

## INSTRUCTION MANUAL

### MONI LOG<sup>®</sup> **MicroShockDetector**

(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 B**, 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.**

**The product complies at intended use with the essential requirements of the following EC-directives ([www.monilog.de](http://www.monilog.de))**

**2014/30/EC (EMC – directive)**

**2011/65/EC (RoHS directive)**

**2012/19/EC (WEEE – directive)**



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## 1. INTRODUCTION

### 1.1 SCOPE OF DELIVERY

Thank you

for having chosen the MONI LOG<sup>®</sup> MicroShockDetector.

#### Scope of delivery<sup>1</sup> (standard):

- MONI LOG<sup>®</sup> MicroShockDetector, incl. 1 R6 (AA, Mignon) exchangeable lithium battery 3.6 V / 2500 mAh,
- Installation CD
  - Configuration software "MONI LOG Analyzer" with integrated software help
  - Driver for USB interface
  - Operating instruction in electronic form (PDF)
  - Application examples, guide for transport monitoring
- Hard copy of the operating instruction, language according to the order
- USB 2.0 interface cable (type A ↔ type Mini AB)

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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 BRIEF INSTRUCTIONS FOR THE INSTALLER

Assuming the MONI LOG<sup>®</sup> MicroShockDetector is pre-programmed for the application and the battery capacity sufficiently, the device only needs to be attached to the cargo and turned on.

The Mounting is preferably with 2 mounting screws or optionally with magnetic bases (see Section 3.4).

Press **briefly** the *control* key (<2 s). If the *status* LED lights green, the device is ready and you have nothing to do. Otherwise, press the *control* key for at least 2 seconds until the *status* LED lights up and then release the key.

To switch off the MicroShockDetector, press the *control* key for at least 4 sec. until the *status* LED lights up red. In all other states, the device can be operated only by means of the Analyzer software (see Section 3.2).

### 1.3 FUNCTIONALITY

MONI LOG<sup>®</sup> **MicroShockDetector** is a small, universal and cost-effective data logger. Designed for long-term measurement applications, it is ideally suited for the monitoring of transport goods and critical environments. The integrated sensor system for the detection of shock events and for temperature measurement enables different measuring applications. Configurable alarm thresholds provide reliable detection of limit value exceedances. Shock loads are recorded and assessed in real time, the temperature is recorded in an adjustable interval.



The **compact and mains-independent design** allows an easy fastening on or in the transport goods or transport devices with screws, magnetic bases or glue pads.

The housing of the device protects against dust and water (**Protection level IP 67**) and is therefore also suitable for outdoor use. The MONI LOG<sup>®</sup> MicroShockDetector can thus be used as a universal product companion in the international goods traffic in storage spaces, in transit points and on the rails, also in the water and air traffic.

The **power supply** is realized by a standard, replaceable lithium battery. Due to the very low power consumption and the very long maintenance-free operation time the MONI LOG<sup>®</sup> MicroShockDetector is ideally suited for autonomous long-term applications. Energy-optimized operational settings allow an autonomous running time period of typically 2 years.

The royalty-free configuration program MONI LOG<sup>®</sup> **Analyzer** allows an easy and intuitive configuration of the device. It offers a comprehensive adjustment of the device functions to your application-specific requirements. In addition to the detailed analysis of the device data in measurement tables and graphs, the program also provides export functions in external applications (for example Microsoft Excel). Communication takes place via a **USB interface**.

By the report function an overview of the measurement data, including classification of all shocks in acceleration classes and activities of the device will be created immediately without necessary settings.

## 1.4 ENVIROMENTAL AND SAFETY INSTRUCTIONS

### Intended Use

The MONI LOG<sup>®</sup> MicroShockDetector is provided for the verification of transport and storage conditions and must only be used under the operating conditions mentioned in Section 2 below. No safety-relevant functions are derived from it.

The following instructions for handling of Lithium batteries are to be observed.

### Environment & Disposal



The MONI LOG<sup>®</sup> MicroShockDetector contains, except the internal battery, 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 in the MONI LOG<sup>®</sup> MicroShockDetector is realized by a replaceable lithium battery (Typ AA | LR6) 3.6 V 2500 mAh. The battery is not considered as dangerous good during transport of not more than 2 devices on or in a package and can be purchased in the specialist stores or by the equipment supplier.

Operation is not possible with 1.5 V batteries.

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#### **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!

When transporting more than 2 devices or lithium batteries in a package it must be labeled as dangerous good Class 9.

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### Decommissioning

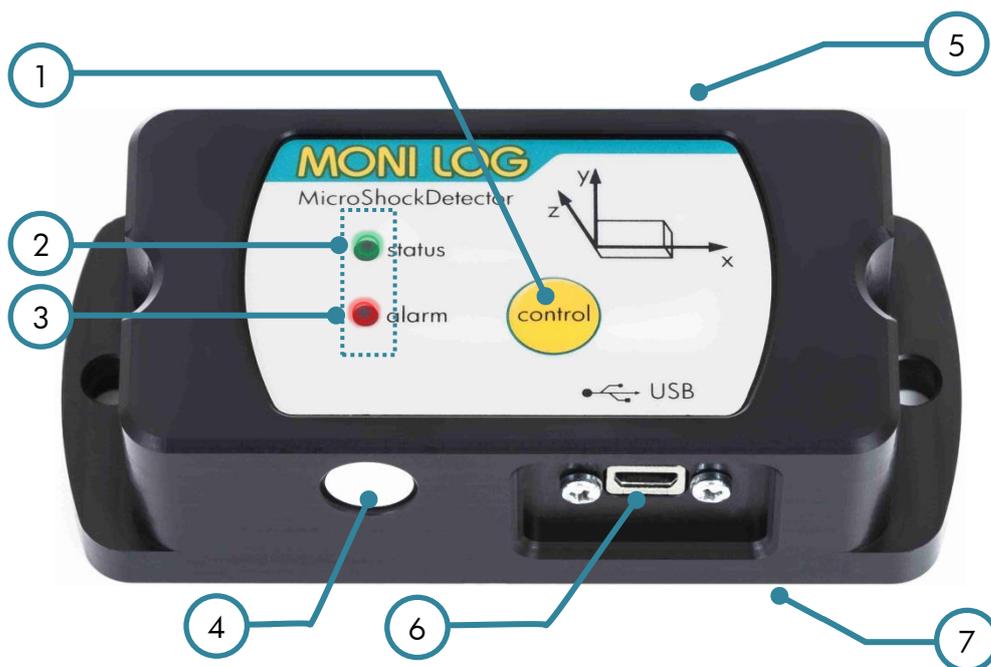
In case of decommissioning the devices must be properly switched off and all batteries must be removed from the cases.

## 2. TECHNICAL DATA

Shock values	200 greatest shock events, thereof 10 greatest events with signal curve of 4 sec duration; resolution 2 ms; valuation from the view point of 3D space vector size
Acceleration sensor	3D-MEMS measuring range $\pm 8\text{ g}$ ; 1 mg resolution; $\pm (2\% \text{ range} + 5\% \text{ value})$ at 13 Hz / 20 °C; $\pm (3\% \text{ range} + 6\% \text{ value})$ at 13 Hz / -20 °C / +60 °C lower filter cut-off frequency 1 Hz for suppressing static acceleration upper filter cut-off frequency 25 Hz fixed
Shock classification	Classification of shocks by amplitude in classes, number of shocks is not limited; >0.25; >0.5g; >1g; >1.5g; >2g; >3g; >4g; >5g
Temperature Measurement	-40°C to +65°C $\pm 1^\circ\text{K}$ (-40°F / 150°F); 100.000 measurement values
Indicators	2 LEDs, for Status and exceeding Alarm limit
controls	One pushbutton for control and switch on/off password protected
Connections	Mini USB 2.0
Operating conditions	-40°C to +65°C; -40°F to +150°F; up to 98% rel. humidity
Power supply	Standard replaceable Lithium battery, size LR06 (AA, Mignon); 3.6 V 2500 mAh (Saft LS14500 or comparable), Typical runtime 12 months in the switch-on period depending on settings
data retention	Retention of measured data independent of battery for at least 10 years
Dimensions	108mm x 48mm x 30mm (LxWxH) 146mm x 50mm x 40mm (LxWxH mounted on magnetic feet)
Case material, weight	plastic housing with stainless steel plate on bottom, mass circa 180g standalone, (380g total with magnetic feet)
Protection	IP67
Calibration	Manufacturer's calibration valid for 2 years
Configurable parameters	X,Y,Z recording threshold, X,Y,Z alarm threshold, minimum shock duration, temperature measurement interval, Start-Stop-time (runtime), password protection, via free Windows software
Data evaluation	Also with the Windows software displayable: Measurement tables, curve graphics, active periods of the device, export functions, reports, statistical analysis, battery monitoring
Software update	The device updates are provided by the manufacturer for the Windows software and for the firmware

### 3. DEVICE DESCRIPTION

#### 3.1 DEVICE STRUCTURE / DEVICE VIEW



- |                               |   |
|-------------------------------|---|
| <b>1</b> On/off/control key   | <b>5</b> Name plate incl. serial number |
| <b>2</b> Status LED green/red | <b>6</b> USB port with cap              |
| <b>3</b> Alarm LED red        | <b>7</b> Battery cover                  |
| <b>4</b> Temperature sensor   |   |

#### 3.2 OPERATION OF THE MICROSHOCKDETECTOR

For the operation of the device there is a *control* key which function is depending on the current status and the duration of the key press. The current status is indicated with 2 LEDs.

## Checking the device on-state

To determine whether the device is switched on or off, press **briefly** the *control* key (<2 s):

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

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

## Switching on device

For switching on device, press briefly the *control* key for at least 2 seconds until the *status* LED lights up. Then release the key. If the device is equipped with an **on/off code**, then it can only be activated via the software. This is indicated by the lightening *status* LED at least for 60 sec. If the software activation is not performed the device switches off again after 60 seconds. To activate the device, connect it during the lightening of the LED to a PC and start the MONI LOG<sup>®</sup> Analyzer. During the reading out the device it will be detected that the device is protected with password. At this point you should enter the device password. Follow the instructions of the software to activate the device. Explanations on the configuration of the on/off code you can find in Chapter 4.3.7 in the section „ Password configuration“.

If no code is necessary, the device begins data recording immediately.

## Switching off device

To switch off the MicroShockDetector, press briefly the *control* key for at least 2 sec. until the LED *alarm* lights up red. If the key is still pressed, the *status* LED lights up red for 1 sec. Now they can be released. The device switches off. This can be checked by short pressing the key. If you release the key during the lightening, the device will be still switched on.

If the device is equipped with an **on/off code**, then it can only be deactivated via the software. To signal this, the LED *status* starts rapid lightening red. To switch off the device, connect it to a PC and start the MONI LOG<sup>®</sup> Analyzer. During the reading out the device it will be detected that it is protected with password. At this point you should enter the device password. By the tab "Configuration" and the key "Password configuration" you can switch off the device. Explanations on the configuration of the on/off code you can find in Chapter 4.3.7 in the section „Password configuration“.

**Display the function state**

Status	Device status	Condition	Secondary condition	Successor status device	LED status green	LED status red	LED alarm red
A0	Device on	Idle task	Operational readiness	A0	Off	Off	Don't care
A1			System error	A1	Off	Off	Don't care
A2			Critical battery status	A2	Off	Off	Don't care
A3			Exceedance of alarm threshold	A3	Don't care	Don't care	Off
B1	Device on	Pressing Key Control $t < 2\text{ s}$	Measurement activated	A0 possibly A3	1 s	off	Don't care
B2			Measurement deactivated	A0 possibly A3	100ms of all 200ms	off	Don't care
B3			Alarm event available	A3	Don't care	Don't care	1s
B4			System error	A1	off	1s	Don't care
			Critical battery status	A2	off	1s	Don't care
B5		Pressing Key Control $2\text{ s} \leq t < 4\text{ s}$	Without active power-off protection by password	Ax or B6	off	off	100ms of all 200ms
B6		Pressing Key Control $t \geq 4\text{ s}$		C0	off	1 s	off
B7	Pressing Key Control $t \geq 2\text{ s}$	With active power-off protection by password	Ax (power-off protection by password)	off	100ms of all 200ms	off	
C0	Device off			C0	off	off	off
C1		Pressing Key Control $t < 2\text{ s}$		C0	off	off	off
C2		Pressing Key Control $t \geq 2\text{ s}$	Battery empty	C0	off	off	off
C3			Without active power-on protection by password	Ax	2 s	off	off
C4			With active power-on protection by password	Ax after valid PW entry on software in 60s C0 after 60s without PW entry	1 s of all 2 s	off	off
C5			Clock is not set after battery change	A1	off	2 s	Don't care
C6	Battery low	C0	off	7 x 1 s blink	Don't care		
D0	Device on	Measurement data recording		Ax	on	off	Off

### 3.3 OPERATION TIME AND BATTERY CHANGE

#### Operation time

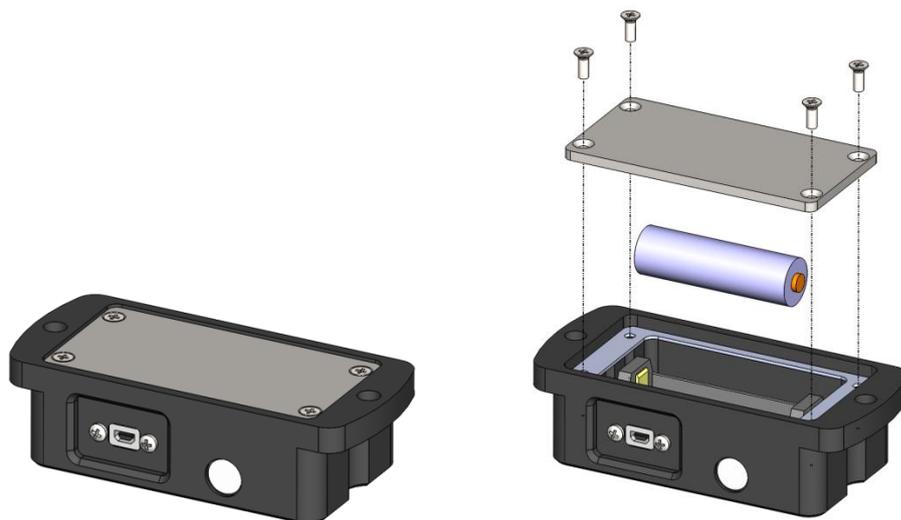
The device runtime of MONI LOG<sup>®</sup> MicroShockDetector depends on the set measurement parameters, the battery type and the use conditions. The number of shocks on the triggering threshold of the device is mainly decisive. Assuming that the device is activated by shocks 100,000 times, the typical runtime of a battery is about 1 year (see shock counter Section 4.3.2). The actual remaining battery charge is monitored by the device and displayed by the software.

#### Battery change

Prior to a battery change the MONI LOG<sup>®</sup> MicroShockDetector must be properly switched off, otherwise the data loss of the device cannot be excluded.

For the change of the battery proceed as follows:

- 1) Remove the battery cover by loosening the fastening screws by means of a screw driver. (Cross slot H size 1). Afterwards, you can pull out the battery out of the battery holder.
- 2) Now, insert the new battery according to the specified polarity into the device.
- 3) In a last step, screw again the battery cover onto the device. Pay attention to the maximum tightening torque of 0.3 Nm and the correct position of the seal.




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#### Attention:

Ensure the correct polarity when inserting the batteries! After replacing the battery *status* LED is red and the clock must be set with the analyzer software (see Section 4.3.7)

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### 3.4 MOUNTING INFORMATION

The device can be mounted on the transport material by 2 mounting screws (see Image 1), according to the mounting halls. Optionally, the device can also be mounted using magnetic bases on magnetic surfaces. The use of the glue pads is also possible if they do not have a shock-absorbing foam coating.

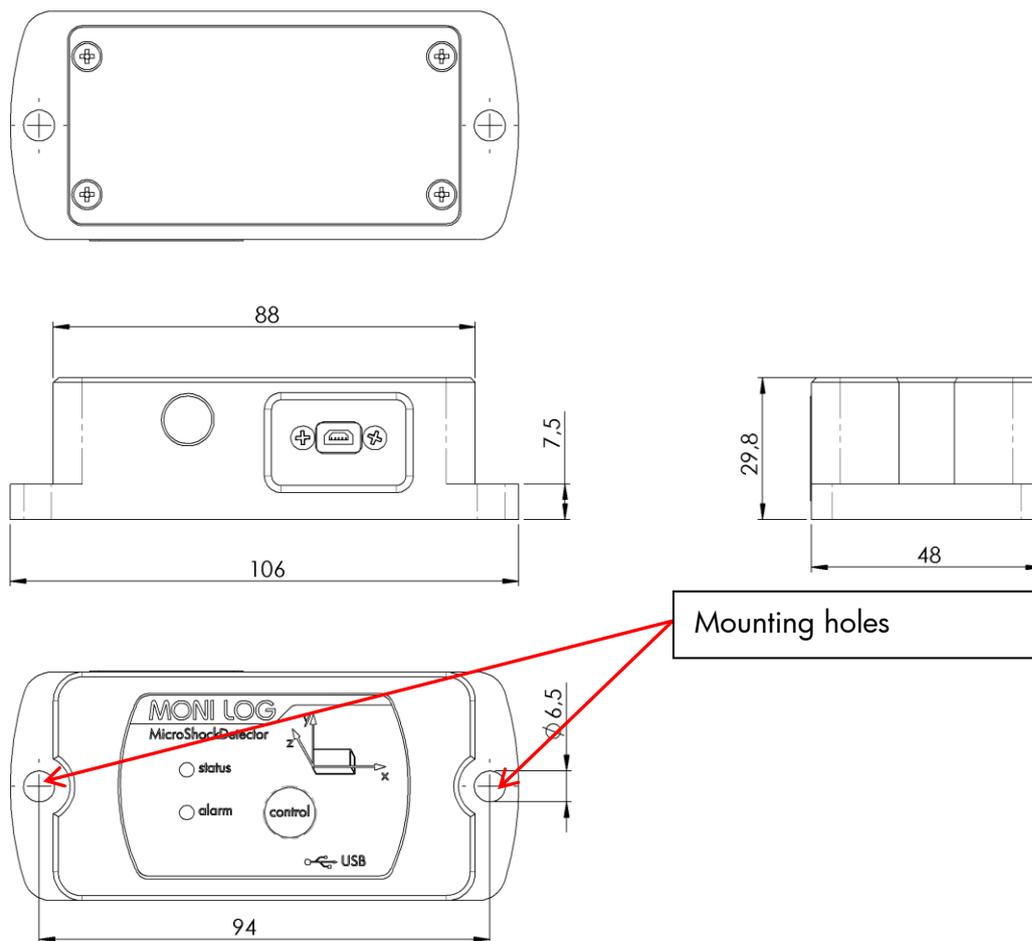


Image 1: Dimensions and mounting information of the MicroShockDetector (dimensions in mm)

## 4. PC-SOFTWARE – MONI LOG<sup>®</sup> ANALYZER

The evaluation programme MONI LOG<sup>®</sup> Analyzer can be used both for the readout and configuration of the MONI LOG<sup>®</sup> MicroShockDetector and other MONI LOG<sup>®</sup> devices. 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.

### 4.1 INSTALLATION

#### 4.1.1 General software installation

The included CD contains the software installation MONI LOG<sup>®</sup> Analyzer, the driver for the USB interface and documentation. Please start the installation by double clicking on the file "setup.exe" and follow the instructions.

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**Note:**

To install the software and the USB driver you need administrator rights on the PC

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#### 4.1.2 USB driver

If the MONI LOG<sup>®</sup> MicroShockDetector is connected for the first time it may be necessary to install a USB driver on the PC. The "FTDI CDM Driver" is included on the installation CD and is set with the software installation if it is not already present on the PC.

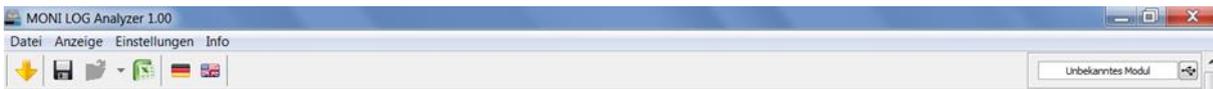
Now connect the MONI LOG<sup>®</sup> MicroShockDetector by means of the included USB cable with your PC. While the device connects to the PC the *status* LED lights up green. After the LED has gone off, the USB is ready and you can read data from the device with the MONI LOG<sup>®</sup> Analyzer.

## 4.2 GENERAL USE OF THE PC-SOFTWARE

### 4.2.1 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 software has been active before plugging of the device or you want to connect a device to a different COM port, select the device via the USB menu at the top right.



#### 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.

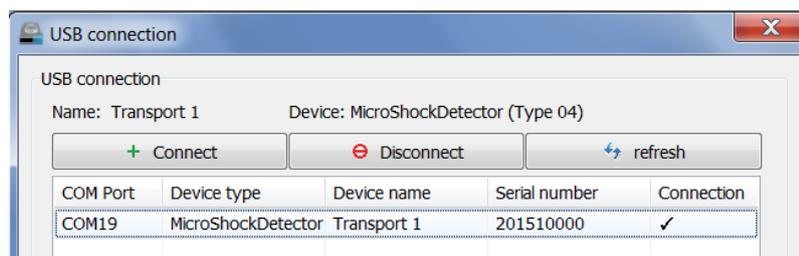


Image 2: USB connection window, connection established to COM19

After a successful USB connection, the status data of the connected device are displayed:

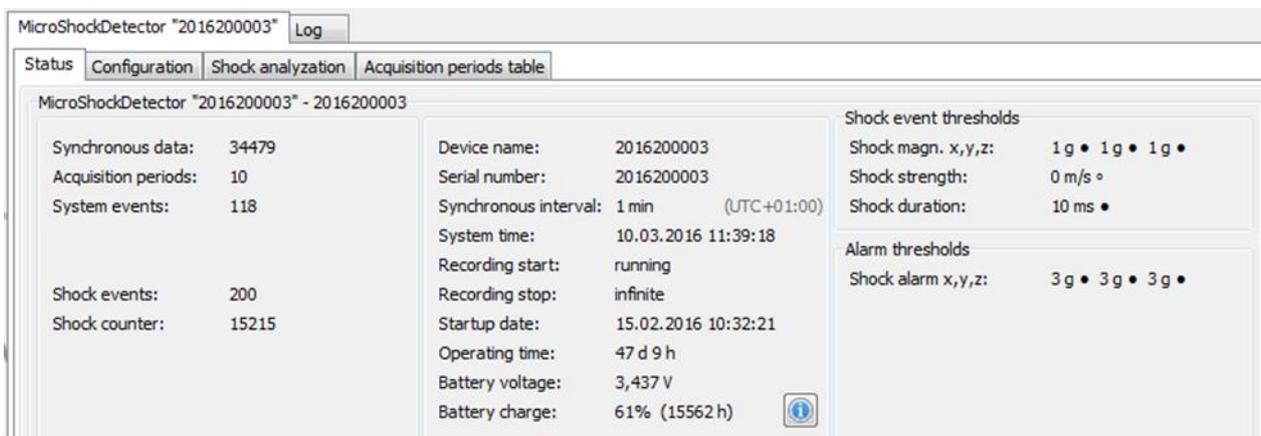


Image 3: Status view

By the icon  or menu „File / Download measuring data“ you can load the additional measurement data, as described in Section 4.3.1.

#### 4.2.2 File area

The data read out by the device from the USB can be saved by icon  or menu „Save file“ on a data carrier. Please observe that the measurement data are included in the file only if it has been read out by . In the other case only the status data are included. The saved data can also be loaded in the PC programme. The button  „Open file “opens the dialog for choosing a file. One click on the button with the  Excel icon exports the read out data in an Excel 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 performance of configuration commands, connection setup to devices, saving of data, etc. are listed here.

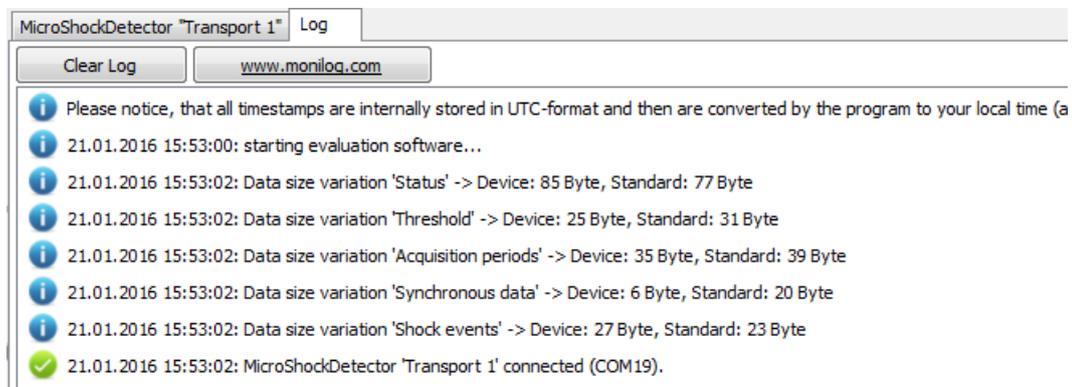


Image 4: Log window

#### 4.2.4 View of measurement data

The measurement data should first be read out as described above, either from a connected device or exist in an open file. The representation is possible in each case as a graph or table.

## Graphs

In a graph it is possible to zoom in. For this, draw up a selection window using the mouse (see Image 5). 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 .

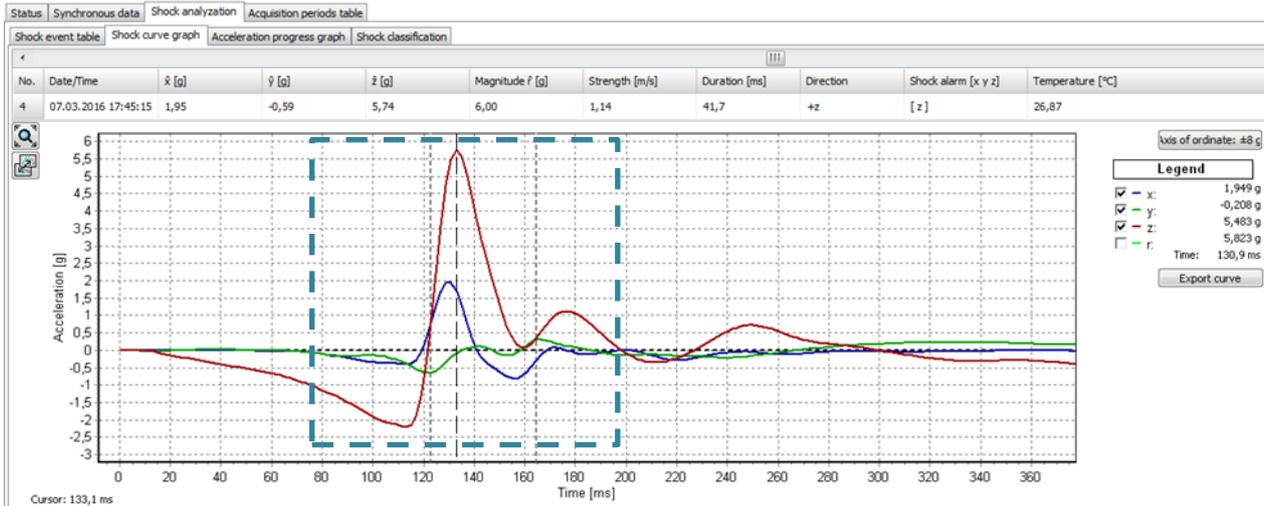


Image 5: Zoom selection window

## 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.

No.	Date	Time	Temperature [°C]
1	07.03.2016	13:26:40	26,12
2	07.03.2016	13:36:39	25,50
3	07.03.2016	13:46:39	25,25
4	07.03.2016	13:56:39	25,00

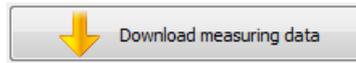
Image 6: Sorting table columns

## 4.3 MONI LOG<sup>®</sup> MICROSHOCKDETECTOR

### 4.3.1 Readout of status, configuration and measurement data

After connecting to the device status data, configuration and acquisition periods are automatically read and displayed as described in Image 3. The measurement data, such as temperature data

or shock curves are manually requested by the button



. This may take a few seconds to several minutes, depending on the number of data records. A progress bar shows the current selection status. According to the available measurements the associated program managers and graphs are opening. A detailed description of the program areas can be found in the following chapters.

Please do not disconnect the USB cable from your PC or MicroShockDetector as long as data transmission takes place!

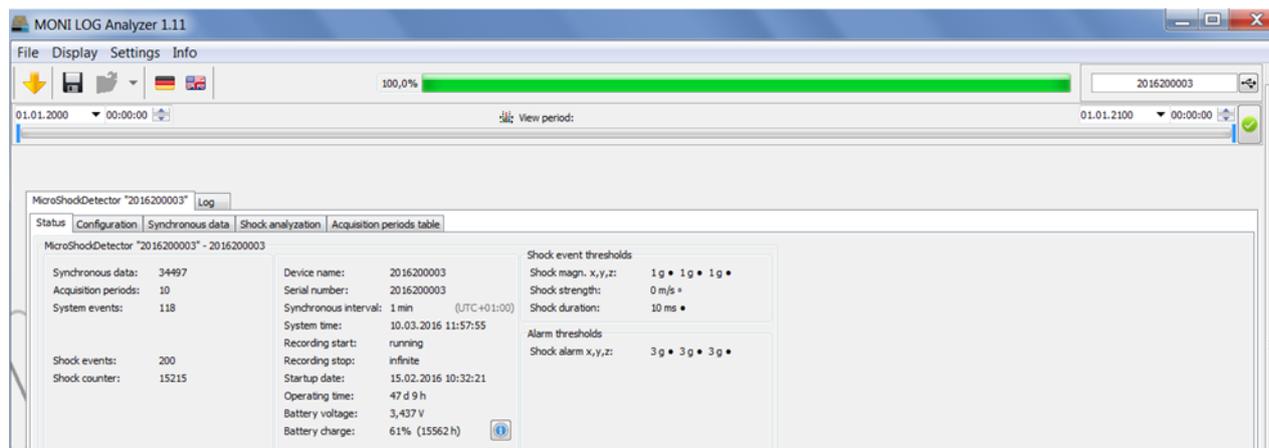


Image 7: Overview after reading the measurement data of a MicroShockDetector

The view period of data can be limited to the desired time range by the view period. This simplifies data analysis and finding of certain events. Enter in the fields the desired start and end date and confirm your entry using the Enter key on your keyboard or the green button on the input field on the right. The view period can also be adjusted using the slide bar, where the blue bars are moved by the mouse (see Image 8).

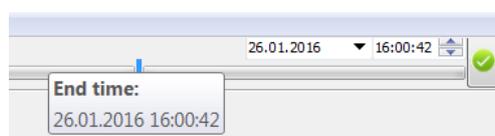


Image 8: Slide bar for view period

### 4.3.2 measurement data, status, thresholds

The parameters, represented on the Image 7, have following meanings:

#### Measurement data (Column 1):

- Synchronous data: number of the continuously stored data records of the temperature measurement
- Acquisition periods: number of the time periods, when the module was ready to measure
- System events: number of the external events (see Section 4.3.3)
- Shock events: number of the shock records, which have exceeded thresholds
- Shock counter: total number of the shocks which have led to the activation of the device, regardless of whether the shocks were recorded

#### Status data (Column 2):

- Device name: device name, selected by the user (freely selectable)
- Serial number: serial number of the device (unchangeable)
- Recording start: beginning of the measuring or running
- Recording stop: end of the measuring or infinite
- Synchronous interval: time interval for the time-synchronous (continuous) recording of the temperature
- System time: internal time of the device
- Startup date: date of the first start up
- Operating time: total running time of the device
- Battery voltage: actual voltage of the battery
- Battery charge: remaining battery charge, details will be shown by clicking on the battery icon
- Firmware version: actual firmware version of the device
- Hardware version: actual hardware version of the device

### Shock event thresholds (Column 3):

- Shock magnitude x,y,z: minimal amplitude of the acceleration (storage criterion); is adjustable and activatable for each axis
- Shock strength: minimal „Area under the curve of the resultant space vector“, additionally adjustable storage criterion
- Shock duration: minimal duration of an impact (storage criterion)
- Shock alarm x,y,z: acceleration value, from which an alarm is displayed, is adjustable and activatable for each axis

The threshold values, marked by a filled circle •, must be all reached at the same time to store a shock event.

### 4.3.3 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 menu option “Settings - Advanced diagnostics”.

The corresponding view opens in the lower image area. The events can be displaced by the bar.

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.
- Channels configured: Limits or thresholds were activated/changed
- Device switched off: The sensor module was switched off
- Time synchronized: The system time of the device was configured
- USB aktive: The event was generated by activities of the USB interface

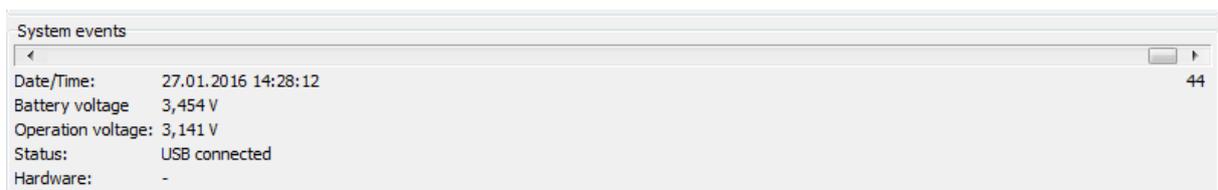


Image 9: Display of system events of a MONI LOG<sup>®</sup> MicroShockDetector

### 4.3.4 Acquisition periods

The acquisition periods offer an overview of the individual configuration time segments of the MONI LOG<sup>®</sup> MicroShockDetector. This way it can be retraced how the sensor module was configured at the respective period.

No.	Start time	End time	Δt	Status	Memor	Interv	Magn1	Magn1	Magn1	Streng	Durati	Shock	Shock	Shock	Vaer
1	22.01.2016 16:10:28	22.01.2016 16:11:10	42 s	USB connected, Thresholds configured	0%	10 min	1g •	1g •	1g •	0m/s ◦	0ms ◦	3g •	3g •	3g •	3,38V
2	22.01.2016 16:11:10	23.01.2016 10:22:34	18 h 11 min 24 s	Device turned off	1%	1 min	1g •	1g •	1g •	0m/s ◦	5ms ◦	3g •	3g •	3g •	3,34V
3	23.01.2016 10:22:44	24.01.2016 12:46:59	1 d 2 h 24 min 15 s	USB connected, Thresholds configured	2%	1 min	1g •	1g •	1g •	0m/s ◦	5ms ◦	3g •	3g •	3g •	3,42V
4	24.01.2016 12:46:59	-	3 d 2 h 35 min 45 s	Device active	4%	1 min	1g •	1g •	1g •	0m/s ◦	1ms ◦	3g •	3g •	3g •	3,42V

Image 10: 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.

### 4.3.5 Synchronous data

Synchronous data are measurements, synchronously and continuously recorded at a fixed interval. The records are continuously displayed in a table (see Image 11). In the program tab "Synchronous data graph" the synchronous data are displayed graphically. The measurements of the cursor position are displayed in the legend on the right side of the graph.

#### Table of the temperature measurements

▲ No.	Date	Time	Temperature [°C]
1	21.01.2016	11:58:06	24,37
2	21.01.2016	12:03:06	24,25
3	21.01.2016	12:08:06	24,37
4	21.01.2016	12:13:06	24,25
5	21.01.2016	12:18:06	24,00
6	21.01.2016	12:23:06	23,87
7	21.01.2016	12:28:06	23,62

Image 11: View of synchronous data table

## Graph of the temperature measurements

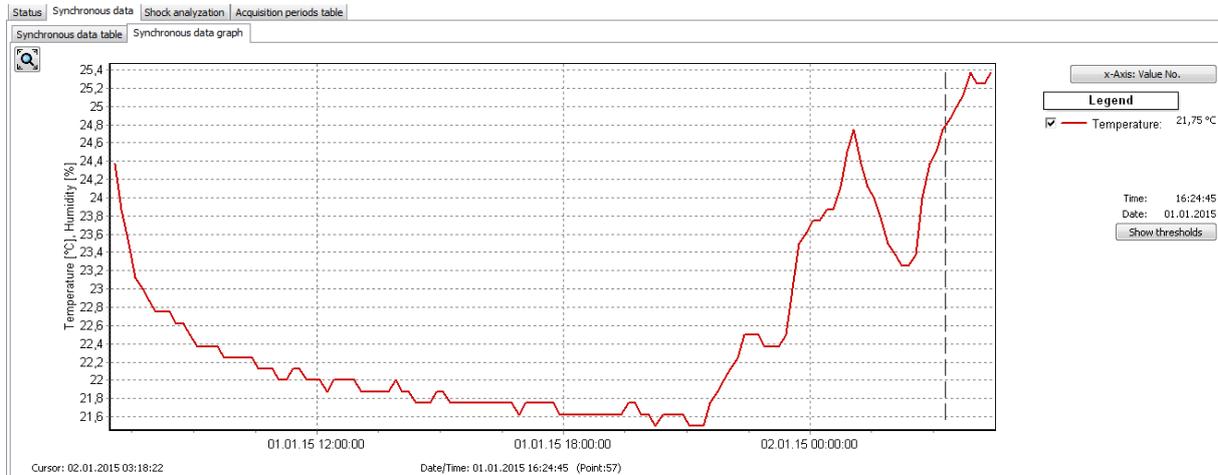


Image 12: View of synchronous data graph

### 4.3.6 Shock events and shock curves

A MONI LOG<sup>®</sup> MicroShockDetector registers 200 largest shock events by the set threshold values and the 10 largest shocks of it to the curve progression of over 4 seconds.

All shock events are tabular performed under the program tab „Shock event table“. The corresponding curve can be invoked by double-click on the table row, if the circle symbol • is available in the column "Curve".

No.	Date/Time	$\ddot{x}$ [g]	$\ddot{y}$ [g]	$\ddot{z}$ [g]	Magnitude $\ddot{r}$ [g]	Strength [m/s]	Duration [ms]	Direction	Shock alarm [x y z]	Temperature [°C]	Curve
1	09.03.2016 16:40:08	-3,17	1,37	-1,22	3,24	0,49	23,8	-x	[ x ]	28,00	•
2	09.03.2016 16:40:13	0,65	0,87	3,34	3,50	0,99	39,7	+z	[ z ]	27,87	•
3	09.03.2016 16:42:01	0,04	0,00	0,81	0,81	0,69	138,8	+z	-	27,87	-
4	09.03.2016 16:46:30	0,25	-0,19	0,42	0,51	0,13	31,7	+z	-	28,25	-
5	09.03.2016 16:46:35	-0,23	-0,44	0,23	0,54	0,37	89,3	-y	-	28,25	-

Image 13: Shock event table

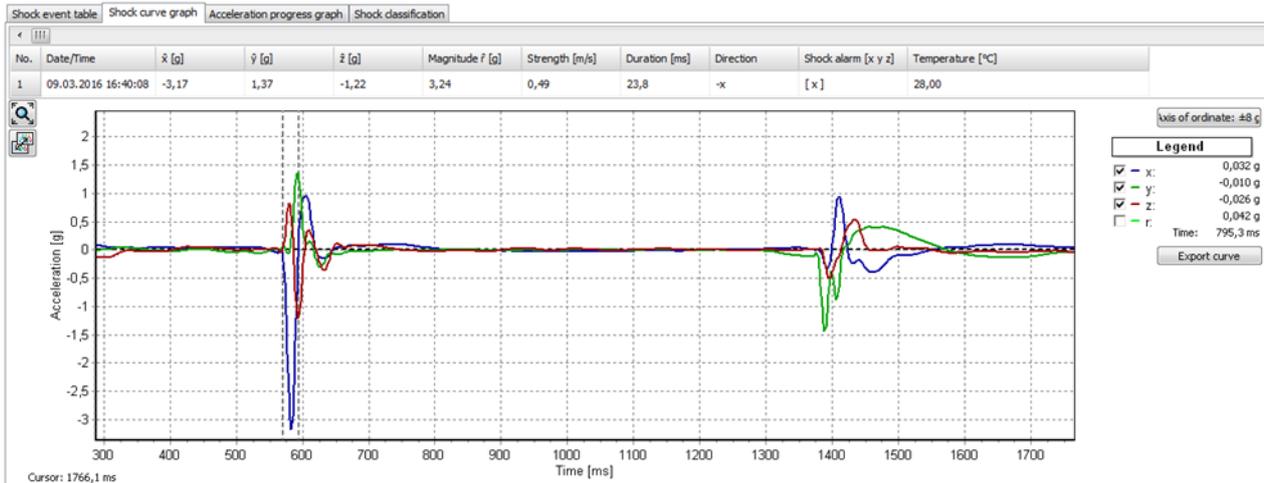


Image 14: Shock curve graph

The shock curves can be browsed by the overlying scrollbars. By activating or deactivating the "Hook" in the legend on the right side, the x,y, z-channel and the amount curve can be blended out (see Image 14). The two dashed vertical lines mark the selected impact within the curve period.

The vertical graph axis is switched between the maximum values of the curve and the full measuring range of  $\pm 8$  g by the button „Axis of ordinate“.

### Principle of the shock recording:

The shock recording starts when the value of the acceleration exceeds the internal trigger threshold of 0.25 g on at least one measurement channel (approximately 3% of the measuring range, red lines in Image 15).

The measuring points are continuously recorded with 500 Hz per channel and then filtered on an upper cut off frequency of 25 Hz. In addition it selects separate shock impacts. A shock impact starts exceeding the trigger threshold on at least one measurement channel and ends when the main thrust (channel with the absolute maximum of shock) changes sign (zero crossing) or all 3 channels fall below the trigger threshold again. Within a period of 4 s more shock impacts can occur, for example, by vibration. The impact with the largest amplitude is evaluated at the end of a curve period and compared with the configured criteria. A shock curve is permanently stored if the registration thresholds met on at least one measurement channel, shock strength and shock duration for this shock impact.

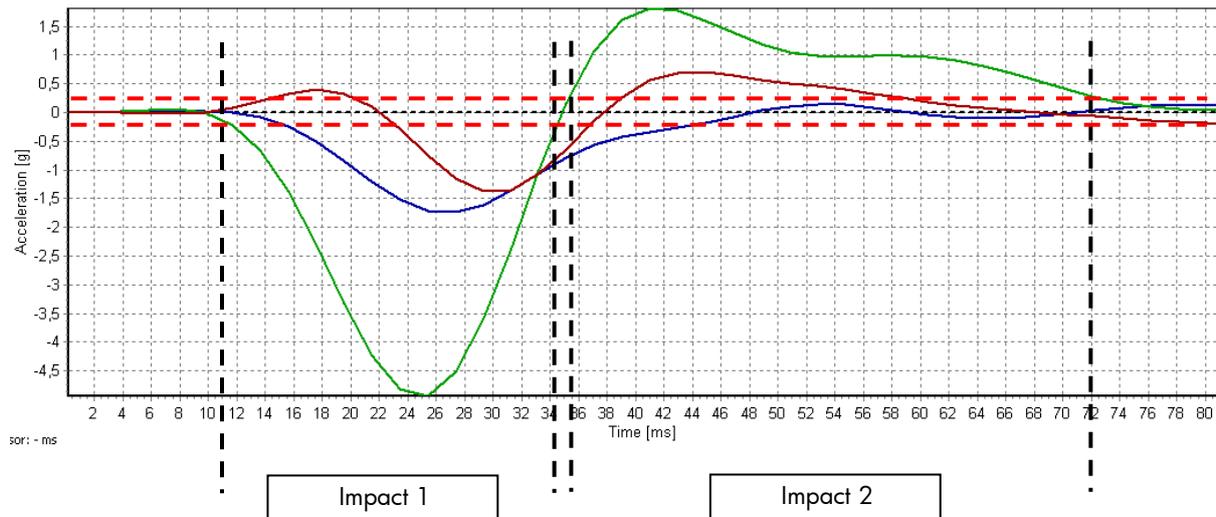


Image 15: valuation of shock events

As a shock event is considered the largest single impact within the sampling time of 4 s, which meets all the set conditions (amount of shock, shock strength, shock duration) (in this example Image 15 Impact 1). In addition to the measurement of the 3 channels, a value for the space vector and integrated value for the shock strength of this impact are calculated at each measurement point. The shock strength is equivalent to the difference speed.

Space vector:  $R = \sqrt{x^2 + y^2 + z^2}$

Shock strength:  $dv = \sum_0^n R * 2ms$

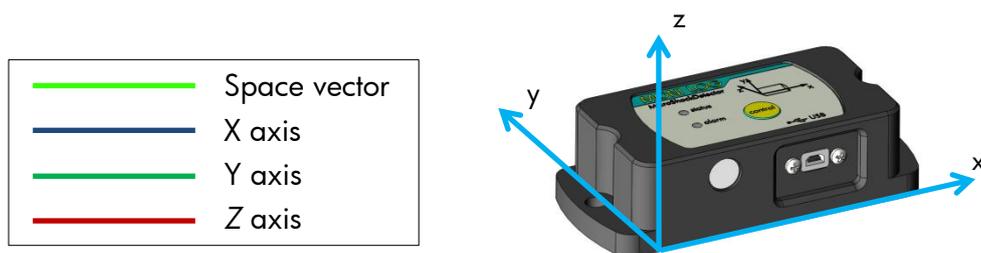


Image 16: MicroShockDetector main axes of acceleration

### Shock classification

The MONI LOG<sup>®</sup> MicroShockDetector evaluates the acceleration amplitude of all shocks separated by the thrusts X, Y and Z and the resulting space vector R. All shocks are specified by the amplitude in laid down threshold classes regardless of whether these are stored as shock events or shock curve with timestamp and measurement. It is displayed as a table and graph (Image 17).

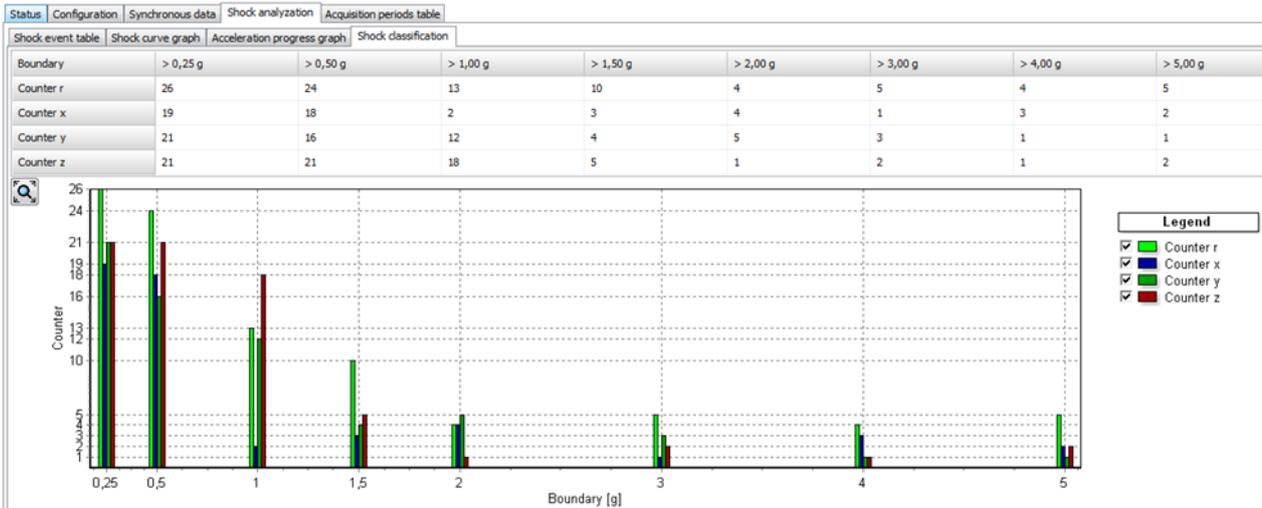


Image 17: Shock classification

### Acceleration progress graph

Recorded shock events with their maximum acceleration amplitudes are shown in a line graph (Image 18). It is possible to zoom into the curve shape in. By the button "Calculate average" statistical values of acceleration are calculated on all shock events.



Image 18: Acceleration progress graph

### 4.3.7 Configuration of the MicroShockDetector

The configuration section is only visible if a device is connected to USB, which you can configure. When viewing records from files this window does not appear (Image 19).

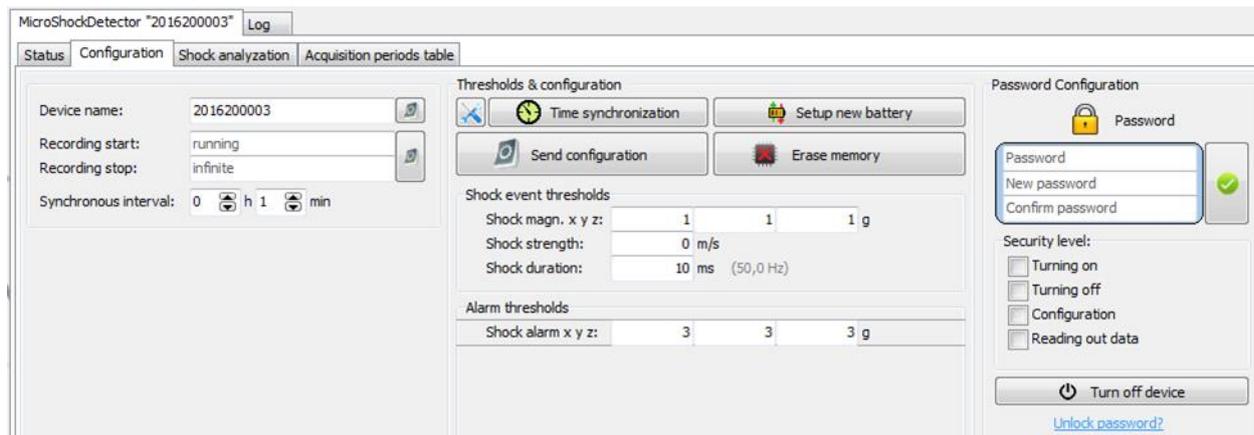


Image 19: Configuration of the device

For the meaning of the used settings see also Section 4.3.2. By the icon  you can restore the default settings.

The **buttons** have the following functions:

- Time synchronisation: synchronizes the clock in the device to PC time
- Setup new battery: resets the battery consumption meter after the change of the battery in the device
- Send configuration: sends the all settings to the device
- Erase memory: deletes the all data in the memory of the device

### Configuration of the registration thresholds:

The correct configuration of the registration thresholds is fundamental for the storage of the shock measurements. A shock must reach the shock amount, specified at least on one axis X, Y or Z and at the same time the minimum shock length. When a value greater than 0 m/s is entered, the shock strength must be also met as a criterion (see also Section 4.3.6 Principle of the shock recording).

### Change of the synchronous interval and of the alarm thresholds:

The configuration of the synchronous interval is performed using the selection fields "Synchronous interval" in hours and minutes (*Image 19*). During the configuration of the zero no record of the time-synchronous temperature measurements takes place.

The entry fields for the limit values of the alarm display are next to it. On the basis of the configured thresholds, shock events are marked with shock direction if exceeding of the threshold is detected during the measurement run (*Image 13*). The alarm threshold for each axis must be at

least as large as the associated recording threshold. As soon as the first alarm has been detected the red *alarm* LED lights for status request.

### Erase Memory:

The function „Erase Memory“ erases the all data, stored in the device.

---

#### Attention!

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

---

### Configuration of password and access rights:

It is possible to protect the device with a password and different access rights. The password may contain up to 8 characters. By clicking on the green tick the new password settings are transmitted.

---

#### Note:

To remove a password again, leave the field "New password" empty.

---



Image 20: Creating/changing password



Image 21: disable password

- *Password:* Enter the current password or a master password
- *New password:* Enter the desired new password
- *Confirm password:* Please enter the new password for confirmation

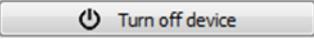
- *Turning on:* If this field and a password are activated the software is required to turn on the device. The *control* button must be pressed >2s until the *status* LED blinks green; then made the USB connection within 1 minute and enter the password to turn on the device.
- *Turning off:* If this field and a password are activated the turn off is only possible by use of the button . Then the password is requested (Image 22).
- *Configuration:* If this field and a password are activated changes in configuration and erase memory are only possible after entering the password (Image 22).
- *Reading out data:* If this field and a password are activated the password is requested when making the USB connection (Image 22).



Image 22: unlocking of USB connection, configuration or On / off switching

If you lose the password, click on [Unlock password?](#). This opens your default e-mail program with a prepared email and a device-specific key to the address [transport@smt-elektronik.de](mailto:transport@smt-elektronik.de). You will receive a temporary master password in a short time. You will need to enter this password when queried (Image 22) or in the field *password* (Image 20). Then a new password can be assigned for the device as described above.

### **Change of the device name:**

The device name of the MONI LOG® MicroShockDetector can be changed by the user. The maximum of up to 16 characters is available. The designation will be saved and transmitted to the device by pressing the ENTER key on your keyboard or by clicking the button next to it on the right. The designation can be selected individually. It makes sense to name the designation according to measuring point, measurement task, etc. (for example, "Transport 1").

---

### **Adjust recording period:**

The desired recording period for the device can also be set by the user. If a recording period is defined, the measurement recording begins at the starting time. By exceeding the stop time point, the measurement recording is stopped. If the entry fields are not empty, the measurement recording runs as long as the device is switched on.

---

The entry of the starting and stop time proceed in local time in date format:

**dd.mm.yyyy hh:mm:ss**  
**(Day.Month.Year Hour:Minute:Second)**

---

The configuration of the recording period is possible by pressing the ENTER key on your keyboard or by clicking the button on the right.

### **Configuration of the device time:**

The synchronization of the system time is done by clicking on the clock icon. The device works internally with Coordinated Universal Time (UTC). This is the same all over the world, this means independent from the time zones. The PC program shows, however, depending on the time zone setting of your PC, the time, converted to your local system.

## 5. FIRMWARE-UPDATE

### 5.1 PREPARATION

Through a firmware update, a MONI LOG<sup>®</sup> MicroShockDetector receives an updated application program if this update file is provided by the manufacturer.

**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<sup>®</sup> MicroShockDetector 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<sup>®</sup> device yet!
- Ensure that on your computer no MONI LOG<sup>®</sup> Analyzer programmes are executed.

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#### **Attention!**

Back up all measurement, diagnostics and configuration data of your device prior to the firmware update to prevent a possible data loss. The memory is reset to default settings.

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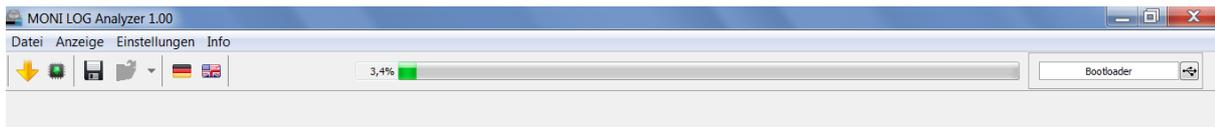
In the switched off condition of the device connect the USB cable and keep the *control* key pressed (~1 second, *status* LED is illuminated **green**) until the *status* LED starts to flash **red** with 1 Hz. The update mode is active now. It only remains active as long as the USB cable is connected. 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 5.2 „Carrying out update“.

## 5.2 CARRYING OUT UPDATE

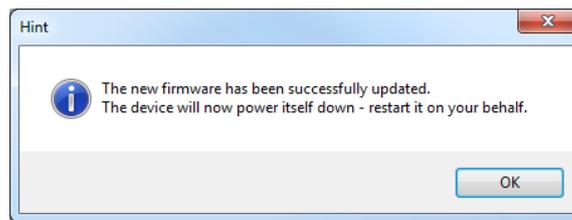
After you have started your MONI LOG<sup>®</sup> device in the update mode, start the PC software. The PC software should automatically detect the MONI LOG<sup>®</sup> device which is in the update mode and open a window to select an „Encrypted Hex File“.

After selecting the update file the charging process, which must not be interrupted, starts. The status LED illuminates red permanently.



*Image 23: Firmware update*

If the progress bar shows 100%, then the message of the successful completion of the update appears.



*Image 24: Information message after successful firmware update*

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

If the update process fails, a corresponding error message is displayed, the MONI LOG<sup>®</sup> 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 5 „Firmware-Update“.

## WARRANTY CERTIFICATE

### MONI LOG<sup>®</sup> MicroShockDetector

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 ELEKTRONIK GmbH

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