

INSTRUCTION MANUAL

for

MONI LOG[®] EnDaL smart

(Transport data logger)



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.

This device complies with Industry Canada's RSS-310. Operation is subject to the condition that this device must not cause harmful interference and must accept any interference, including interference that may cause undesired operation of the device.



Cet appareil est conforme à la norme RSS-310 d'Industrie Canada. L'opération est soumise à la condition que ce dispositif ne doit pas causer d'interférence nuisible et doit accepter toute interférence, y compris les interférences qui peuvent entraîner un mauvais fonctionnement de l'appareil.



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)

This device has been designed to operate with the antennas listed below (see Technical Parameter). 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

Thank you

for having chosen the MONI LOG[®] EnDaL smart.

Scope of delivery¹ (standard):

- MONI LOG[®] EnDaL smart, incl. 2 x R14, alkaline or lithium batteries according to your requirement
- Installation CD
 - Configuration software „MONI LOG Analyzer“ 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)
- GPS antenna

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.

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

1.2 FUNKTIONALITY

The MONI LOG® **EnDaL smart** is a universal data logger. Developed for long-term measurement applications, it is perfectly suited 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, and inclination enables a wide range of different measurement applications.

Configured alarm thresholds ensure the reliable detection of exceedances of limit values. The possibility of position determination of the MONI LOG® **EnDaL smart** at events and time-controlled allows both the verification of the transport route and a precise localisation of critical transport processes.



The up to 15,000 recorded position data sets, including speed and direction, can be imported afterwards into Google Earth or similar software and be evaluated.

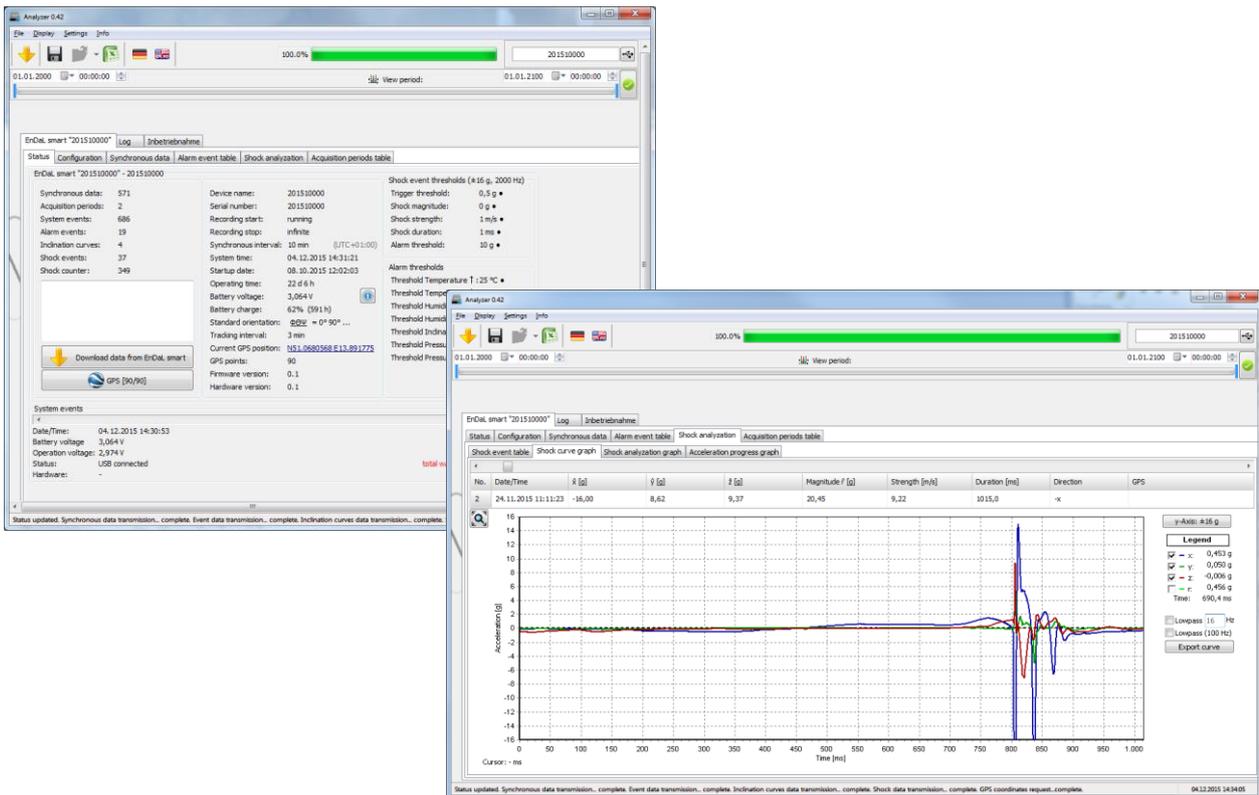


The **compact and network-independent design** enables simple fixing on or in transport goods and transport devices.

The case of the device protects against dust and splash water (**degree of protection IP 65**) and thus is also suitable for the exterior use. Thanks to this, the MONI LOG® **EnDaL smart** 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. Thanks to very low current consumption and associated very long, maintenance-free operating time, the MONI LOG® **EnDaL smart** is perfectly suited for self-sufficient long-term applications. Energy-optimised operating settings render possible a self-sufficient operational time of up to one year under rough ambient conditions.

The licence-free configuration software **MONI LOG[®] Analyzer** 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[®] EnDaL smart contains, excluding the internal batteries, no corrosive or environmentally damaging substances.

Used batteries must be immediately removed from the device and be 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[®] EnDaL smart by means of 2 exchangeable alkaline or lithium batteries (type C | R14). These can be bought in specialized stores according to the specification stated in the instruction manual.

When lithium batteries are used on transport, the MONI LOG[®] EnDaL smart must be labelled as hazardous material of class 9, according to the Worldwide UN classification. 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!

Decommissioning

In case of decommissioning the devices must be properly switched off and all batteries must be removed from the cases and be disposed of in an environmentally friendly manner.

2. TECHNICAL PARAMETERS

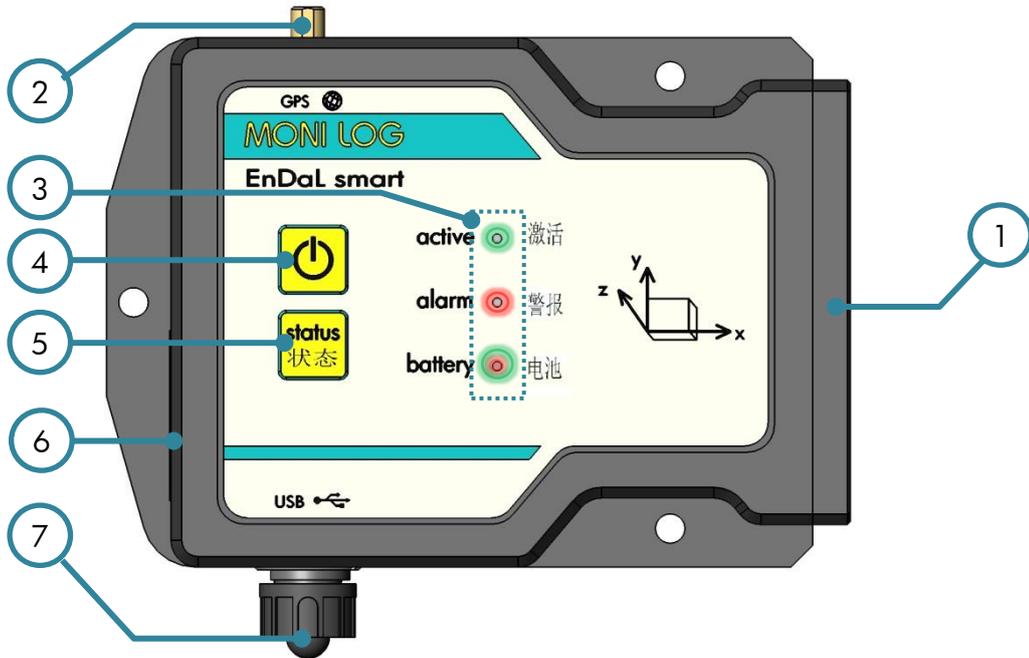
Case	
Case material	Aluminium, powder-coated
Degree of protection	IP67
Weight	<ul style="list-style-type: none"> • 0.8 kg (standard version without batteries) 38g (each magnetic base, 3 pieces per module optional)
Dimensions (H/W/D)	35 x 140 x 100 mm ³ (standard version) Ø25mm x 15mm (small magnetic base)
Mounting type	surface mounting (screw fixing recommended), alternatively magnetic base mounting (upon request)
Application conditions	
Operating and storage conditions	<ul style="list-style-type: none"> ▪ -20°C to +70°C with alkaline batteries ▪ -40°C to +85°C with Lithium batteries
Data memory, time	
Data retention	minimum 10 years (independent of battery condition)
Memory type/size	32 MB flash parameter and data memory
System time	Date / Time as UTC time supported independently from the power supply by an internal battery, exchange at SMT & HYBRID after 6 years needed
Voltage supply	
Internal	<ul style="list-style-type: none"> ▪ 2 batteries of type C or R14 exchangeable <ul style="list-style-type: none"> ○ alkaline batteries (2 x 1.5 V; 8000 mAh) ○ Lithium batteries exchangeable (2 x 3.6 V; 8500 mAh) ▪ Service life: at least 1 year (in case of synchronous interval of 10 min, all options active)
External interfaces	
USB	<ul style="list-style-type: none"> ▪ USB 2.0 Client (Mini-USB AB)
Indicating and operating elements	
LED	1 green <i>active</i> LED 1 red <i>alarm</i> LED 1 red-green <i>battery</i> LED (bicoloured)
Key button	1 On/Off key

	1 status key	
Position determination		
Channels	32 satellites (GPS, SBAS, BeiDou, QZSS)	
Antenna	SMA socket for the connection of an external active antenna 50 Ω (3-30 mA / 3 V / rod or cable antenna)	
Tested GPS antenna		
Type	<ul style="list-style-type: none"> ▪ Chinmore GS-10DSMA3V-002 (magnetic antenna with cable, SMA plug) 	
Amplification/ Impedance	<ul style="list-style-type: none"> ▪ 30 dBi / 50 Ω 	
Device approval	<ul style="list-style-type: none"> ▪ CE, IC, FCC 	
Device sensors		
Measuring quantity	Measuring range	Tolerance
acceleration/shock	+/- 16 g (3 axes)	+/- 50 mg
	Upon exceedance of a recording threshold, a shock curve (2kHz, 1sec) is recorded. The 500 largest shock curves are saved. (optional: 100g/400g; 1kHz)	(+/- 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)
Inclination	Inclination calculation from static acceleration Upon exceedance of an inclination threshold, an inclination curve (12 Hz, 8 sec) is recorded. Up to 640 inclination curves are saved.	+/- 5 degrees

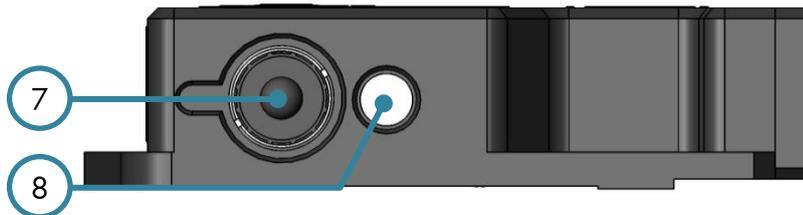
3. DEVICE DESCRIPTION OF MONI LOG® EndaL smart

3.1 DEVICE SETUP / DEVICE VIEW

Top view:



Front view:



- | | |
|------------------------------------|--------------------------------------|
| 1 Battery cover | 5 <i>status</i> key |
| 2 connector for GPS antenna | 6 Name plate |
| 3 Status and activity LEDs | 7 USB port |
| 4 <i>On/Off</i> key | 8 Temperature/humidity sensor |

3.2 OPERATION OF THE MONI LOG[®] EnDaL smart

For the operation of the device, there is an "On/Off" key and a "status" key. The "On/Off" key serves to activate and to deactivate the device. The "status" key serves to request a simple visual status output. For the visualisation of the possible statuses, there are 3 LEDs available at the device.

Checking the on-state of the device

In order to determine whether the MONI LOG[®] EnDaL smart is switched on or off, **briefly** press the *On/Off* key:

Green active-LED does **not** light up → the device is **OFF**

Green active-LED **briefly** lights up → the device is **ON**

Switching on the device

To switch on the EnDaL smart, press the *On/Off* key (~1 second) until the **green** LED lights up. After that, release the key. Subsequently, the device starts recording data.

If the device is provided with a switch-on/switch-off code, it can only be activated via the software. In order to signalise this, the *active* LED and the *alarm*-LED begin to flash when the *On/Off* key is pressed for a longer time (~1 second). If no activation is carried out via the software, the device switches off again after 20 seconds. In order to activate the device, connect it to a PC while the *active* and the *alarm*-LEDs are flashing, and start the MONI LOG[®] Analyzer. When reading out the device, it is recognised that the device is password-protected. At this point you are requested to enter the device password. Follow the instructions of the software in order to switch on the device.

Explanations for the configuration of the switch-on/switch-off code can be found in chapter 4.3.11 in the paragraph „Password configuration“

Switching off the device

To switch off the EnDaL smart, keep the *On/Off* key pressed. After a short time, the **red** *alarm*-LED will start to flash. If you continue to keep it pressed, it will light permanently. Now it can be released. Then the device switches off. This can be verified by briefly pressing the *On/Off* key or the *status* key.

If the *On/Off* key is released while the *alarm*-LED is flashing, the device remains switched on.

If the device is provided with a switch-on/switch-off code, it can only be deactivated via the software. In order to signalise this, the *active*-LED begins to light up and the *alarm*-LED begins to flash when the *On/Off* key is pressed for a longer time (~1 second). In order to switch off the device, connect it to a PC and start the MONI LOG® Analyzer. When reading out the device, it is recognised that the device is password-protected. At this point you are requested to enter the device password. Via the tab "Configuration" and the button "Code word configuration", you can switch off the device now.

Explanations for the configuration of the switch-on/switch-off code can be found in chapter 4.3.11 in the paragraph „Password configuration“

3.3 MEANING OF THE LED STATUSES

LED	What?	How?	When?	2 nd L E D ?	Meaning
Green (active)	illuminated	~ 1 second	switching on	-	device switched on
Green (active) & Red (alarm)	flashing	max. 20 seconds	switching on	Green & Red	a switch-on password via software is expected
Green (active)	illuminated	1x flashing briefly	key pressed briefly	-	device is active
Green (active)	illuminated	~ 1 second	USB active	-	USB connected/disconnected
Green (active)	flashing	irregularly	USB active	-	USB data transmission
Green (active)	illuminated	0.1 - 8 seconds	device active	-	recording of shock, synchronous or event data
Green (active)	flashing	regularly	device active		searching for GPS coordinates
Green & Red	illuminated	4 seconds permanently	USB configuration	Green & Red	memory is deleted

LED	What?	How?	When?	2 nd LED ?	Meaning
Red (alarm)	flashing	3x briefly	<i>On/Off</i> key pressed longer than 2s	-	device prepares deactivation
Red (alarm)	illuminated	while key is pressed	<i>On/Off</i> key pressed longer than 3s	-	device switches off (LED goes out when key is released)
Red (alarm)	flashing	up to 3x briefly	<i>On/Off</i> key pressed longer than 2s → and then released	Green flashes briefly	device remains switched on
Red (alarm)	flashing	3x briefly, 3x long, 3x briefly (SOS)	switching on	Green	Hardware error in the memory
Red (alarm)	flashing	3x briefly, 3x long, 3x briefly (SOS)	switching on	-	Battery empty, device switches off again
Red (alarm)	flashing	5x briefly	switching on or USB configuration	Green	main position could not be determined → inclination event inactive
Red (alarm)	flashing	sustained at 1 Hz	switching on	-	Update mode active or no valid firmware found

Green (active)	illuminated	while pressed	<i>status</i> key pressed	others possible	device is active and records data
Green (active)	not illuminated	while pressed	<i>status</i> key pressed	others possible	device is inactive, it is before the time of activation or after the time of deactivation (no data are recorded)
Green (active)		while pressed	<i>status</i> key pressed	others possible	

LED	What?	How?	When?	2 nd LED?	Meaning
Red (alarm)	illuminated	while pressed	<i>status</i> key pressed	others possible	An alarm value has been exceeded
Red (alarm)	not illuminated	while pressed	<i>status</i> key pressed	others possible	No alarm values has been exceeded yet
Green (battery)	illuminated	while pressed	<i>status</i> key pressed	others possible	The battery still has a residual charge of more than 50%
Orange (battery)	illuminated	while pressed	<i>status</i> key pressed	others possible	The battery has a residual charge between 50% and 25%
Red (battery)	illuminated	while pressed	<i>status</i> key pressed	others possible	The battery has a residual charge between 25% and 10%
Red (battery)	flashing	while pressed	<i>status</i> key pressed	others possible	The battery has a residual charge of less than 10%

3.4 DEVICE RUNTIME AND BATTERY CHANGE

Device runtime

The device runtime of the MONI LOG® EnDaL smart depends on the set measurement parameters. Here, the interval setting of the GPS position determination is the key factor. The connection between device runtime and GPS or synchronous interval is illustrated in the following figure:

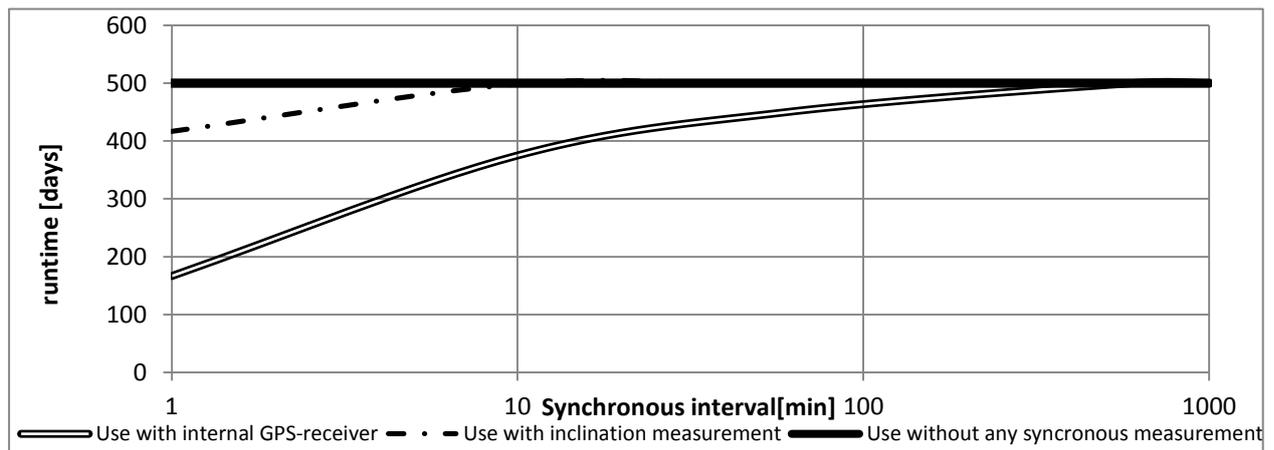


Figure 1: Estimation of the device runtime in dependence on the synchronous interval

Battery change

Prior to the battery change, the MONI LOG® EnDaL smart must be properly switched off. Otherwise a data loss of the device cannot be excluded.

Attention:

Ensure the right 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 (cross recess, H size2).
Remove the battery bridge by loosening the fastening screws by means of a screw driver (hexagon socket, size 2.5 mm). Afterwards, you can simply remove the batteries.
- 2) Now insert the new battery according to the specified polarity into the device.
- 3) In a last step, screw in tight again the battery bridge and the battery cover. Please take into account the maximum tightening torque of 0.5 Nm.



3.5 MOUNTING INFORMATION

The device can be attached by means of 3 fastening screws (see Figure 2) on the transported goods, according to the marked mounting holes. Optionally, the device can also be mounted on magnetic surfaces with the aid of magnetic bases.

For the mounting of the GPS antenna of the MONI LOG® EnDaL it must be taken into account that a clear view from the mounting location to the sky considerably improves the GPS reception conditions. An enclosure or covering of the GPS antenna may considerably deteriorate the GPS reception or even completely prevent it. A poor GPS reception may lead to an increased current consumption and thus to a shortened device runtime.

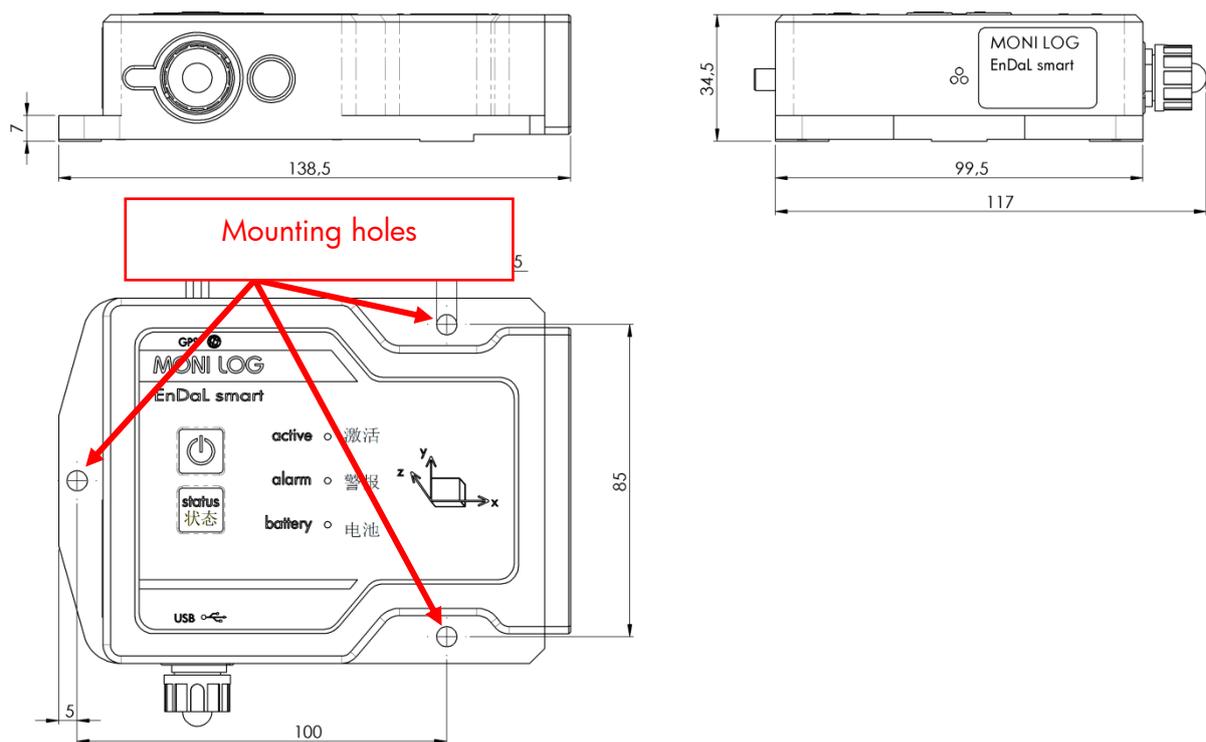


Figure 2: Dimensions and mounting information of the EnDaL smart

4. PC SOFTWARE – MONI LOG® ANALYZER

The software MONI LOG® Analyzer can be used both for the readout and configuration of the MONI LOG® EnDaL smart and other MONI LOG® devices. It is intended for the display and analysis of the recorded data in tabular and graphic form. Furthermore, data sets can be saved locally on your PC or loaded from your PC.

4.1 INSTALLATION

4.1.1 General software installation

The supplied CD contains the installation of the Software MONI LOG® Analyzer. Please start the installation by double-clicking on the file „setup.exe“, and follow the instructions.

Together with the installation of the evaluation software MONI LOG® Analyzer, the required USB device driver is installed. If the installation of the USB driver was not successful, the driver can be installed manually. Please refer to chapter 4.1.2 .

4.1.2 USB driver

Note:

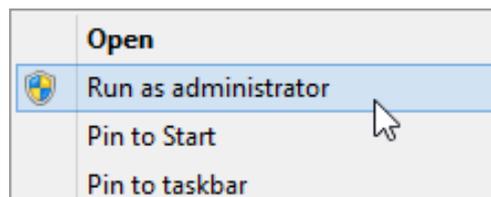
If there are problems with the installation of MONI LOG[®] Analyzer, it may be necessary to install the driver for the USB connection manually.

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

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

Installation process

1. Connect the MONI LOG[®] EnDaL smart by means of the included USB cable to your PC. When connecting the device, the green *active-LED* lights up. After the LED has gone out, the USB device is ready.
2. Open the folder of the included CD and execute the file “USB-driver-install.exe” as administrator. (via right-click)



3. Follow the instructions until the installation is finished. Subsequently, you can read out the MONI LOG[®] EnDaL smart using the software MONI LOG[®] Analyzer.

4.2 GENERAL USE OF THE PC SOFTWARE

4.2.1 Establishing the device connection

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

If the evaluation programme has already been active before plugging the device, move the mouse in the area [COM-Port] (Figure 3). The connection is established automatically. If you would like to connect a device at another COM-Port, click onto the USB symbol and select it in the selection window (see for this Figure 4).



Figure 3: No connection → select COM-Port

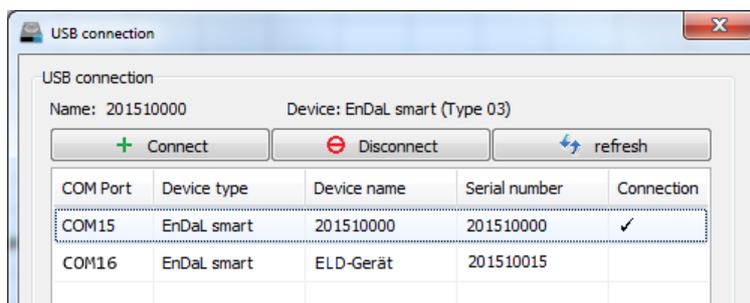


Figure 4: USB connection window: currently connected to COM15
COM16 also available

In case of connection problems:

If no connection can be established to the device, select the Refresh button (blue double arrow) and disconnect the USB cable from the device. Afterwards, reconnect it with the USB cable.

4.2.2 File area

Data that are read out from a MONI LOG® device can be saved as file. A click on the button “Save file” opens the corresponding dialogue. A click on the button with the Excel symbol exports the read-out files into an Excel file.



Figure 5: File area

Likewise, saved data can be fed again into the PC programme. The button “Load file” opens the corresponding dialogue for the selection of the desired file.

4.2.3 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 device during the established USB connection. Error messages and notes, e.g. for executing configuration commands, connection establishment to devices, saving of data etc. are listed here.



Figure 6: Log-window

4.2.4 View of the measurement data

Graphs

In a graph it is possible to zoom in. For this purpose, draw up a selection window using the mouse (see Figure 7). The view of linear represented graphs can be shifted using the held right mouse button . Logarithmically represented graphs can be zoomed at the desired place, but cannot be moved. By moving the mouse wheel up/down, concentric zooming is carried out. The standard zoom is restored by double-clicking on the graph, or using the button .

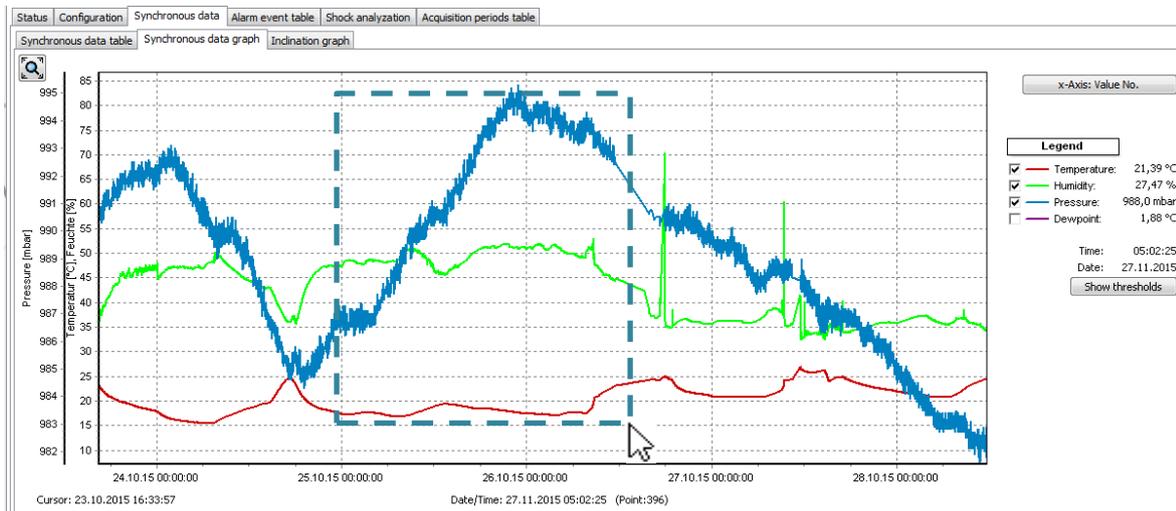


Figure 7: Zoom-selection window

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 the maximum/minimum values. The sorting is made alternately in ascending and descending order. The data sets remain unchanged by this.

Synchronous data table									
		Synchronous data graph			Inclination graph				
Calculate extremes									
No.	Date	Time	Temperature [°C]	Humidity [%]	Dewpoint [°C]	Pressure [mbar]	Light [lx]	Inclination x [g]	Inclination y [g]
1	24.11.2015	11:12:25	24,77	39,07	9,91	989,9	0,0	-0,006	-0,012
2	24.11.2015	11:22:25	24,95	21,77	1,64	989,2	0,0	0,004	-0,011
3	24.11.2015	11:32:25	24,98	21,31	1,37	989,1	0,0	0,001	-0,011
4	24.11.2015	11:42:25	25,02	21,25	1,36	989,1	0,0	0,003	-0,012
5	24.11.2015	11:52:25	25,08	21,58	1,62	988,8	0,0	0,004	-0,010
6	24.11.2015	12:02:25	25,13	21,49	1,61	988,8	0,0	0,002	-0,011
7	24.11.2015	12:12:25	25,19	21,25	1,50	988,5	0,0	0,002	-0,012
8	24.11.2015	12:22:25	25,24	21,25	1,54	988,6	0,0	0,002	-0,012
9	24.11.2015	12:32:25	25,29	21,19	1,54	988,2	0,0	0,000	-0,014

Figure 8: Sorting the table columns

4.3 MONI LOG® EnDaL smart...

4.3.1 Reading out status, configuration and measurement data

After the connection to the EnDaL smart is successfully established, the following information is shown in the PC programme:

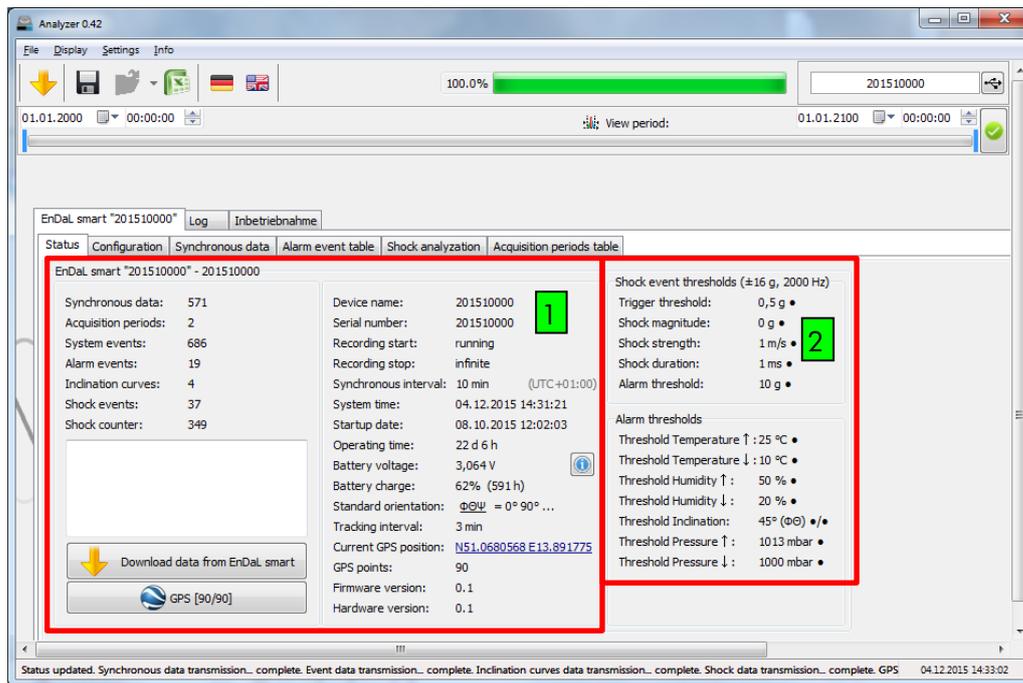


Figure 9: Programme view during connection with MONI LOG® EnDaL smart

- 1) Status data EnDaL smart
- 2) set configuration parameters

After the connection to the device is established, the status data, configuration and acquisition periods are read out automatically. The measurement data, such as synchronous data or shock curves, are retrieved manually via the button „Read out EnDaL smart“. 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. 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 not disconnect the USB cable from your PC or EnDaL smart, as long as the data transmission takes place!

4.3.2 Overview window

The overview shows the current system time, the set synchronous interval and the number of the saved data sets (see Figure 10).

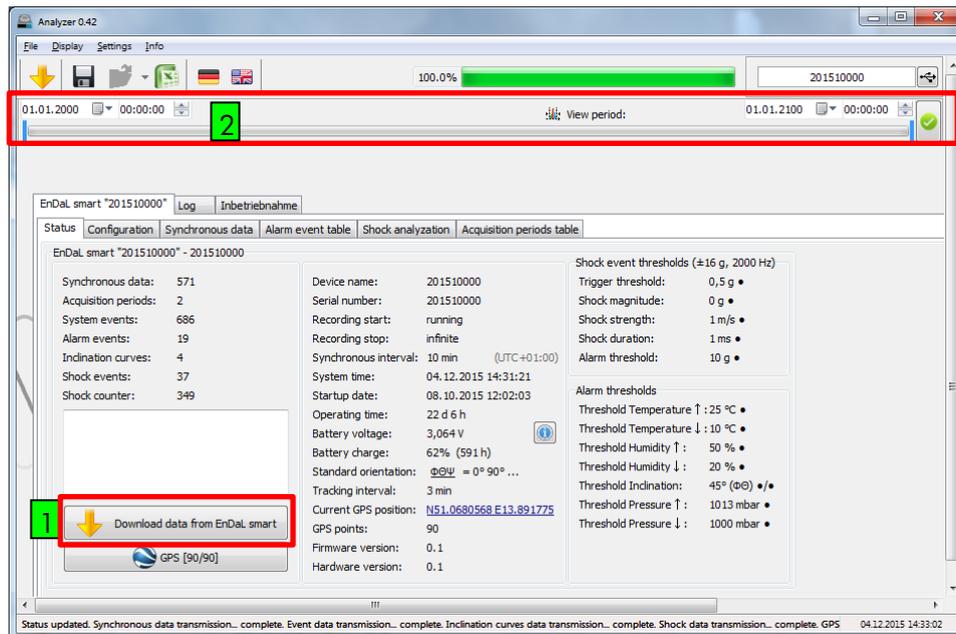


Figure 10: Overview window of the EnDaL smart

Moreover, the following functions are available in the overview window:

1) Reading out the measurement and diagnostic data

The retrieval of all recorded measured values and diagnostic data is made by clicking on the button "Reading out EnDaL smart". According to the available measured values the corresponding programme and diagram tabs open.

2) Defining the view period

By means of the view period (see Figure 10, no. 2), the display of data can be limited to the desired time range. This facilitates the data analysis and the finding of certain events. Enter the desired start and end date in the fields and confirm the entry with the aid of the Enter key of your keyboard or by means of the green button to the right of the input fields.

Furthermore, the view period can be adjusted via the slide bar; by moving the blue bars with the mouse (see Figure 11).

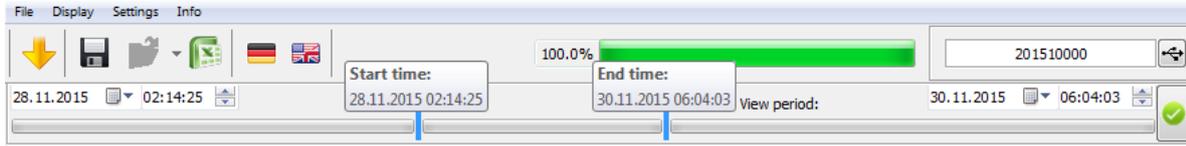


Figure 11: Slide bar for view period

4.3.3 Status and thresholds

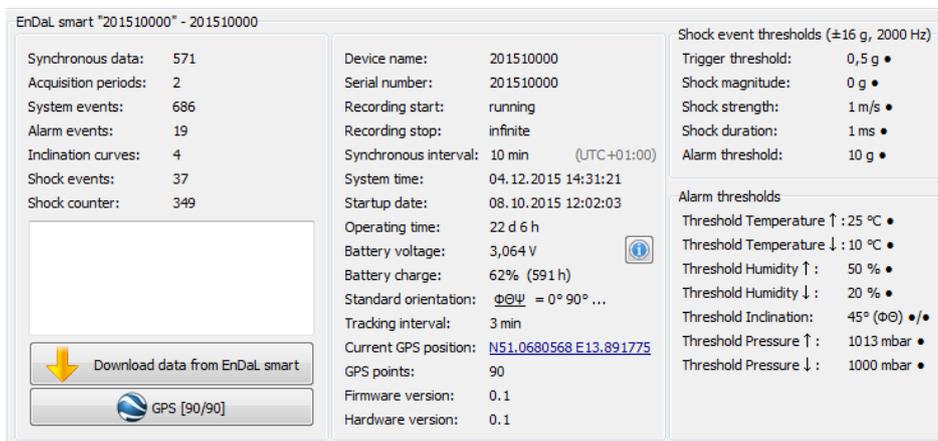


Figure 12: Status and set configuration of a sensor module

Status data:

- Intervals: *number of synchronous records*
- logging periods: *number of the started active periods*
- System events: *number of the recorded events for the extended diagnosis*
- Alarm events: *number of the events with exceedance of alarm thresholds (shock, inclination, temperature, humidity or/and pressure)*
- Inclination curves: *number of the inclination curves due to the exceedance of threshold for inclination events*
- Shock events: *recorded shock curves due to the exceedance of the recording threshold for shock events*

- Shock release counter: *number of the releases by the release threshold of the device. Shocks that will not reach the set recording thresholds (shock magnitude, shock strength and shock duration) are rejected again. Thus, this value is purely informative and signalises that events have been detected by the device.*
- Device name: *device designation by the user (freely selectable)*
- Notes field: *field for programming a note in the device (mailbox)*
- Serial number: *serial number of the device (unchangeable)*
- Start of recording: *beginning of the measurement recording by user or by measurement programme*
- Stop of recording: *end of the measurement recording by user or by measurement programme*
- Synchronous interval: *set interval, at which synchronous data are recorded (temperature, humidity, pressure, inclination, GPS).*
- System time: *current time at the PC, with which the device had been read out.*
- Commissioning: *date and time of the first commissioning*
- Operating hours: *total operating time of the device since commissioning at the manufacturer*
- Battery voltage: *voltage of the device battery*
- Battery level: *current percentage battery reserve (estimated device runtime in hours)*
- Zero position inclination: *spatial position of the device when the recording starts*
- GPS tracking: *set interval, for the determination of the current GPS position*
- Last GPS position: *last determined GPS position with deposited link to Google Maps*
- GPS points: *number of the successfully determined GPS position data*
- Firmware version: *current firmware version of the device*
- Hardware version: *current Hardware version of the device*

Shock event thresholds:

- Release threshold: *acceleration value, above which the scanning is activated*
- Recording threshold shock magnitude: *minimal amplitude of the acceleration (storage criterion)*
- Recording threshold shock strength: *minimal „area below the curve“ (storage criterion)*
- Recording threshold shock duration: *minimal duration of the event (storage criterion)*
- Shock alarm threshold: *acceleration value, above which an alarm event is created*
- Memory criterion: *The shock event must reach at least the stated values to befit for memory. This serves to hide the insignificantly small shock events and in this way not to load excessively memory and transmission path (Bluetooth & E-Mail).*
- Filled circle • : *event active*
- Non-filled circle ° : *event not active*

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*
- Inclination/inclination curve: *If the device tilts from its zero position by the stated angle (e.g. 30°), an event is created.
Inclination curves record the course of the tilting over a period of some seconds.*
- Pressure upper/lower: *Upon exceedance/falling below of the values, an event is created*

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 with 12 Hz during a timeframe of 3 seconds; i.e., a faster tilting cannot be detected under certain circumstances.

4.3.4 System events

The system events show events that concern the status and the operating behaviour of the device. Possible errors in the hardware are also recorded. The display field for system events is normally hidden and can be shown by activating the option “Extended diagnosis” in the menu „Settings”.

The following system events can occur:

- Turned on: the device had been switched on
- Hour counter: 24 h of operating time of the device are expired
- Device configured: the device had been configured.
- Thresholds configured: alarm events/thresholds were activated/changed
- Turned off: the device had been switched off
- Time synchronised: the system time of the device had been configured
- USB (dis)connected: the event was caused by activities via the USB interface
- GPS active: device searches GPS-coordinates
- Hardware inactive: parts of the device had been deactivated
- Failure: an internal error occurred please contact the manufacturer

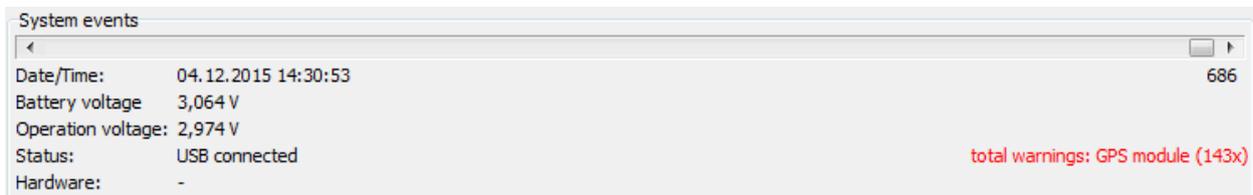


Figure 13: Display of the system events of a MONI LOG® EnDaL smart

4.3.5 Logging periods

The logging periods offer an overview on the individual configuration time segments of the MONI LOG® EnDaL smart. In this way, it can be traced back how the device was configured at the respective period of time.

No.	Start time	End time	Δt	Status	Memor	Interval	Magnit.	Strengt	Duratio	Shock z	Pressure ↑	Pressure ↓	Inclination (Al	Temperz	Te		
1	23.10.2015 16:17:02	26.10.2015 12:06:59	2 d 1	Gerät ausgeschaltet, Batterie niedrig	0%	2 min	8g ●	0m/s ◦	0ms ◦	0g ◦	1013mbar ◦	0mbar ◦	45° (-) ◦/◦	0°C ◦	0°C ◦	0% ◦	0%
2	26.10.2015 15:17:57	26.10.2015 15:19:43	1 min	USB verbunden, Schwellen konfiguriert	0%	2 min	8g ●	0m/s ◦	0ms ◦	0g ◦	1013mbar ◦	0mbar ◦	45° (-) ◦/◦	0°C ◦	0°C ◦	0% ◦	0%
3	04.11.2015 10:19:23	04.11.2015 10:19:59	36 s	USB verbunden, Schwellen konfiguriert, Kanäle kr	0%	1 min	5g ●	0m/s ◦	2ms ●	10g ●	1013mbar ◦	0mbar ●	45° (ΦΘ) ●/	0°C ●	0°C ●	0% ●	0%
4	04.11.2015 10:19:59	-	9 s	Gerät aktiv	0%	1 min	5g ●	0m/s ◦	2ms ●	10g ●	1013mbar ◦	0mbar ●	45° (ΦΘ) ●/	25°C ●	10°C ●	50% ●	20°
5																	

Figure 14: Table with logging periods

The start and end time, the active time period and the reason which has led to the completion of the logging period are shown. Moreover, all set thresholds and event channels for the period are recorded. A new logging period begins, when the device had been switched off or configured.

4.3.6 Synchronous data graphs

Synchronous values - temperature, humidity, inclination & air pressure:

The up to 200,000 data sets of the synchronous values are shown consecutively in a table (see Figure 15). In the programme tab “Synchronous values graph” the synchronous data are shown as a graph. By activating or deactivating the “check marks” in the legend on the right side, the graphs for the quantities temperature, air humidity, air pressure and inclination can be switched on or off (see Figure 16).

No.	Date	Time	Temperature [°C]	Humidity [%]	Dewpoint [°C]	Pressure [mbar]	Light [lx]	Inclination x [g]	Inclination y [g]	Inclination z [g]	Angle Φ	Angle Θ	Angle Ψ	GF
1	23.10.2015	16:17:02	24,43	40,93	10,30	990,6	-0,212	1,024	0,376	69,8°	119,4°	-11,7°	N51.0679807, E13.8	
2	23.10.2015	16:18:59	24,26	35,59	8,08	990,7	-0,215	1,029	0,375	70,0°	119,8°	-11,8°		
3	23.10.2015	16:20:59	24,07	34,98	7,66	990,6	-0,215	1,029	0,373	70,1°	120,0°	-11,8°	N51.0679661, E13.8	
4	23.10.2015	16:22:59	23,91	35,25	7,63	990,4	-0,212	1,029	0,375	70,0°	119,5°	-11,6°	N51.0680594, E13.8	
5	23.10.2015	16:24:59	23,74	35,16	7,44	990,3	-0,211	1,031	0,370	70,3°	119,7°	-11,6°	N51.0679438, E13.8	
6	23.10.2015	16:26:59	23,53	35,65	7,46	990,1	-0,217	1,029	0,373	70,1°	120,2°	-11,9°	N51.0680684, E13.8	
7	23.10.2015	16:28:59	23,47	36,14	7,61	990,5	-0,214	1,027	0,376	69,9°	119,6°	-11,8°	N51.0677467, E13.8	
8	23.10.2015	16:30:59	23,34	36,66	7,70	990,6	-0,212	1,027	0,377	69,8°	119,4°	-11,7°	N51.0677144, E13.8	

Figure 15: View of synchronous data table

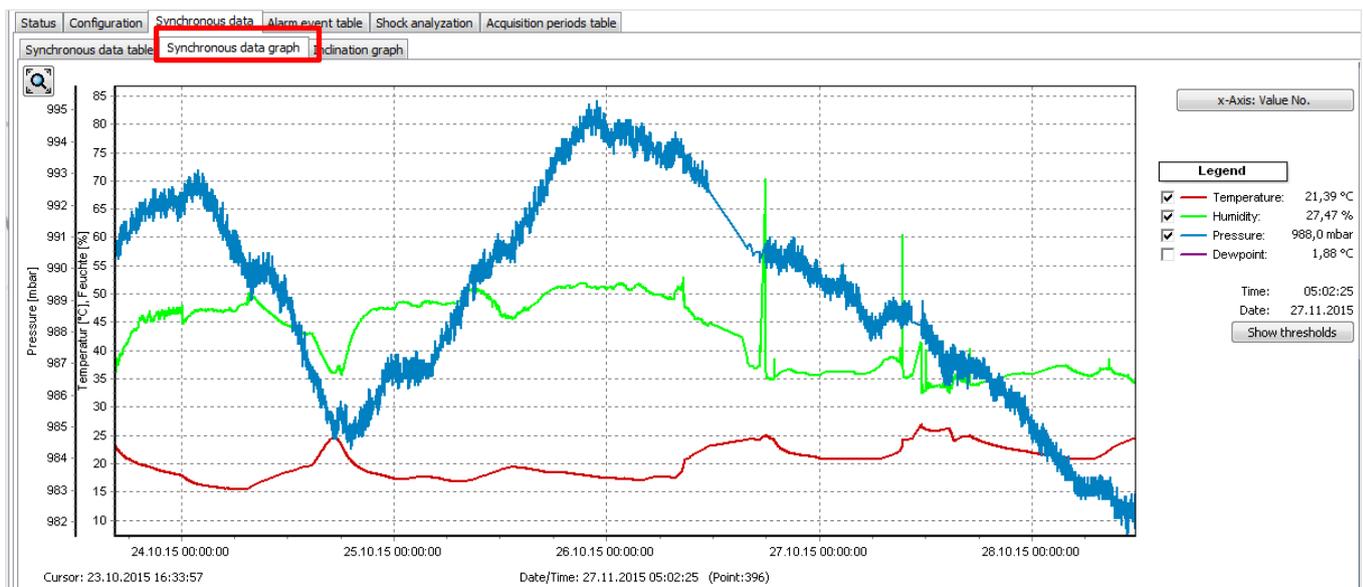


Figure 16: View of synchronous data graph

Inclination graph:

In the programme tab “Inclination position graph”, the static inclination values of the synchronous dates are shown as a graph. By activating or deactivating the “check marks” in the legend on the right side, the x-, y- and z-channel can be switched on or off respectively (see Figure 17). The static inclination can be superimposed by occurring accelerations. The representable area is at ± 2 g. For that purpose, check the magnitude: if it significantly deviates from 1 g, then the actual position is no longer reliably determinable.



Figure 17: 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, use is made of the graphical representation of the three spatial angles in the style of analogous aircraft instruments. The designations are based upon the ENU reference system (“right hand rule”, see https://en.wikipedia.org/wiki/Aircraft_principal_axes).

Calculation of the angles:

- Rotation around x-axis: roll angle $\Phi = \arctan (y/z)$
- Rotation around y-axis: pitch angle $\Theta = \arctan (z/x)$
- Rotation around 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 $(0^\circ, 0^\circ, 0^\circ)$, but $(0^\circ, 90^\circ, -)$. The roll angle is 0° , since the z-axis shows in the direction of the axis of the Earth. The pitch angle is 90° , since the x-axis is standing vertically to the axis of the Earth (namely horizontal). The yaw angle (rotation around the z-axis) cannot be determined, since the gravitational acceleration for both reference axes (x- & y-axis) is almost zero.

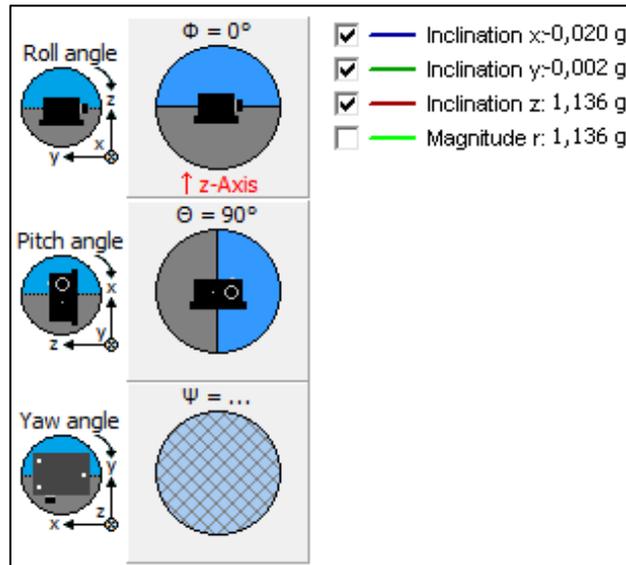


Figure 18: Example of inclination angle display

4.3.7 Inclination curves

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

Inclination events often superimpose with acceleration events in reality. Check in case of inclination curves, if the magnitude has a course of approximately 1 g. If this is the case, this is a “gentle tilting” without jerky movements (see Figure 19). In the other case, a “vibration” or a similar jerky process has triggered the inclination event.

For inclination curves, also the angular display is available.

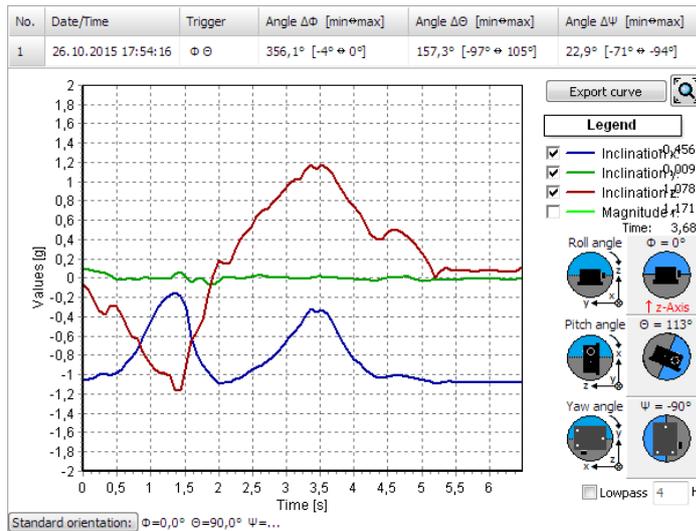


Figure 19: Inclination curves graph

4.3.8 Alarm events

Alarm events comprise all events created by exceeding/falling below alarm thresholds. IN the MONI LOG® EnDaL smart, up to 29,000 alarm events can be stored. They are listed in the programme tab “alarm events” as single tables (pressure events, temperature/humidity events, inclination events/inclination curves, and shock alarm events). With the corresponding configuration, a GPS coordinate point is created for every event. The number of the event is additionally specified in brackets in the data table.

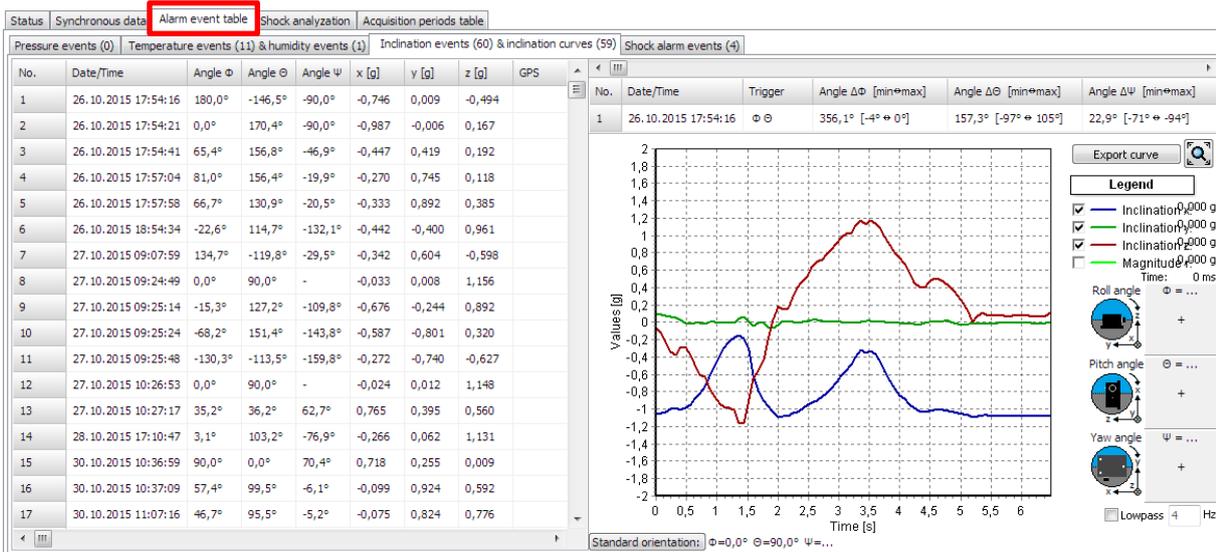


Figure 20: Inclination event table and inclination curves graph

4.3.9 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.

Status Synchronous data Shock analysis Acquisition periods table										
Shock event table Shock curve graph Shock analysis graph Acceleration progress graph										
No.	Date/Time	\hat{x} [g]	\hat{y} [g]	\hat{z} [g]	Magnitude \hat{r} [g]	Strength [m/s]	Duration [ms]	Direction	Curve	GPS
1	19.11.2015 07:28:21	10,00	10,00	10,00	17,32	107,29	2247,7		•	
2	19.11.2015 07:28:23	-10,00	-10,00	-10,00	17,32	107,29	2207,2		•	
3	19.11.2015 07:28:25	-10,00	-10,00	-10,00	17,32	107,29	2478,0		•	
4	19.11.2015 07:28:27	10,00	10,00	10,00	17,32	107,37	280,4		•	

Figure 21: Shock event table

In the programme tab “Shock curves graph” the recorded shock curves are shown as a graph. By activating or deactivating the “check marks” in the legend on the right side, the x,y,z- the magnitude curve can be shown or hidden respectively (see

Figure 22)

In addition, by activating the low-pass filter function and input of the critical 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 “Display range: ± 16 g”, the vertical graph axis is switched between the limits of the curve and ± 16 g.

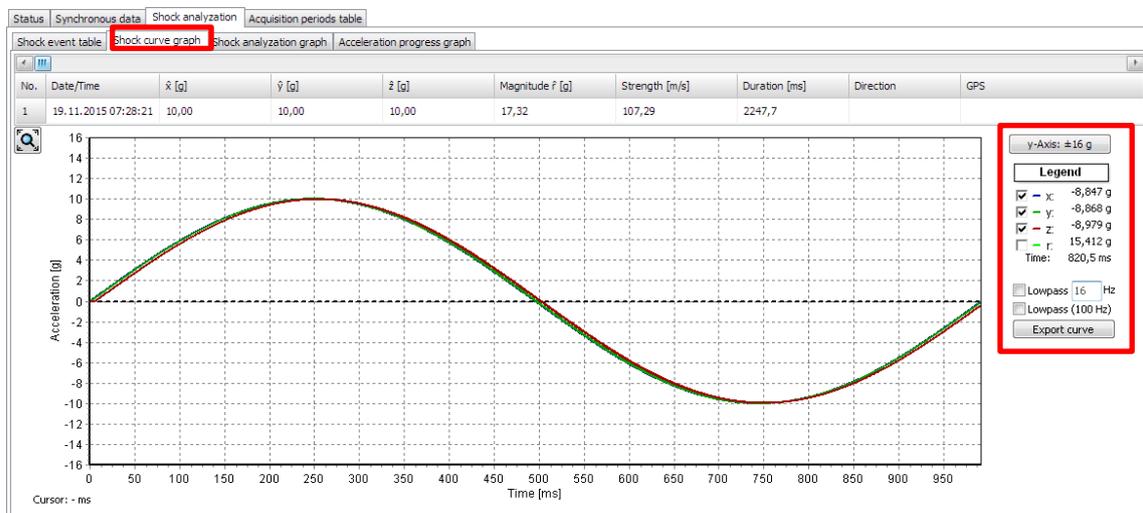


Figure 22: Shock curves graph

Shock recording:

The shock recording begins, when 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 (triggering threshold = 1/2 * 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.

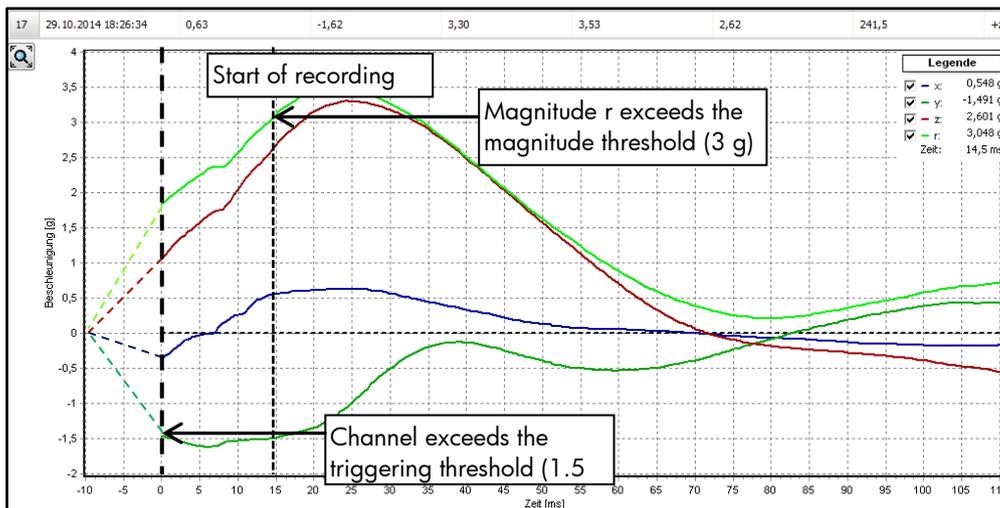


Figure 23: Criteria for the shock recording

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 Figure 24. The 1st pulse begins with the start of the recording and fades away again very quickly here. 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, not longer than 100 ms (3). At point (4), the fading condition is finally fulfilled and the 2nd pulse is completed. More than 200 milliseconds after that, the 3rd pulse is

finally detected. Though the 3rd 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.

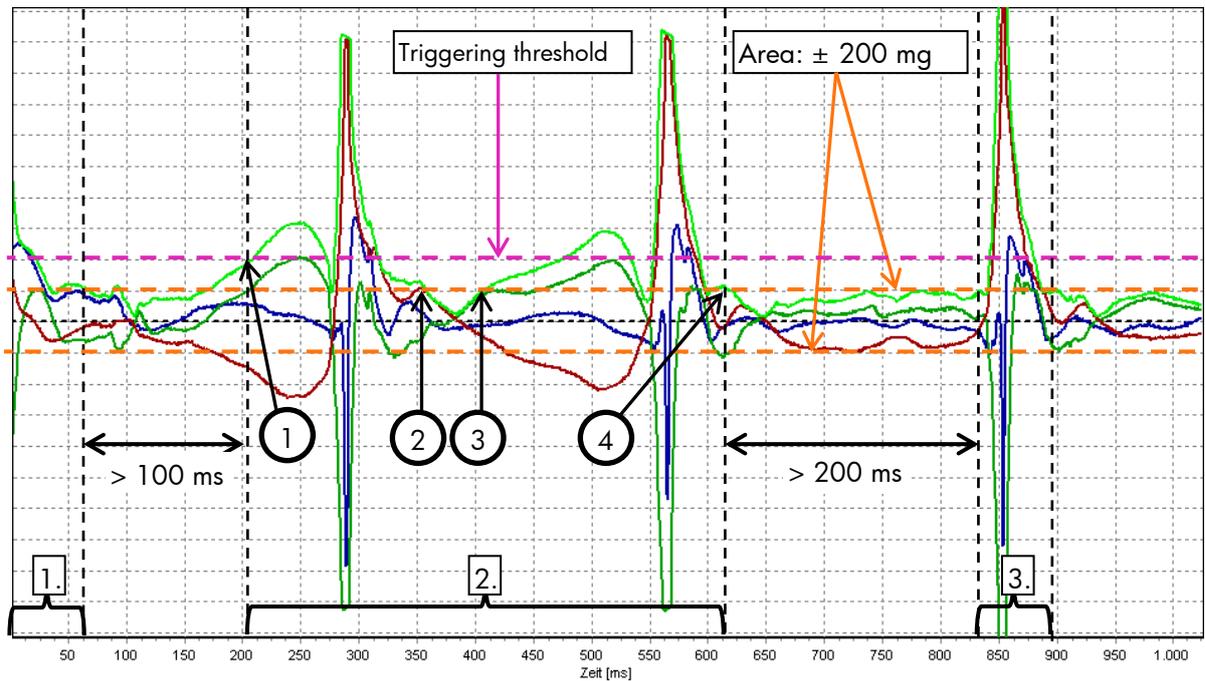


Figure 24: Shock curve with 3 single pulses

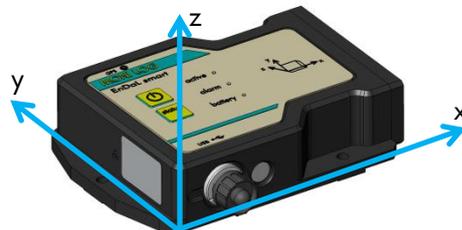
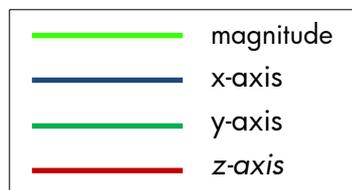


Figure 25: EnDaL smart main axes for acceleration/inclination

4.3.10 GPS position determination

The MONI LOG® EnDaL smart offers the possibility to determine the current GPS position in definable intervals (tracking function), during the recording of synchronous data, and during the detection of shock and alarm events.

Configuration of the GPS tracking

The GPS tracking interval can be defined in the field “GPS tracking” (see Figure 26). If no GPS tracking should be carried out, then no event channel has to be activated or the interval has to be set to “0 h” and “0 min”.

Note:

The configuration of the intervals for the position determination has a substantial influence on the device runtime! Please see chapter 3.4 in this regard.

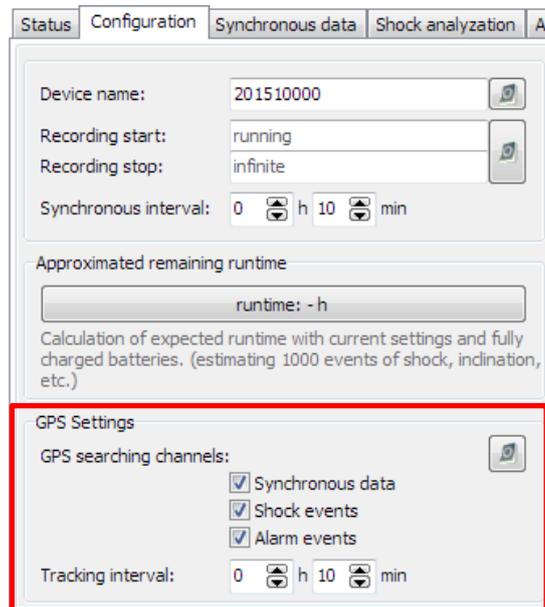


Figure 26: Configuration of the GPS tracking

Furthermore, one can adjust here at what time or event GPS coordinates shall be searched. Here one can choose between the general shock event (all recording thresholds exceeded), alarm events (shock, temperature, humidity, inclination, pressure), a synchronous recording and a GPS tracking interval.

Export and representation of the GPS recording in Google Earth

The recorded GPS data can be viewed with the aid of Google-Earth. In order to create a corresponding route coordinates file, click in the menu tab "Status" on the button "GPS" (see Figure 27). The number indicated in brackets corresponds to the number of the recorded GPS data sets.

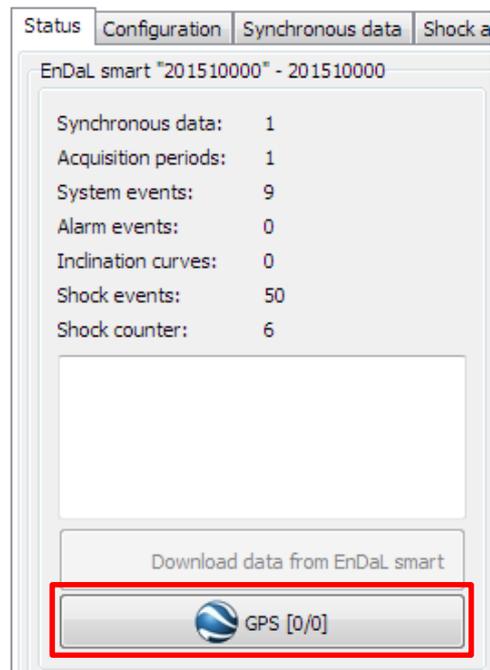


Figure 27: Reading out the recorded GPS data

The notification window that opens up subsequently (see Figure 28) allows to additionally save the created position data in the selected format in any directory by clicking on „Ja“ (Yes). By clicking on „Nein“ (No), no the file will not be saved additionally.

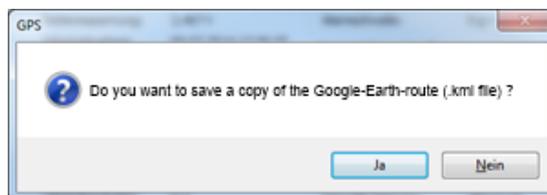


Figure 28: Additional saving of the created .gpx or .kml-file to a user-defined memory location.

If Google-Earth is installed on your PC, Google-Earth will be started now automatically. The Figure 29 shows an example view of the GPS data in Google-Earth.

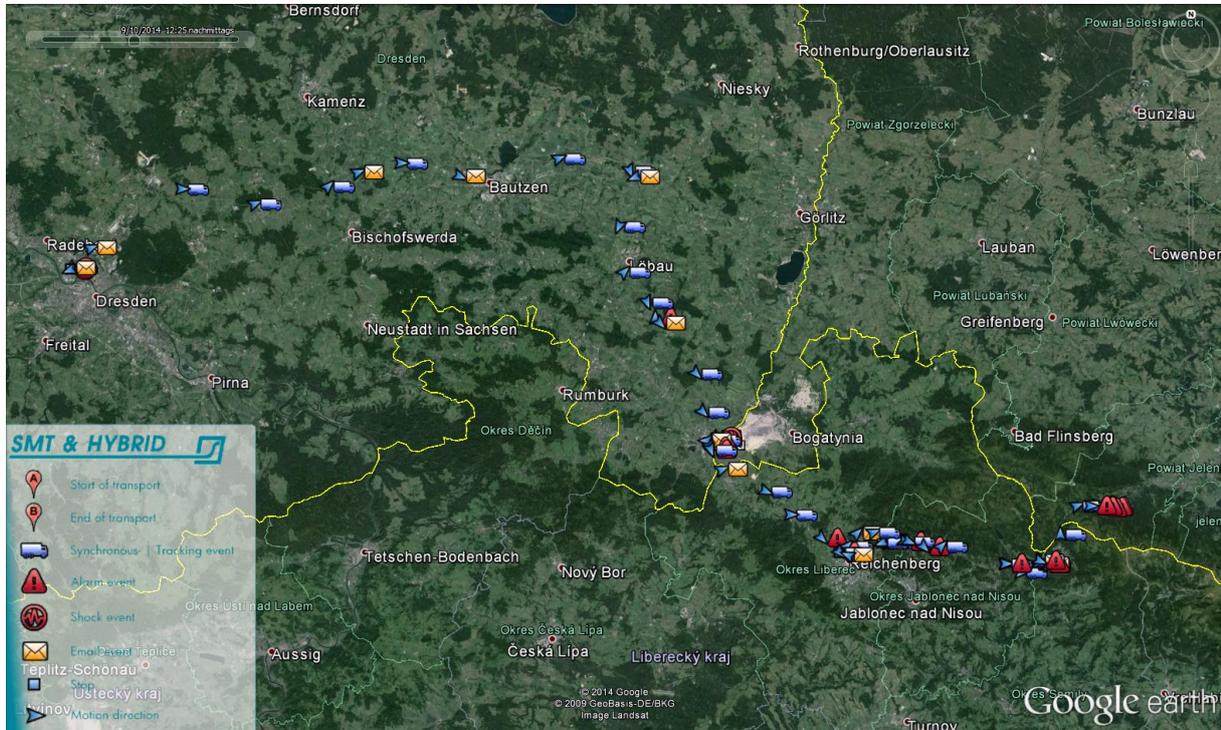


Figure 29: Representation of GPS data in Google Earth

The symbols displayed on the map show:

- | | | | |
|--|--------------------|--|---|
| | Beginning of route | | Tracking point |
| | End of route | | Direction of motion
(starting from 3.0 km/h) |
| | Alarm event | | Stop position |
| | Shock event | | |

A Click on one of the symbols opens a field with additional information of the GPS point
(see Figure 30)

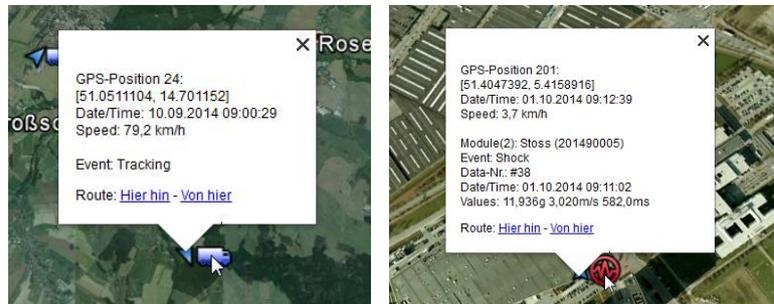


Figure 30: Exemplary representation of the information fields of the GPS points

4.3.11 Configuration of the MONI LOG® EnDaL smart

Changing the device name

The name of the device can be changed in the programme tab “Configuration” in the input field “Device name” (see Figure 31). Up to 16 characters are available for the device name. By pressing the Enter key of your keyboard or by clicking on the configuration button  the new device name is transferred.

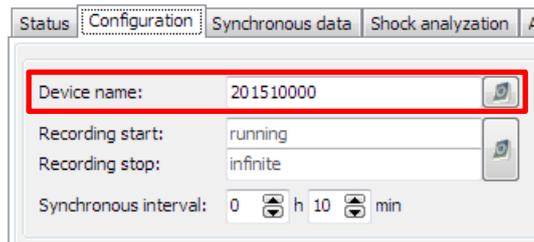


Figure 31: Changing the device name

Setting the recording period:

The desired recording period for the device can likewise be set by the user (see Figure 32). When a recording period is defined, the measured value recording at the start time begins. The measured value recording will be terminated when the stop time is exceeded. If the input fields are not left empty, the measurement recording is running a long as the device is switched on.

The input of start time and stop time is made in local time in the date format:

dd.mm.yyyy hh:mm:ss
(day.month.year hour:minute:second)

The recording period is configured by pressing the Enter key on your keyboard or by clicking on the button „Transferring the configuration “.

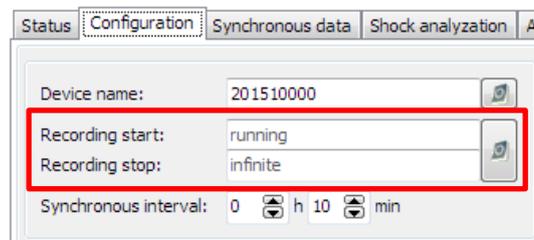


Figure 32: Configuration of the recording period

Setting the device time

The device time can be set by clicking on the clock symbol in the programme tab “**Configuration**” (see Figure 33). The synchronisation is made by means of the system time of your PC.

All time specifications are made in the PC programme according to the time zone setting of your PC. Internally, the device works with the Universal Time Coordinated (UTC). Thus, a clear temporal assignment of the events with a point in time is always possible.

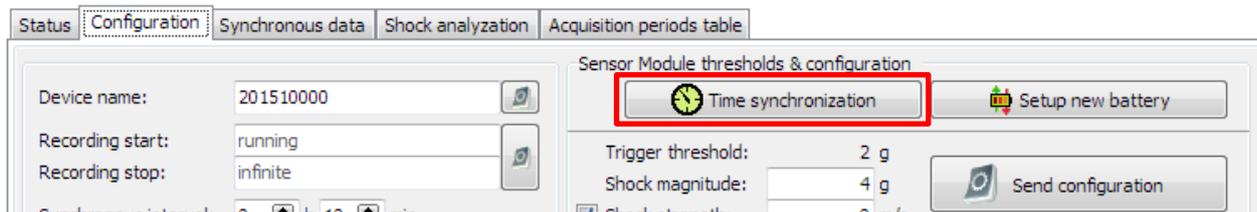


Figure 33: Setting the device time

During the operation, the device time is always synchronised per GPS, when the GPS position is determined by the activity of the GPS tracking, the synchronous recording or as events of the device occur.

Configuration of the measurement parameters

The configuration area will only be visible, when a device is connected that you can configure. When viewing data sets from files, this window is not displayed (Figure 34).

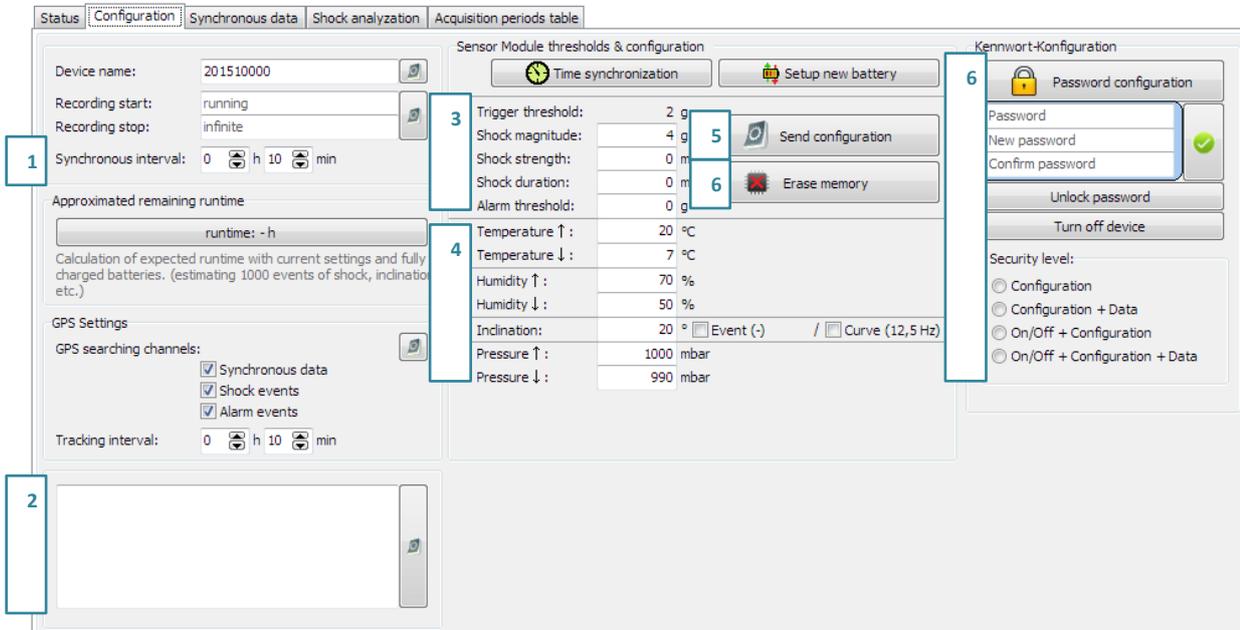


Figure 34: Measurement data configuration area EnDaL smart

- 1) Synchronous interval: *Time between the synchronous recording of measurement data (temperature, humidity, pressure, inclination and GPS)*
- 2) Text field: *Text that is saved in the device concerning the transport (e.g. order number, destination, client, supplier, owner)*
- 3) Configuration for shock measurement
- 4) Configuration for alarm events
- 5) Transferring the configuration: *Sends all currently made settings to the sensor module*
- 6) Deleting the memory: *Deletes all data in the memory of the sensor module*
- 7) Configure password: *Enables the modification, the configuration and the resetting of the device password, as well as a shutdown of the device via software*

Note:

Please refer to the description in chapter 4.3.3 „Status and thresholds“ for the meaning of the individual setting fields.

Changing the synchronous interval & setting of alarm events:

The setting of the synchronous interval is made with the aid of the selection fields (Figure 34, no. 1) “Synchronous interval” (in hours + minutes).

The input fields below (Figure 34, no. 2 u. 3) allow to parametrise the alarm events. By means of the adjusted threshold values (partially, lower and upper threshold values are adjustable) alarm events are saved, if an exceedance of or a falling below the threshold values is detected during the measurement run. An activated “check marks” in front of the input fields activates the creation of the alarm events. If alarm events have occurred, this is shown when actuating the *status* key above the *alarm*-LED.

The settings are saved by clicking on “Transferring the configuration” (Figure 34, no. 4) and are transferred to the device.

Deleting the memory:

The function “Deleting the memory” (see Figure 34, no. 5) deletes all data that are stored in the EnDaL smart.

Attention!

Make sure that you have read out the data completely and that you have saved them as *.esm-file before deleting them! Deleted data cannot be recovered!

Configure password:

It is possible to protect the MONI LOG® EnDaL smart with a password (Figure 34, no. 6). By means of this password, different operations of the device can be protected. If a password is set, a user, who does not know the password, has only restricted rights.

There are the following password levels:

- Configuration is password-protected
- Data + configuration are password-protected
- Activation and deactivation of the device + configuration are password-protected
- Activation and deactivation of the device + data + configuration are password-protected

The password may contain up to 4 digits. By clicking on the green check mark, the new password is transferred.

Note:

In order to remove a password again, just leave the field "New password" empty.

Figure 35: Create/change password

- *Old password:*
Enter the existing password here
- *New password:*
Enter the desired new password here
- *Repeat password:*
Enter the new password again for confirmation
- *Security level:*
Select, which options should be protected with the password

If you have forgotten the configuration password, you can request a device-specific, time-limited master password from the manufacturer. Via the button "Resetting the password settings", you get to the entry of this.

WARRANTY CERTIFICATE

MONI LOG® EnDaL smart

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.

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