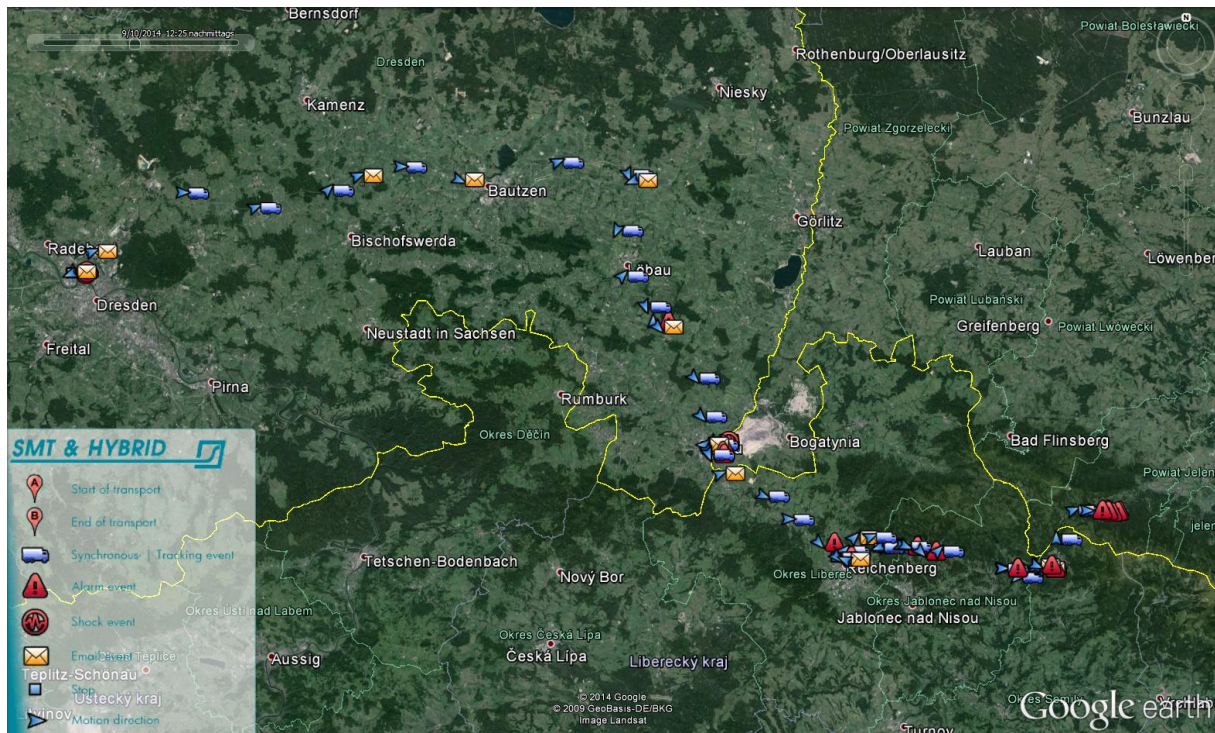
Image 19: Representation of GPS data in Google Earth

The symbols represented on the map show:

(A)	Route start	✉	Email sending
(B)	Route end	🚚	Tracking point
⚠	Alarm event	◢	Driving direction (from 3.0 km/h)
〰	Shock event	◻	Stop position

A click on one of the symbols opens a field with additional information of the GPS point (see Image 20)

Image 20: Example representation of the information fields of the GPS points

5.3.4 Recording period

The recording period facilitates the operation of the MONI LOG® data link sensor in a settable period. This way the energy demand of the device can be lowered outside the recording period by not carrying out the email sending and the determination of the GPS position.

The following operating processes are affected by the specification of the recording period:

- Sending of status emails
- Sending of alarm emails
- Determination of GPS positions (tracking and alarm events)

The operation of the radio communications to the sensor modules is not affected by the specification of a recording period. This means, the sensor modules are further accessible by radio outside the recording period as well.

The setting of recording start time and recording stop time is carried out in the menu tab "Data link configuration" (see Image 21). The specified date-time syntax (DD.MM.YY HH:MM:SS) must be absolutely complied with during the setting. If no limitation of the start or stop time is defined, the corresponding field must be left blank.
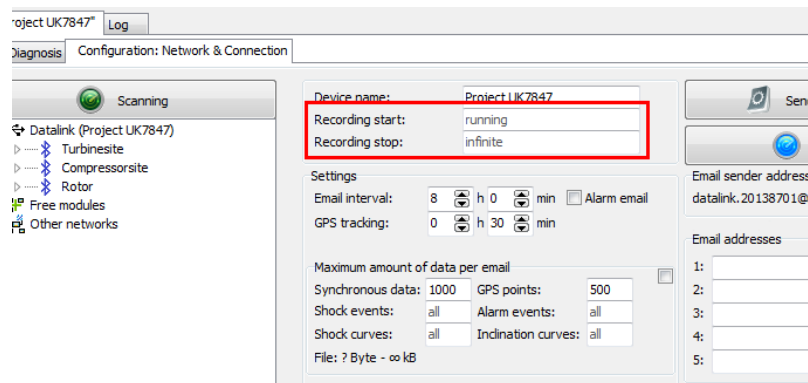
Image 21: Configuration of recording start and stop time

A brief explanation of different configuration cases is carried out below:

a) The recording start is in the future

The first email sending and the first GPS positioning are carried out upon reaching the set point in time and subsequently in the specified intervals.

b) The recording start is in the past

The existing email and GPS intervals are not affected.

c) The recording stop is in the future

The existing email and GPS intervals are not affected. Interval time points that would take place after the recording stop are no longer carried out.

d) The recording stop is in the past

With a transfer of this setting from now onwards no email sending and no determination of the GPS position take place any more. If in this moment a GPS determination is carried out, it will be interrupted.

e) The recording stop lies chronologically before the recording start

This setting is impermissible. The recording start time and recording stop time are automatically interchanged in this case, so that a permissible recording period is created.

5.3.5 Setting up and editing of the sensor network

Adding of sensor modules to the sensor network

During the initial configuration of the sensor network no sensor modules are assigned yet to the MONI LOG® data link sensor. In order to add sensor modules located in the vicinity to the sensor network, at first a search for them must take place. For this, click on the button "Scanning" (see Image 22). Now, for a time period of 30 seconds a search for available sensor modules takes place. By a renewed click on the button "Scanning" the search process can be terminated prematurely.

Note:

Ensure that the sensor modules that should be added to the network are switched on and are within the range!
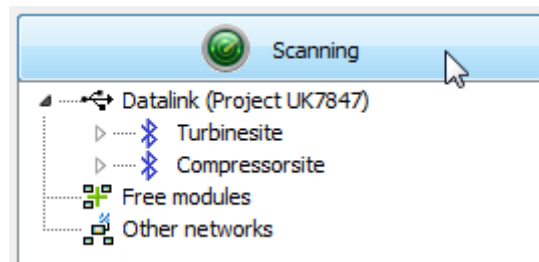
Image 22: Starting the scanning

Within a very short time the sensor modules located in the surrounding area become visible in the programme window and are sorted according to their access authorisation into the groups "Free modules" and "Connected modules" (see Image 23).
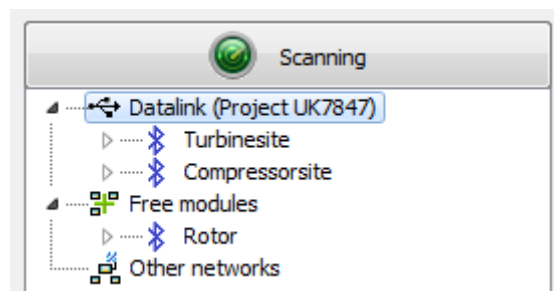
Image 23: Sensor modules found during the scanning

Sensor modules which are situated in the group "Free modules" are not assigned yet to any sensor network. They can be added into the own sensor network.

Sensor modules which are situated in the group "Connected modules" are already assigned to other sensor networks. They can**not** be added to a particular sensor network.

To assign an available module to a particular sensor network, simply move the desired module via drag and drop from the area "Free modules" into the group "Data link" (see Image 24). The sensor module is situated now in the group "Data link". Alternatively, the sensor module can also be added into the network by clicking with the right mouse key on the corresponding sensor module and by selecting the option "Add to the network" in the appearing menu.

Afterwards, the MONI LOG® data link sensor tries to establish the first connection to the sensor module. During this time the symbol of the sensor module is greyed out (see Image 25). After successful connection setup the symbol turns blue (see Image 26). The sensor module can be used in the sensor network now.
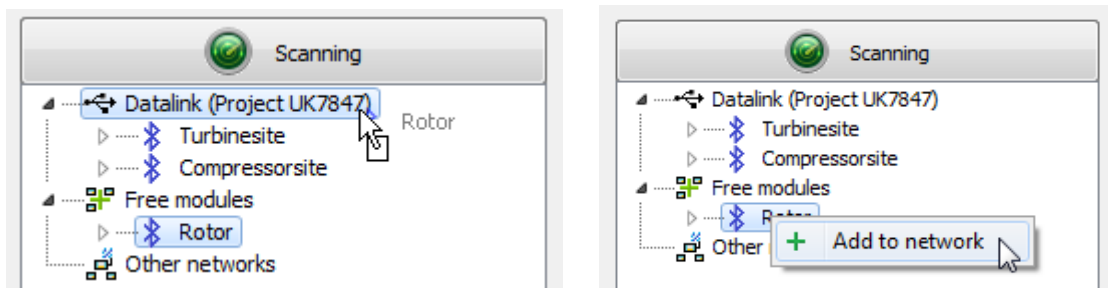
Image 24: Adding of new sensor modules to the sensor network
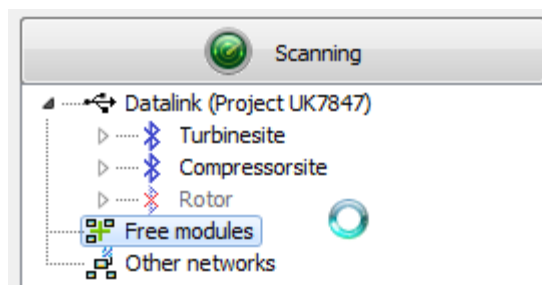
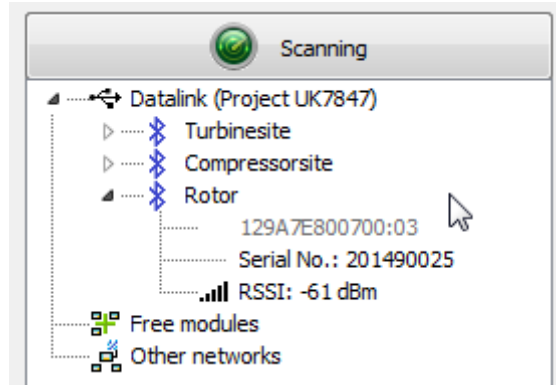*Image 25: First connection setup to the just added sensor module*

Image 26: The just added sensor module is now available

Removal of sensor modules from the sensor network

In order to remove the sensor modules from the particular sensor network, simply pull the desired sensor module via drag and drop from the group "Data link" in the group "Free modules".

Alternatively, the sensor module can also be removed from the network by clicking with the right mouse key on the corresponding sensor module and by selecting the option "Remove from network" in the appearing menu (see Image 27).

Note:

Only sensor modules which are accessible by radio can be removed from the network (modules with blue symbol)!
If a sensor module is removed from the network, all data of the sensor module saved in the MONI LOG® data link sensor will be erased (see Image 28)! In the sensor module itself the data remain preserved.
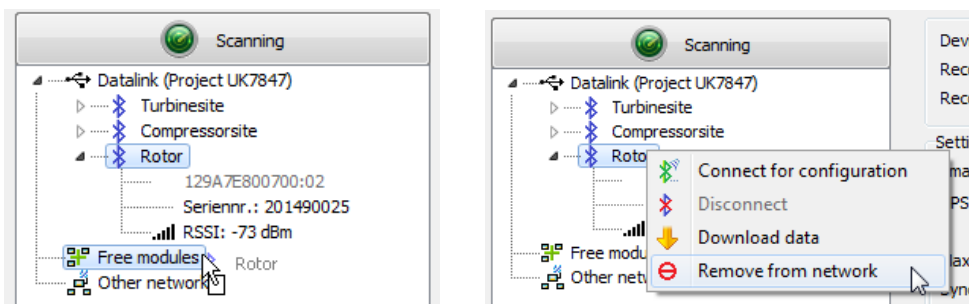
Image 27: Removal of sensor modules from the sensor network
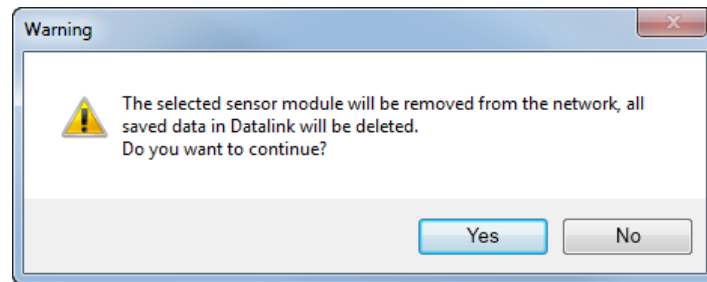
Image 28: During the removal of sensor modules from the sensor network the measurement data of the sensor module are erased from the MONI LOG® data link sensor

After successful removal of the sensor module from the sensor network the module is located in the group "Free modules" (see Image 29). It is now available for the integration into other sensor networks.
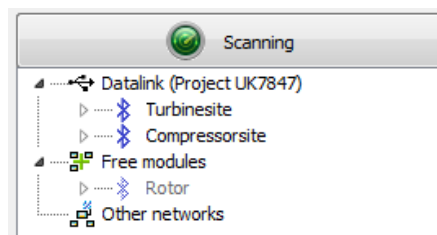

Image 29: Sensor modules after the removal from the sensor network

5.3.6 Password configuration

Within the MONI LOG® data link sensor the following password types are defined:

- **On/Off code**

  The On/Off code protects the MONI LOG® data link sensor against unauthorised or accidental switching on and switching off of the device. In case of a delivery from the factory no On/Off code is configured.

- **Configuration password**

  The configuration password protects the MONI LOG® data link sensor against unauthorised readout and configuration by means of the PC software. In case of a delivery from the factory no configuration password is configured.

Change of device passwords

Both the On/Off code and the configuration password can be changed in the PC programme in the menu tab "Data link configuration".

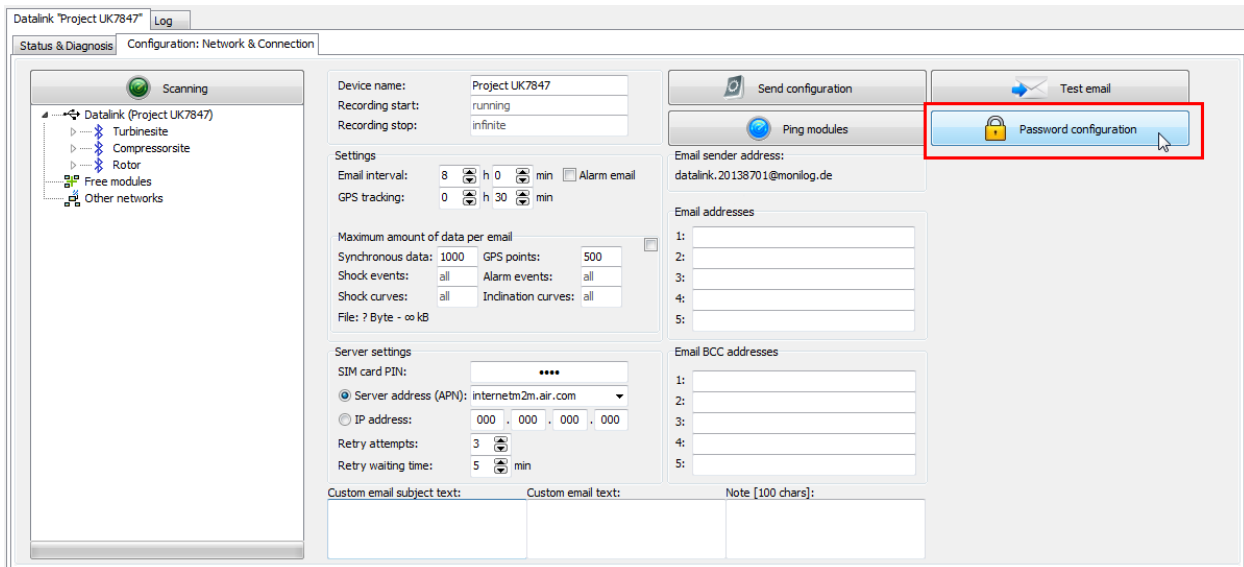1. Click there on the button "Password configuration" (see Image 30).

Image 30: Password configuration of the MONI LOG® *data link sensor*

2. After that, the fields open for the input of new passwords (see Image 31):

a) Configuration password

These fields facilitate the input of a new configuration password. Enter the current configuration password for the change and, in addition, the new password (incl. repetition of the password as confirmation in the third input line).
Maximum 8 signs (letters and figures) are permissible.
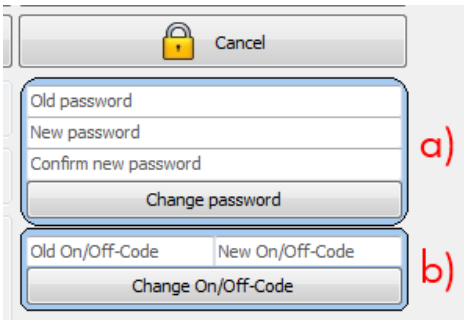
If the current configuration password shall be erased (i.e., the device no longer has any configuration password), the lines for the new password must be left blank. Accordingly, the field "Old password" must also be left blank, if no configuration password is configured for the device.

b) On/Off code

The change of the On/Off code is carried out by analogy with the change of the configuration password. A repetition of the new On/Off code as confirmation is unnecessary.
Maximum 2 signs (only figures!) are permissible.

3. For the completion of the configuration click on the button "Change password" or on the button "Change On/Off code".

Image 31: Input fields for the password change

If you have forgotten your On/Off code or your configuration password, please contact the technical support for further instructions!

5.3.7 Configuration of the MONI LOG® sensor module via the radio interface

If the MONI LOG® data link sensor is connected via the USB interface with the PC programme, sensor modules situated in the sensor network can be configured by radio. The corresponding sensor modules must be switched on for this and be located in the radio range (see Image 32).

In order to establish the radio communication for the configuration, click in the programme tab "Data link configuration" by right click on the corresponding sensor module and select the option "Connect for configuration" (Image 33). Afterwards, the configuration connection is established (see Image 34). This can take up to 10 seconds. After successful setup of the connection the configuration menu of the sensor module opens automatically. In addition, the current status and the configuration of the sensor module are read out via radio (see Image 35). The symbol of the

selected sensor module is shown now in green colour in the device overview. The configuration can be carried out now according to chapter 5.4.10 "Configuration of the sensor module".
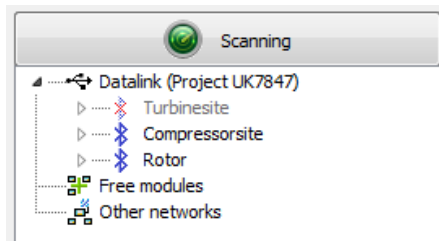

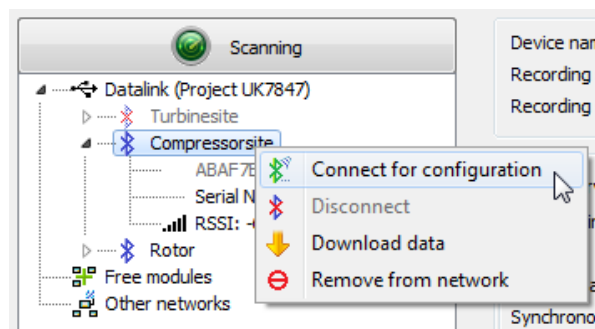*Image 32: Sensor modules situated in range have a blue symbol*
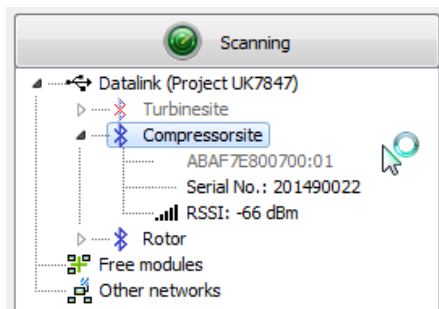

Image 33: Setup of the configuration connection

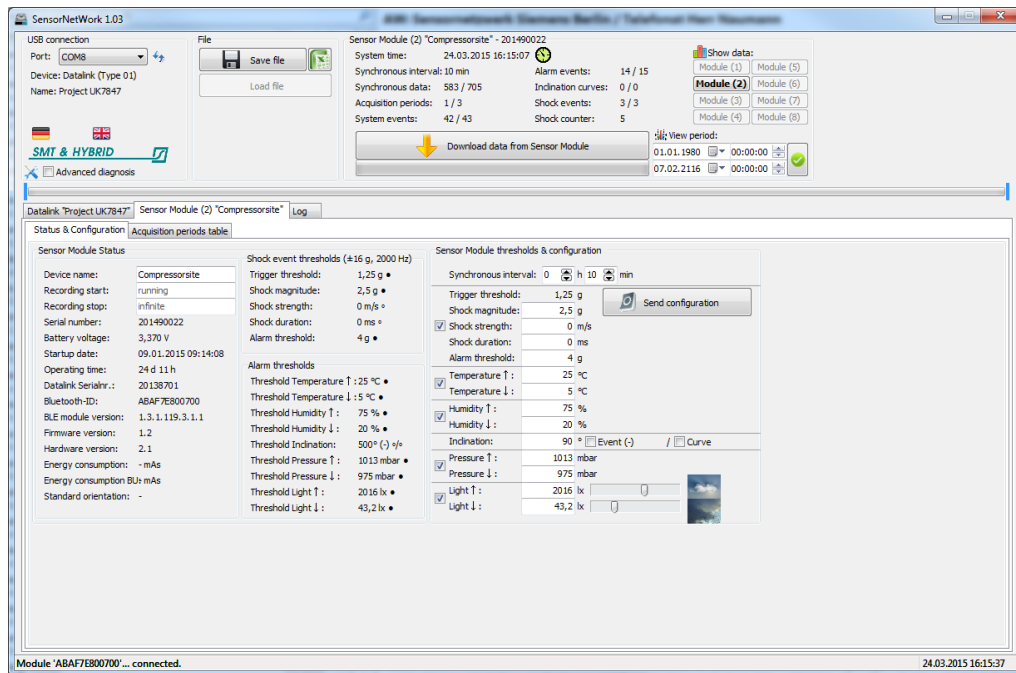*Image 34: The setup of the connection takes up several seconds*

Image 35: Configuration view after the successful setup of the configuration connection

Function limitation in comparison to the direct configuration of the sensor module via the USB interface:

- The memory of the sensor module cannot be erased via radio

- The measurement data of the sensor module retrieved via the MONI LOG® data link sensor correspond to the measurement data that are saved in the MONI LOG® data link sensor. They can deviate regarding the completeness, among other things, from the data volume which is saved in the sensor module.

After completion of the configuration the configuration connection of the sensor module must be disconnected again. For this, click again by right click on the corresponding sensor module and select the option "Disconnect" (see Image 36). After successful disconnection of the configuration connection the symbol of the sensor module is shown again in blue colour.
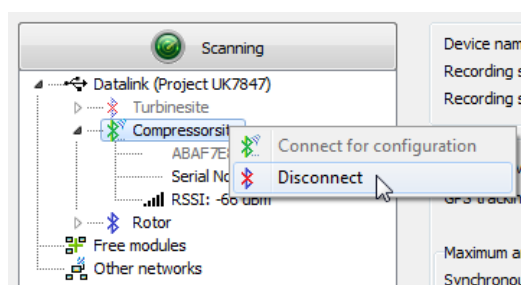

Image 36: Disconnection of configuration connection

5.3.8 Readout of measurement data of sensor modules

By means of the PC programme via the MONI LOG® data link sensor all measurement data of the sensor modules saved **in the device** can be retrieved, independent of the connection state and the radio accessibility. For this there are two possibilities:

1) Retrieval of all data of all sensor modules

To retrieve all measurement data all at once, click in the menu tab "Status & Configuration" on the button "Data link readout" (see Image 37). Subsequently, the saved data are read out. This can take up some time.
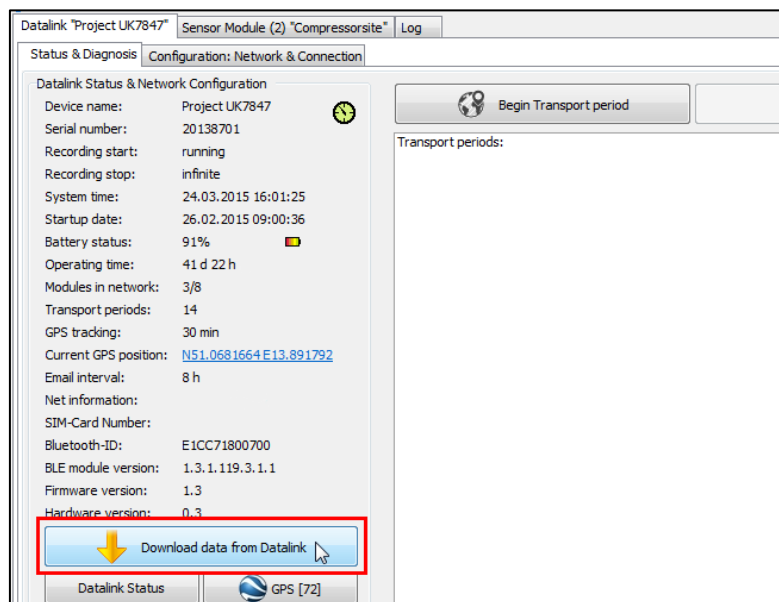

Image 37: Retrieval of all measurement data of all sensor modules saved in the MONI LOG® data link sensor

2) Retrieval of all data of a certain sensor module

To retrieve the measurement data of a certain sensor module, click in the menu tab "Data link configuration" by right click on the desired sensor module of its sensor network (sensor modules of the group "Data link"). Select subsequently in the opening menu the option "Read out data" (Image 38). After that, all data of the sensor module are read out.
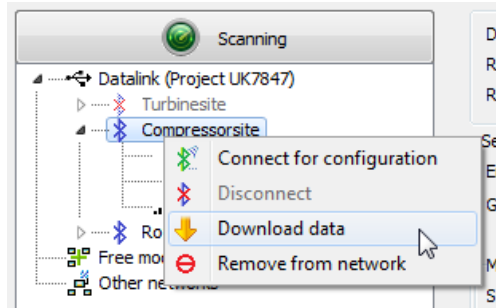
Image 38: Retrieval of all measurement data of a single sensor module saved in the MONI LOG®
data link sensor

View of already read out measurement data of the sensor modules

All already read out measurement data of the sensor modules remain preserved for the view in the PC programme until the PC programme is closed or the USB connection to the MONI LOG® data link sensor is disconnected.

The measurement data of the sensor module are always selectable by a click on the appropriate key in the upper right programme area under "Display data" (see Image 39). The font of the key of the currently displayed sensor module is shown respectively in bold.
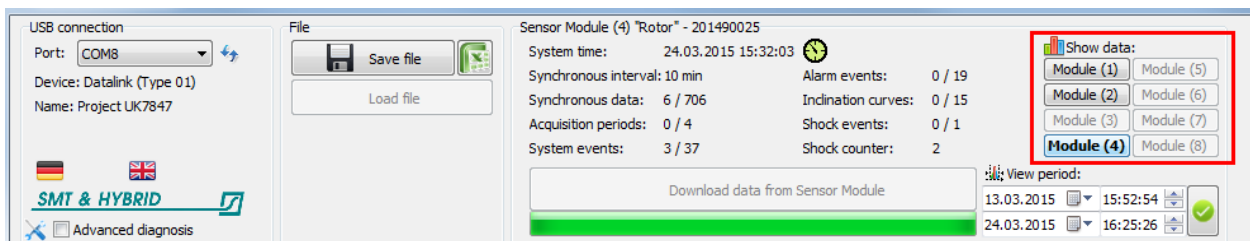

Image 39: Switchover of the measurement data view between single sensor modules

5.4 MONI LOG® SENSOR MODULE

5.4.1 Readout of status, configuration and measurement data

After successful setup of the connection to the sensor module the following information is shown in the PC programme:
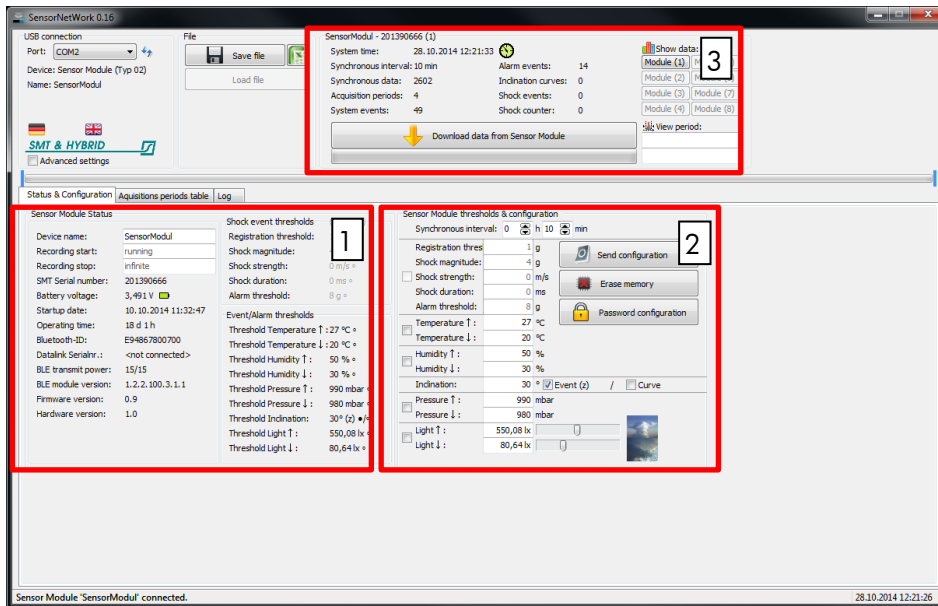

Image 40: *Programme view during connection with sensor module*

1) Status and set configuration
2) Setting configuration
3) Overview window of sensor module

After the connection setup to the sensor module status data, configuration and acquisition periods are read out automatically. The measurement data, e.g., synchronous data or shock curves, are retrieved manually by means of the button "Read out sensor module". This can take up, depending on the number of the data sets, a few seconds to several minutes. A progress bar shows the current readout status. According to the available measured values the corresponding programme tabs and graphs open.

A detailed description of the programme areas can be found in the following chapters.

Please do <u>not</u> disconnect the USB cable from your PC or sensor module as long as data transmission takes place!

5.4.2 Overview window

The overview shows the current system time, the set synchronous interval and the number of the saved data sets (see Image 41).
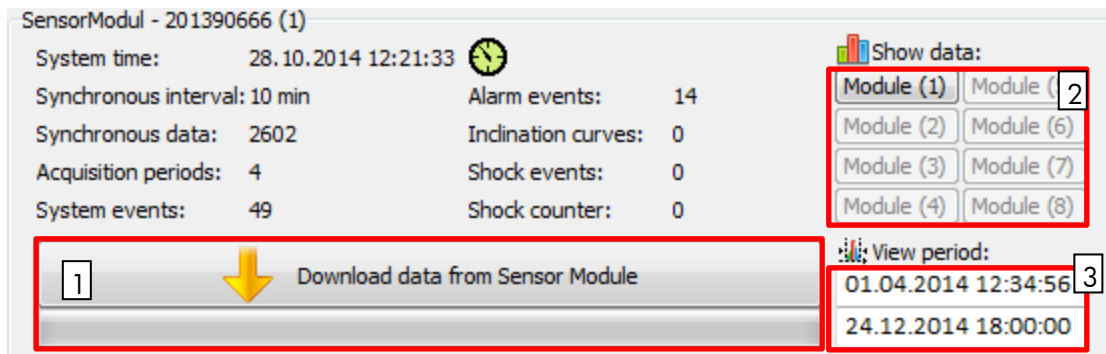

Image 41: Overview window of the sensor module

In addition, in the overview window the following functions are available:

1) Reading out measurement and diagnostics data of the sensor module

The retrieval of all recorded measured values and diagnostics data is carried out by a click on the button "Read out sensor module". According to the available measured values the corresponding tabs and graphs open.

2) Show data of another module

Upon clicking on the module buttons in the data display area (see Image 41, no. 2) a switchover is made between the display of data of different network modules.

3) Defining view period

With the view period (see Image 41, no. 3) the display of data can be limited to the desired time range. This simplifies the data analysis and the finding of certain events. Enter the desired start and end date in the fields and confirm the input by means of the Enter key of your keyboard or by the green button on the right of the input fields. The view period can also be adjusted by means of the slide bar by moving the blue bar with the mouse (see
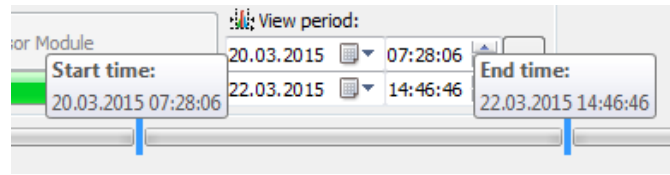
Image 42).

Image 42*: Slide bar for view period*

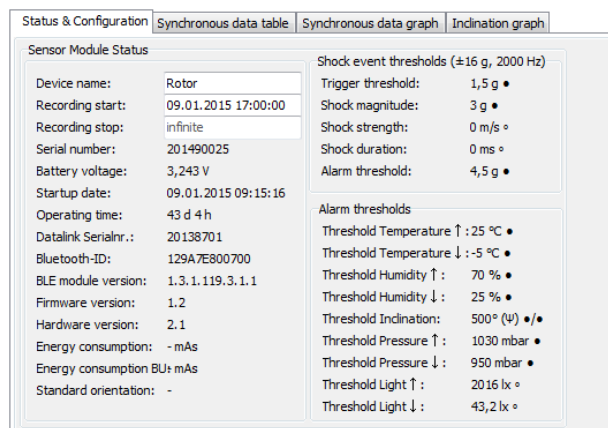## 5.4.3 Status and thresholds

Image 43: Status and set configuration of a sensor module

Status data:

- Device name: *device name by user (freely selectable)*

- Recording start: *start of measurement recording*

- Recording stop: *end of measurement recording*

- SMT serial number: device *serial number*

- Battery voltage: *voltage of the sensor module battery*

- Startup: *date and time of the first startup*

- Operating hours: *total operating time of the sensor module*

- Bluetooth-ID: *unique MAC address of the Bluetooth unit*

- BLE module version: *firmware and hardware version of the Bluetooth unit*

- Data link serial no.: *serial number of the assigned* MONI LOG® *data link sensor*

- Transmission level: *level of the radio transmit power*

- Firmware version: *current firmware version of the sensor module*

- Hardware version: *current hardware version of the sensor module*

Shock event thresholds:

- Triggering threshold: *acceleration value from which the scanning is activated*

- Shock magnitude: *minimum amplitude of acceleration (memory criterion)*

- Shock strength: *minimum "area below the curve" (memory criterion)*

- Shock duration: *minimum duration of event (memory criterion)*

- Shock alarm threshold: *acceleration value from which an alarm event is created*

- Memory criterion: *The shock event must reach at least the stated values to be fit for memory. This serves to hide the insignificantly small shock events and this way not to load excessively memory and transmission path (Bluetooth & Email).*

- filled circle • :   *event active*

- not filled circle ° :   *event inactive*

Event/Alarm thresholds:

- Temperature upper/lower: *Upon exceedance/falling below an event is created*

- Humidity upper/lower: *Upon exceedance/falling below an event is created*

- Pressure upper/lower: *Upon exceedance/falling below an event is created*

- Light upper/lower: *Upon exceedance/falling below an event is created*

- Inclination/Inclination curve: *If the device tilts from its main position by the stated angle (e.g., 30°), an event is created.*
  Inclination curves record the course of the tilting over a period of several seconds.

Notes on inclination events:

As the inclination is naturally superimposed with other movements and put under general scatterings, the minimum threshold is limited to an angle of 5°. The scanning is carried out at a frequency of 10 Hz over a period of 3 seconds, i.e., a faster tilting cannot be detected under certain circumstances.

5.4.4 System events

The system events show events that concern the status and the operating behaviour of the sensor module. Existing errors in the hardware are also recorded. The display field for system events is normally hidden and can be displayed by activating the option "Advanced diagnostics" (see Image 44).

Image 44: Displaying system events via Advanced diagnostics

The following system events can occur:

- Start: The sensor module was switched on

- Hour counter: 24 h of operating time of the sensor modules are expired

- Device configured: The sensor module was configured.

- Interrupts configured: Alarm events/Thresholds were activated/changed

- Device switched off: The sensor module was switched off

- BLE connection loss: The sensor module has lost the radio communication to the
                                  MONI LOG® data link sensor

- **Network configured:** The sensor module was added to a sensor network or removed from a sensor network

- **Time synchronised:** The system time of the sensor module was configured

- **Bluetooth active:** The event was called by activities via the radio interface.

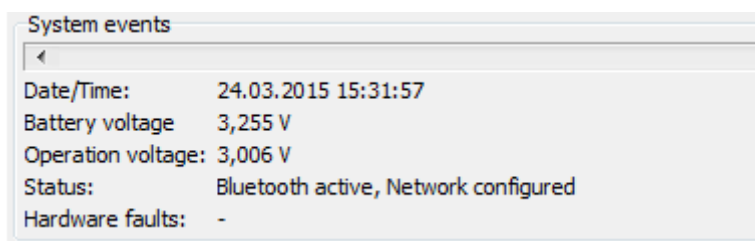- **USB active:** The event was called forth by activities via the USB interface

Image 45: Display of sensor module system events

5.4.5 Acquisition periods

The acquisition periods offer an overview of the individual configuration time segments of the sensor module. This way it can be retraced how the sensor module was configured at the respective period.

Image 46: Table of acquisition periods

The start and end time, the active time period and the reason which has led to the completion of the acquisition period are shown. Furthermore, all set thresholds and event channels are registered for the period. A new acquisition period begins, if the device was switched off or has been configured.

5.4.6 Synchronous data graphs

Synchronous values - temperature, humidity, pressure & light:

The data sets of the synchronous values are shown consecutively in a table (see Image 47). In the programme tab "Synchronous values graph" the synchronous data are shown as a graph. By activating or deactivating the "check mark" in the key on the right side the graphs for the physical quantities temperature, air humidity, air pressure and light intensity can be switched on or off (see Image 48).

Image 47: View of synchronous data table

Image 48: View of synchronous data graph

Inclination graph:

In the programme tab "*Inclination position graph*" the static inclination values of the synchronous data are shown as a graph. By activating or deactivating the "check mark" in the key on the right side respectively the x-, y- and z-channel can be switched on or off (see Image 49). The static inclination can be superimposed by the occurring accelerations. The representable area is at ± 2 g. For this check the magnitude: if it significantly deviates from 1 g, then the actual position is no longer reliably determinable.
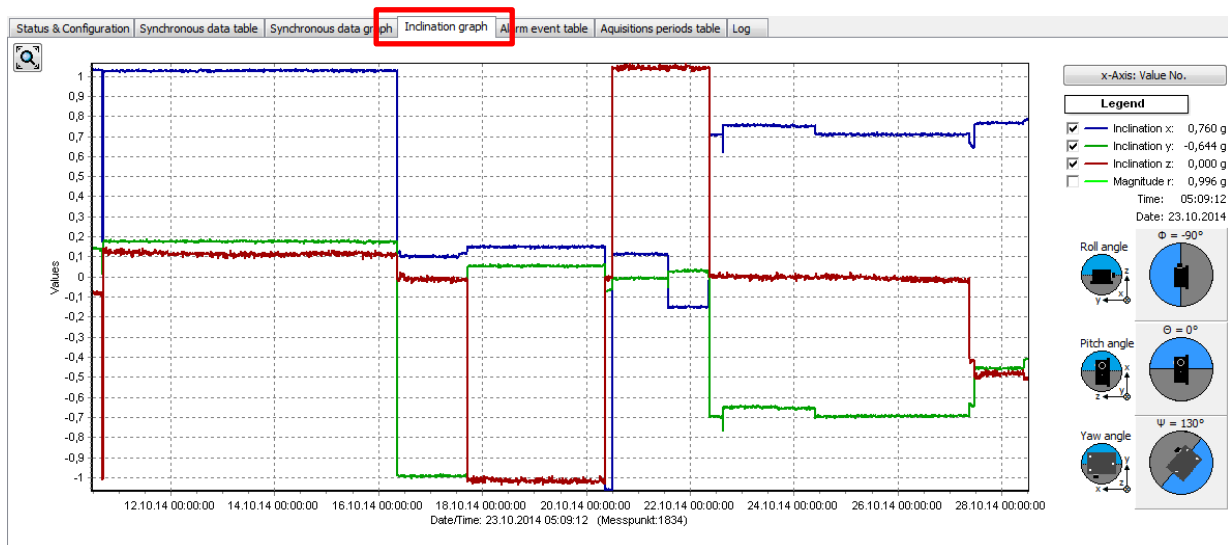

Image 49: View of inclination position graph

Inclination angle:

The human imagination quickly reaches its limits in case of a three-dimensional representation of the spatial position of three coloured lines. For the better understanding of the orientation of the sensor module the use is made of a graphic representation of the three solid angles in the style of analogous aircraft instruments. The descriptions are based upon the ENU reference system ("right-hand rule", see http://en.wikipedia.org/wiki/Aircraft_principal_axes).

Calculation of angles:

- Rotation about x-axis: Roll angle $\Phi = \arctan(y/z)$

- Rotation about y-axis: Pitch angle $\Theta = \arctan(z/x)$

- Rotation about z-axis: Yaw angle $\Psi = \arctan(x/y)$

By this definition the angles in the normal position of the device on the table are not (0°,0°,0°), but (0°,90°,--). The roll angle is 0°, as the z-axis shows in the direction of the axis of the Earth. The pitch angle is 90°, as the x-axis is standing vertically to the axis of the Earth (namely horizontal). The yaw angle (rotation about the z-axis) cannot be determined, as the gravitational acceleration for both references axes (x- & y-axis) is almost zero.
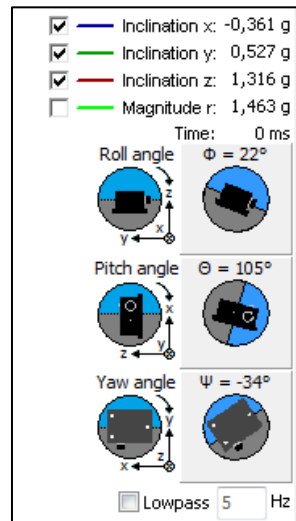

Image 50: Example of inclination angle display

5.4.7 Inclination curves

Inclination curves record the inclination for further 8 seconds as course of the curve after one inclination event.

Inclination events often overlap in reality with acceleration events. Check in case of inclination curves whether the magnitude has a course of approximately 1 g. If this is the case, this is a "gentle tilting" without jerky movements (see Image 51). In the other case a "vibration" or a similar jerky process has triggered the inclination event.

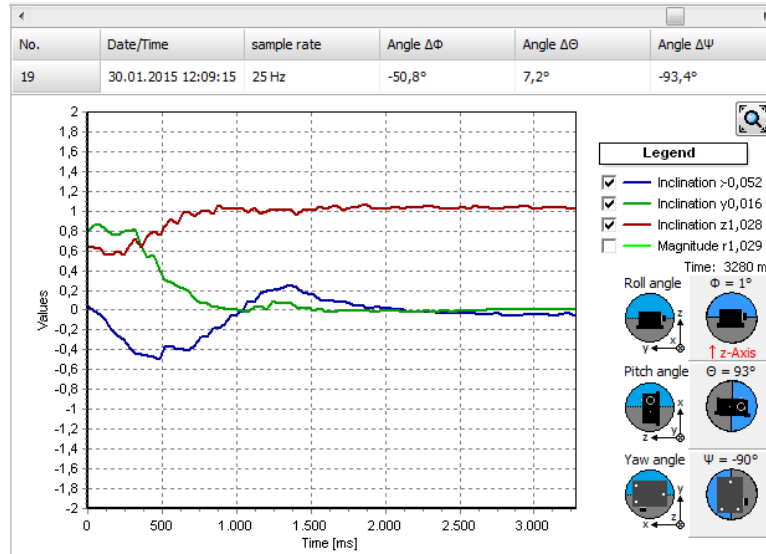For inclination curves there is also an angle display.

Image 51: Inclination curves graph

5.4.8 Alarm events

Alarm events comprise all events created by exceeding/falling below alarm thresholds. They are listed in the programme tab "Alarm events" as single tables (light events, pressure events, temperature/humidity events, inclination events/inclination curves, shock alarm events). In combination with a MONI LOG® data link sensor a GPS coordinates point is created for every event. The number of the event is additionally given in the data table in brackets.

Image 52: Inclination event table and inclination curves graph

5.4.9 Shock events and shock curves

All shock events are set out in tabular form under the programme tab "Shock events". By a double click on the table row the corresponding curve can be accessed.

No.	Date/Time	$\hat{x}$ [g]	$\hat{y}$ [g]	$\hat{z}$ [g]	Magnitude $\hat{r}$ [g]	Strength [m/s]	Duration [ms]	Direction	Curve
1	30.01.2015 14:28:32	5,67	-1,17	-2,22	5,70	30,21	1024,0	+x	
2	30.01.2015 14:28:33	-3,96	-2,13	-3,96	5,56	28,55	1024,0	-x	
3	30.01.2015 14:28:34	-4,21	-1,55	-3,30	5,45	28,16	1024,0	-x	
4	30.01.2015 14:28:35	-4,37	-1,54	-2,59	5,24	23,89	1024,0	-x	
5	30.01.2015 14:28:36	-5,05	-1,63	-2,46	5,78	29,05	1024,0	+x	
6	30.01.2015 14:28:38	-5,38	-1,86	-2,83	5,92	31,98	1024,0	+x	
7	30.01.2015 14:28:39	-5,63	-1,60	1,46	5,83	31,26	1024,0	+x	
8	30.01.2015 14:28:40	-5,75	1,17	-1,25	5,78	31,03	1024,0	+x	
9	30.01.2015 14:28:41	-5,37	0,85	-2,83	5,37	29,17	1024,0	+x	
10	30.01.2015 14:28:42	-4,78	-1,07	-2,67	5,29	27,87	1024,0	-x	
11	30.01.2015 14:28:43	-4,43	-1,07	-2,57	4,74	26,66	1024,0	+x	
12	30.01.2015 14:28:44	-4,65	-1,32	-2,51	5,30	28,26	1024,0	+x	
13	30.01.2015 14:28:45	-4,92	-1,27	-2,53	5,53	26,78	1024,0	-x	
14	30.01.2015 14:28:46	-4,49	-1,17	-2,27	4,86	26,62	1024,0	-x	
15	30.01.2015 14:28:47	4,01	-1,04	1,82	4,23	24,37	1024,0	+x	
16	30.01.2015 14:28:48	-4,21	-1,05	1,71	4,43	24,44	1024,0	-x	
17	30.01.2015 14:28:49	-4,50	-0,63	1,66	4,52	25,68	1024,0	-x	

Image 53: Shock event table

In the programme tab "Shock curves" the recorded shock curves are shown as a graph. By activating or deactivating the "check mark" in the key on the right side respectively x,y,z-channel and the magnitude curve can be unhidden or hidden (see Image 54)

In addition, by activating the low-pass filter function and input of the cut-off frequency the unwanted high frequency portions can be filtered out from the view. This is a view option and it does not change the original data.

By means of the button "y-axis: …" the vertical graph axis is switched over between the limits of the curve and ± 16 g.
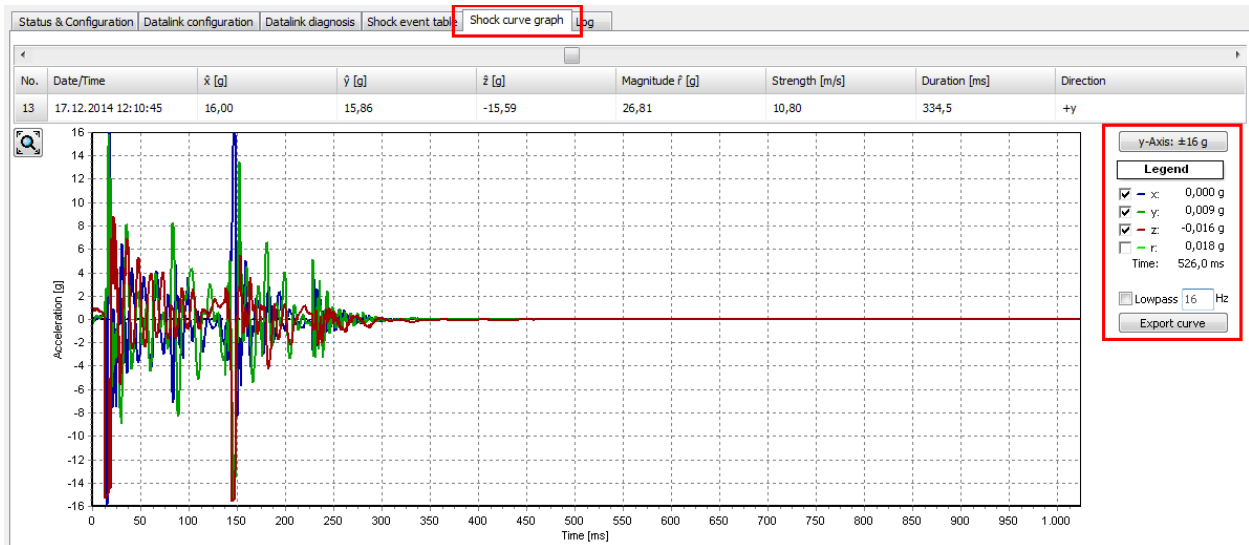
Image 54: Shock curves graph

Shock recording:

The shock recording begins, if the value of the acceleration exceeds the triggering threshold. The triggering threshold is configured internally by the device and depends on the set magnitude threshold (currently: triggering threshold = ½*magnitude threshold, minimum: 500 mg). This way, processes which lie chronologically before the actual exceeding of the magnitude threshold are also registered.

A shock event is saved if the recording thresholds for shock magnitude, shock strength and shock duration are at least fulfilled.
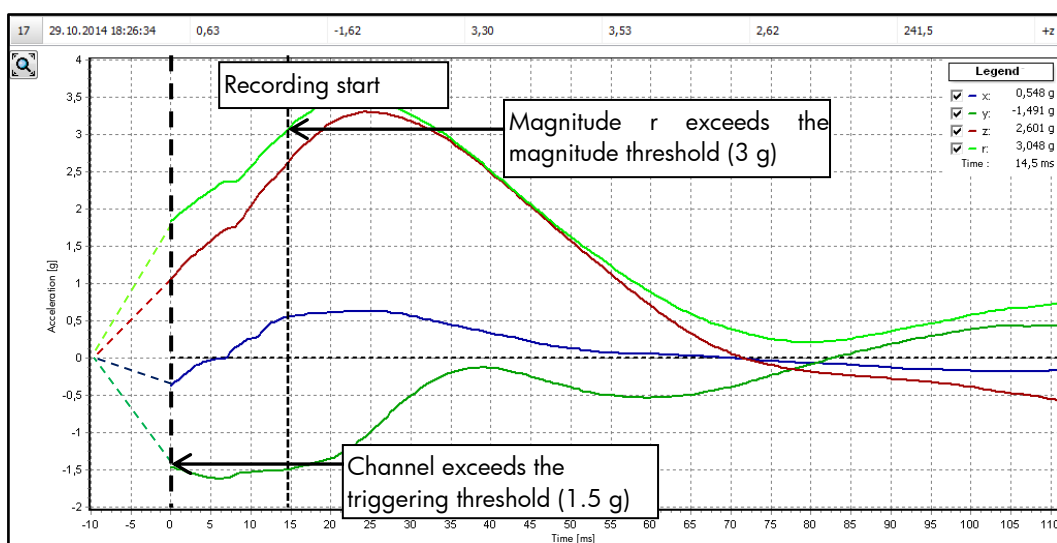

Image 55: Criteria for the shock recording

The largest single pulse within the scanning time of 1024 ms is considered as a shock event, which meets all set conditions (shock magnitude, shock strength, shock duration). A single pulse is deemed to be completed, if all three channels (x,y,z) are below 200 mg according to magnitude for more than 100 ms (fading condition). The shock pulses are compared with each other regarding their shock strength (corresponds to time integral over the course of the shock magnitude).

The following should be explained on the basis of Image 56. The 1st pulse begins with the start of the recording and fades away again very quickly. The following 2nd pulse begins with the repeated exceeding of the triggering threshold (1). At point (2) all channels fall below the 200mg limit, however, no longer than 100 ms (3). At point (4) the fading condition is finally fulfilled and the 2nd pulse is completed. In over 200 milliseconds after that the 3d pulse is finally detected. Though the 3nd pulse shows the highest maximum amplitude, the 2nd pulse is the greatest with respect to the shock strength and is used here for the shock evaluation.
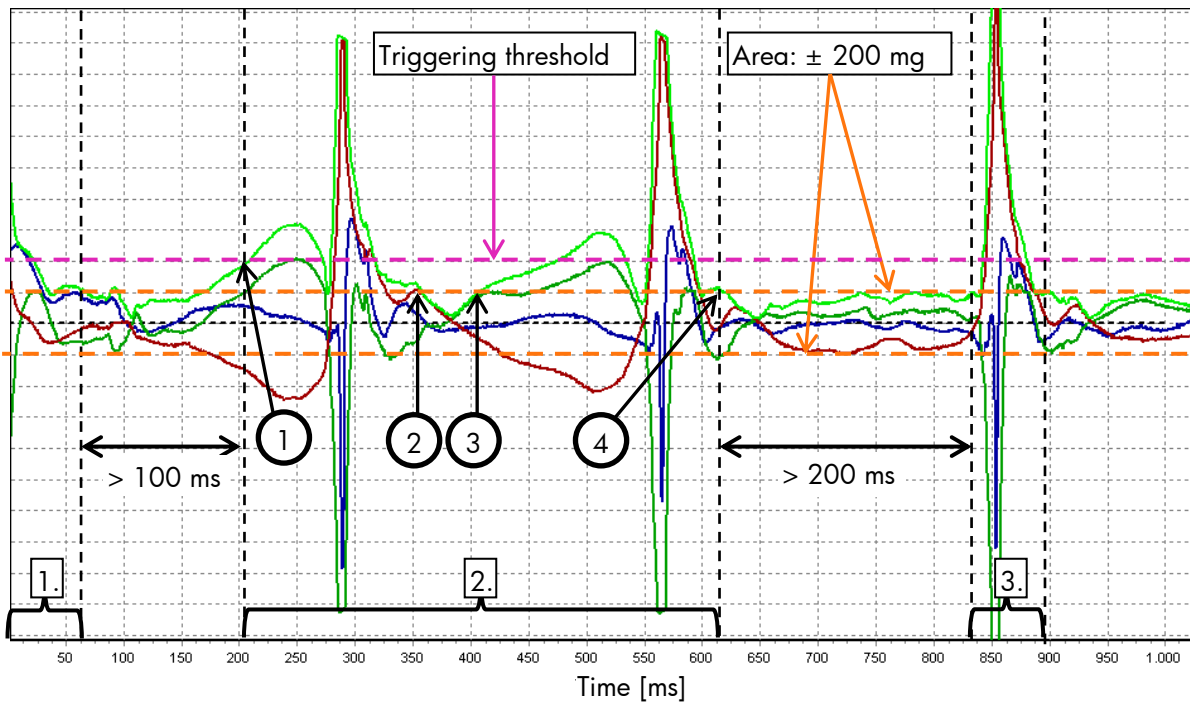

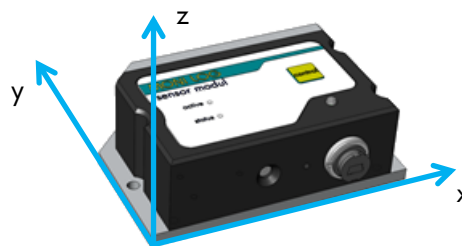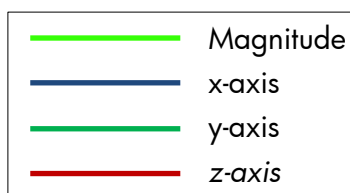Image 56: Shock curve with 3 single pulses

Image 57: Sensor module main axes for acceleration/inclination

5.4.10 Configuration of the sensor module

The configuration area becomes only then visible, if a sensor module which is configurable (via USB or via Bluetooth) is connected. When viewing data sets from files or in the MONI LOG® data link sensor this window is not shown (Image 58).
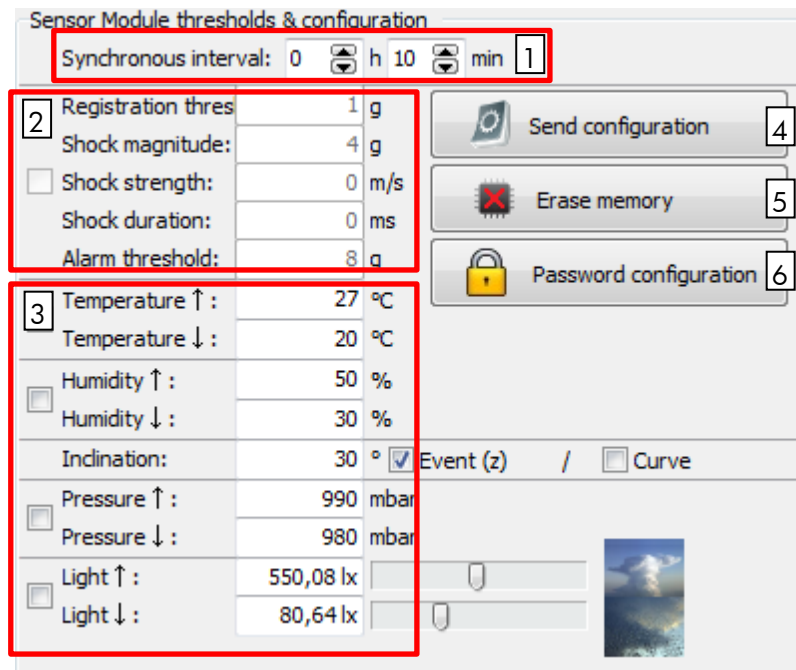

Image 58: Measurement data configuration area of sensor module

1) Synchronous interval: *Time between the synchronous recording of measurement data (temperature, humidity, pressure, inclination and light)*

2) Configuration for shock measurement

3) Configuration for alarm events

4) Send configuration: *Sends all currently performed settings to the sensor module*

5) Erase memory: *Erases all data in the memory of the sensor modules*

6) Password configuration: *Enables the change of the device password*

Note:
The meaning of the individual settings fields can be
found in the description in chapter 5.4.3 "Status and thresholds".

Change of synchronous interval & setting of alarm events:

The setting of the synchronous interval is carried out with the help of the selection fields (Image 58, no. 1) "Synchronous interval" (in hours + minutes).

The input fields lying below (Image 58, no. 2 and 3) enable the parameterisation of alarm events. On the basis of the set threshold values (settable partially below and upper threshold values) alarm events are saved, if during the measurement run the exceedance or falling below of threshold values is detected. A set check mark in front of the input fields activates the generation of the alarm events. In the MONI LOG® data link sensor there is a setting possibility for occurring events to send directly an email (alarm email).

The settings are saved and transferred to the sensor module by a click on "Send configuration" (Image 58, no. 4).

Attention!
Shock events can only be recorded, if the sensor module
is equipped for this, otherwise the area (2) is highlighted in grey!

Erase memory:

The function "Erase memory" (see Image 58, no. 5) erases all data located in the sensor module. This function is only available in case of a direct USB connection to a sensor module.

Attention!
Ensure that you have completely read out the data and saved them
as *.snw file before erasing! Erased data cannot be restored!

Password configuration:

There is a possibility to protect the sensor module with a password (Image 58, no. 6). All accesses via USB are blocked during password activity until the password is entered correctly. The password may contain up to 8 signs. By a click on the green check mark the new password is transferred.

Note:
To remove a password again, simply leave the field "New password" free.

Image 59: Creating/changing password

- *Old password:*   Enter here the existing password
- *New password:*   Enter here the desired new password
- *Repeat password:*   Enter the new password again for confirmation

Change of the sensor module device name:

The device name of the sensor module can be changed by the user (see Image 60). Maximum 16 signs are available for this. By pressing the Enter key of your keyboard the name is saved and transferred to the sensor module.

The name of the module can be selected individually. A naming according to measuring point, measuring task, etc. is recommended (e.g., "storage space rear").

Setting recording period:

The desired recording period for the device can also be set by the user (see Image 60). If a recording period is defined, the measured value recording begins at the start time. With the exceedance of the stop time the measured value recording is ended. If the input fields are left blank, the measurement recording runs as long as the device is switched on.

The input of start and stop time is carried out in the date format: **dd.mm.yyyy hh:mm:ss**

The configuration of the recording period is carried out by activation of the Enter key on your keyboard or by a click on the button "Send configuration".
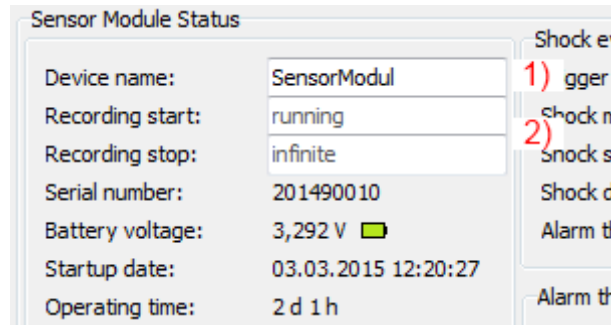
Image 60: Configuration of device name (1) and recording period (2)

Setting of sensor module device time

The synchronisation of the system time is carried out by a click on the clock symbol (see Image 61). The sensor module operates inside the device with coordinated universal time (UTC). It is the same worldwide, i.e., independent of time zones. The evaluation programme shows the system time converted to your local time depending on the time zone setting of your PC.

Image 61: Setting of sensor module device time

6. FIRMWARE UPDATE

6.1 PREPARATION

Prior to the firmware update the following points must be observed:

- The activation of the update mode can only be carried out, if the MONI LOG® data link sensor or the MONI LOG® sensor module is switched off. If your device is still switched on, please switch it off.

- Have ready the included mini USB cable and plug one end of the cable in a free USB port of your computer for the preparation. Do **not** plug the USB cable into the MONI LOG® device yet!

- Ensure that on your computer no sensor network PC programmes are executed and all necessary drivers are installed.

Note:

Back up all measurement and diagnostics data of your device prior to the firmware update to prevent a possible data loss in case of an update failure.

6.1.1 MONI LOG® data link sensor

In the switched off condition of the device press the key SET and afterwards additionally the key MODE and keep both keys pressed for at least 5 seconds (observe display). Now, plug, according to the request appearing in the display, the other end of the USB cable into the USB port of the MONI LOG® data link sensor. After successful detection of the USB connection the text "Ready" appears in the display.

If within 30 seconds no USB cable is plugged in, the device switches automatically off after the time has expired.

Proceed now with the instructions according to chapter 6.2 "Carrying out update".

6.1.2 MONI LOG® sensor module

In the switched off condition of the device connect the USB cable and keep the *control* key pressed (~5 seconds, green LED is illuminated) until the red LED starts to flash with 1 Hz. The update mode is active now. It only remains active as long as the USB cable is connected. If the *control* key is released before the detection of the update mode, the device starts the normal operating mode.

Proceed now with the instructions according to chapter 6.2 "Carrying out update".

6.2 CARRYING OUT UPDATE

After you have started your **MONI LOG**® device in the update mode, start the PC software. The PC software should automatically detect the **MONI LOG**® device which is in the update mode and open an info window which you can close by a click on "OK" (see Image 62).

All images of this chapter show the firmware update of a **MONI LOG**® data link sensor. The procedure during the firmware update of a **MONI LOG**® sensor module is identical. The name of the shown update file deviates, where applicable, from the name of the provided update file.
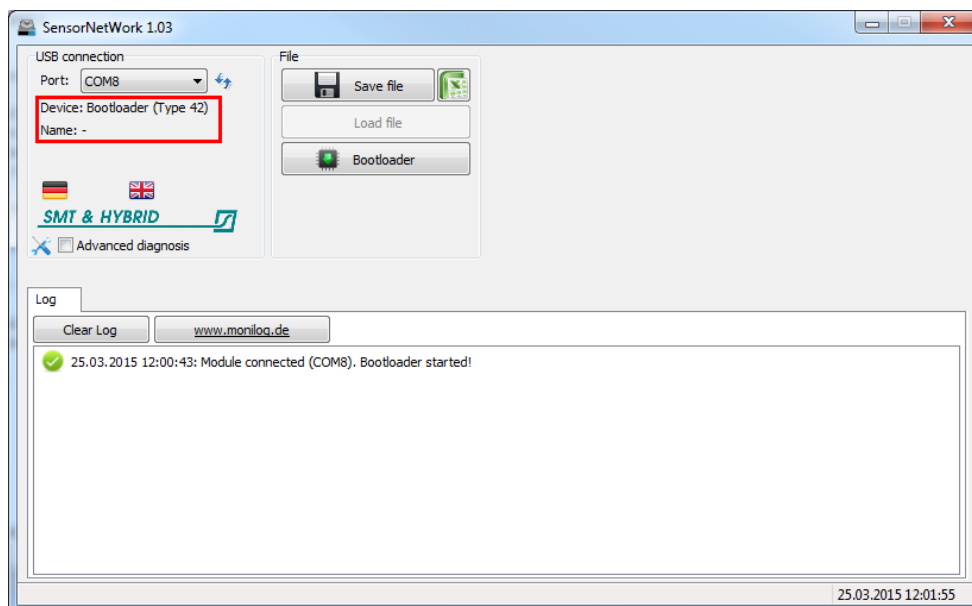

Image 62: Successful detection of the update mode in the PC programme

Now, click on the button "Bootloader" (Image 63). Afterwards, a file dialogue opens in which you select and open the corresponding update file for your **MONI LOG**® device (Image 64).
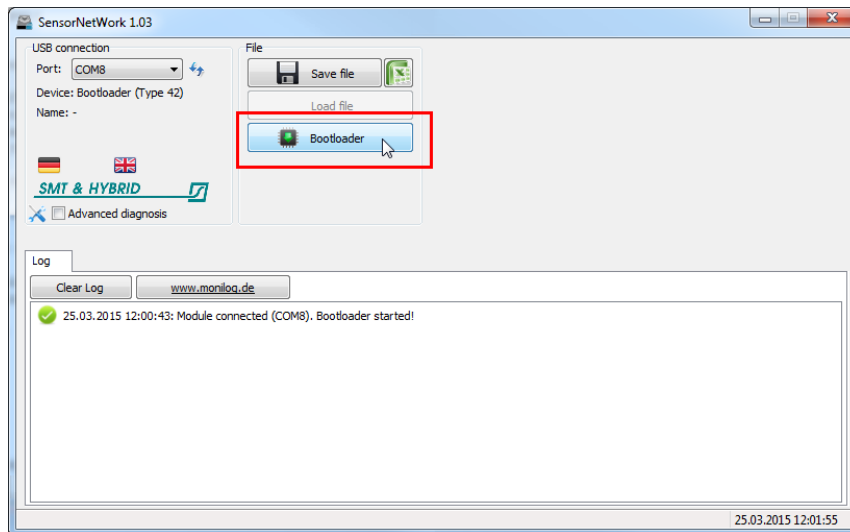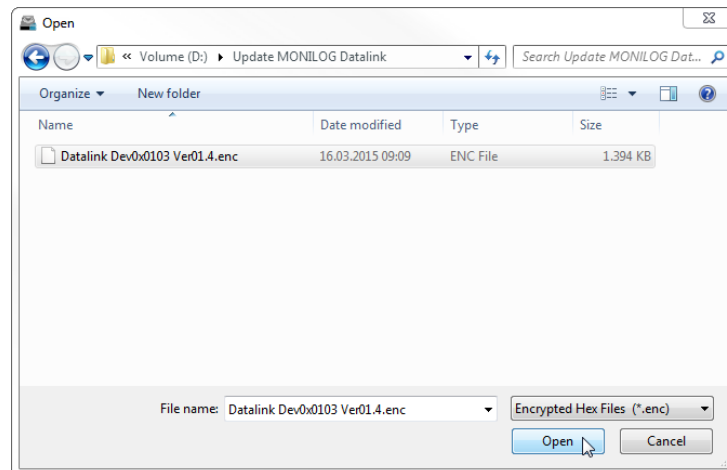
Image 63: Start of the firmware update

Image 64: Selection of the corresponding update file in the file manager

To start the update process click on the button "Yes" in the appearing window (see Image 65). To interrupt the update process, click on "No". After a click on "Yes" the update process cannot be interrupted.

To prevent device defects, the USB cable must not be removed from the device until the completion of the update! The progress of the update process can be followed as percentage indicator in the button "Bootloader".
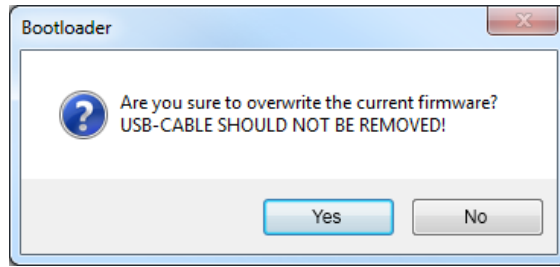
Image 65: Confirmation of the firmware update

After successful completion of the update a corresponding information window is displayed (see Image 66). The **MONI LOG®** device will switch off automatically independently at the same time.
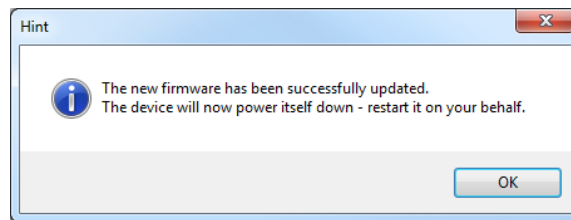

Image 66: Information message after successful firmware update

To start the normal operating mode of the device, unplug the USB cable. The device can be switched on normally again.

If the update process fails, a corresponding error message is displayed (see Image 67), the **MONI LOG®** device switches off independently. Due to the update interruption the device firmware could not be completely installed. In some circumstances, the device is not switchable any more in the normal operating mode due to this. Please repeat the update process according to the instructions of the entire chapter 6 ″Firmware Update″.
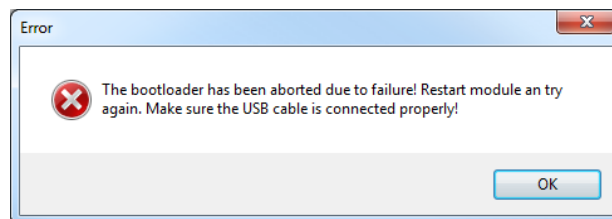

Image 67: Information message after failure of the firmware update

7. DECLARATION OF CONFORMITY

WARRANTY CERTIFICATE

MONI LOG® data link sensor and MONI LOG® sensor module

Against submission of this warranty certificate we grant a 12-month warranty from the date of delivery for the above instrument.

In case of deficiencies we first have the right of rectification, either rectification of the deficiency or subsequent delivery. Should the rectification fail, and only then, we will take back the instrument and reimburse the purchase price. Any further warranty claims shall be excluded.

This warranty covers all faults that impair the proper functioning of the instrument due to technical defects of individual components or assemblies.

Batteries and rechargeable batteries as expendables are not covered by this warranty.

This warranty will only be granted if the instrument has been used properly for its intended purpose.

Any attempts of the warrantee or third persons to repair the instruments or to intervene in any other way exclude warranty claims.

Any mechanical damage which is the result of undue stress also excludes warranty claims.

We will immediately notify the warrantee of any repair work excluded from warranty coverage.

If the instrument is sent in together with the warranty certificate, this will be considered as a repair order for the elimination of all damage.

The warrantee can exclude partial services.

In case of any malfunctions of the instrument, please state the serial no. You can find it on type label or on the logs when evaluating your data.

SMT & HYBRID GmbH	**Telephone:**	+49 351 / 266 13 0
An der Prießnitzaue 22	**Fax.:**	+49 351 / 266 13 10
D – 01328 Dresden	**Email:**	info@smt-hybrid.de
GERMANY		

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