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MADE IN GERMANY

Henning Sensor Suite

V 1.97

Operating Manual

Copyright

Warranty

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We are welcoming your suggestions and comments.

Address

Henning GmbH & Co. KG

Loher Str. 4
58332 Schwelm
Germany

FON: +49 2336 / 9 29 8 – 0
FAX: +49 2336 / 9 29 8 – 100

eMail: info@henning-gmbh.de
URL : http://www.henning-gmbh.de/

Service-Hotline: +49 2336 / 9 29 8 - 232

Subject to technical changes.

Content

1 General Instructions

1.1 How to use this operating manual

In order to use the system in a correct way, it is important to read the entire manual before starting to perform measurements on elevators. Particularly important information, such as warnings and cautions are designated with a warning symbol and a highlighted text.

1.2 General safety and work instructions

This Software and the associated sensors are measuring tools to be utilized by lift professionals exclusively. The system cannot compensate for their expertise, but supports them in the assessment of lift systems. Therefore, not only an understanding of the actual operation of the system is required, but also knowledge about the theoretical background of the method employed to be able to comprehend the extent of the activities to be undertaken and the resulting consequences.

The instructions in the manual have to be strictly observed.

Please observe the instructions in the operation manual for the correct and safe operation of the system.

1.3 Maintenance and calibration

The sensors and other modules have been developed to be applied at elevators on a daily basis and have already been proved to be successful in practice.
The sensors are very precise measuring instruments which have to be treated very carefully. If the sensors were exposed to excessive mechanical influences or electric shocks, the correct function of the sensors should be verified.

We recommend at least one annual service check of the electronic components. The calibration of the Sensors should also be carried out annually.

1.4 Application in explosion-proof facilities

The sensors described here have no approval for application in explosion-proof environments. Please observe the relevant regulations.

1.5 Liability and consequential damage

Henning GmbH & Co. KG is not liable for the damage caused by ignoring the instructions of this manual or other protection rules or rules for protection against accidents. The provisions of warranty and liability according to the licence agreement for the *Henning Sensor Suite* are applicable.
As far as permitted by law, Henning GmbH & Co. KG excludes any warranty for fitness and suitability for a particular purpose, whether expressly stipulated or implied.

Henning GmbH & Co. KG is not liable for any damages including loss of profit or lost information, interruption of business or other financial losses.

Please be sure that the system is only applied by expert personnel that understand the consequences of the application.
All applicable safety requirements have to be carefully observed.

2 Scope of Delivery

The Henning Sensor Suite is usually delivered together with the respective Sensor hardware on a disk. The latest version is available on our website at any time www.henning-gmbh.de; the download is free of charge.

3 Installation

The Henning sensor suite runs on all Windows operating systems from Windows XP (note the special instructions for Windows XP in the following subchapter). A specific hardware configuration is not required. We recommend a processor of at least 1 GHz, RAM of at least 4GB of, free hard-drive space of 100 MB, a monitor with a minimum resolution of 1024 x 768 pixels and the ability to connect USB devices to the PC.

You have to have a administrator-rights to install Henning Sensor Suite on your PC.

On the installation-disk there are two files (setup.exe, HGSui-te_setup.msi). Start the setup.exe file and you will be guided through the installation process.

3.1 Installation under Windows XP

For installation under Windows XP, the so-called “Windows Language Support Service Pack” is required. This is usually already pre-installed. Should this not be the case, it may be downloaded from the following URL:

http://www.microsoft.com/enus/download/details.aspx?amp;DisplayLang=en&id=25241

The installation of the “Windows Language Support Service Pack” must be carried out prior to the Installation of the Henning Sensor Suite.

3.2 Installation under Windows 10

To make use of the Bluetooth functionality of some sensors, please make sure that you have installed all the latest Windows 10 updates (in particular the KB3093266 update).

3.3 Hardware Drivers

The devices of the latest generation, provided that they are connected via the USB interface, are so-called “Human Interface Devices”. For such devices, the necessary driver is already integrated into the Windows operating system. Currently only the sound level meter, the pressure sensor HS1 and the AE12 controller require a special driver. This can be found in the installation directory under the subdirectory 'Drivers'.

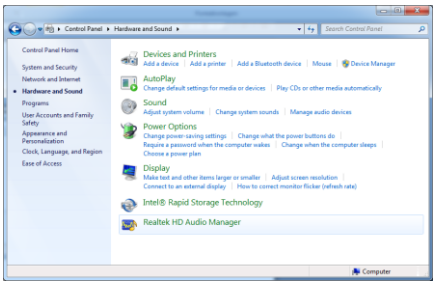
3.4 Establishing Bluetooth Pairing

You need a Bluetooth adapter on the computer in order to establish a wireless Bluetooth connection. In case the computer does not have such an adapter in place, use our optional Bluetooth adapter. Under the Windows 7 operating system (and subsequent versions), follow the instructions of the operating system. These appear as soon as you have connected the Bluetooth adapter to your computer. In exceptional cases, depending on your computer configuration, it can happen that the adapter is not automatically detected and installed by the system. In this case, use the supplied installation CD and follow the instructions of the installation program. The operating instructions of the Bluetooth adapter is also found on the CD.

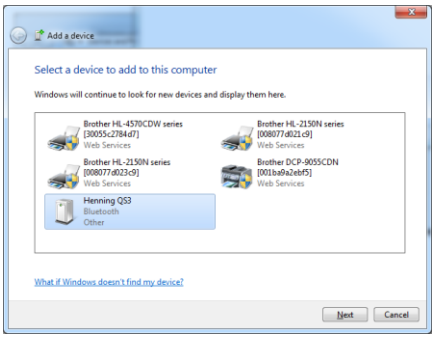
To be able to use the wireless connection between one of the measuring devices and the computer, you must log the respective measuring device on the computer. Here the login procedure is described under Windows 7; for other operating systems, make the settings accordingly. All measuring devices use the Bluetooth PIN as the main key

0000
(four zeros)

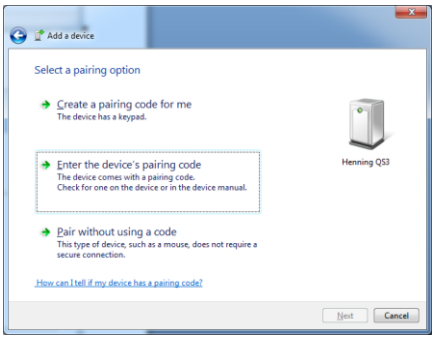
To log the measuring device on to the computer, please turn this on.



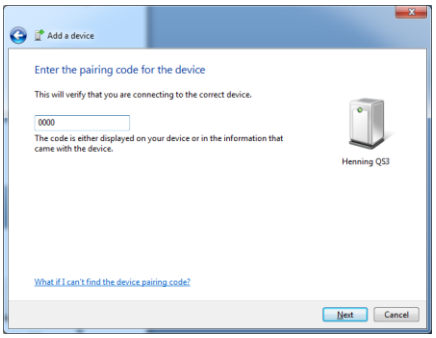
Open the category of “Hardware and Sound” on the System Control.
Find the “Add Bluetooth Device” entry and start it with a mouse click.
Make sure that the measuring device is turned on.



Now all available Bluetooth devices will be searched and listed. Select the respective entry with a double click.



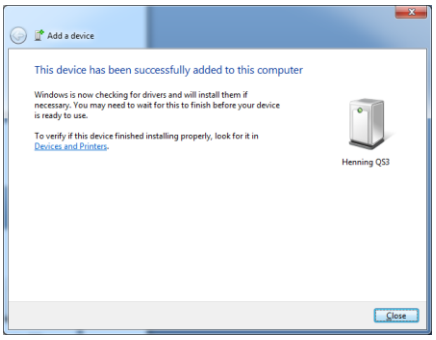
In the next dialogue box, select that you intend to enter the “coupling code of the device”.



The coupling code is 0000. Enter this and confirm with “Next”.

The device is then configured.

At the end of the installation, click on “Close”.



The measuring device is now available as a virtual COM port on your Windows system, and it can be listed on the software as a directly via USB connected device can be used.

4 Software-Interface

The software interface is divided into two main elements: The management and administration display and the main display area. In the management and administration area projects and measurements, basic software settings and several additional tools such as data-import is being managed. In the main display area, the individual sensor dialog-fields and the dialogues for the evaluation of stored measurements are displayed.

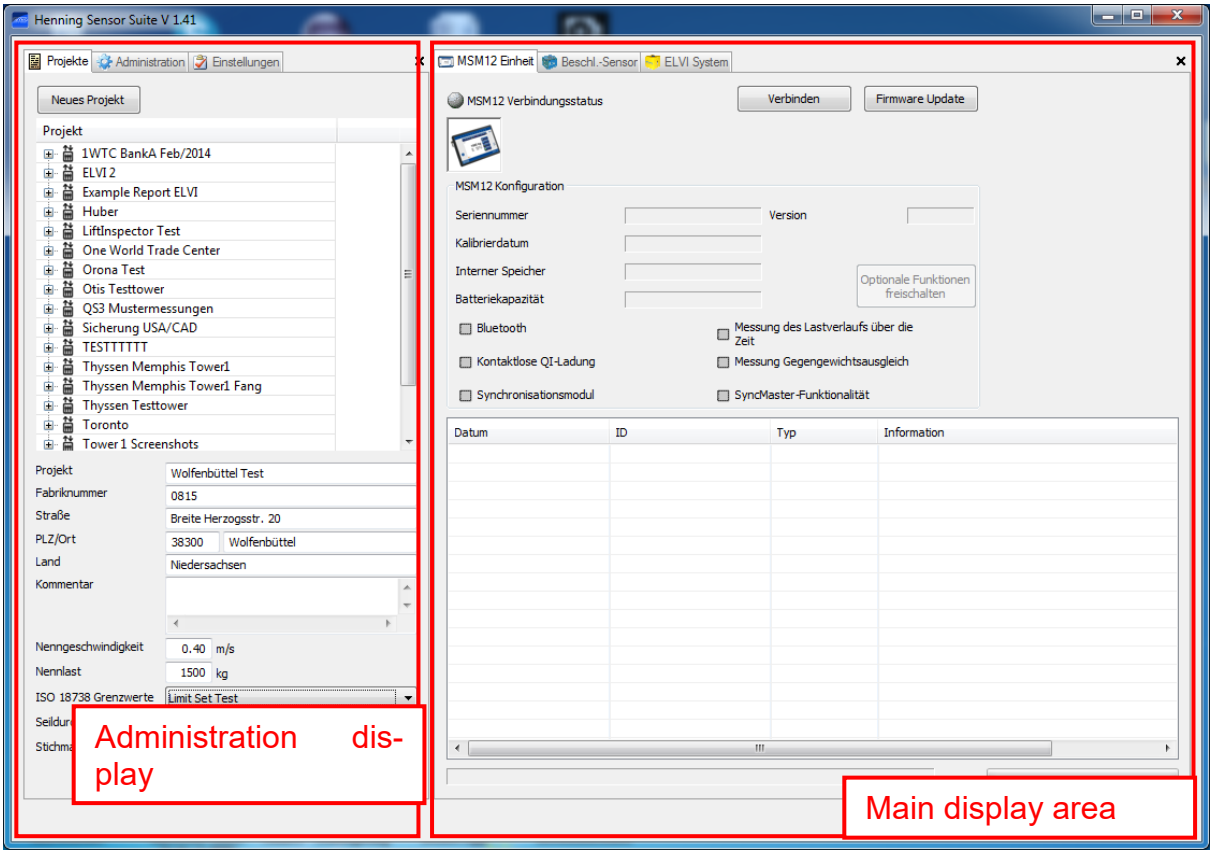
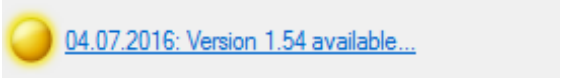


Illustration 1: Software-Interface

You may adjust the degree of division between the two areas. Move the mouse to the vertical dividing line between the two areas
(the mouse cursor then changes to this shape: ⟺) and change the division ratio by moving the mouse while holding down the left mouse button. The changes take effect as soon as you release the mouse button.

4.1 Update Notification

Once the PC has been connected to the Internet, a search for new versions of the software is automatically started.
If a new version is available, the following message is displayed at the bottom left hand side of the software interface:



4.2 Management & Administration Display

4.2.1 Project-Management

Within the software, an elevator/escalator represents a project. If you want to group certain elevators/escalators, it makes sense to name the individual projects in a similar fashion, (e.g. sample project lift 1, Sample Project Lift 2, etc.). As the software lists the individual projects in alphabetical order, the projects of the group will be dis-

played together.
The project management consists of a list in tree-format, the elevators being the branches, and the branches dividing into the individual measurements. The project data of the currently selected project is shown below the list.

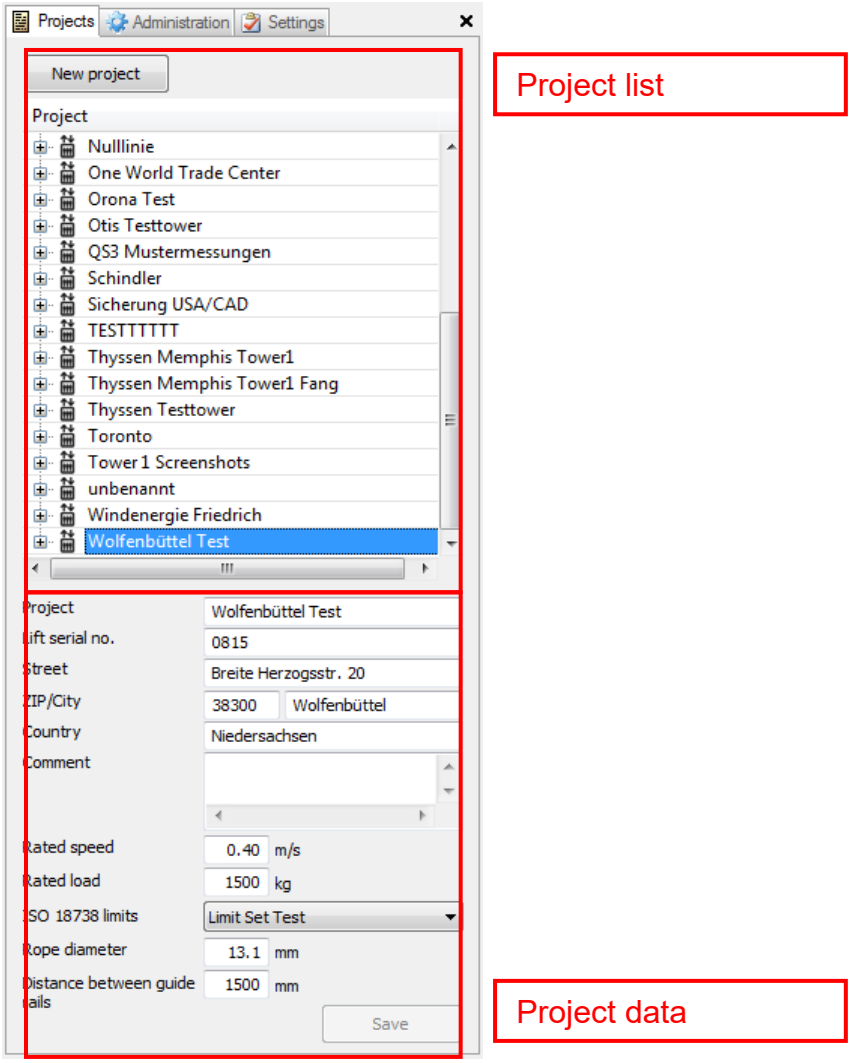


Illustration 2: Project management

4.2.1.1 List of Projects

Within the project list, the projects are listed in alphabetical order. Newly created projects will be added to the end of the list and sorted alphabetically after the program has been re-started again. In front of each entry you will find a plus sign; when this is clicked, the corresponding project-branch opens and lists the subcategories (sorted by measuring device). Once a project has been clicked or highlighted (marked in blue, see Illustration 2), the data which have been stored by the user will be displayed in the project (see. Chapter 4.1.1.3).

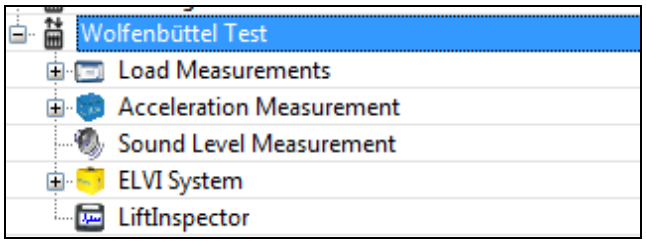
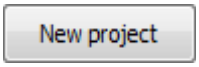


Illustration 3: Project-Subcategories

The subcategories may also have additional branches that are opened by clicking on the associated plus sign.

4.2.1.2 Creating a new Project

The button 

which you will find at the top of the Project-Management, creates a new project, which will appear as “untitled” in the project list. The cursor will automatically change into the project data to be completed by the user.
(compare chapter 4.2.1.4).

4.2.1.3 Importing a Project

The button v which you will find at the top of the Project-Management, imports a project from an existing project export file, which will appear as a new entry in the project list.

4.2.1.4 Project-Data

4.2.1.4.1 Elevators

Relevant elevator parameter may be entered into Project-Data. As soon as a project has been chosen in the project list, the relevant data is displayed.

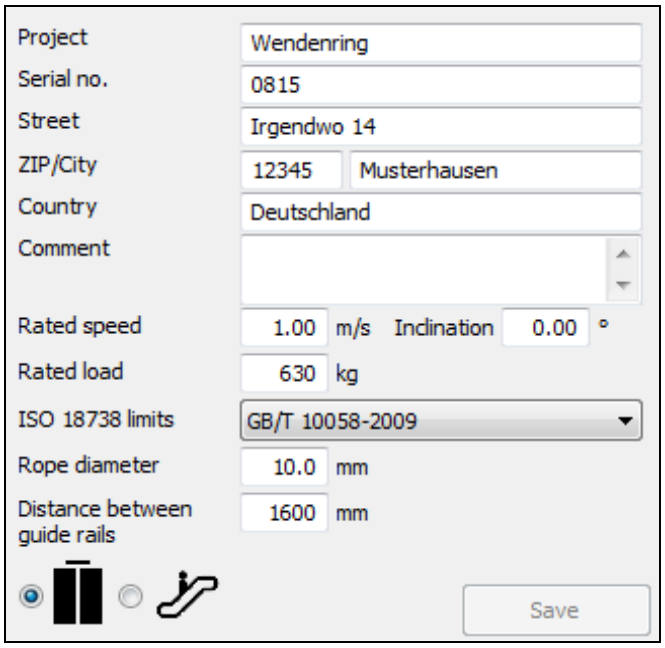


Illustration 4: Project-Data Elevators

The project data, as far as it relates to values related to physical units, will be converted automatically, when the physical unit is changed.

Of particular importance is the entry of the rope diameters; if a unit conversion into inches has been done. In this case, the software expects the value to be a fraction (for example 3/8).

Once changes have been made to the project data, the button Save will be unlocked.

Changes to the project data will only be saved, if after changing the button Save is pressed.

For “ISO 8100-34 Limits” you may select an existing limit value set (Grenzwertsatzverwaltung vgl. Kapitel 4.2.2.1 Setting ISO 8100-34).

4.2.1.4.2 Escalators/Moving Walks

Relevant escalator parameter may be entered into Project-Data. As soon as a project has been chosen in the project list, the relevant data is displayed.

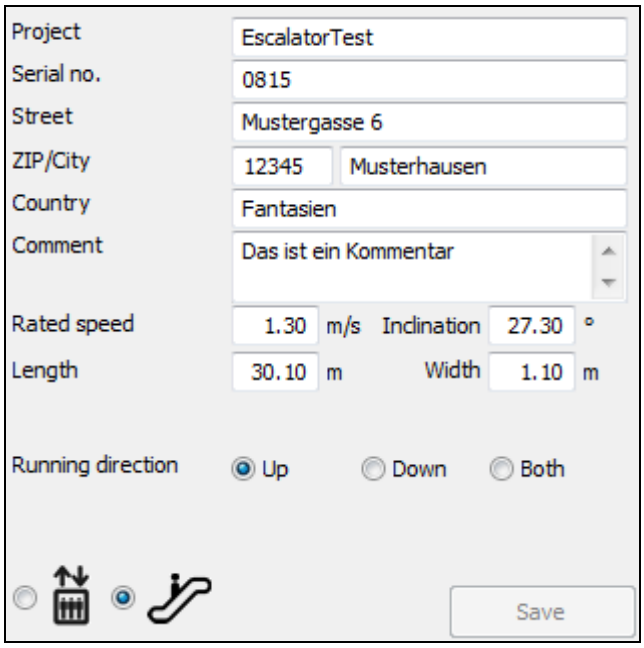


Illustration 5: Project-Data Escalators

The project data, as far as it relates to values related to physical units, will be converted automatically, when the physical unit is changed.

Once changes have been made to the project data, the button Save will be unlocked.

Changes to the project data will only be saved, if after changing the button Save is pressed.

For “ISO 8100-34 Limits” you may select an existing limit value set (Grenzwertsatzverwaltung vgl. Kapitel 4.2.2.1 Setting ISO 8100-34).

4.2.1.5 Online Measurements

With some sensors on-line measurements may be recorded. The sensors have to be connected directly to the computer. The measurement data in these cases will only be stored on the computer and not in the sensor itself.

The online measurement is available for:

-The rope load evaluation MSM12
-The accelerometer QS3
-And the sound level meter 8921

To start an online measurement, right-click on the project in the project list (different behavior with escalator projects), to which the new measurement should be saved. After clicking the following context menu appears:

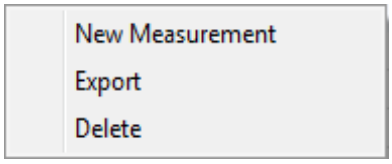


Illustration 6: Context menu projects

Once “New Measurement” has been selected, a new user dialog will be displayed in the main display area:

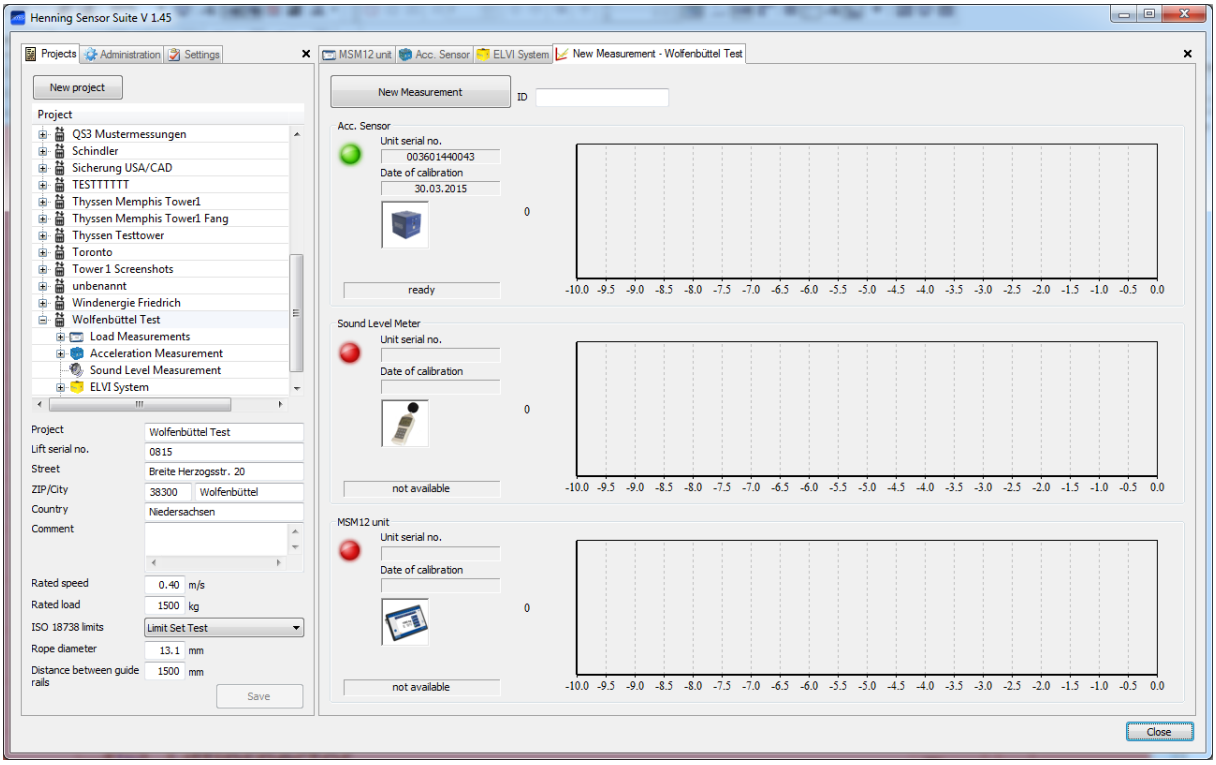


Illustration 7: User’s Dialog “New Measurement”

The software automatically searches for sensors which are connected and shows the status of the devices via a coloured icon:

Device not found or not connected

Device found, but not ready for measurement

Device found and ready for measurement

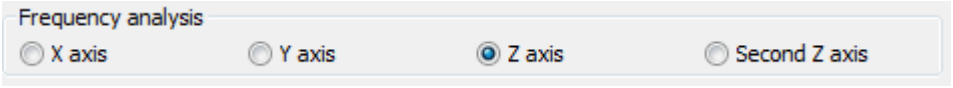
The measurement may be named by any ID. The ID must be assigned before the start of the measurement.

The measurement is started and ended via the button 

Once the measurement has been completed, the data is available in the respective sub-project list.

The data of all devices involved in a measurement will be presented synchronized. Depending on the computing power of the utilized PC, the online presentation might jerk. This can be adjusted by using the parameter "Screen refresh rate" (compare chapter 4.2.3 Settings***)***

For the acceleration data of the sensor QS3 a live frequencies-analysis is calculated in displayed in the curve view. The axis for FFT evaluation might be selected by the following selection:



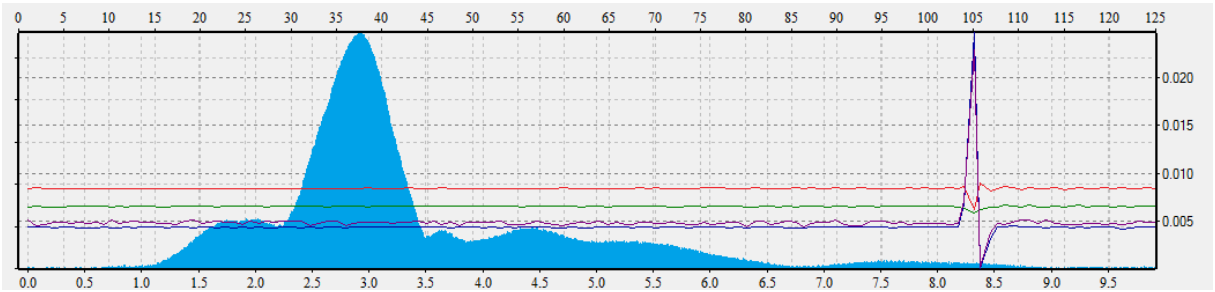


Illustration 8: Online-FFT fort he acceleration data, plotted in light blue

4.2.1.6 Deleting a Project

To delete a project, click with the right mouse key on the relevant project in the project list. After clicking the following context-menu will appear:

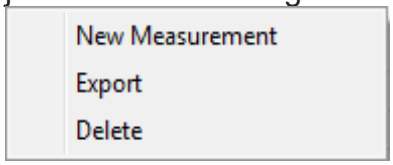


Illustration 9: Context-Menu Projects

If the button "Delete" is selected, the entire project will be deleted after a safety question has been asked. Alternatively, after selecting the project the "Del" key may be

used.

The deletion process is irreversible. All data and measurements are removed from the computer. Deleted projects cannot be restored.

4.2.1.7 Exporting a Project

To export a project, click with the right mouse key on the relevant project in the project list. After clicking the following context-menu will appear:

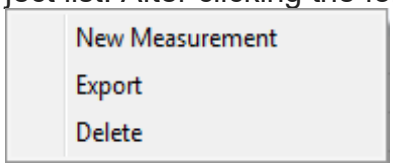


Illustration 10: Context-Menu Projects

If the button “Export” is selected, the entire project will be exported to a export file. You will be asked for the destination export file name in a separate dialog box.

4.2.1.8 Existing Measurements

Measurements may be found in the subcategories of projects from the project list. All measurements are provided with a time stamp and ID. The latter can be allocated either in the relevant sensor (depending on sensor type) or in the software. A right-click on the measurement will the following context menu:

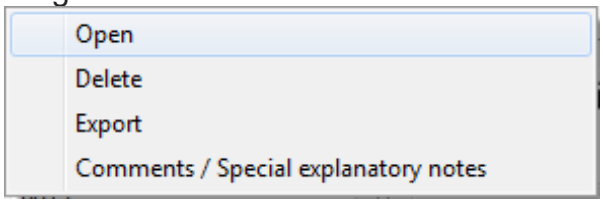


Illustration 11: Context-Menu Measurements

4.2.1.8.1 Opening Measurements

In order to open a measurement double-click with the left mouse-key to select a file. The actual measurement then opens in a new tab in the main display area. Alternatively, if you click with the right mouse-key to select a file, a pop-up menu (see Illustration 8: Context Menu Measurements) will appear, in which “open” may be selected to display the measurement. For more information on measurement display and evaluation tools may be found in the relevant sections of chapter 4.2 Main Display Area

4.2.1.8.2 Deleting a Measurement

If the button “Delete” from the context-menu is selected (see illustration 8, Context-Menu Measurements), the measurement will be deleted after a safety question has

been asked. Alternatively, after selecting the measurement, the “Del” key may be used.

The deletion process is irreversible. The measurements are removed from the computer. Deleted Measurements cannot be restored.

4.2.1.8.3 Exporting a Measurement

To export individual measurements, use the key „Export” in the context-menu (see illustration 8, Context-Menu Measurements). The measurement will be stored with a file name ending on TML.

Depending on the type of measurement the export will consist of more than one file. We therefore recommend to export into a newly created folder.

4.2.1.8.4 Importing Measurements

Importing measurements is not done via the context-menu for measurements, but through the context menu of the subcategory of the relevant project. The procedure for import is therefore as follows:

1. Choose project and select by clicking the „+” sign to show the subcategories
2. Depending on the measurement to be imported, right-click on the subcategory
3. click the button „Import” in the context-menu
4. Select the file to be imported in the file selection dialog

To import, for example, an acceleration measurement into the project “QS3 Sample Measurements”, right click on the subcategory “Acceleration Measurement”:

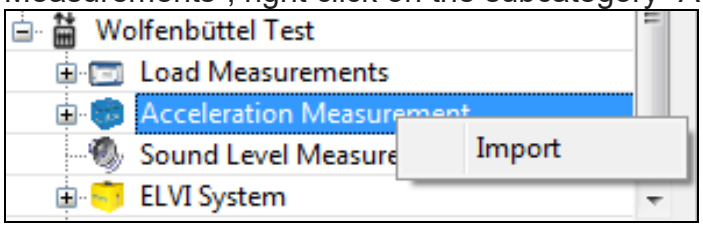


Illustration 12: Example Import of Measurement

4.2.1.8.5 Commenting on a measurement

For each measurement (with the exception of Lift-Inspector measurements), a comment may be stored. This comment will be displayed on the associated reports. To add a comment, select a measurement from the context-menu (see illustration 8:

Context-Menu Measurements) the entry “Comments/Special Explanatory Notes”. Enter your comments into the dialog box and save by clicking the “Apply” button.

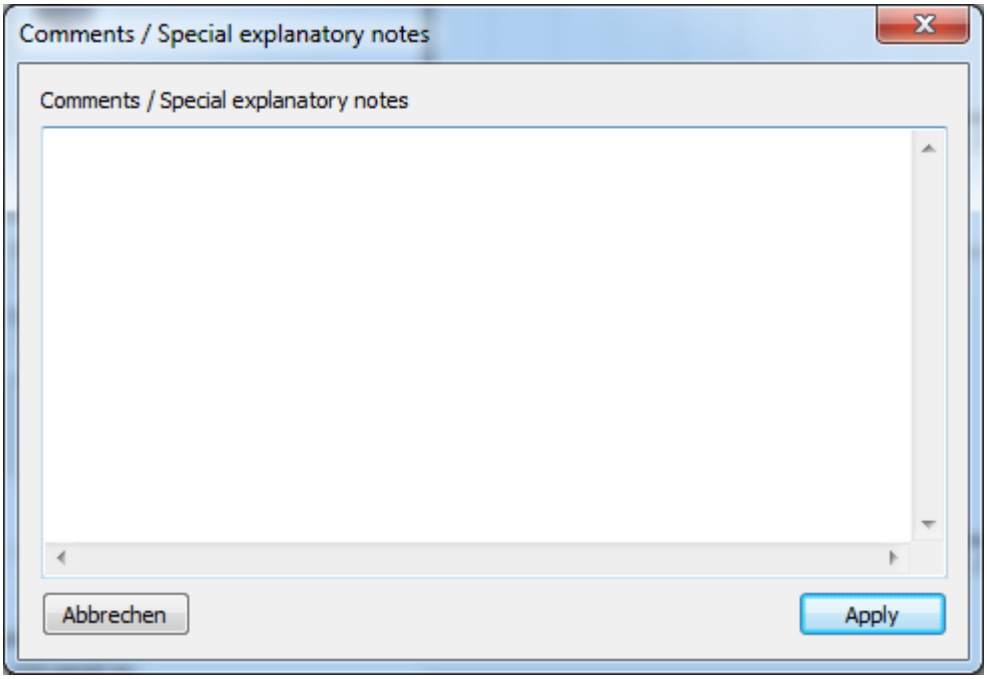


Illustration 13: Commenting a Measurement

4.2.2 Administration

In the administration area of the Henning Sensor Suite basic settings for the software are being made. In addition, other useful tools and software wizard can be found, for example for importing data from previous software versions.

4.2.2.1 Setting ISO 8100-34 Limits

ISO 18738 for measuring ride quality in elevators does not impose any limits. Instead, the standard provides the necessary algorithms and procedures to make driving quality measurable.

It remains up to the user to create his own set of limits, which apply to the relevant elevators, depending on the application (hotel lift, elevator in public institutions, freight elevators, etc.) and the desired ride-quality. The Henning Sensor Suite provides a limit management for this. It can hold any number of limit sets the user may desire. Single elevator or projects may be allocated exactly to a certain set of limits (see. Chapter 4.1.1.3 Project Data).

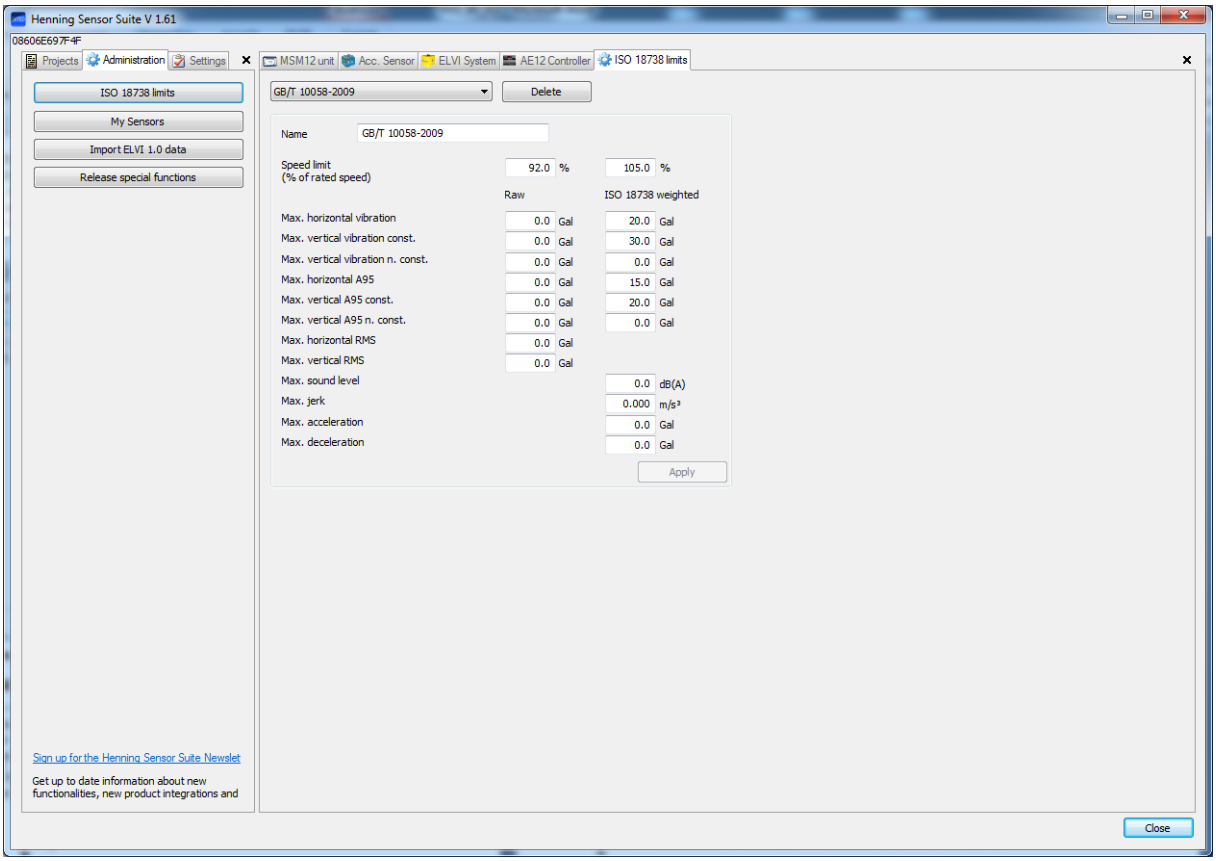
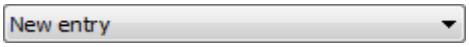


Illustration 14: Managing ISO 8100-34 Limits

4.2.2.1.1 Creating Limits

To create a new set of limits, choose 

in the drop-down menu. Subsequently, the name and the actual limits for the various parameters in accordance with ISO 8100-34 should be entered.
Once all the entries have been made, the new set of limits can be saved with the button. 

The limit set is permanently stored in the database of the Henning Sensor Suite.

Limits that are set to "0", will not appear in the report output.

4.2.2.1.2 Changing a Limit Set

To change an existing limit set, first selected it in the drop-down menu.

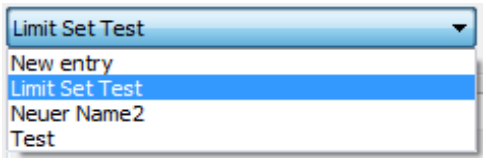


Illustration 15: Choosing an existing limit set

The selected limit set is then displayed and may be edited. Once editing is complete, the changes must be saved by pressing the Apply button.

4.2.2.1.3 Deleting a Limit Set

To change a limit set, first selected it in the drop-down menu and delete it by pressing the Delete button.

The deletion process is irreversible. The limit set is removed completely from the computer. Should the limit set have already been used for some projects, the limits of these projects are still available.

4.2.2.2 Managing „My Sensors”

All sensors, which had been connected at least once connected to the Henning sensor suite will be added to the list “My Sensors”. The list is used for a quick overview of the software versions and the calibration statuses of sensors and devices. The list of respective sensors may be found within the device groups. For each sensor and device the serial number, the current software version (if available), the last calibration date and the number of weeks until the next calibration is due is indicated. Sensors which should be calibrated within the next four weeks are marked orange. Is the calibration overdue, units will be marked red in the list.

With each start the software the Henning sensor suite checks, if the calibration of the sensors has expired. If at least one sensor is found with an expired calibration, the software will automatically switch into the “My Sensors” list after the start.
These warnings may be turned off for individual sensors. For this purpose, the checkbox of the relevant sensor (to be found at the top of each list line) has to be marked and then the button Disable warning has to be pressed. This button inverts the current alert status. This means that the warning for a marked sensor will be activated or deactivated depending on the status before the change.

The current alarm status is also displayed as a column within the list.

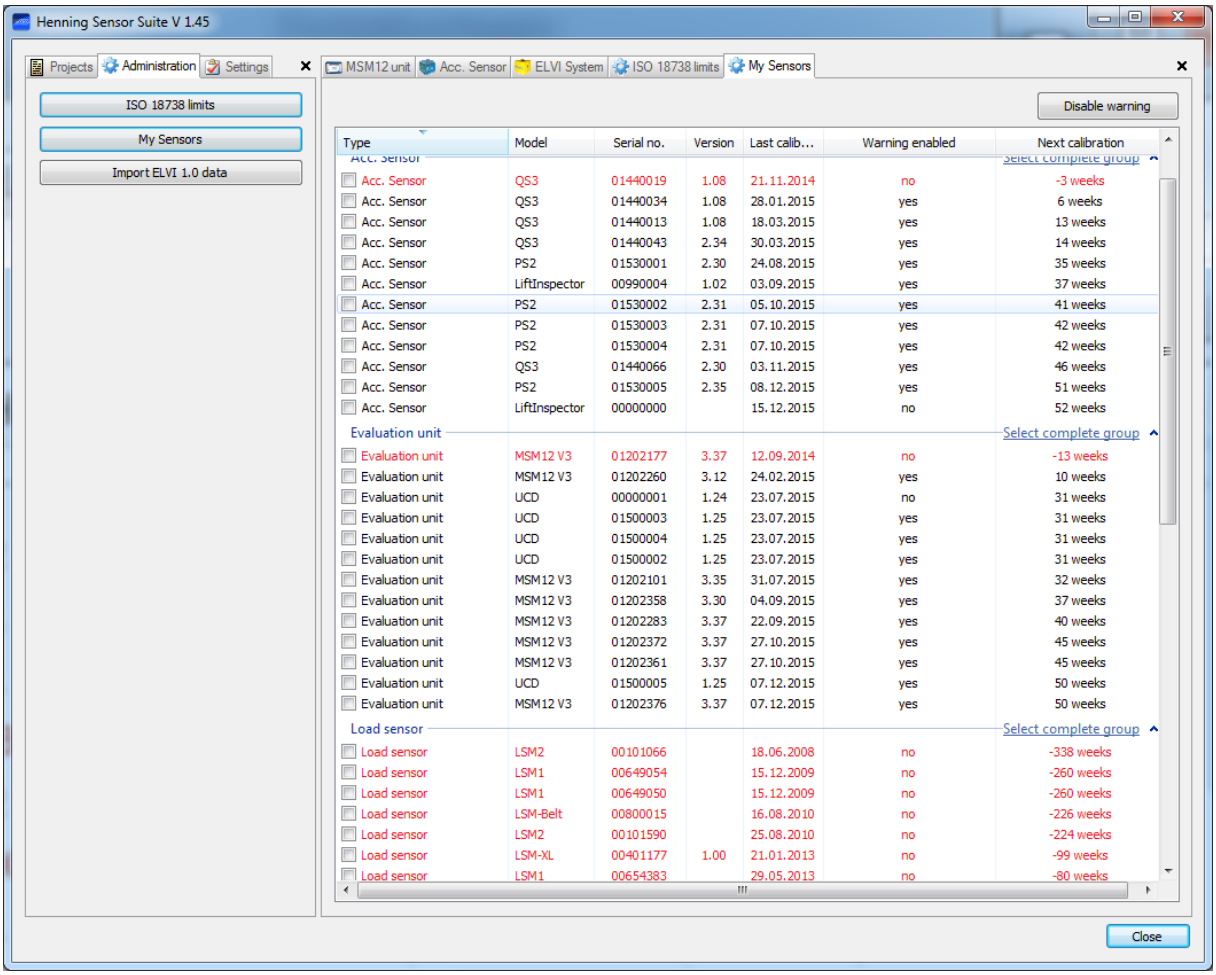


Illustration 16: List "My Sensors" with sensors and devices which have been connected to the Henning sensor suite previously

4.2.2.3 ELVI 1.0 Importing Data

This feature allows the database inventory of ELVI 1.0 to be read into the system.

4.2.2.3.1 Requirements

The import can only be completed, if the ELVI software has been installed properly on the computer. The Henning Sensor Suite performs database queries and accesses files of the existing database of the ELVI 1.0 system.

4.2.2.3.2 Execution

Once this function has been selected, the Henning Sensor Suite automatically creates a list of projects present in the ELVI 1.0 database. This list shows the projects to be imported which may be selected with the Checkbox. Once all projects to be imported are selected, the button Start import is used. Depending on the number of projects to be imported, this process may take some time.

Progress is shown at the progress bar next to the button Start import

Once the import has been completed, the imported projects are accessible via full project list (see Chapter 4.1.1.1 project list).

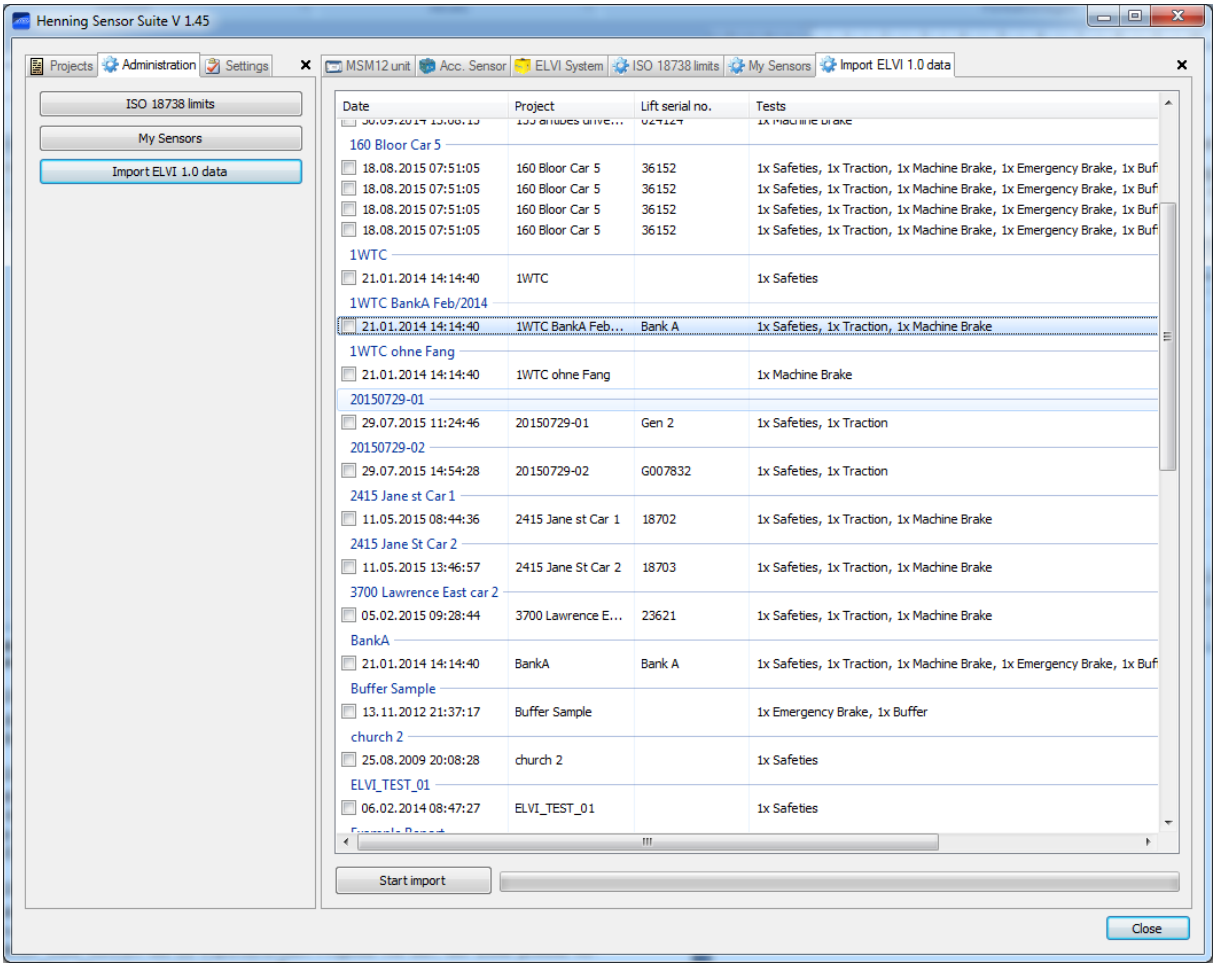


Illustration 17: Importing ELVI 1.0 Projects

4.2.2.4 Enable optional functions

This function is utilized to enable special functions in the Henning Sensor Suite. Clicking on the relevant button opens a file dialog in which a license file must be selected. After the license file has been read, the software must be closed and restarted. The new functions are then available.

4.2.3 Settings

Settings are not applied retrospectively! The program must be restarted after changing the language for example, or after changing a curve colour the corresponding measurement must be reopened to show the change.

Parameter	Description	
Language		
Language	automatically	Language of operating system will be utilized
	Language	Various languages available, list is constantly being updated
Units		
Acceleration	Unit, in which all acceleration values are shown	
Jerk	Unit, in which all jerk values are shown	
Speed	Unit, in which all speed values are shown	
Distance	Unit, in which all distance values are shown	
Load	Unit, in which all load values are shown	
Pressure	Unit, in which all pressure values are shown	
Diameter	Unit, in which all diameter values are shown (usually for frequency analysis)	
Rope Diameter	Unit, in which all rope load values are shown. If Inch is chosen, the format will show fractions (i.e. 3/8 Inch)	
Data Transmission		
Delete automatically after transmission	If this function activated, all data will be deleted from the sensor automatically after it has been read out	
Report Settings		
Logo File	At this point, an image file in the format JPEG, BMP, TIFF, PNG or GIF may be selected that is used as a logo on all reports. The optimum size (W x H) is 75.5 mm x 29.0 mm. Any other sizes are scaled up or scaled down.	
Creating averages of the drive sections in the ISO 8100-34 report	If this function is activated, two pages will be added to the ISO 8100-34 report showing the averages of all parameters of the upwards and downwards drives	
ISO 8100-34 raw data results from	Raw data	If this option is chosen, the ISO 8100-34 report of raw data results will be based on the actual raw data
	10 Hz low-pass filtered	With this option, the raw data results are being determined from the 10 Hz low-pass filtered acceleration data.

Ignore transgression of standard-deviation	If this option is set to "yes", the acceleration data is not checked for position-plausibility and the evaluation will be carried out in any event
Curve Display Area	
Auxiliary-Grid Colour	Sets the colour for the dotted auxiliary grid
Text Fonts	Sets the text font for the inscriptions of the axis
Text Colour	Sets the text colour for the inscriptions of the axis
Zoom Colour	Sets the colour of the zoom-rectangle which is operated with the mouse for zooming
Legends	
Showing Legends	Specifies, if legend is shown in the curve display
Text Fonts	Sets the text font for the legend
Background Colour	Sets the colour of the legend background
Left Axis ***Lower Axis*** ***Right Axis*** ***Upper Axis***	
Activating Scrollbar	Activates or disables the scrollbar for the relevant axis (see chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**, operating the curve display)
Line Colour	Sets the colour for the axis
Text Colour	Sets the text colour for the inscriptions of the axis
Text Font	Sets the text font for the inscriptions of the axis
Load Measurement	
Line Colour CH 1 to CH 12	Sets the colour for the load curves of MSM12's respective measuring channels
Total	Sets the colour for the complete load profile of all active measuring channels
Acceleration Measurement	
X-Axis	Sets the colour, in which the curves of the X-axis are displayed in charts
Y-Axis	Sets the colour, in which the curves of the Y-axis are displayed in charts
Z-Axis	Sets the colour, in which the curves of the Z-axis are displayed in charts
Additional. Z-Axis	Sets the colour, in which the curves of the additional Z-axis are displayed in charts
Speed	Sets the colour, in which the speed curves are displayed in charts
Distance	Sets the colour, in which the distance curves are displayed in charts
Jerk	Sets the colour, in which the jerk curves are displayed in charts

Scaling	Automatically (axis)	In this option the software scales each acceleration axis separately depending on the maximum values measured
	Automatically (all Axis)	In this option the software scales each acceleration axis with the same value, depending on the maximum values measured
	Manually	In this option the software scales the acceleration axis scaled to the three parameters below
Scaling X-Axis manually	Scaling the curves of the X-axis; parameter „Scaling" hast to be set to „manually"	
Scaling Y-Axis manually	Scaling the curves of the Y-axis; parameter „Scaling" hast to be set to „manually"	
Scaling Z-Axis manually	Scaling the curves of the Z-axis; parameter „Scaling" hast to be set to „manually"	
Sound Level Measurement		
Line Colour	Sets the colour fort he sound-level curves	
Online-Measurement		
Screen Refresh Rate	During online-measurements, i.e. Measurements which are started and terminated via Henning sensor suite, (see Chapter 4.2.1.5 Online Measurements), series of measurements are displayed live on the screen. Depending on the computing capacity of your PC, the data may be displayed in a somewhat jerky fashion. In such a case, the default parameters (50 Hz) may be reduced to achieve a more pleasing output.	
Virtual COM-Port (Bluetooth		
Acc. Sensor QS3	Sets the virtual COM port for the bluetooth connection of the specific device	
MSM12 Unit		
Acc. Sensor PS2		
ELVI UCD		
Display Tabs		
MSM12 Unit	Shows and hide the specific tabulator in the main display area.	
Acc.Sensor QS3		
ELVI		
AE12 Controller		

Emergency Stop Analysis (AddOn)	
Low-Pass Filter Frequency	Sets the filter frequency used to filter the acceleration data from which the maximum and average deceleration values are determined. Also applies to the peak examination.
Peak-Limit for Determionation of Time Span	Specifies the limit (in g) from which the peaks are examined for the duration of the exceedance of these limits

4.3 Main Display

4.3.1 Operating the Curve Display

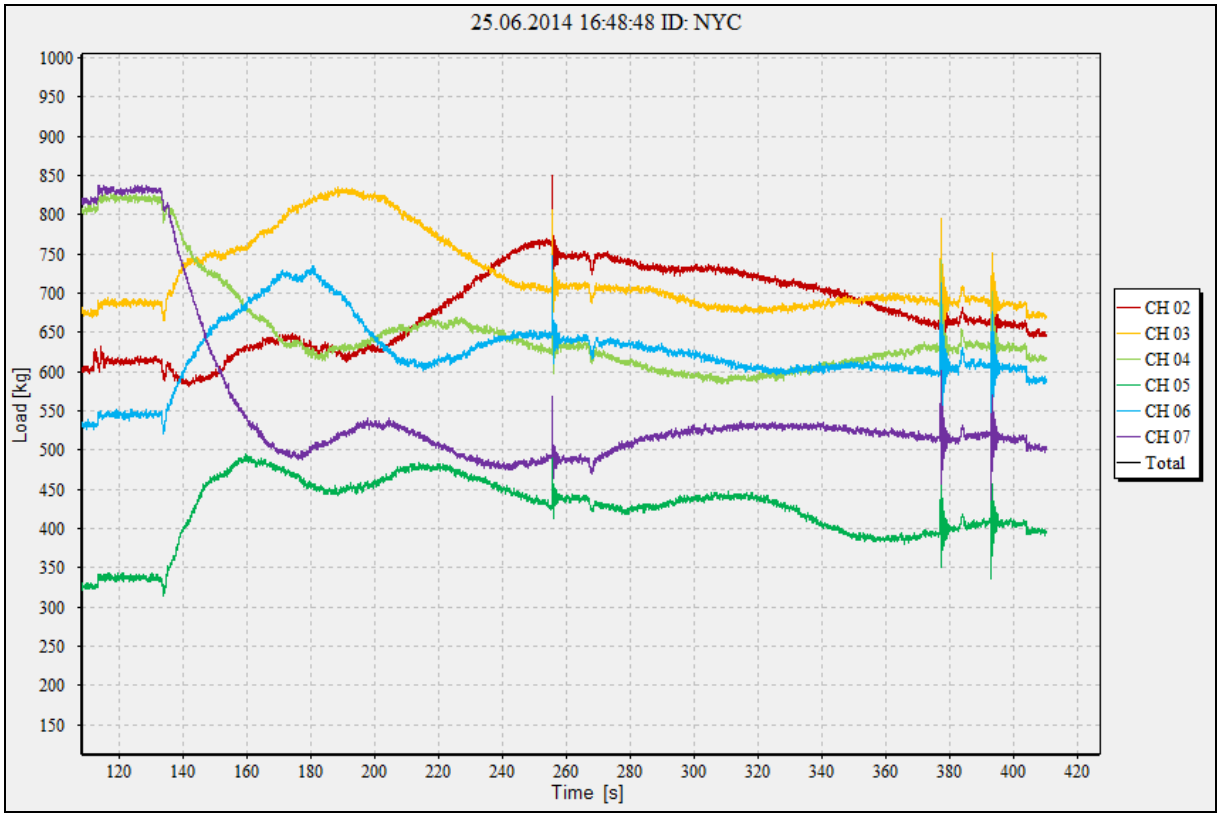


Illustration 18: Example of curves, measured while lit is travelling

4.3.1.1 Zooming

In order to enlarge a certain area of the curve display a zooming operation may be performed with the mouse. For this, the mouse pointer has to be positioned at the upper left corner of the area which is to be magnified. Keeping the left mouse button pressed, move the mouse in the direction of the lower right corner of the area to be magnified. During this process, a zoom rectangle appears, indicating the area to be enlarged. Once the left mouse button is released, the zooming has been performed.

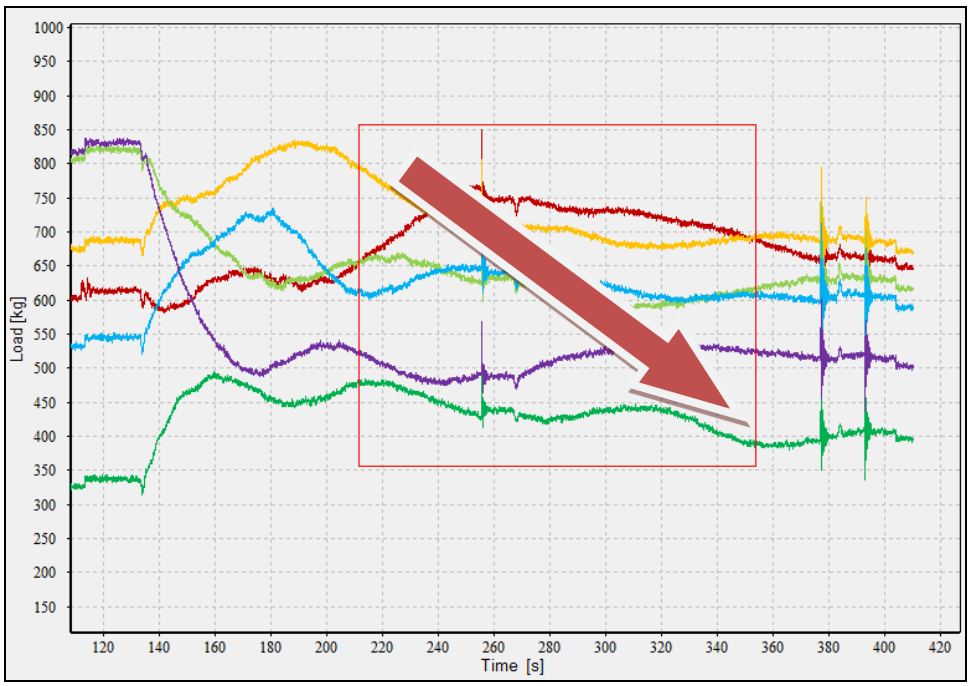


Illustration 19: Curve View while Zooming

To revert the zooming, an inverted zoom may be performed at any point of the curve view, i.e. the zoom selection begins at the bottom right hand corner and is pulled towards the upper left hand corner.

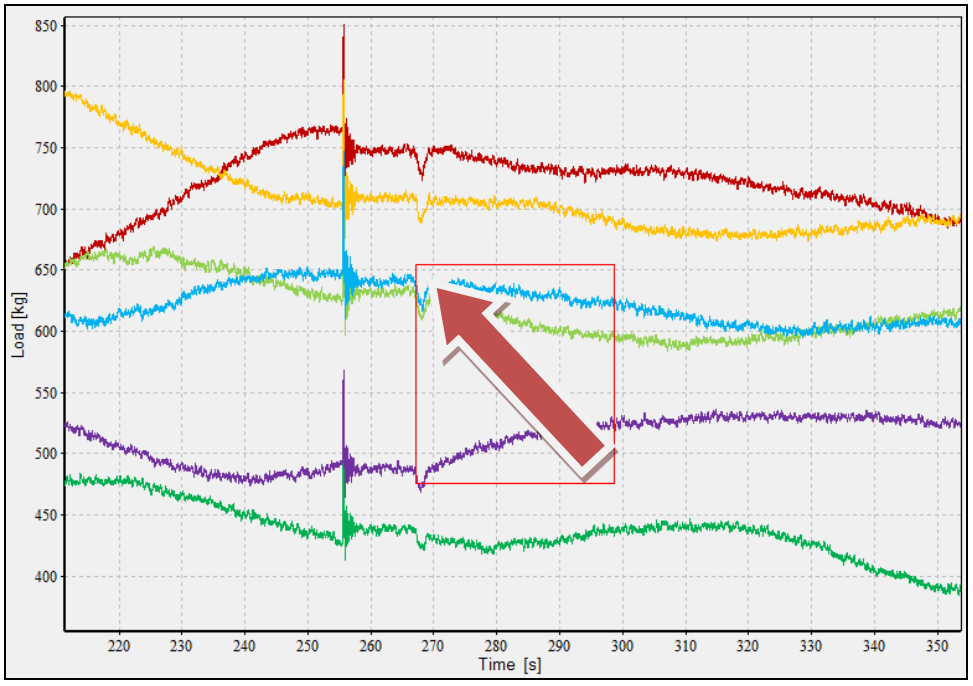


Illustration 20: Inverted Zoom

4.3.1.2 Scrolling

After a zooming operation has been performed and if the scroll bars have been enabled (see chapter 4.1.3 Settings) navigation within the curve display may be done via the scrollbars. As soon as the mouse is coming close to an axis, the relevant scroll bar is displayed.

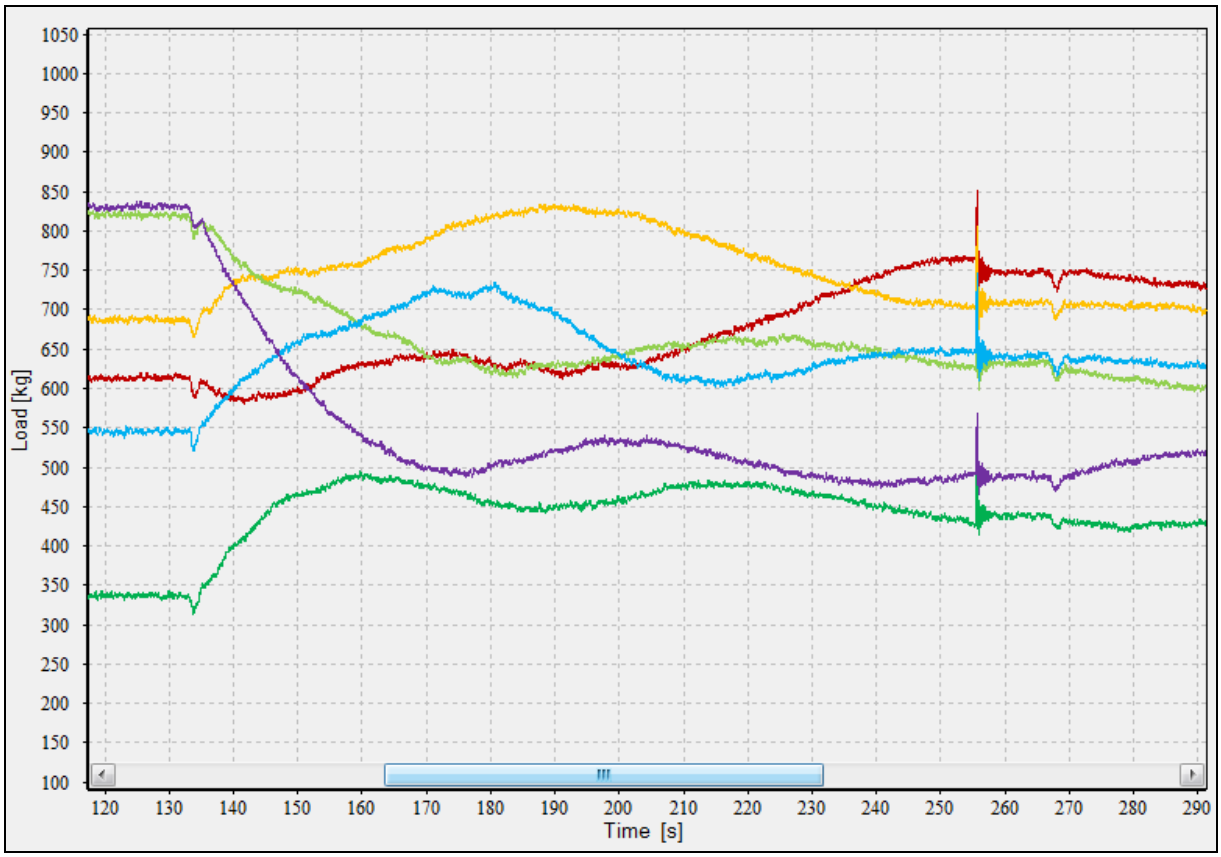


Illustration 21: Curve Display with Scroll Bar for lower Axis

The scroll bar may now be moved with the mouse to compose the image. In the above example, when the time range is shifted to the right it moves to the beginning of the measurement, if it is shifted to the left it moves to the end of the measurement.

4.3.1.3 Sliding

A click with the right mouse button into the diagram allows you to move the curves. The right mouse button has to be kept pressed for this. All movements during the period the mouse button is kept pressed lead to the corresponding shift of all curves in the diagram.

4.3.1.4 Instantaneous Values

This feature is not available for all diagrams.

If the mouse cursor is moved over a measurement point on the diagram, its appearance will change from an arrow to a crosshairs. If the left mouse button is pressed, the so marked instantaneous values of this curve are displayed in a window in the foreground. This window will also be displayed when the diagram is printed.
The current instantaneous value may be shifted in the time range by the arrow left key or the arrow right key.

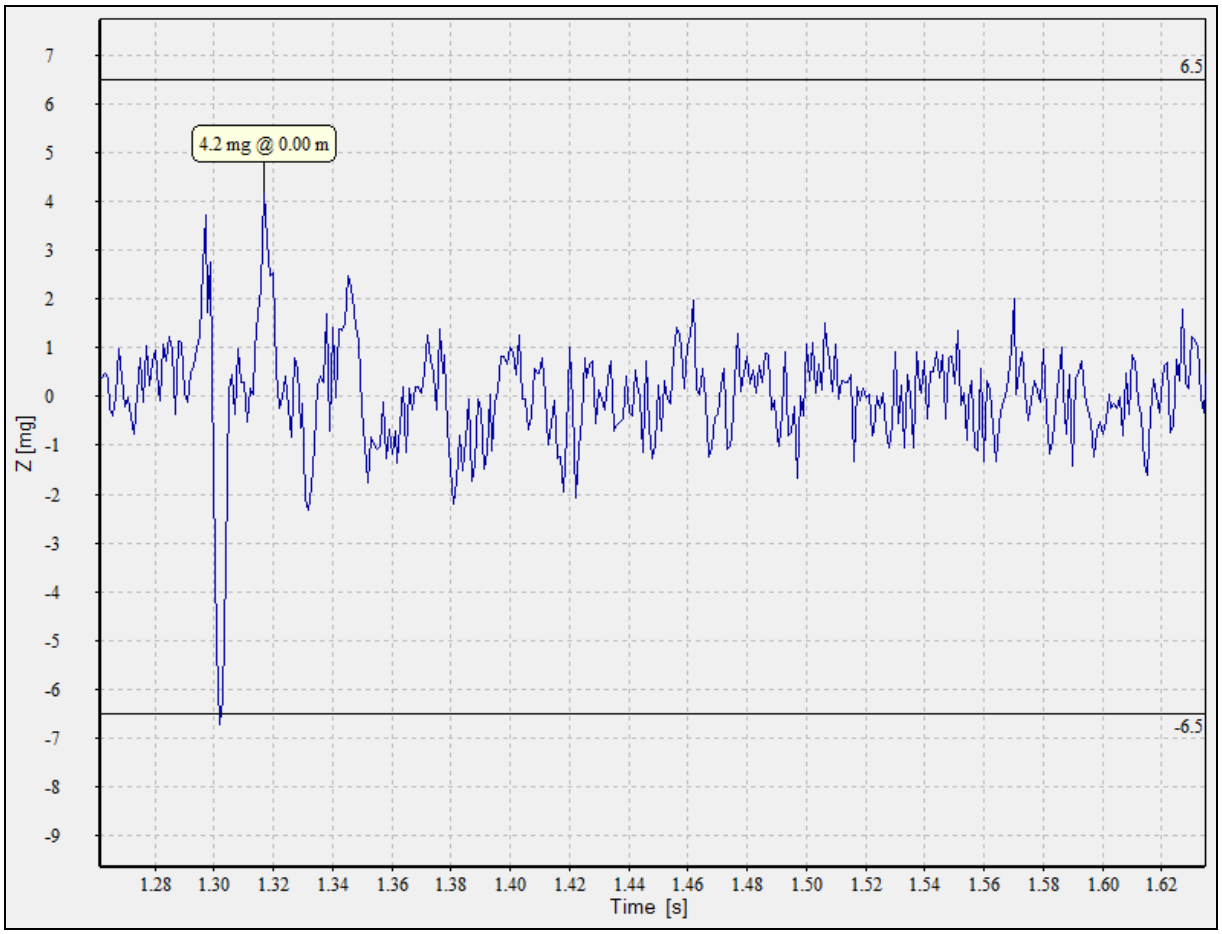


Illustration 22: Curve with Instantaneous Values inserted

4.3.1.5 Establishing Averages

This feature is not available for every curve display

Via the button Average tool average values of the displayed measurement data over any chosen period of time may be determined. For this purpose the two vertical cursor lines can be moved with the mouse to the start and end of the desired time range. The averages are shown in the legend subsequently. This feature can be disabled by clicking the button Zoom

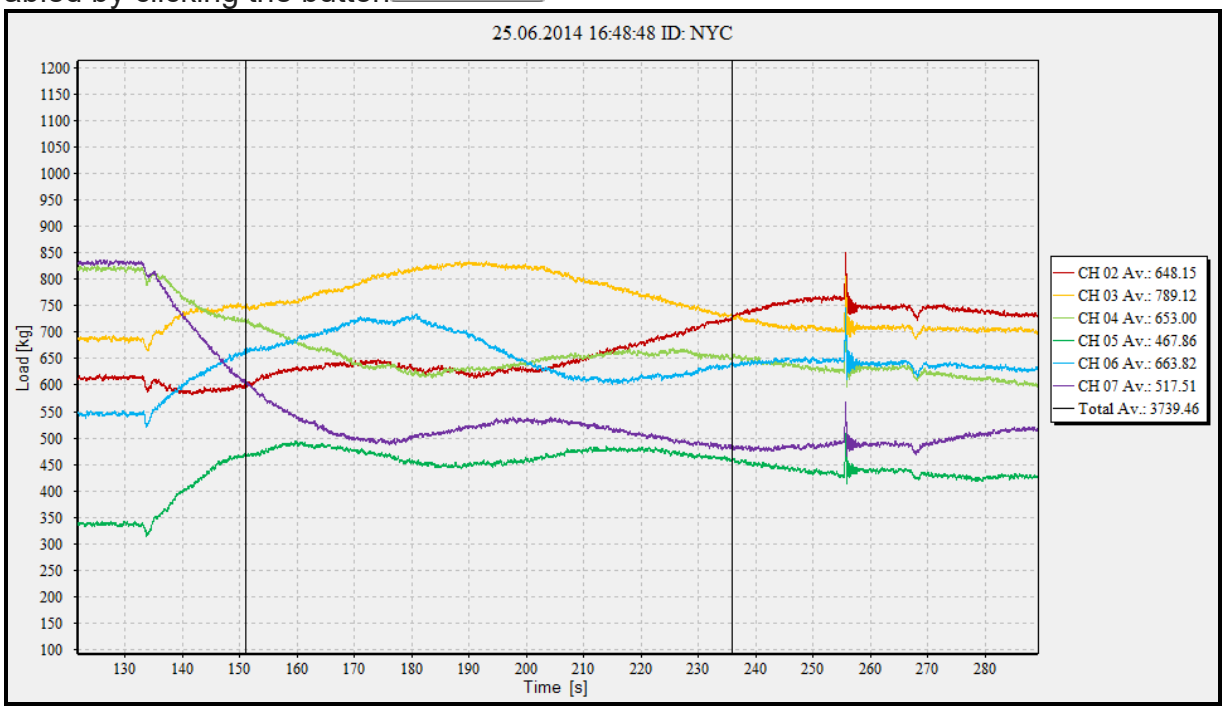


Illustration 23: Curves with Average Tool activated

4.3.1.6 Display Curve Information

This feature is not available for every curve display

If the function Show curve info has been activated, the absolute minimum and maximum, as well as the average value are shown in the graph.

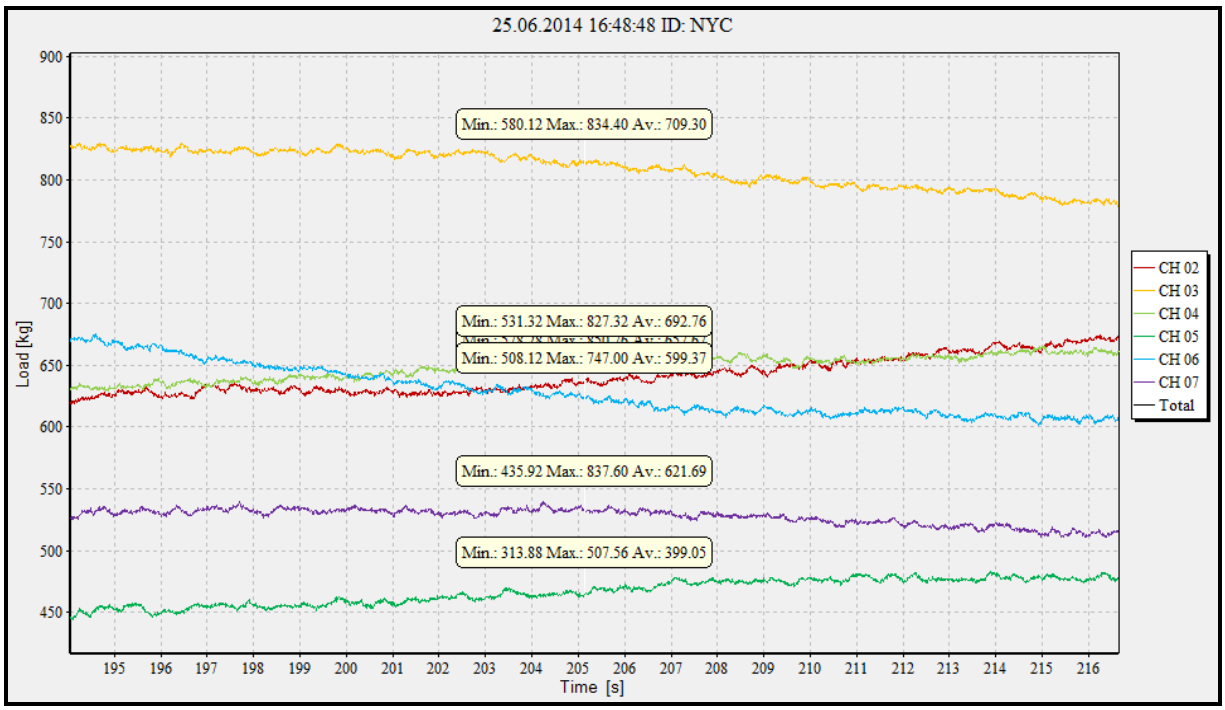


Illustration 24: Curve Information Displayed with Curves

4.3.1.7 Calculating Optimal Rope Loads

This feature is not available for every curve display

If an elevator is showing varying load distributions in the rope set while driving, the installation may not be regarded ideal or well adjusted. Such a system, however, can be adjusted optimally. If the total load distribution on each rope depending on the current car position when driving over the entire shaft height is known, optimal single rope setting can be calculated which prevent individual ropes taking an inordinate amount of load at certain moments and a harmonious load distribution in the rope set is provided instead. The feature Optimal tensioning calculates the optimal rope tension for a previously measured rope load curve according to the formula of Professor Feyrer. The results of this calculation are shown in the legend.

4.3.1.8 Printing Curves

This feature is not available for every curve display

Via the button Print the current curve may be printed or saved as PDF (see. Chapter 7 Reports).

4.3.1.9 Exporting Curves

This feature is not available for every curve display

Via the button Save As CSV File the currently displayed curves can be exported into a CSV-file. A dialog box will open querying the location and file name to be created.

4.3.1.10 Section Analysis

This Function May Not Be Available In Every Curve View.

Double clicking the right mouse button within the time range of the curve view will mark the start position for a new analysis. In the curve view, this is indicated by the “Start” marking, which is highlighted in yellow. The next double click using the right mouse button will set the end index of the time range, and the analysis will automatically start again over the chosen range.

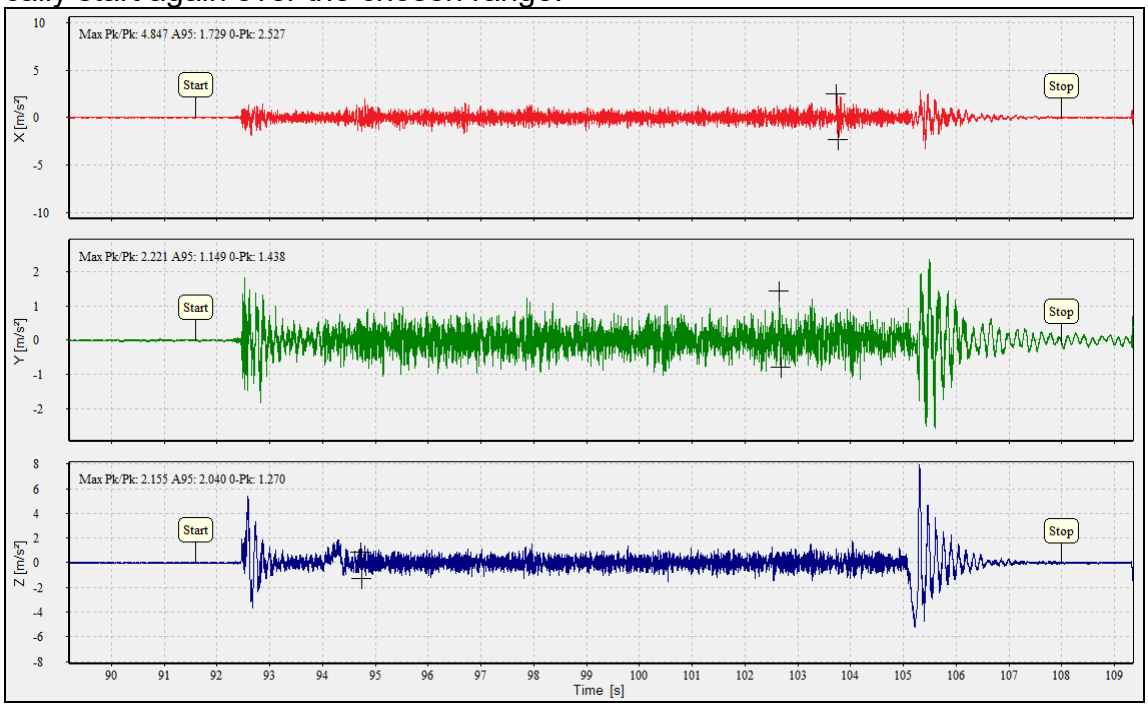


Illustration 25: Marked section in a measurement view

4.3.2 MSM12 Evaluation Unit

The index card “MSM 12 Unit” is found in the main display area. The evaluation unit MSM12 can be managed and read out.

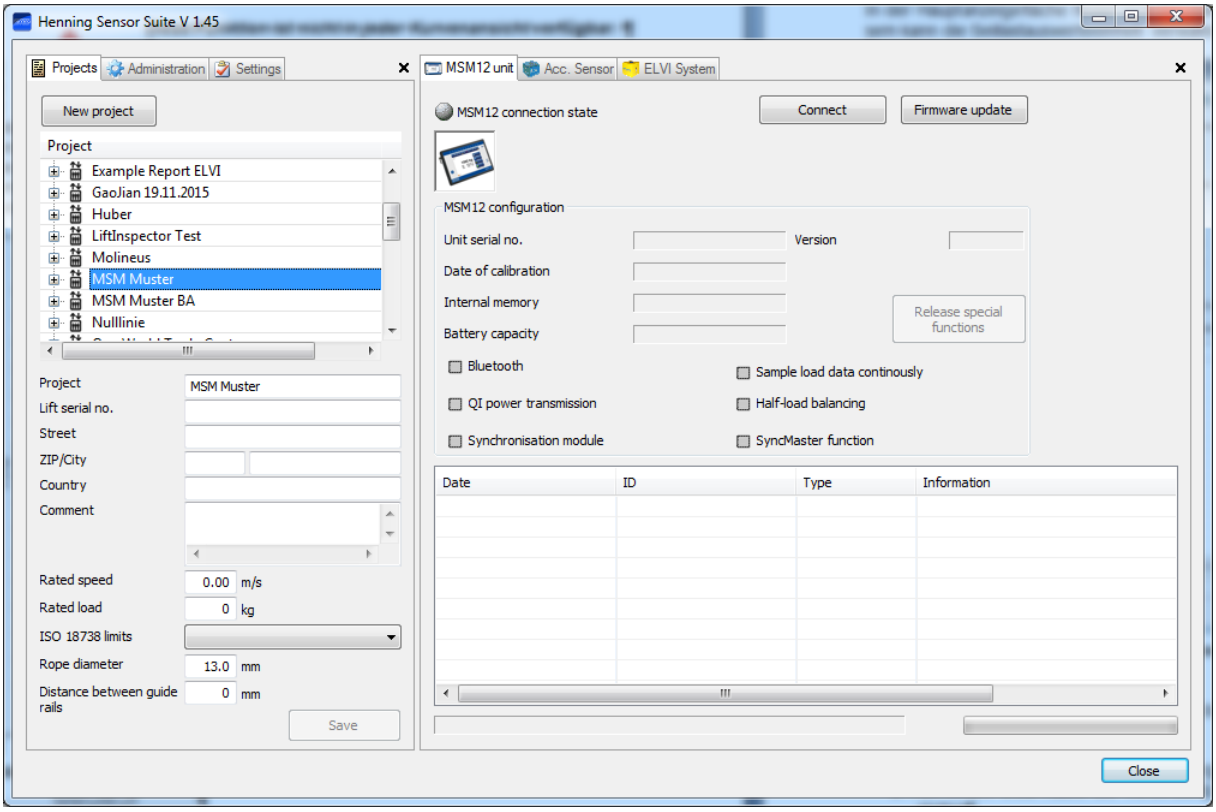
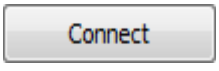


Illustration 26: Managing the Evaluation Unit MSM12

4.3.2.1 Connecting

To connect theMSM12 to the PC the following steps have to be executed:

1. Switch the MSM12 on and wait for the booting process
2. Establish connection between MSM12 and computer via USB-cable
3. Press the button 

Once the connection has been established successfully, the MSM-connection-status changes to green and the device information can be read.
While the MSM12 is actively connection to the computer it cannot be used for measuring. The screen on the MSM12 automatically switches to the following lock screen:

Illustration 27: Lock Screen of MSM12

To terminate the connection, press the button 

In the same way, connections can be established over the Bluetooth interface (if available). Please note that the devices are initially paired with the computer (see section3.43.4).

4.3.2.2 Device Information

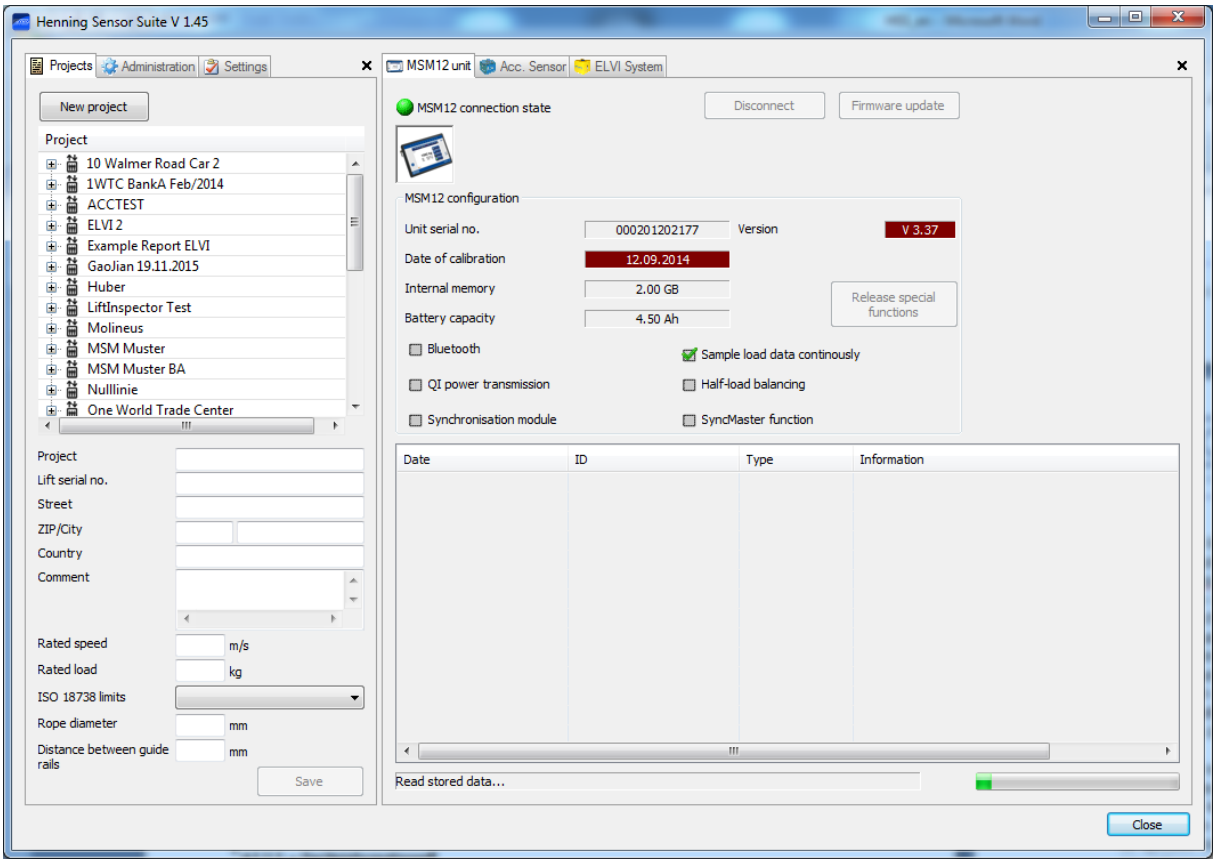


Illustration 28: Device Information of MSM12 displayed

Once the MSM12 is connected to the PC software, the serial number, date of last calibration, software version and which soft- and hardware options are installed will be read out and displayed.

Currently there are three hardware options available:

1. Bluetooth - If this option is marked, the MSM12 features an internal Bluetooth chip, by which the MSM12 can be connected to the PC or suitable smartphones
2. Contactless QI-charge - the QI-charge is a current standard, which currently is being used mainly with smartphones. With this device the MSM12 may be charged inductively without a cable connection, by placing it on a special QI-contact mat.
3. Synchronization Module - If this module is installed, the MSM12 may be synchronize with other devices. This is particularly interesting when aiming to obtain time-synchronous measurements of rope loads and the simultaneous vibrations.

There are three further software option available:

1. Continuous Load Measuring – if this option has been activated on the device, the MSM12 can record the loads of the individual during the elevator ride. This option is especially interesting when the rope wear of an elevator system is to be improved (see. Chapter 4.2.2.7.4 Continuous load measurement).
2. Counterweight Balancing - This software option provides the possibility for easy and comfortable determination of the counterweight balancing (see chapter 4.2.2.7.3 Counterweight Balancing).
3. SyncMaster - This feature is still being developed and may not be activated.

If the calibration date (see Figure 22: Device Information of MSM12 displayed) has been highlighted red, the recommended calibration interval has been exceeded. If the software version has been marked red, a new firmware for the MSM12 (see. chapter. 4.2.2.3 Firmware Update) is available, which should be installed in any case.

4.3.2.3 Firmware Update

To carry out a firmware3 update, the MSM12 has to be connected to the PC-software (see chapter **Fehler! Verweisquelle konnte nicht gefunden werden.** Connecting).

After connecting, press the button 

If a new firmware is available for installation, the following notice will be displayed:

The firmware update may now be carried out. Do not switch off the device during installation! Please also check if the batteries have been charged sufficiently.

Once this notice has been confirmed positively, start the firmware update. The process should not be interrupted under any circumstances.
During the process the progress is displayed at the bottom of the window by a progress-indicator. After the firmware update has been completed the following message appears and the device reboots:

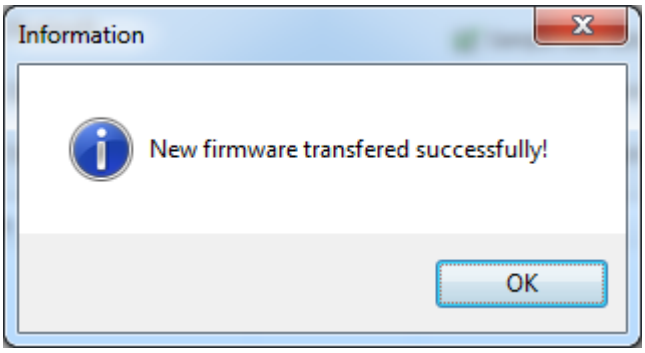


Illustration 29: New firmware transferred successfully

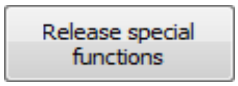
If the update process have been interrupted, there is a possibility that the device will not be ready to operate (the booting will not be completed). In this case the device must be sent back to the Manufacturer for a completion of the firmware update.

4.3.2.4 Unlocking Options

There are three software options available for the MSM12:

1. Continuous Load Measuring – if this option has been activated on the device, the MSM12 can record the loads of the individual during the elevator ride. This option is especially interesting when the rope wear of an elevator system is to be improved (see. Chapter 4.2.2.7.4 Continuous load measurement).
2. Counterweight Balancing - This software option provides the possibility for easy and comfortable determination of the counterweight balancing (see chapter 4.2.2.7.3 Counterweight Balancing).
3. Traction - With this function, the traction of the elevator system can be measured at any position in the shaft using the load measurement tool.

These options may be ordered directly from works when ordering the device, but they may also be retrofitted and unlocked by the user. For the latter case, the user is sent a so called “unlocking file”. It will feature the file extension “* .msmV3”.
To unlock the function, the MSM12 (see chapter. 4.2.2.1 Connecting) has to be connected to the computer.

The button 

hast to be pressed and the relevant file has to be selected in the file selection menu. The unlocking information is then transferred and stored in the MSM12 and the new features are permanently available.

4.3.2.5 Reading out Measurements

Once the MSM12 has been connected to the PC (see. Chapter 4.2.2.1 Connecting) the measurements will be read out automatically. This may take several minutes depending on the number and size of the individual measurements. The progress of downloading will be displayed in the progress indicator at the bottom of the dialog window. Once all measurements have been downloaded, they are sorted by type of measurement and displayed in the measurement list of the dialog box:

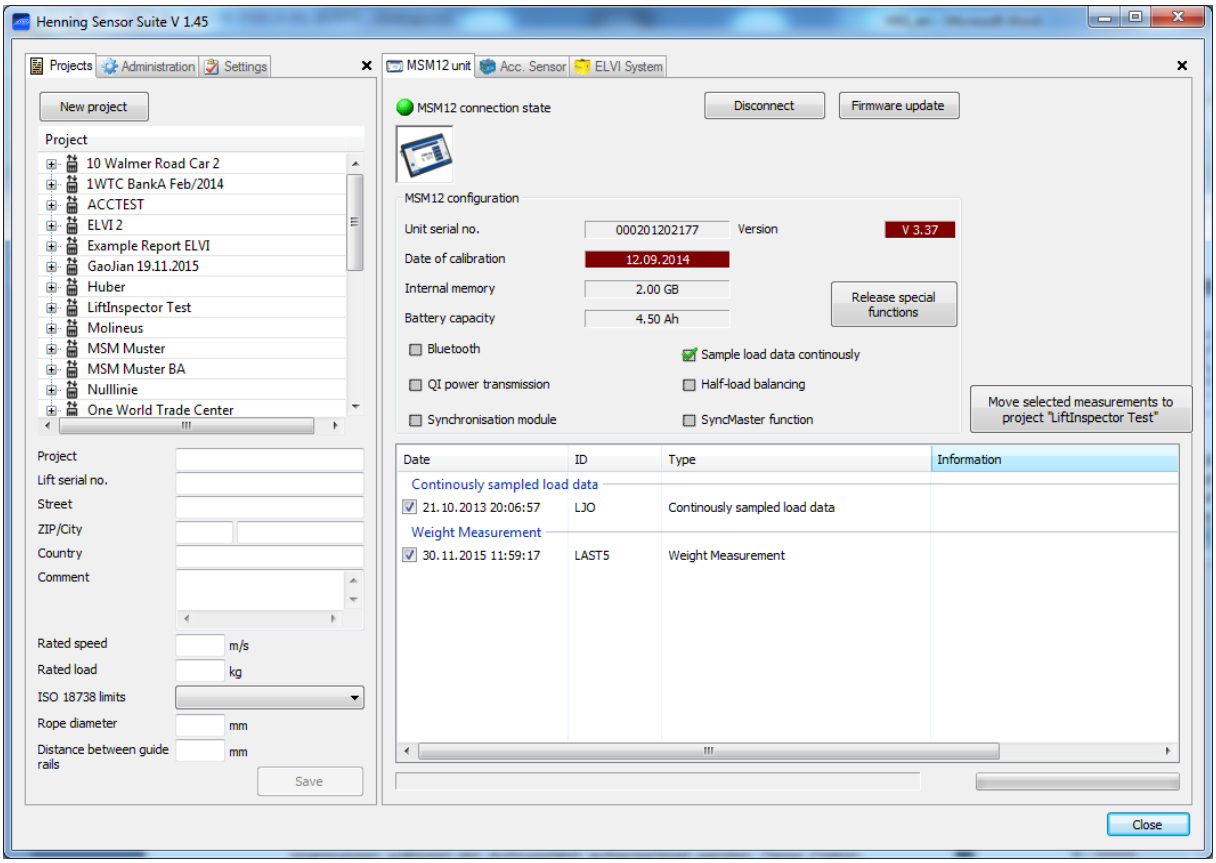
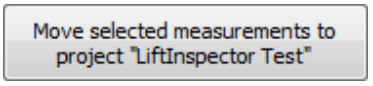


Illustration 30: Dialog Box MSM12 showing 5 measurements in the list

The measurements are assigned to the appropriate Project by checking the selection box, pressing the left mouse button and moving it to the relevant project. As soon as the left mouse button is released, the measurements are added to the project.

Alternatively, you may use the button 

Select the desired target project in the project list, mark the measurements to be transferred with a check mark and press the button.

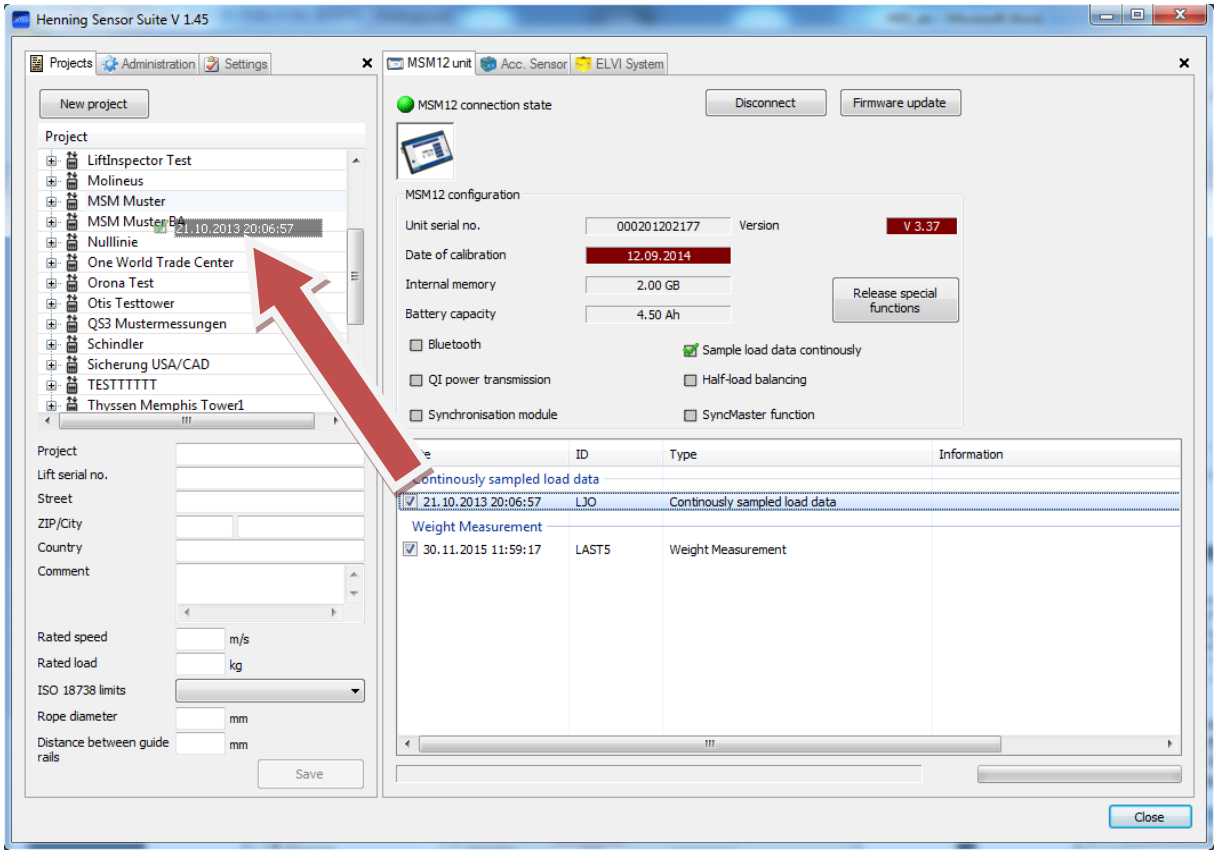


Illustration 31: Assigning a measurement from MSM12 to a project

Depending on the software settings (see 4.1.3 Settings) measurements are deleted or retained by the device during this process.

4.3.2.6 Deleting Measurements

To delete measurements from the device without assigning them to a project first, the measurements have to be marked with a check mark in the selection box and then pressing the “Delete” key on the keyboard. After another security prompt the measurements are removed from the device permanently.

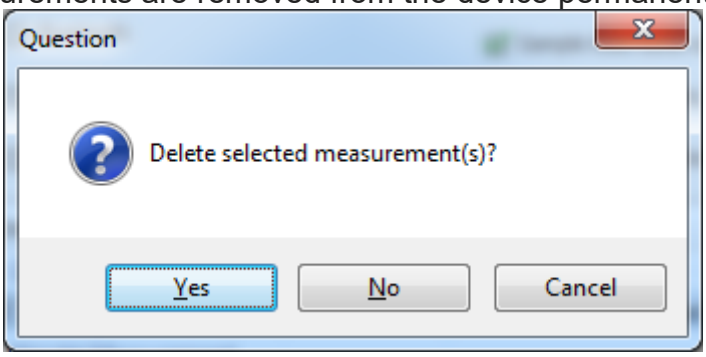


Figure 32: Security query “Delete measurements”

This process cannot be reversed!

4.3.2.7 Displaying Measurements

Once a measurement is stored within a project, it may be displayed. For this purpose, open the project in question and the subcategory “load measurement” with a double click of the left mouse button on the desired measurement. A user dialog will open depending on the type of measurement (see the following subchapter).

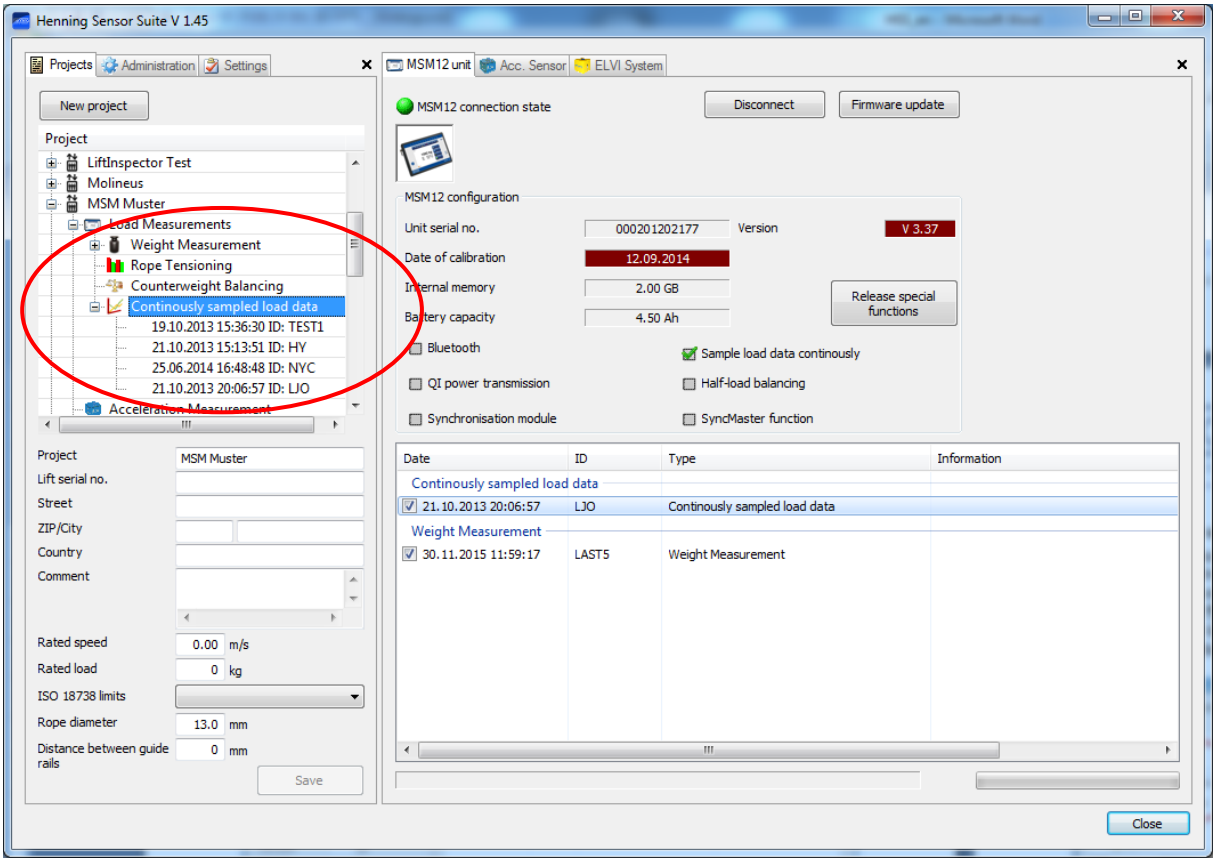
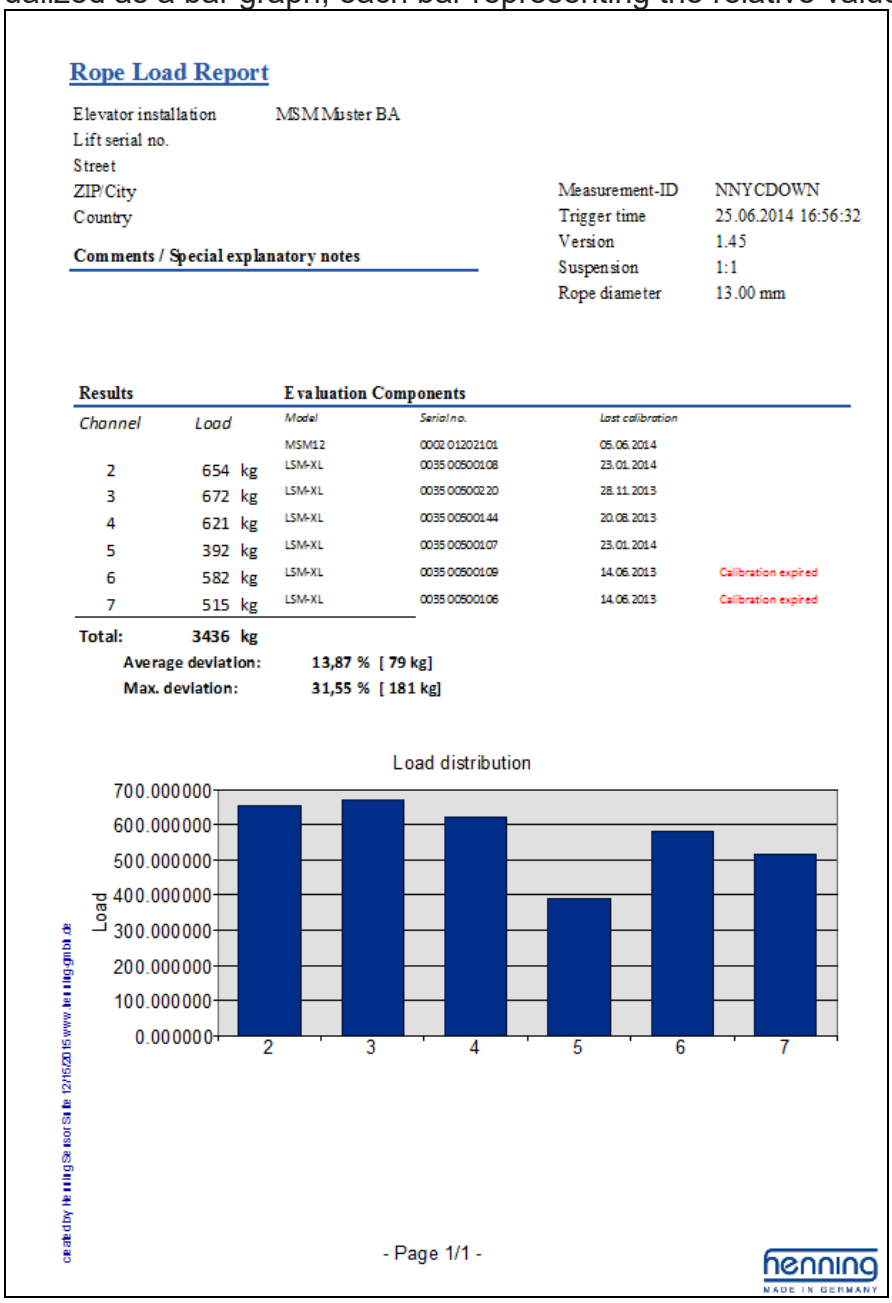


Illustration 33: MSM12 Opening Measurements

4.3.2.7.1 Load Measurement

The load measurement opens in a report presentation. In the upper third, you will find the details on the installation, as they have been entered in the project data (the measurement ID is the ID which was assigned via the MSM12 for the measurement in question.). The optional measurement-comments are also shown here. At the top right the logo selected settings in the logo will be displayed, if one has been selected. In the middle third, the equipment and sensors which have been used as well as their calibration status are shown along with the measured individual rope loads. If the calibration of a sensor is no longer valid because the calibration interval has been exceeded, the information will be shown accordingly. In addition to the total weight of the measured set of ropes, maximum and average deviation between the ropes is displayed. As these are decisive for a possible rope wear, please strive for

small values. In the lower third, the current load distribution in the set of ropes is visualized as a bar graph, each bar representing the relative values of one load sensor.



Rope Load Report

Elevator installation MSM Muster BA
Lift serial no.
Street
ZIP/City
Country

Comments / Special explanatory notes

Measurement-ID NNYCDOWN
Trigger time 25.06.2014 16:56:32
Version 1.45
Suspension 1:1
Rope diameter 13.00 mm

Results

Channel	Load
2	654 kg
3	672 kg
4	621 kg
5	392 kg
6	582 kg
7	515 kg
Total:	**3436 kg**

Evaluation Components

Model	Serial no.	Last calibration	
MSM12	0002 012021 01	05.06.2014	
LSM-XL	0035 00500108	23.01.2014	
LSM-XL	0035 00500220	28.11.2013	
LSM-XL	0035 00500144	20.08.2013	
LSM-XL	0035 00500107	23.01.2014	
LSM-XL	0035 00500109	14.06.2013	Calibration expired
LSM-XL	0035 00500106	14.06.2013	Calibration expired

Average deviation: **13,87 % [79 kg]**
Max. deviation: **31,55 % [181 kg]**

Load distribution

created by Henning Sensor Suite 12/05/2015 www.henning-gmbh.de

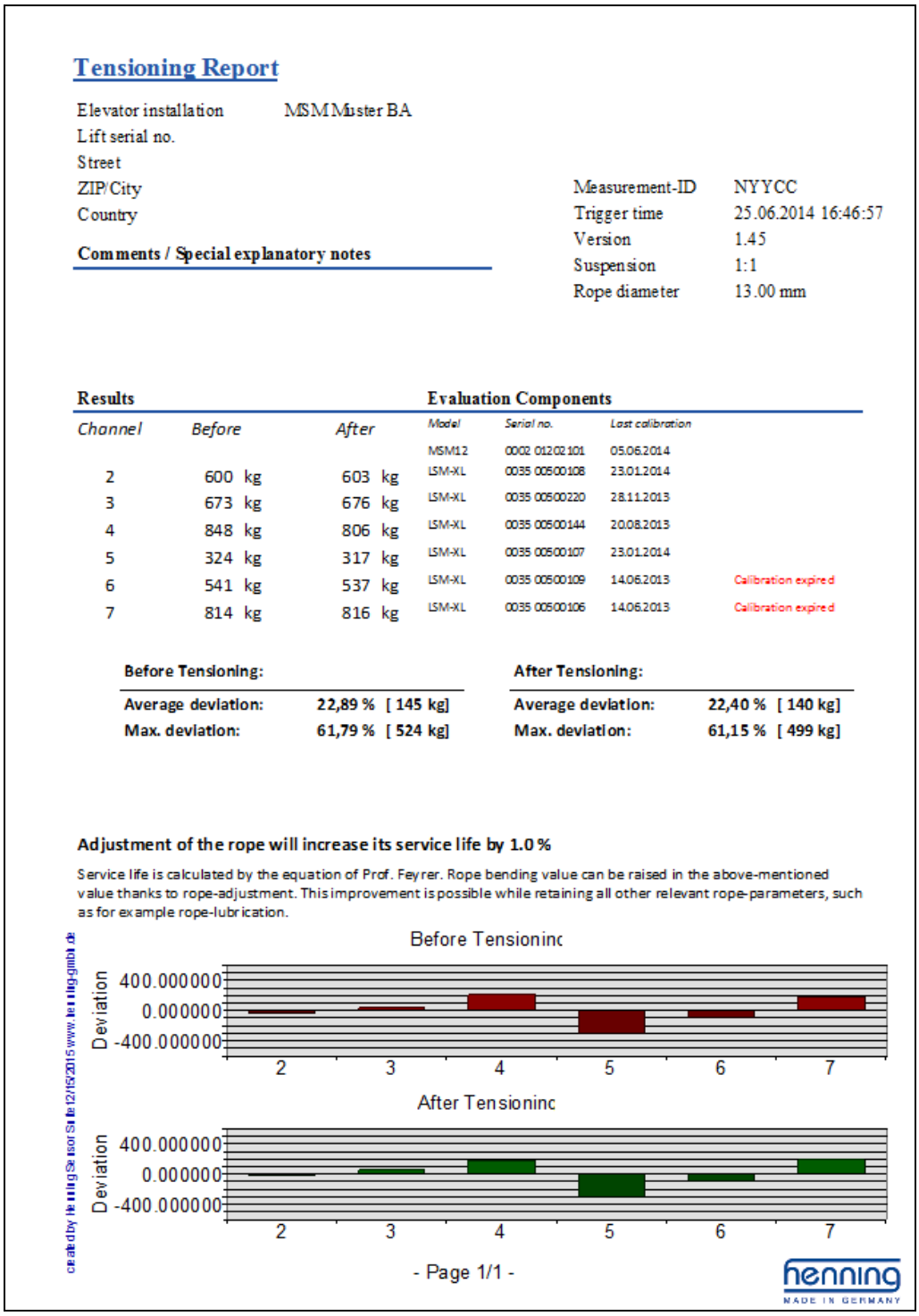
- Page 1/1 -

Illustration 34: Report-Display of a Load Measurement

4.3.2.7.2 Rope Tensioning

The project data in the rope tensioning report is analogous to the one of the load measurement report. The output of the devices and sensors used for the measurement in the middle third is similar to the load measurement report, but there are two values for each sensor, one each showing the load distribution before the individual ropes have been adjusted and one thereafter. Accordingly, there are two values for the maximum and average deviation of the individual cables in the set of ropes. Be-

low you will find a formula by Prof. Feyrer, with which the effect of the rope adjusting can be quantified in relation to the lifetime of the ropes. This life-lengthening or shortening is given as a percentage value.
In the lower third of the report, there are two bar graphs. These show the deviation of each rope from the optimum rope setting. The upper bar graph visualizes this for the time before the ropes have been adjusted, the lower for the time thereafter.



Tensioning Report

Elevator installation MSM Muster BA
Lift serial no.
Street
ZIP/City
Country

Comments / Special explanatory notes

Measurement-ID NYYCC
Trigger time 25.06.2014 16:46:57
Version 1.45
Suspension 1:1
Rope diameter 13.00 mm

Results

Channel	Before	After
2	600 kg	603 kg
3	673 kg	676 kg
4	848 kg	806 kg
5	324 kg	317 kg
6	541 kg	537 kg
7	814 kg	816 kg

Evaluation Components

Model	Serial no.	Last calibration	
MSM12	0002 01202101	05.06.2014	
LSM-XL	0035 00500108	23.01.2014	
LSM-XL	0035 00500220	28.11.2013	
LSM-XL	0035 00500144	20.08.2013	
LSM-XL	0035 00500107	23.01.2014	
LSM-XL	0035 00500109	14.06.2013	Calibration expired
LSM-XL	0035 00500106	14.06.2013	Calibration expired

Before Tensioning:
Average deviation: 22,89 % [145 kg]
Max. deviation: 61,79 % [524 kg]

After Tensioning:
Average deviation: 22,40 % [140 kg]
Max. deviation: 61,15 % [499 kg]

Adjustment of the rope will increase its service life by 1.0 %

Service life is calculated by the equation of Prof. Feyrer. Rope bending value can be raised in the above-mentioned value thanks to rope-adjustment. This improvement is possible while retaining all other relevant rope-parameters, such as for example rope-lubrication.

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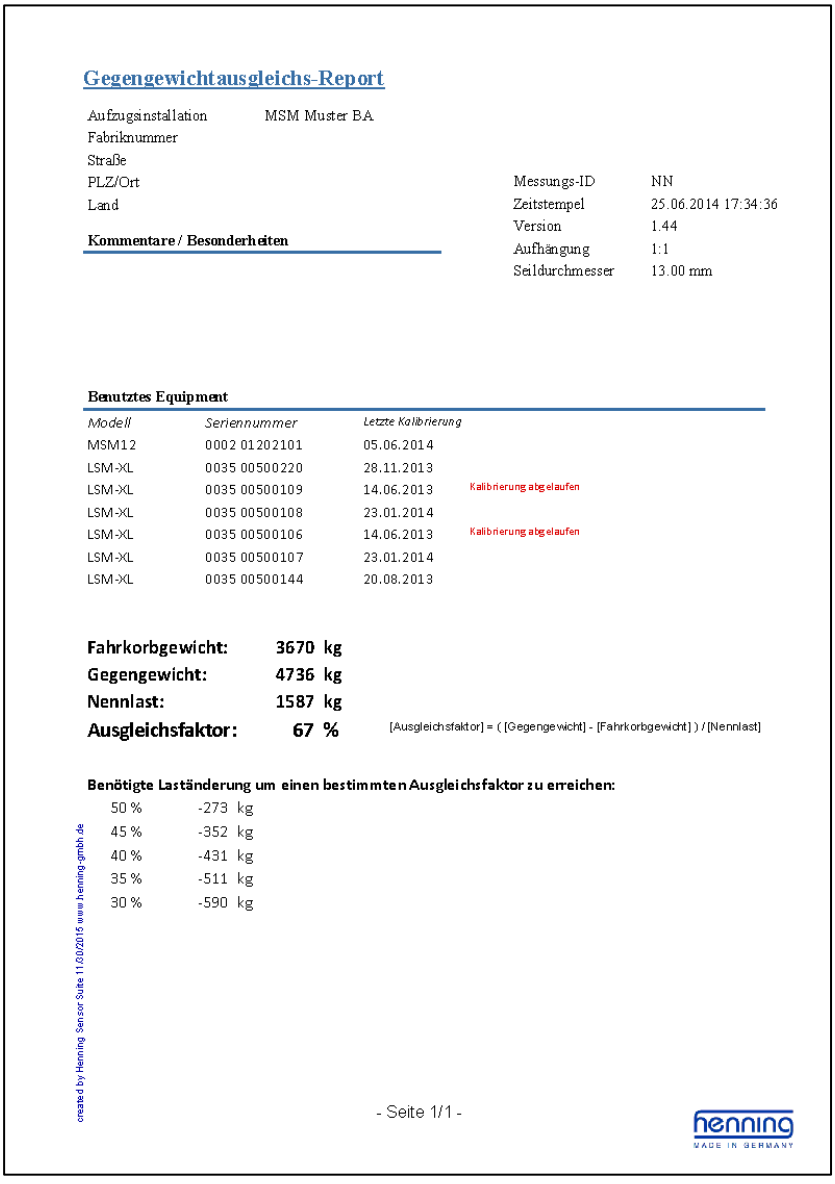
Illustration 35: Rope Tensioning Report

4.3.2.7.3 Counterweight Balancing (optional)

The counterweight-balancing function is a software option that may be unlocked for your MSM12. The report header and display of sensors in the counterbalancing report is similar to the two aforementioned reports. Below that, the measured car weight, the weight of the counter weight, the rated load of the respective elevator in-

stallation and the counterbalancing determined by the wizard are shown. In the lower third of the report the necessary changes in load on the counterweight side are listed which have to be performed in order to achieve a certain counterweight compensation ratio.



Gegengewichtausgleichs-Report

Aufzugsinstallation MSM Muster BA
Fabriknummer
Straße
PLZ/Ort
Land

Kommentare / Besonderheiten

Messungs-ID NN
Zeitstempel 25.06.2014 17:34:36
Version 1.44
Aufhängung 1:1
Seildurchmesser 13.00 mm

Benutztes Equipment

Modell	Seriennummer	Letzte Kalibrierung	
MSM12	0002 01202101	05.06.2014	
LSM-XL	0035 00500220	28.11.2013	
LSM-XL	0035 00500109	14.06.2013	Kalibrierung abgelaufen
LSM-XL	0035 00500108	23.01.2014	
LSM-XL	0035 00500106	14.06.2013	Kalibrierung abgelaufen
LSM-XL	0035 00500107	23.01.2014	
LSM-XL	0035 00500144	20.08.2013	

Fahrkorbgewicht: 3670 kg
Gegengewicht: 4736 kg
Nennlast: 1587 kg
Ausgleichsfaktor: 67 % [Ausgleichsfaktor] = ([Gegengewicht] - [Fahrkorbgewicht]) / [Nennlast]

Benötigte Laständerung um einen bestimmten Ausgleichsfaktor zu erreichen:

50 %	-273 kg
45 %	-352 kg
40 %	-431 kg
35 %	-511 kg
30 %	-590 kg

created by Henning Sensor Suite 11.00/2015 www.henning-gmbh.de

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Illustration 36: Counterweight-Balancing Report

4.3.2.7.4 Continuous Load Measuring (optional)

The presentation of the continuous load measurement is not in report format but rather a graph which can be used by the user interactively (see. Section 4.3.1 Operating the Curve Display). A double click on a measurement opens the following window in the main display:

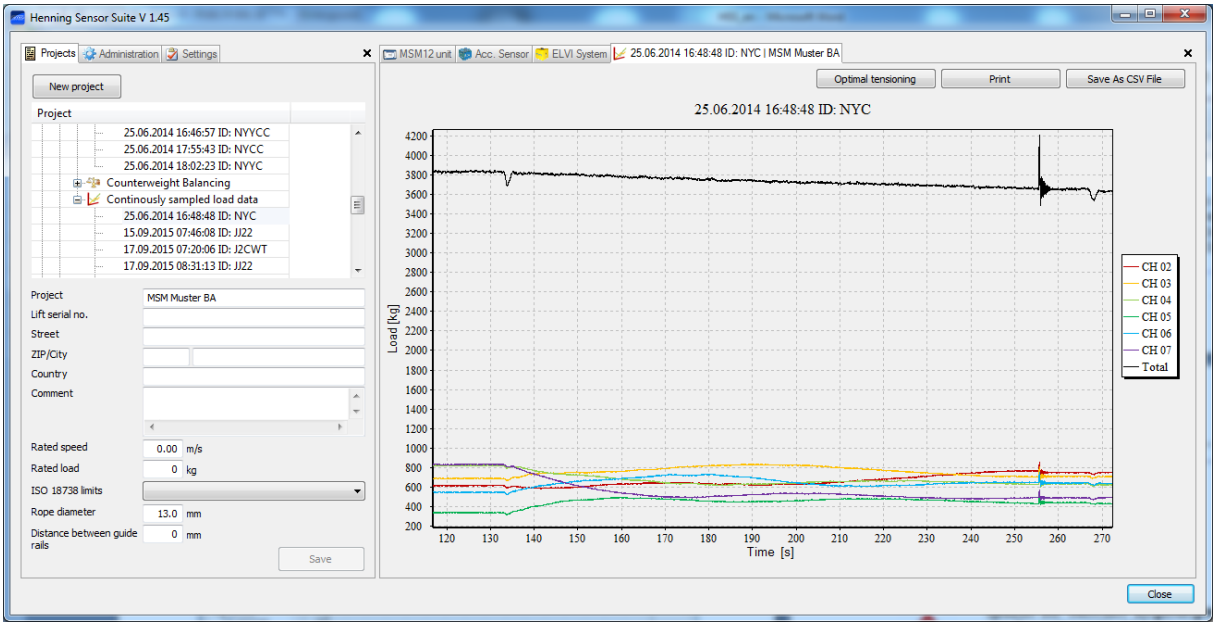


Illustration 37: Presentation of Continuous Load Measuring

The individual load curves measured during an elevator ride enable the user to draw valuable information for minimizing the rope wear especially on multi suspended elevators. In such elevator installations the individual cable tension is in fact very dependent on the current hoisting height and thus varies during a ride. A uniform adjustment of the rope tension for example on the ground floor may not be effective on another floor and may even be detrimental to the rope wear. The Henning sensor suite supports the user when adjusting such complex installations. After pressing the button Optimal tensioning the system examines the entire recorded history of rope tensions for an optimal adjustment of the ropes and selects the optimal settings for all hoisting heights. The result is displayed in the legend of the curve in the form of a percentage deviation; when setting the individual rope loads, instead of the theoretically ideal setting this percentage deviation has to be set. In the example in illustration 32: Example “Optimal Rope Adjustment” the result is therefore applicable as follows:

The measured total load is about 3800 kg spread over 6 ropes, which corresponds to an ideal setting 633 kilograms for each rope. However, as clearly visible in the example, the cable tensions change during the ride, channel 07 initially carrying nearly 850 kg of the total load, but only 500 kg at the end of the ride.

The software has calculates a percentage deviation from the ideal load of 633 kg for each channel. Applied to the individual measuring channels, the ropes have to be set to the following loads:

- Channel 02: 633 kg * 92,5% = 586 kg
- Channel 03: 633 kg * 84,3% = 533 kg

- Channel 04: 633 kg * 87,3% = 553 kg
- Channel 05: 633 kg * 134,8% = 853 kg
- Channel 06: 633 kg * 102,1% = 646 kg
- Channel 07: 633 kg * 99,0% = 627 kg

Especially on multiple suspended elevators, the total weight will change because of the weight of the ropes and / or the travelling cable and compensation devices, depending on the hoisting height. The calculation has to be performed according to the total weight of the installation!

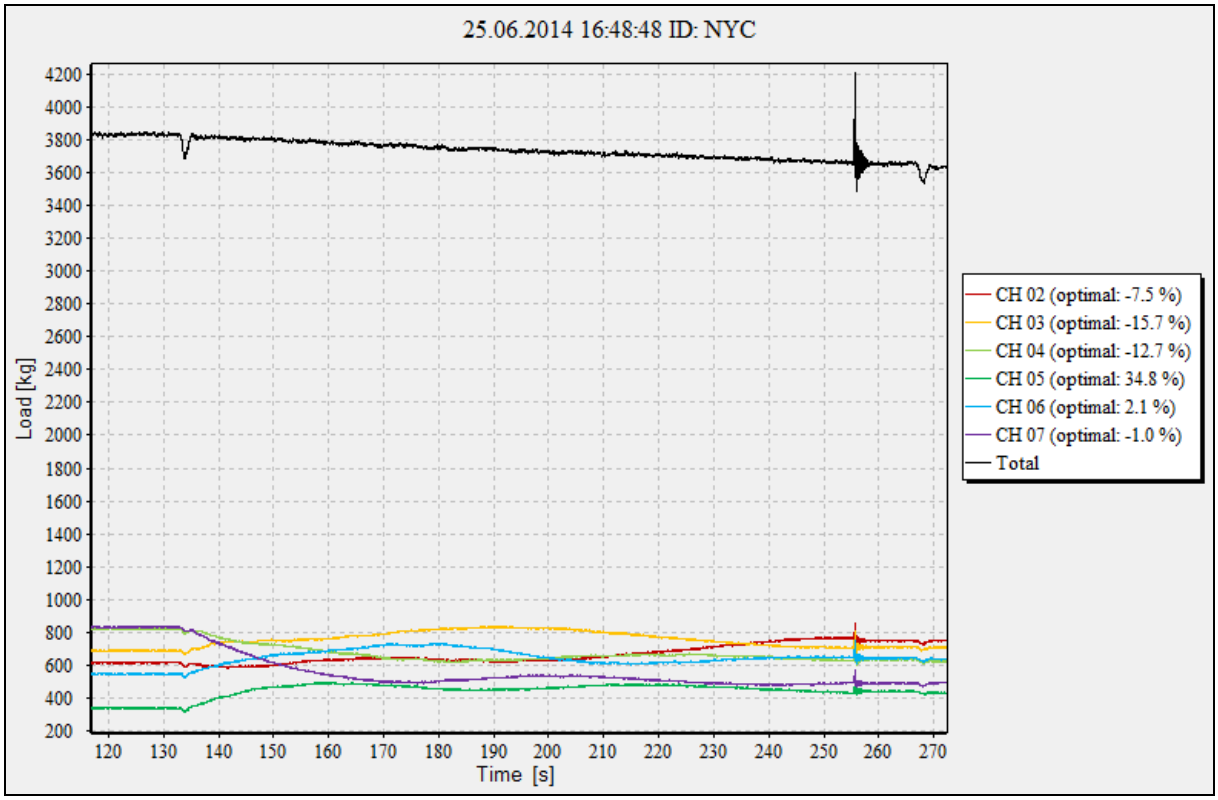


Illustration 38: Example "Optimal Rope Adjustment"

4.3.2.8 Operating MSM12

4.3.2.8.1 Safety and Shipping Instruction

The Evaluation units MSM12 V3 are equipped with lithium - ion batteries.

Safety Instructions

- Lithium-ion batteries react violently when coming into contact with water (fully charged ones in particular)

- Do not store Li-Ion batteries near combustible material
- Do not overcharge Li-Ion batteries
- Do not short-circuit Li-Ion batteries
- Li-Ion batteries are sensitive to mechanical damage. After internal short-circuiting and contact with air they may be highly combustible (even 30 minutes after the actual short circuiting).

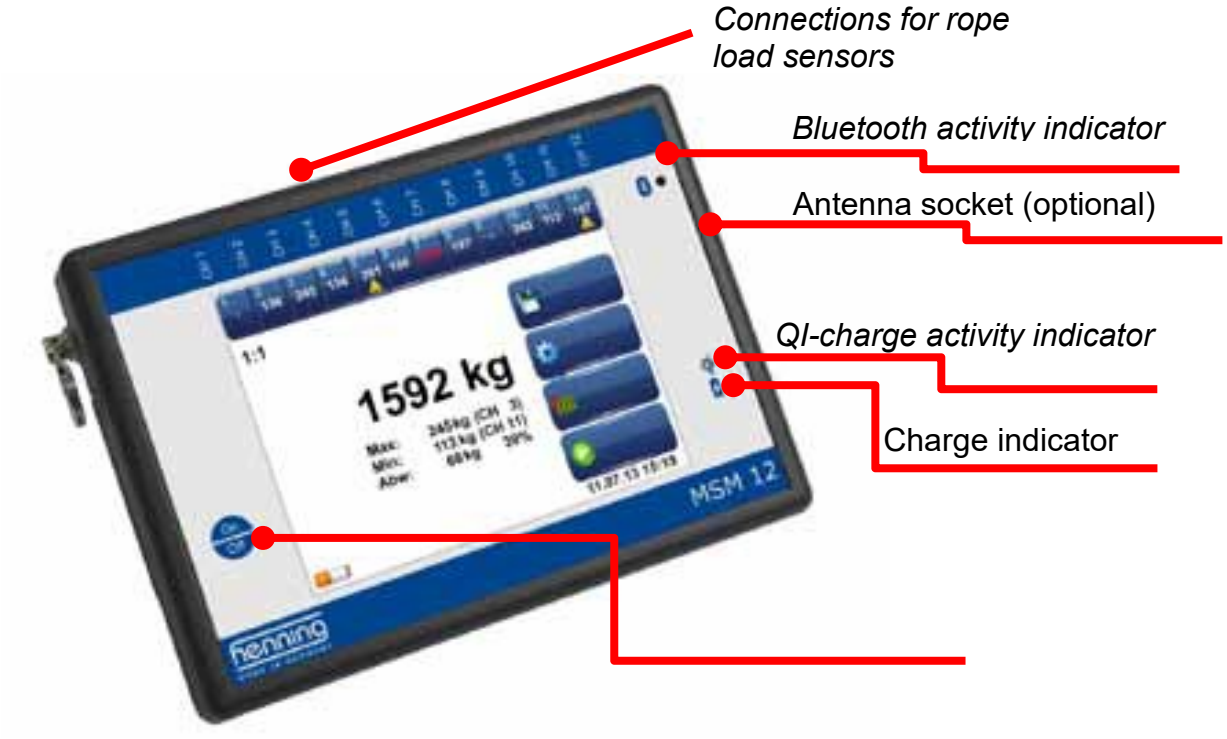
Shipping Instructions

The batteries contained in the evaluation units MSM 12 comply with UN 3481, li-ion batteries contained in equipment (UN-regulations governing the shipment of lithium batteries of 1st January 2009). Please observe special restrictions in connection with li-ion batteries, especially regarding airfreight and / or request appropriate information from your logistics partner before shipping.

General Advice

Please protect the evaluation unit MSM12 against dust, moisture and impact. We recommend the optional protection case made from padded cordura, incorporating a large trans-parent window. (part #: 455099)

4.3.2.8.2 Control Elements



4.3.2.8.3 Technical Data

Power is supplied by internal lithium-ion batteries with a capacity of 4,5 AH (Basic), 6,75 AH (Premium) or 9 AH (Extended).

Sensor Connections: 12

Bandwidth:	30 Hz
Sample frequency:	100 Hz
Connections:	USB, Bluetooth (optional)
Protection Class:	IP00 SKIII (SELV)
L x W x H (mm):	190 x 138 x 46
Weight:	650 g

4.3.2.8.4 Charging the Batteries

When switched on, the main screen shows the batteries' current state of charge. Please charge the batteries as soon as the battery status changes to red status. During charging, the charge control changes to continuously red light.

Please switch the unit off while charging, as otherwise most of the energy will be used up for the operation of the unit.

4.3.2.8.4.1 USB Adapter

For charging via USB-connection, please connect the MSM12 with the USB-cable to the charging adapter and connect the adapter to the main power supply. Charging will take, depending on the state of the batteries, between 9 and 18 hours.

4.3.2.8.4.2 Qi-charge

For charging via Qi-interface, please connect the Qi-charger to the USB charging adapter. Place the evaluation unit MSM12 onto the centre of the charger, main screen facing away from the charger. If positioned correctly, the charge control will change into active mode and the Qi-charge indicator will be activated after ca. 2 seconds. Charging will take up to 9 hours.

4.3.2.8.5 Starting the Device

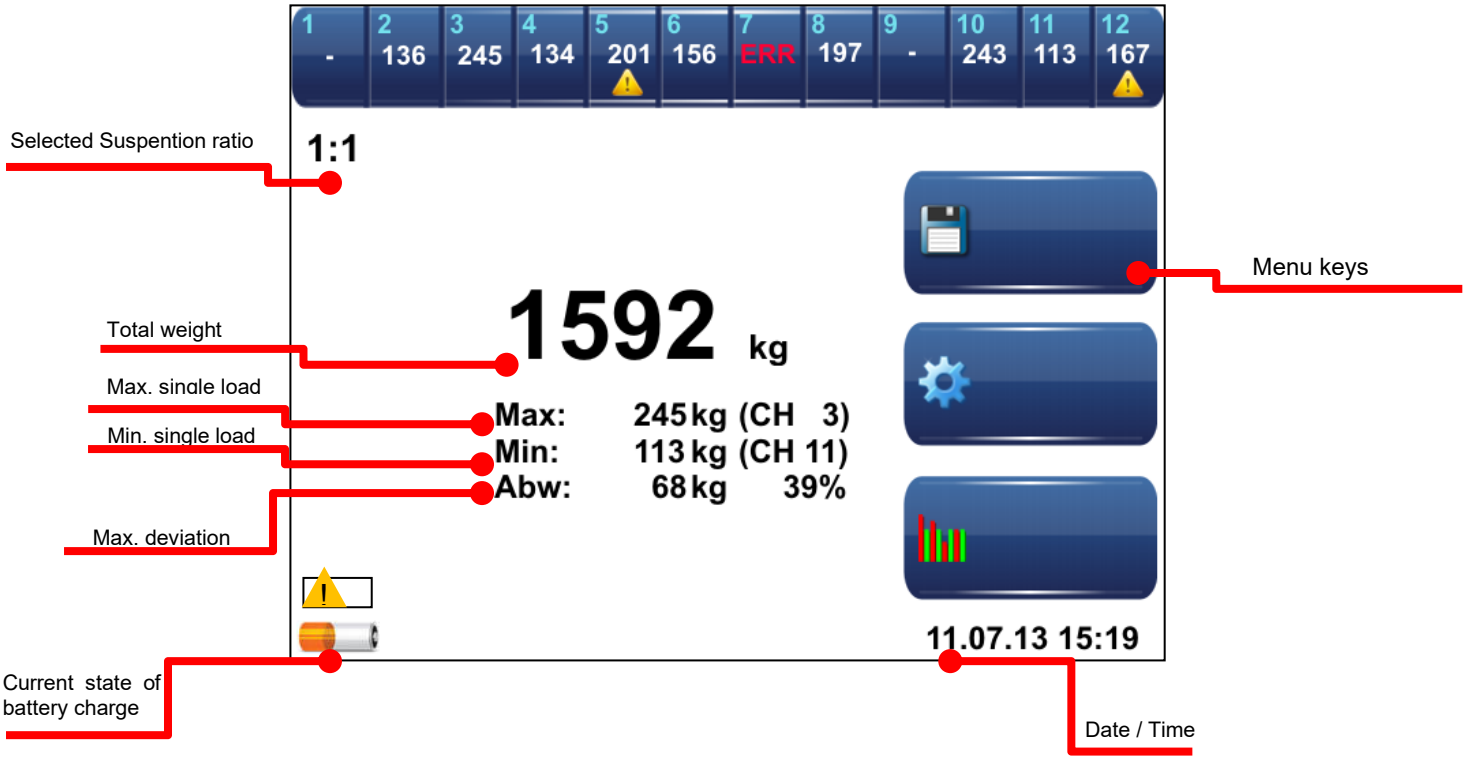
In order to switch on the MSM12 mobile rope load meter please press the on/off switch for a minimum of 3 seconds. The display now shows the Weight Watcher logo as well as a progress bar. After a short time the display switches over to the main display. The MSM12 is now ready for operation.

To switch off please press the on/off switch for minimum 3 seconds again. The device switches off and the display lighting is extinguished. If the batteries are rundown, the MSM12 switches off automatically.
Below, the main display of the mobile rope load evaluation unit MSM12 is shown. The upper two lines display the status bar indicating the individual weight of each rope under the corresponding measuring channel number.

Below, in the centre, the total weight resulting from the individual weights as well as the maximum individual load, minimum individual load and the maximum deviation and the corresponding measuring channel numbers are indicated. At the right side four menu keys are to be found which will be described in detail later. In the lower

left-hand corner the charge status of the batteries is displayed. On the upper left below the status bar the selected suspension ratio is shown.

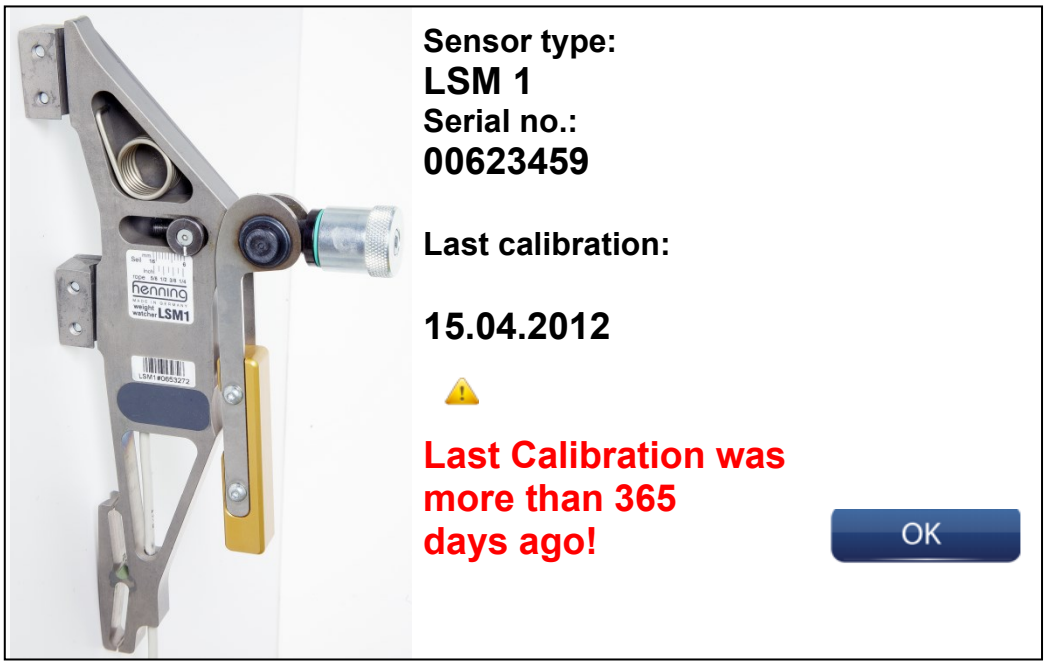
Sensor value 1 to 12 / Status Bar



The individual sensor display shows the measured load of each connected rope load sensor.
Please note: The load in the status bar on top will not be calculated on the basis of the selected suspension ratio.
If a connected sensor is defective, *ERR* will be displayed. The yellow warning-triangle ⚠ will show up, as soon as the calibration of the corresponding sensor has expired.
A touch on one of the sensor-keys in the status bar will open a separate window showing the data of the corresponding sensor (s. chapter 4.3.2.8.6 Sensor Information).
The suspension ratio of the elevator can be selected manually by the user. The displayed total weight is calculated by this factor. The individual weight displayed per sensor remains unaffected. (s. chapter 4.3.2.8.7 Choosing Suspension Type).
The total weight is the sum of all individual rope loads measured, converted according to the suspension ratio (if applicable). The output can be selected in different weight units such as kilogram, tons, Newton, English pounds, short tons or long tons.
The maximum individual rope load shows the actual load and the measuring channel number of the sensor which is loaded with the highest weight in the rope set. The minimum individual rope load display shows the corresponding information for the rope with the lowest load.

The maximum deviation shows the deviation (absolute as well as percentage) of the rope with the greatest deviation from the average calculated from all ropes. The example in figure shows a total weight of 1,529 kg distributed among nine ropes. This means that under ideal conditions each rope should carry 177 kg. However, the rope at measuring channel 3 carries 245 kg, i.e. 68 kg (absolute) or 39 % more load (rounding errors possible).
The **calibration warning** will be displayed, if the last calibration of the evaluation unit has been one year ago (or longer). (s. chapter 4.3.2.8.11 Unit Info).

4.3.2.8.6 Sensor Information

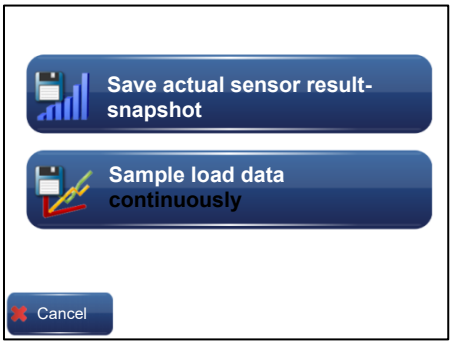


4.3.2.8.7 Choosing Suspension Type

In this menu section one can enter the suspension ratio of the elevator at which you want to carry out measurements. The ratio is displayed on the main display; however, it is not permanently stored in the evaluation unit. After a restart the evaluation unit will automatically be displaying a suspension of 1 : 1.
By means of the suspension ratio the displayed total weight is calculated. The suspension ratio has no influence on the individual rope loads.

4.3.2.8.8 Saving Data

By touching the key “save”, a selection menu opens, in which one can choose between the options “save current weight distribution” and “measurement of load curve”, if you have purchased the optional software “curve storage”. If not, the unit switches automatically to the allocation of the project-ID (s. chapter 4.3.2.8.8.1 Save actual sensor result-snapshot).



4.3.2.8.8.1 Save actual sensor result-snapshot

As soon as this key is activated, the data of all connected rope load sensors is evaluated; the sensor- and load-data is being saved in the evaluation unit. One can allocate a project-ID at this point.
Reports can be issued via the PC-software.

4.3.2.8.8.2 Continuous Measurements (optional)

As soon as this key is activated, the data of all connected rope load sensors is evaluated continuously until the measurement is terminated by pressing the key “save”.
The data is being saved in the evaluation unit via “allocation of project-ID” and reports can be issued with the PC-software.

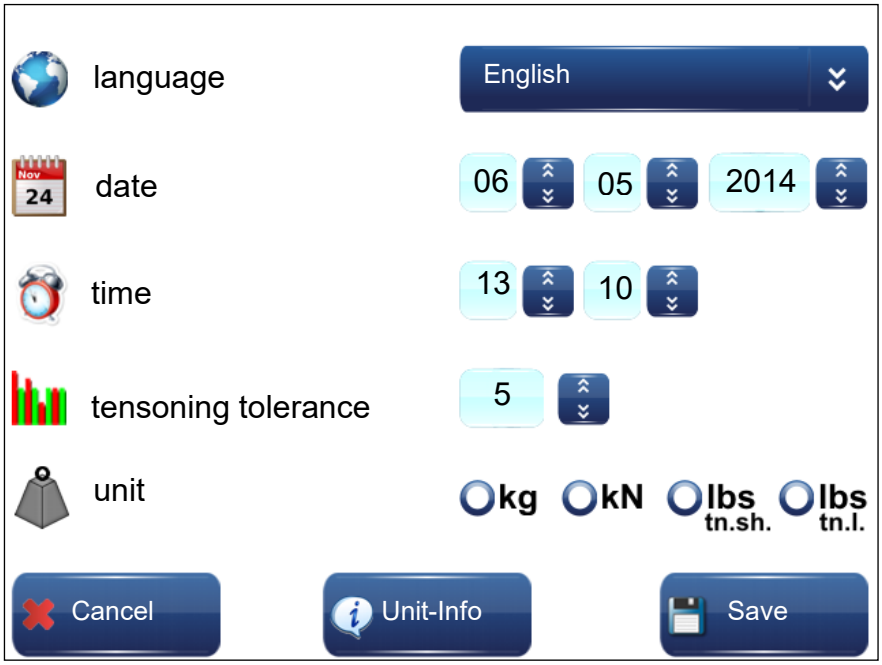
***D*uring the measurement no sensors may be removed oder added!**

4.3.2.8.9 Allocation of Project-ID

The project-ID may consist of up to 16 characters which can be chosen randomly. They help to identify the project and will be printed on each report created from this particular data.

4.3.2.8.10 Configuration

The menu „configuration" is for selecting language, date, time, display settings as well as tolerances. The latter refers to the tolerance which is valid during rope adjustment. A value of 5% means, that each rope may vary only by 5% from the theoretical ideal value.



The settings are saved as soon as the key "save" is pressed. If a new language has been chosen, the unit will reboot automatically. Please see the following chapter for a definition of the key "Unit Info".

4.3.2.8.11 Unit Info

Serial no.:

00623459

Last calibration:

15.04.2012

Last Calibration was more than 365 days ago!

Hardware options:

Internal memory	8 GB
Battery charge	4,5 Ah

☒ Bluetooth
☒ QI-charging
❒ Sync-master

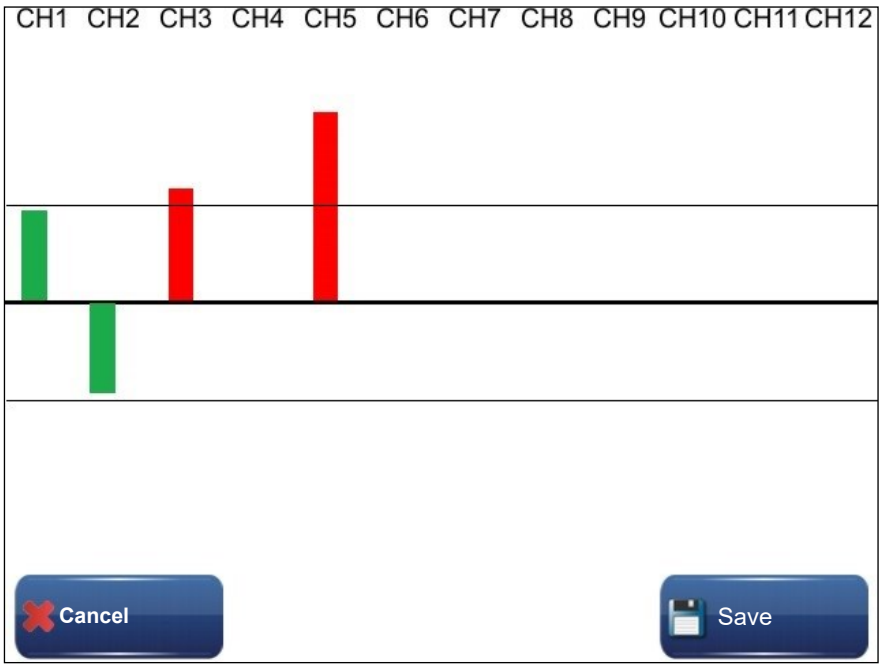
Software options:

☒ Curve storage during the ride
☒ Counterweight compensation measurement
❒ Sync-master

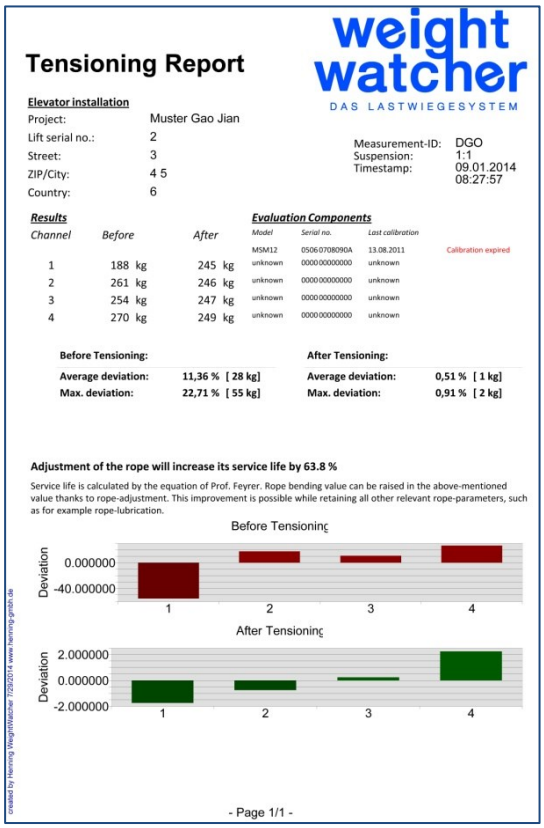
This function shows the user alongside general information like serial number and date the hard- and software installed on this particular unit as well as the date of the last calibration.

4.3.2.8.12 Rope Adjustment Wizard

The rope load wizard will assist you with the uniform adjustment of the ropes. For this purpose the wizard uses the current rope loads as the actual state and calculates a new set point load for each rope. The changed load distribution in the ropes is already taken into consideration when readjusting one of the ropes. Due to a special algorithm it will be possible that all ropes bear the same load after only one adjustment run. Also, during each adjustment process the wizard determines a reference rope which does not have to be adjusted (rope 4 in the illustration). The rope load wizard will only be activated when two or more sensors are connected.
Your goal is to adjust the ropes in such a way, that all bars change their colour from red to green and settle within the two thin horizontal lines, which define the tolerance, which you have set in the menu “configuration”. Bars above of the central line represent tense ropes whereas bars below the centre line represent loose ropes.



As soon as you leave the wizard by pressing the “save” key, the data is stored in the unit and you will be able to allocate a project-ID.
Data can be processed utilizing the PC-software and reports can be issued.



Tensioning Report

weight watcher
DAS LASTWIEGESYSTEM

Elevator installation

Project:	Muster Gao Jian
Lift serial no.:	2
Street:	3
ZIP/City:	4 5
Country:	6

Measurement-ID:	DGO
Suspension:	1:1
Timestamp:	09.01.2014 08:27:57

Results

Channel	Before	After
1	188 kg	245 kg
2	261 kg	246 kg
3	254 kg	247 kg
4	270 kg	249 kg

Evaluation Components

Model	Serial no.	Last calibration	
MSM12	0506 0708090A	13.08.2011	Calibration expired
unknown	000000000000	unknown	
unknown	000000000000	unknown	
unknown	000000000000	unknown	
unknown	000000000000	unknown	

Before Tensioning:		After Tensioning:	
Average deviation:	11,36 % [28 kg]	Average deviation:	0,51 % [1 kg]
Max. deviation:	22,71 % [55 kg]	Max. deviation:	0,91 % [2 kg]

Adjustment of the rope will increase its service life by 63.8 %

Service life is calculated by the equation of Prof. Feyrer. Rope bending value can be raised in the above-mentioned value thanks to rope-adjustment. This improvement is possible while retaining all other relevant rope-parameters, such as for example rope-lubrication.

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4.3.2.8.13 Special Functions

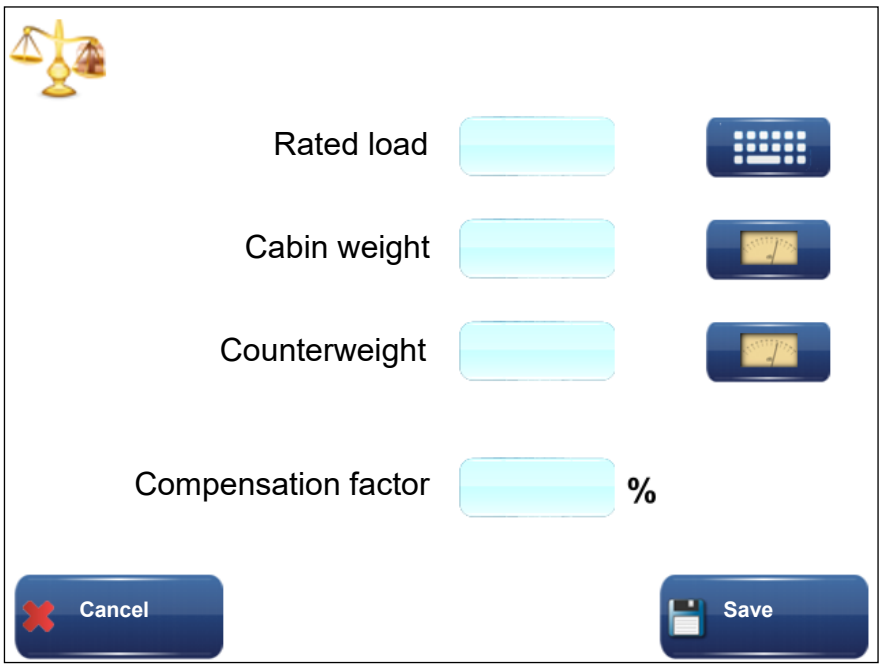
In this part of the menu you will find the software-options available in this particular evaluation-unit.

4.3.2.8.14 Continuous Measurements (optional)

See chapter. Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.**

4.3.2.8.15 Counterweight Compensation (optional)

This software option allows one to determine the counterweight compensation fast and comfortable.



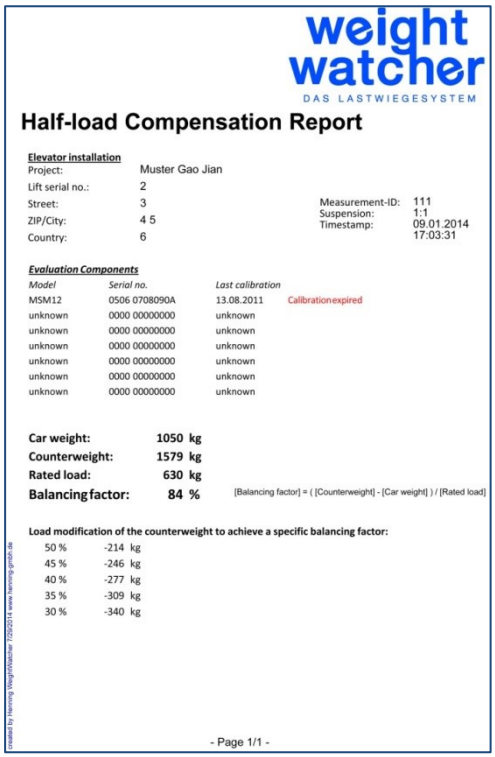
The evaluation unit must be fed the payload of the installation. Please enter it by utilizing the topmost key. A dialogue box will open; please enter the value and save by pressing the “disk-key”.

Afterwards, please install the rope load sensors onto the ropes above the car and press the middle key to determine the weight of the car. Please proceed in the same way with determining the counterweight.

As soon as the unit has been fed all values, the current counterweight compensation will be shown as a percentage. This factor has been calculated according to the following formula:

[Compensation-Factor] = ([Counterweight] – [Car Weight]) / [Rated load]

As soon as you leave the dialogue by pressing the key “save”, you can allocate an additional measurement-ID permanently in the unit and issue reports via the PC-software.



weight watcher
DAS LASTWIEGESYSTEM

Half-load Compensation Report

Elevator installation

Project: Muster Gao Jian
Lift serial no.: 2
Street: 3
ZIP/City: 4 5
Country: 6

Measurement-ID: 111
Suspension: 1:1
Timestamp: 09.01.2014 17:03:31

Evaluation Components

Model	*Serial no.*	*Last calibration*	
MSM12	0506 0708090A	13.08.2011	Calibration expired
unknown	0000 00000000	unknown	
unknown	0000 00000000	unknown	
unknown	0000 00000000	unknown	
unknown	0000 00000000	unknown	
unknown	0000 00000000	unknown	
unknown	0000 00000000	unknown	

Car weight: 1050 kg
Counterweight: 1579 kg
Rated load: 630 kg
Balancing factor: 84 %

[Balancing factor] = ([Counterweight] - [Car weight]) / [Rated load]

Load modification of the counterweight to achieve a specific balancing factor:

50 %	-214 kg
45 %	-246 kg
40 %	-277 kg
35 %	-309 kg
30 %	-340 kg

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4.3.2.8.16 Operating the Sensors

4.3.2.8.16.1 General Notes

Operation

The rope load sensors are based on a patented measuring method which allows to carry out absolute measurements without the need to calibrate the system with weights. The sensor contains a strain gauge, the signals of which are being conditioned by integrated electronics and transmitted via the USB connector of the sensor to the evaluation unit MSM12. Each sensor is calibrated individually.

Connections

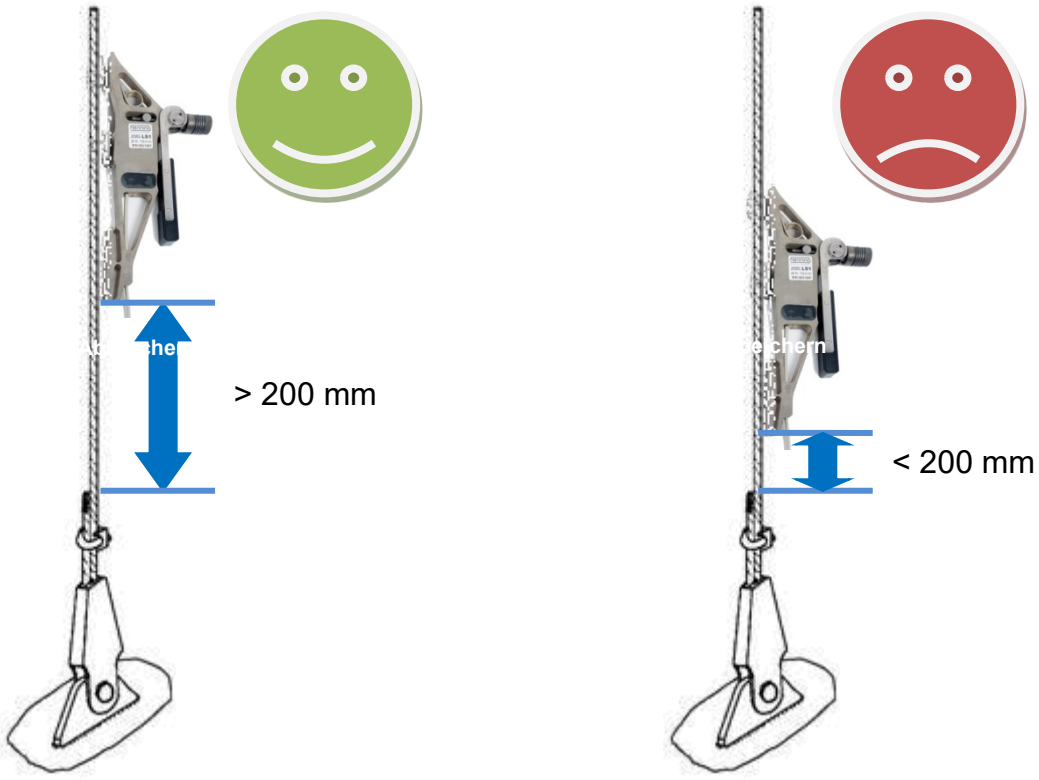
Each LSM sensor features cable with USB-A connector to connect them to the eval-

uation unit MSM12. The sensors have no other connecting options.

To ensure that there is always good electrical contact please keep the sensor plugs free from dust, liquids etc.

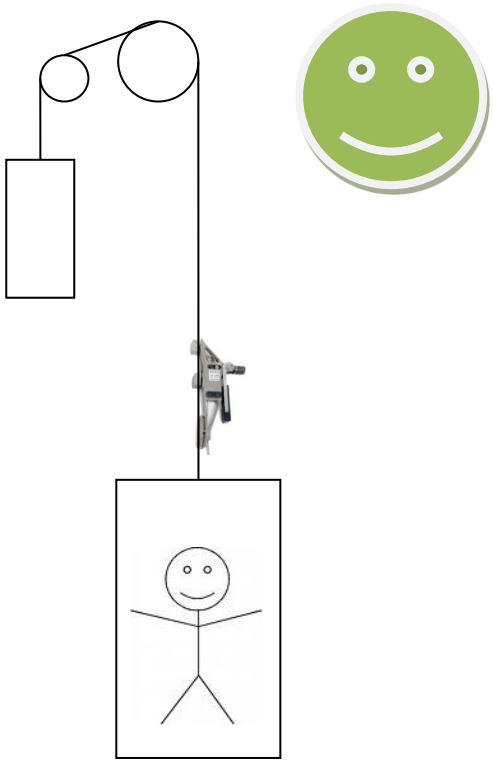
4.3.2.8.16.2 Positioning of Sensors on the Rope

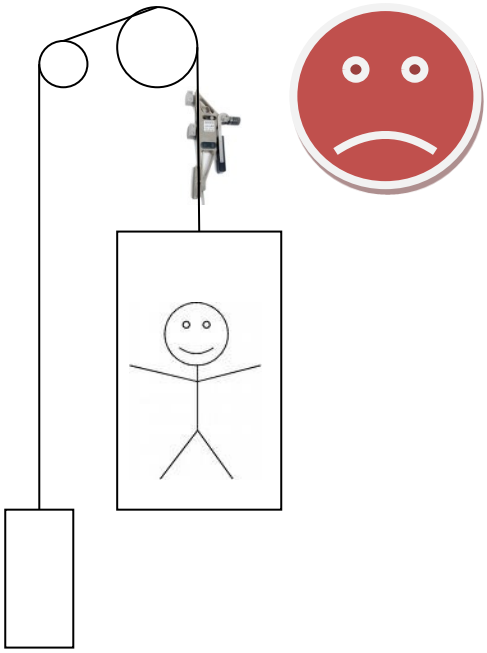
The sensors must be mounted with a minimum clearance of 200 mm to the rope clamps, as a non perpendicular running cable may distort the result of the measurement.



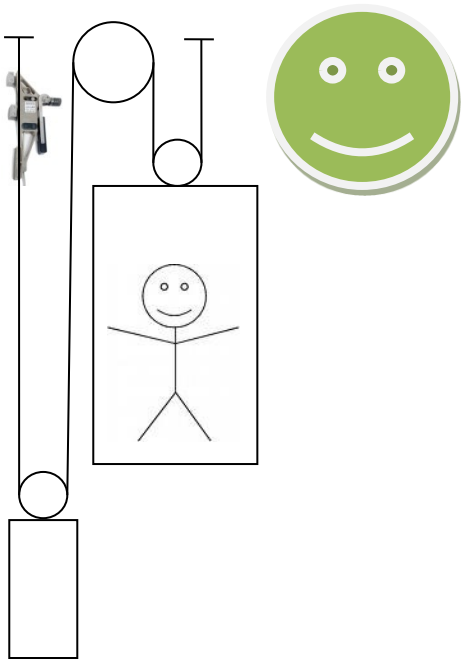
For an accurate measurement, the sensor may be clamped only once onto a particular space in a rope.

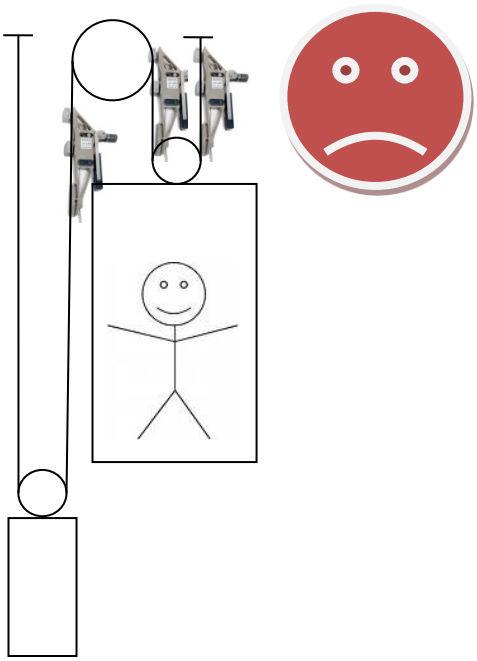
1:1 Suspension

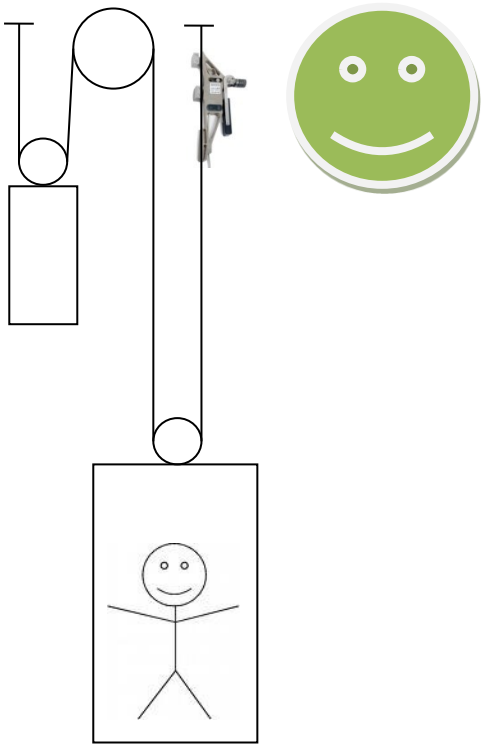


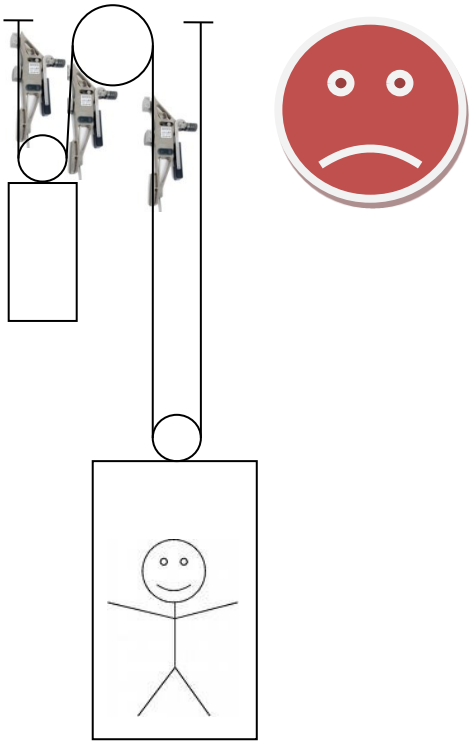


2:1 Suspension









4.3.2.8.17 Rope Adjustment

Generally, the sensors should be mounted in the section of the rope which features maximum lengths without intermediate deflections or traction sheaves, as the ropes will be balancing out only very slightly or none at all during standstill.
If this is not possible due to the layout of the elevator, several rope settings may be carried out in succession. In between the adjustment procedures, the elevator should be driven several times in order to compensate the ropes loads across the traction sheave.

4.3.2.8.18 Friction / Determination of Weight

Due to heavy friction of the car or the counterweight in the guide rails the measuring result may be negatively affected. In such a case it is preferred to determine the weight during a constant travel. This effect is found particularly often in the case of rucksack guides. With roller guides this effect is found generally less frequently than with slide type guides.

If possible, clamp the sensors onto the rope directly above the load to be measured (>= 200 mm) and subsequently travel a short distance upward with constant speed. If there is no difference between the indicated load during the constant travel and while standing still, there is no friction to speak of in the guides and it will not be necessary to carry out the measurement during travel.
If there is a significant difference between the travel and the standstill value, make a note of the value measured during the upward travel and then start a downward travel with constant speed. Make a note of this value too.
The average of the readings obtained during upward and downward travel is the real weight without friction.
By this trick of travelling upwards and downwards and the subsequent determination of an average value you have eliminated the dynamic and static friction of the elevator from the measurements.

In the case of multi-suspensions, please take extra special care that the sensors are not overrun during the measuring travels!

4.3.2.8.19 Installation Sensors LSM1 und LSM2

1. Bring the clamp lever into the “open” position. Place the sensor onto the rope. If this is not possible, open the adjustment-screw several turns. When the sensor is placed on the rope, turn the adjustment-screw in such a way, that the marker matches the appropriate rope diameter on the label. This is only a rough adjustment, the fine tuning will be done by the green o-ring on the adjustment-screw.
2. Now close the clamp lever and taking care that the cable still runs correctly in the sensor groove.

3. Connect the sensor LSM to the evaluation unit MSM12 via the USB cable.

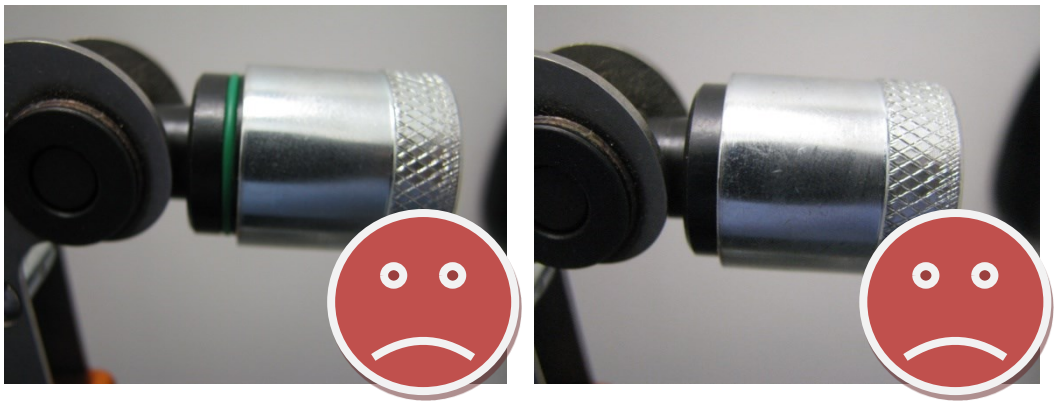
Step 1

Step 2

Step 3

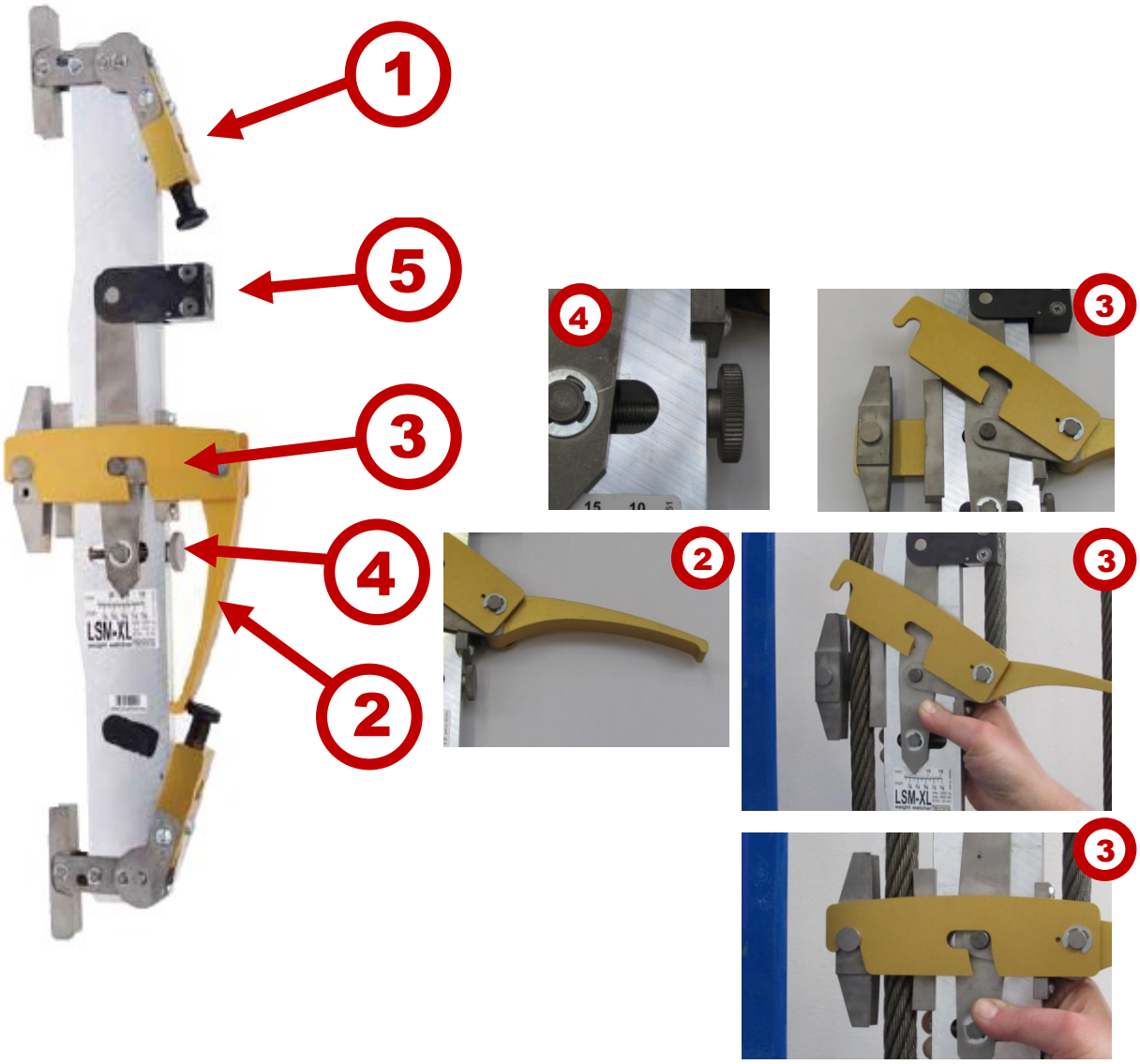
After installation, the correct sensor adjustment should be verified, to ensure that the sensor has been fitted with the right force. The clamping force is correct, if the edge of the adjustment screw's silver cylinder is positioned in the centre of the green o-ring. If the edge of the silver cylinder is not positioned inside the O-ring, the clamping force is wrong and the installation should be repeated.
The following pictures show correctly and incorrectly adjusted rope load sensors:

Incorrectly adjusted:



Correctly adjusted:

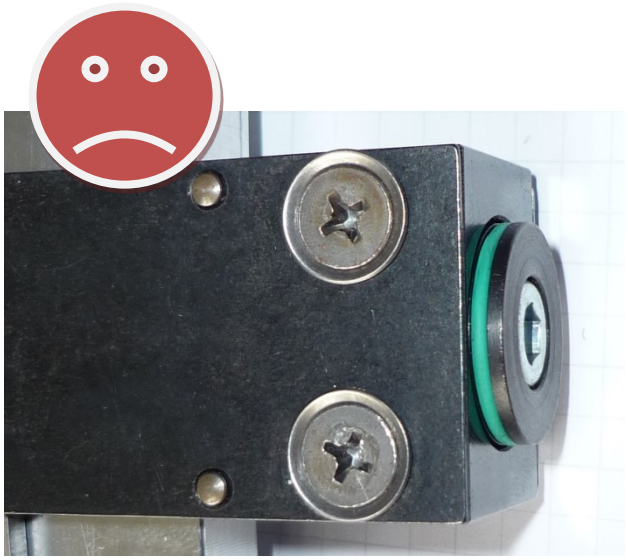
4.3.2.8.20 Installation of Sensors LSM-XL



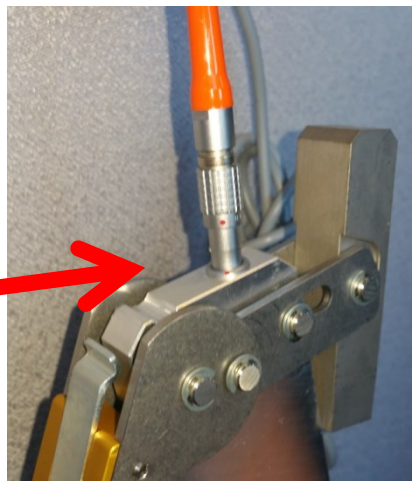
Open both levers 1 as well as lever 2, open strap 3. Adjust the sensor by means of the adjustment screw 4 roughly to the rope diameter and mount the sensor onto the rope. Close strap 3 and after lever 2.
Check the clamping force on indicator 5. If the clamping force is correct, half of the green O-ring will be visible. If this is not the case, open lever 2 again and adjust the clamping force by means of the adjustment screw 4. Close lever 2 again and close both levers 1.

The following pictures show correctly and incorrectly adjusted rope load sensors:

Incorrectly adjusted:



Correctly adjusted:



IMPORTANT ADVICE:

Take care when inserting or removing the cord plug-set.
Handle by the plug unit, **never pull** the electrical cord.
Align red dot on plug with red dot on receptacle of the Sensor.
Forcing the plug in or out will damage pins and severely damage sensor which will require unnecessary/costly repairs.

4.3.2.8.21 Installation of Sensors LSM-BELT

Place the sensor onto the belt and close the strap at the side.
Make sure that the belt is positioned correctly in the in the sensor's corresponding groove. If the belt has only grooves on one side, the flat side should be facing towards the sensor body.

After installation and closing of the lever, the correct sensor adjustment should be verified, to ensure that the sensor has been fitted with the right force. The clamping force is correct, if the edge of the adjustment screw's silver cylinder is positioned in the centre of the green o-ring. If the edge of the silver cylinder is not positioned inside the O-ring, the clamping force is wrong and the installation should be repeated.

Incorrectly adjusted: Correctly adjusted:

4.3.3 Acceleration Sensor QS3

On the main display area on the tab “Acc. sensor”. In this, the acceleration sensor QS3 can be managed and read out.

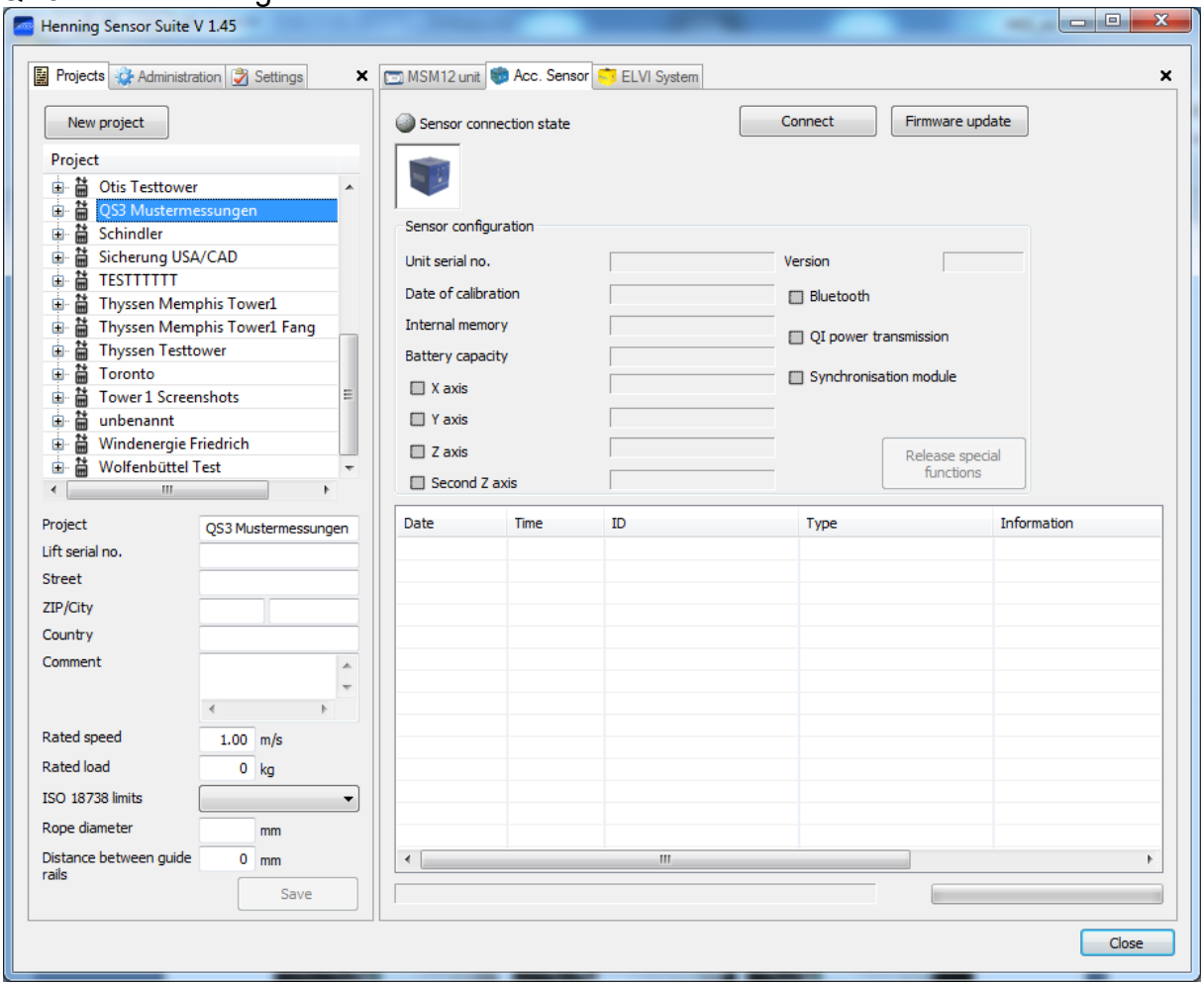
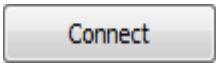


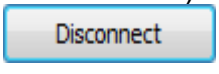
Figure 39: Administration of the acceleration sensor QS3

4.3.3.1 Establishing Connection

To establish connection to a QS3 the following steps must be executed:

1. Turn on the QS3 and await the boot process
2. Use a USB cable to connect the QS3 and computer
3. Press the button 

Once the connection has been successfully established, the “Sensor connection status” turns green and the device information is read.
During an active connection to the computer the QS3 cannot be used for measurements (exception: Online measurement, see Chapter4.2.1.5Online).

In order to again terminate the connection, the button 

will be used.

In the same way, connections can be established over the Bluetooth interface (if available). Please note that the devices are initially paired with the computer (see section3.43.4).

4.3.3.2 Device Information

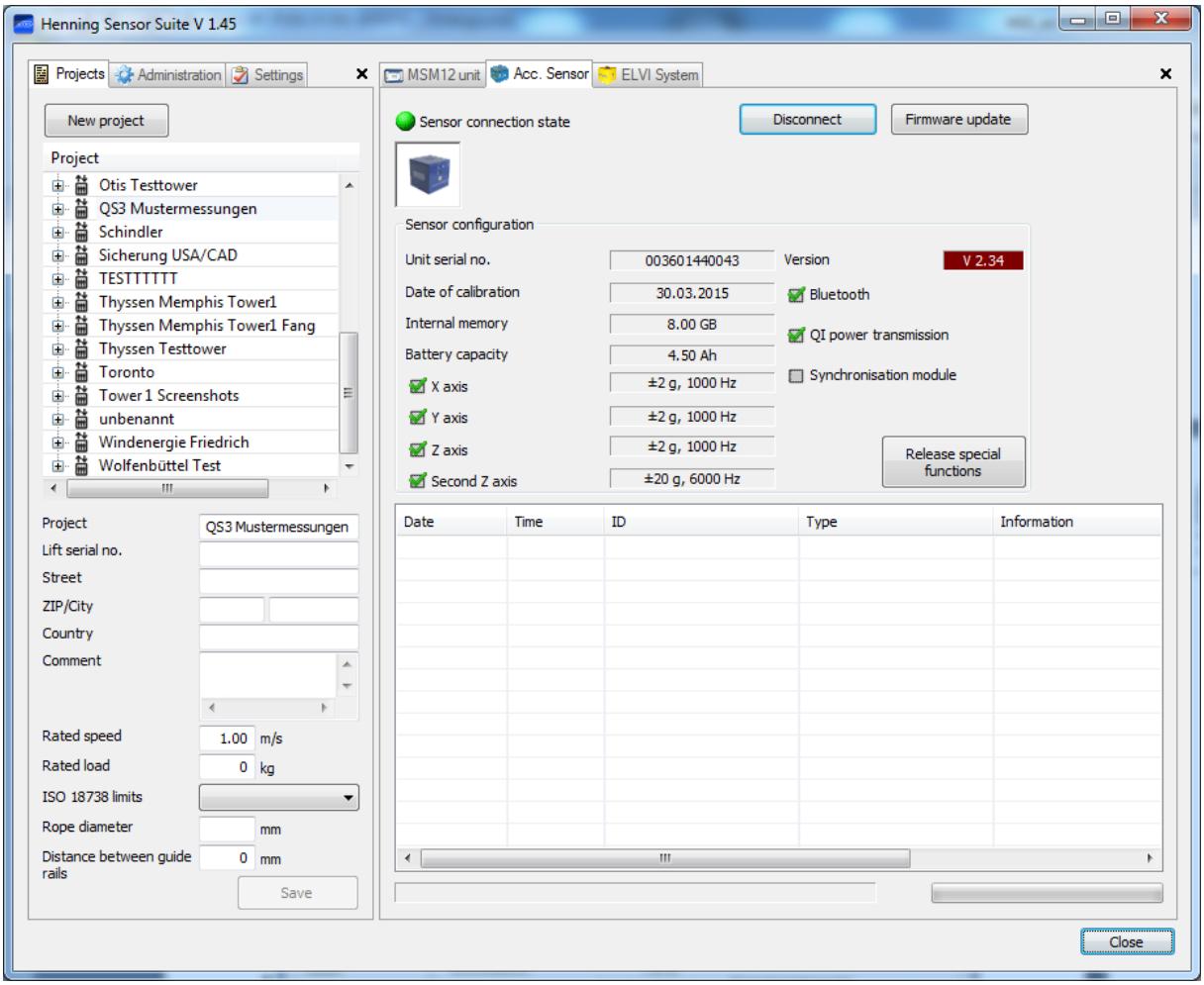


Figure 40: Display of device information of a QS3 acceleration sensor

As soon as QS3 is connected with the PC software, serial number, date of last calibration, software version and installed software and hardware options are read and displayed.

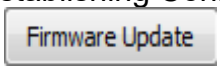
There are seven hardware options available currently:

1. *X-axis* - This option describes whether an acceleration transducer for the axis in question is installed in the sensor and possibly indicates the measuring range and scanning rate.
2. *Y-axis* - This option describes whether an acceleration transducer for the axis in question is installed in the sensor and possibly indicates the measuring range and scanning rate.

3. *Z-axis* - This option describes whether an acceleration transducer for the axis in question is installed in the sensor and possibly indicates the measuring range and scanning rate.
4. *Additional Z-axis* - This option describes whether an acceleration transducer for the axis in question is installed in the sensor and possibly indicates the measuring range and scanning rate.
5. *Bluetooth* - If this option is marked, then the QS3 is provided with an internal Bluetooth chip with which the QS3 can be connected with PC or suitable smartphones
6. *Contactless QI-charge* - The QI-charge is a current standard that is currently spreading rapidly especially in the smartphone market. Using this standard, the QS3 can be charged inductively without a cable connection by being placed passing on a special QI-contact mat.
7. *Synchronisation module* - If this module is installed, the QS3 can synchronise with other devices. This is interesting, for example, to obtain temporary, synchronous measurements of cable loads and simultaneous vibration.

The calibration date is highlighted in red when the recommended calibration interval has been exceeded.
The software version is highlighted in red if there is a new firmware ready for the QS3, which should also be installed in any case (see section4.3.3.3 Firmware Update).

4.3.3.3 Firmware Update

To update a firmware, the QS3 is first connected with the PC software (see Chapter4.3.3.1Establishing Connection).
The button 

is subsequently used.
When a new firmware is ready for installation, the process is started with the following message:

The firmware update can now be executed. During the update, the device must not be switched off! Please also check that the batteries are sufficiently charged.

Once the message has been confirmed positively, the firmware update starts. This process must not be interrupted.
During the process, the progress is visualised by means of a progress display at the bottom of the window. When the firmware update has been completed, the following message will be displayed and the device restarts:

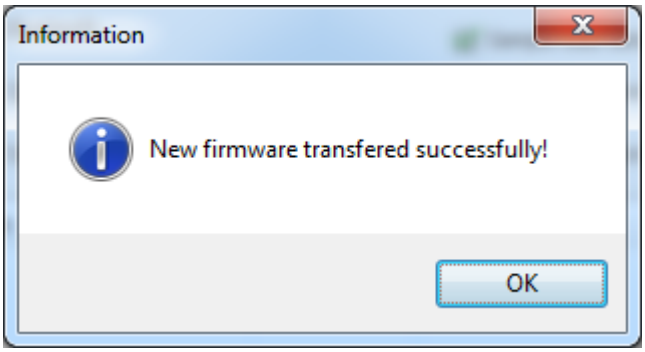
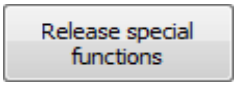


Figure 41: Firmware update successfully completed

If the update process has been interrupted irregularly, there is the possibility that the device is not in an operational state (the booting process is not concluded). In this case, the device must be returned to the manufacturer in order to have the firmware update completed successfully.

4.3.3.4 Enabling Options

Software options can be ordered directly during the delivery of the device, but can also be enabled later by the user.
In the latter case, the user is sent a so-called release file. This has the file extension "*.qs3".
To enable the software, the QS3 is connected to the computer (see Chapter 4.3.3.1 Establishing Connection). The button 

must be subsequently used and the respective file selection dialogue is made. The information on the enabling is then transferred into the QS3 and saved there, the new functions are then continuously available.

4.3.3.5 Reading Measurements

As soon as the QS3 is connected to the PC (see Chapter 4.3.3.1 Establishing Connection) the reading of the measurements stored on the QS3 is started. This may take several minutes depending on the number and size of individual measurements. The progress of download is displayed during the progress on the indicator at the bottom of the dialogue window.
Once all measurements have been downloaded, they are displayed in the measurement list of the dialogue box:

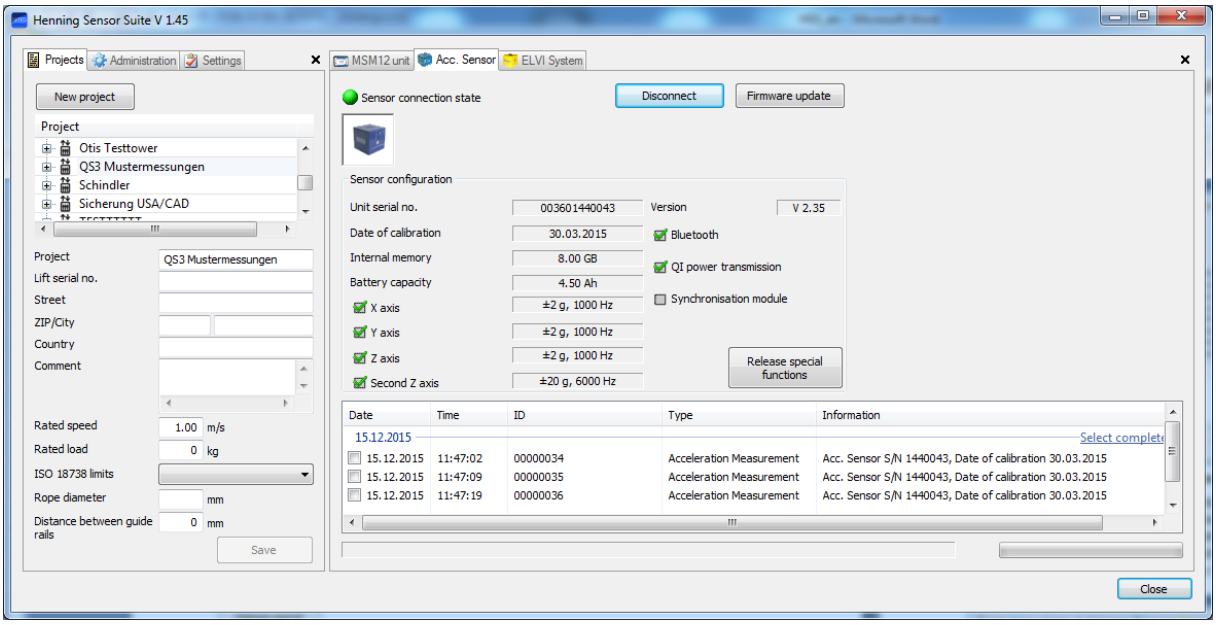


Figure 42: Dialogue QS3 with three downloaded measurements in the measurement list

The measurements are now assigned to the corresponding project, in that first the desired measurements are marked with a tick in the selection box, and the measurements thus highlighted with the mouse while holding down the left mouse button are moved to the corresponding project. As soon as the left mouse button is released, the measurements are added to the corresponding project.

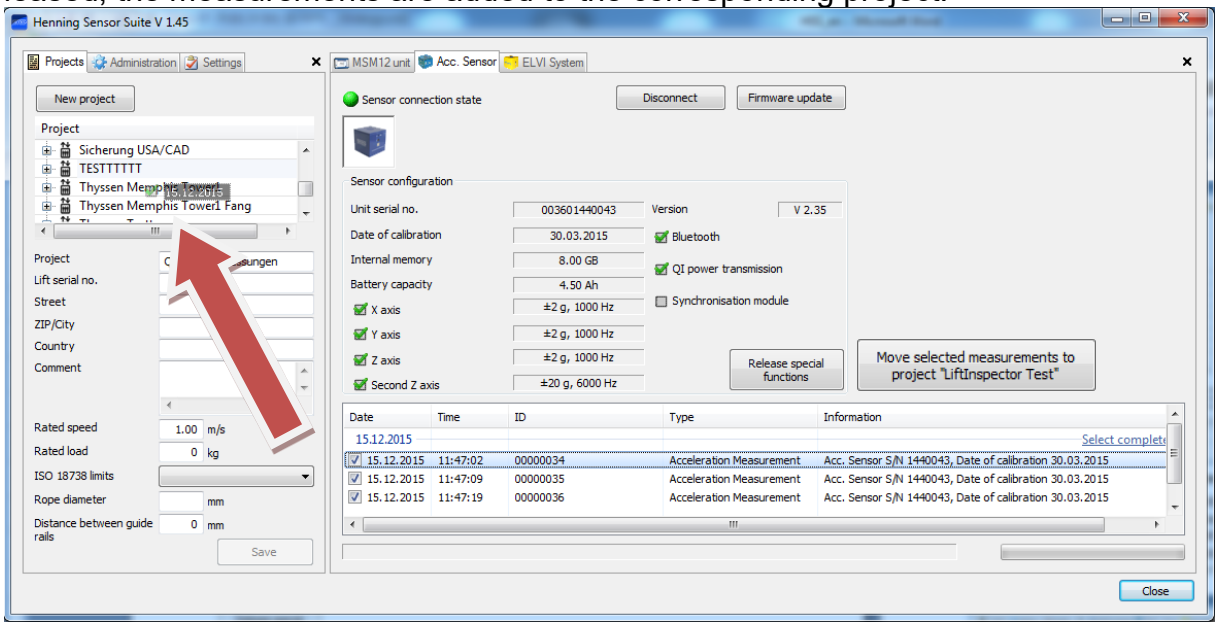
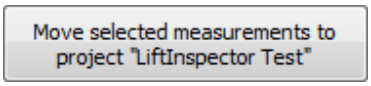


Figure 43: On the QS3 add saved measurements to a project

Depending on the current software settings (see Chapter 4.2.3) the measurements in this process are deleted from the device or retained.

Alternatively, you may use the button 

Select the desired target project in the project list, mark the measurements to be transferred with a check mark and press the button.

4.3.3.6 Delete measurements from device

To delete measurements from the device without having to initially assign them to a project, the relevant measurements are marked with a tick in the associated selection box and then the “Del” key on the keyboard is pressed. After an additional security prompt, the measurements are then permanently deleted from the device.

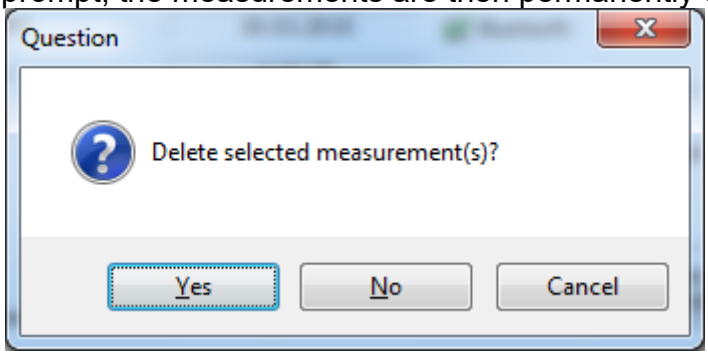


Figure 44: Security query “Delete measurements”

This operation cannot be reversed!

4.3.3.7 Display Measurements

When a measurement is stored in a project, this can be displayed. For this the project concerned and the subcategory “acceleration measurement” is opened and then a double-click with the left mouse button on the desired measurement is executed.

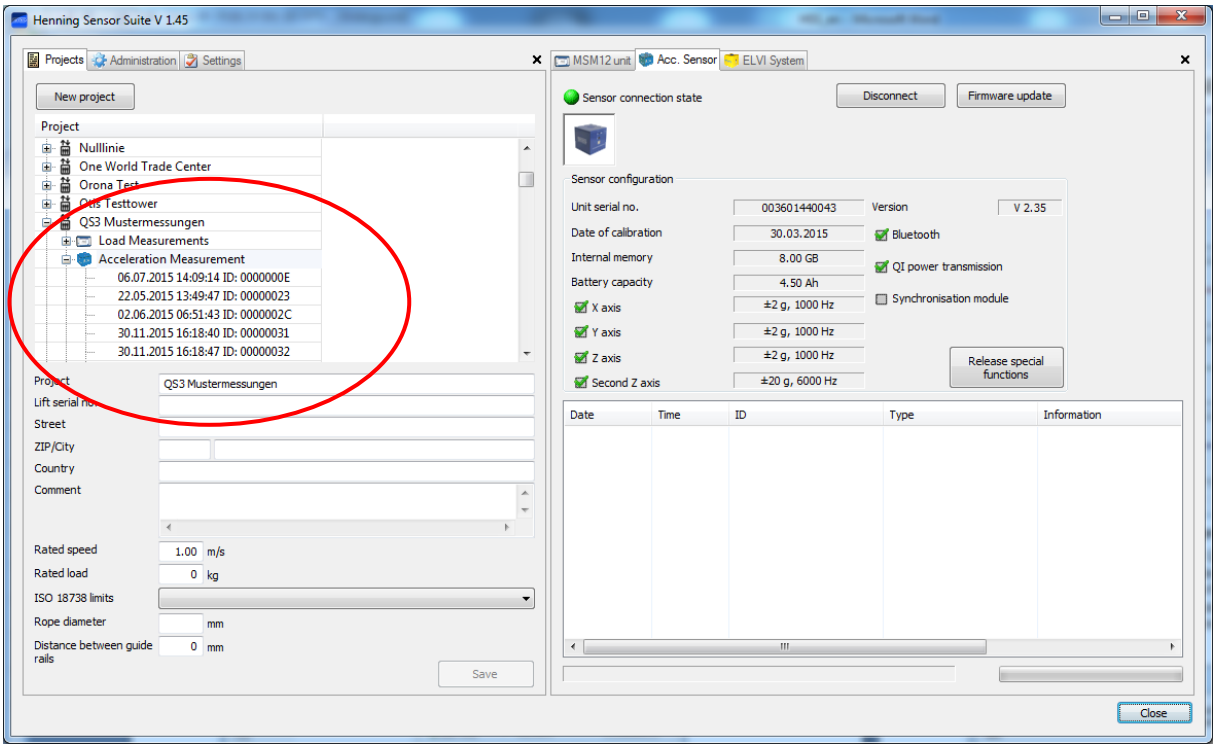


Figure 45: Open QS3 Measurements

The corresponding measurement opens in a new tab on the main display area:

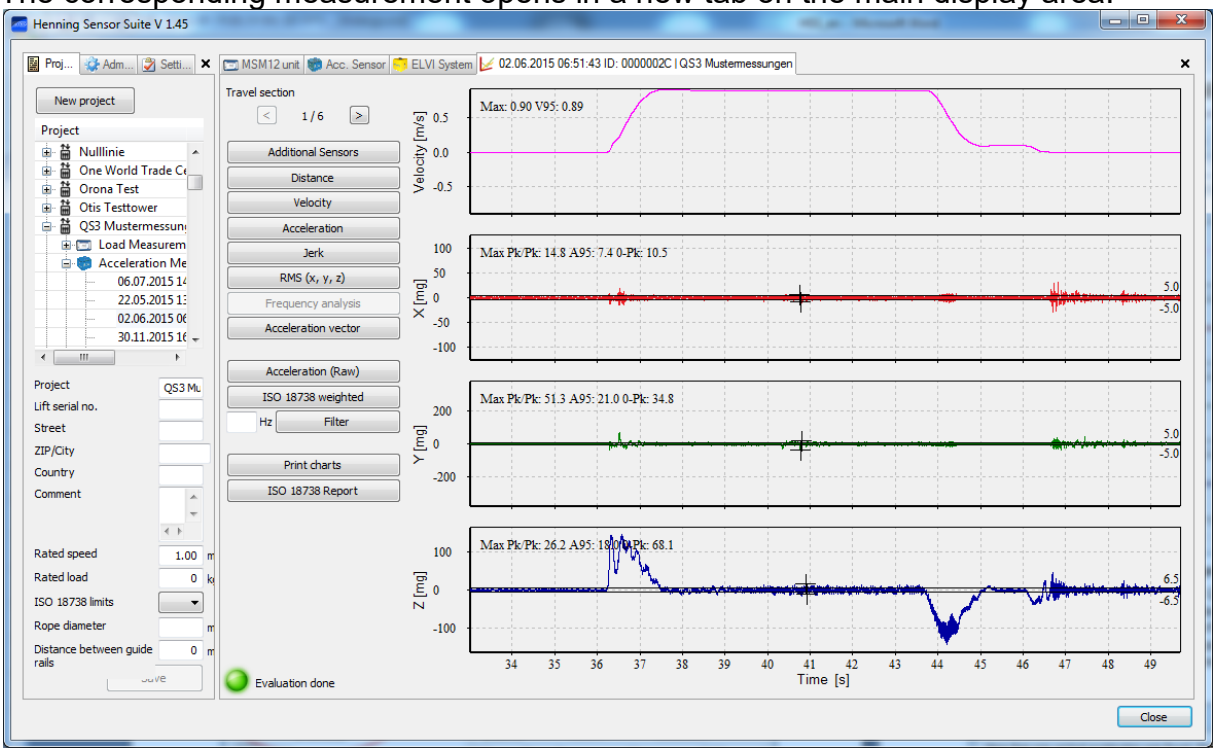


Figure 46: Opened acceleration measurement, recorded with a QS3 sensor

Depending on the components of the QS3 sensor, the following dialogue box opens if the sensor with which the measurement was executed has two vertical acceleration

transducers. The user can determine from which vertical acceleration information the velocities, distances and return flows and if applicable the corresponding ISO18739 results are to be calculated.

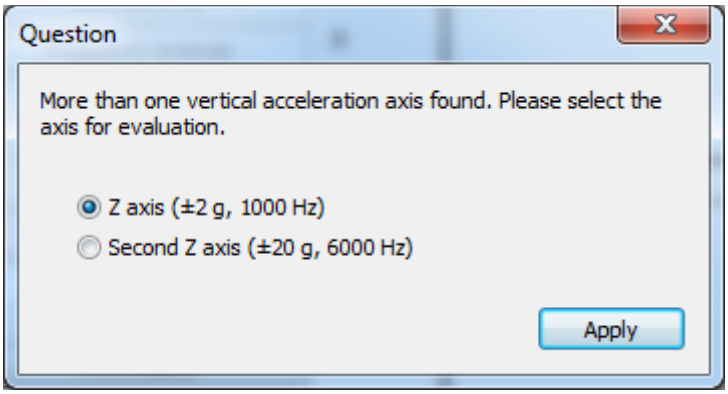


Figure 47: Selection of the vertical axis through which the evaluation shall be executed

Once the acceleration data have been loaded, the analysis of the data according to ISO 8100-34 is started.
The current processing status is displayed at the bottom left with a short text and a virtual LED.

- Error during the evaluation
- Evaluation running
- Evaluation completed successfully

4.3.3.7.1 Error Codes Evaluation According to ISO 8100-34

Possible errors during evaluation are:

Error code	Importance
0x0001	Not enough raw data for acceleration in the X direction
0x0002	Not enough raw data for acceleration in the Y direction
0x0003	Not enough raw data for acceleration in the direction of Z
0x0004	Error in the metrological scaling of acceleration data
0x0005	The standard deviation in the X direction of acceleration is too high
0x0006	The standard deviation in the Y direction of acceleration is too high
0x0007	The standard deviation in the Z direction of acceleration is too high
0x0008	Error in the 1 Hz low-pass filtering of acceleration in the Z direction
0x0009	Error in the 10 Hz low-pass filtering of acceleration in the Z direction
0x000A	Error in the 10 Hz low-pass filtering of acceleration in the X di-

	rection
0x000B	Error in the 10 Hz low-pass filtering of acceleration in the Y direction
0x000C	Error in the whole body frequency weighting in the X direction of acceleration
0x000D	Error in the whole body frequency weighting in the Y direction of acceleration
0x000E	Error in the whole body frequency weighting in the Z direction of acceleration
0x000F	Error in the calculation of the regression line over the return curve
0x0010	Error in the subdivision of the measurement in constant and non-constant areas
0x0011	Errors in the formation of the 2nd-order integration constant
0x0012	Errors in the formation of the integration constant
0x0013	Errors in the compensatory filtering
0x0014	In this measurement no elevator ride is detected

4.3.3.7.2 Combined Curve Representation

By default, four graphs are displayed. In the bottom three the acceleration data of the three spatial directions are loaded. The top graph is occupied with the velocity characteristic as soon as the elevator rides have been evaluated.

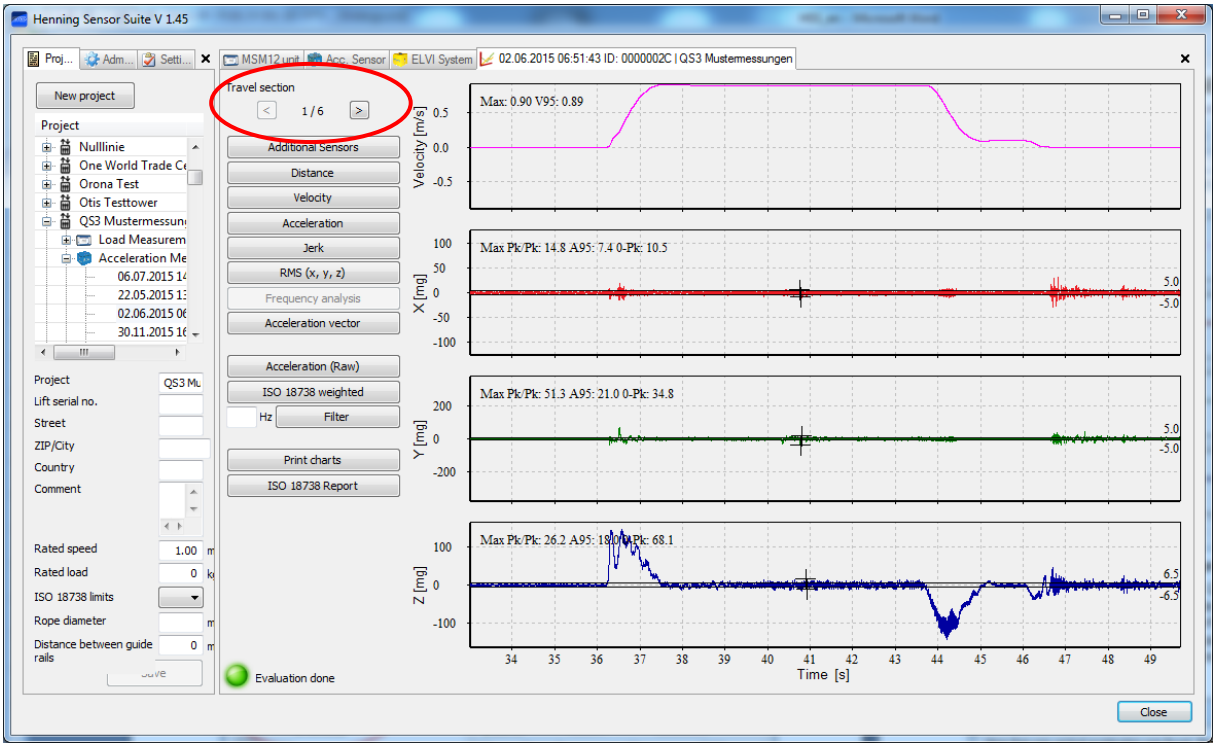


Figure 48: Curve representation of an acceleration measurement

The first ride section is always depicted. Should more than one ride section be recorded, the desired ride section with the Figure 48 marked control elements can be selected.
If changes in the chronological selection of the represented measuring values, e.g. scroll movement or zoom operations are executed in one of the graphs, the displayed time sections of all four graphs change automatically.
In each diagram, the determined characteristic data according to ISO 8100-34 are shown in abbreviated form in the upper left corner.
Furthermore, if a central limiting value theorem for the corresponding project has been selected (see Chapter 4.2.2.1 Setting ISO 8100-34), these are displayed as horizontal border lines in the diagrams.

The operation of curve representations is described in more detail in Chapter 4.3.1Operating the Curve Display.

4.3.3.7.2.1 Fading in Further Curve Characteristics

On the left side of the dialogue box there are several buttons in order to view further curve characteristics.

A single additionally selected curve characteristic, for individual curves, is always displayed in the first of the four graphs. The lower three graphs are used only if it is a representation (e.g. for RMS) that affects all the three acceleration characteristics.

Additional Sensors	The curve characteristics can be called with this button if additional sensors, such as a sound level meter, rope force sensors etc. have still been recorded in addition to the measurement of the accelerations.
Distance	Fades in the distance (displacement) curve characteristic in the upper graph.
Velocity	Fades in the velocity curve characteristic in the upper graph.
Acceleration	Fades in the acceleration curve characteristic in the upper graph.
Jerk	Fades in reverse Curve Characteristic in the upper graph.
RMS (x, y, z)	Fades in per direction of motion the RMS-curve in the three lower graphs.
Acceleration vector	Fades in the acceleration vector in the upper curve view. This can be combined from the three spatial directions.
Acceleration (Raw)	Fades in the raw data of the three acceleration directions in the three lower graphs.
ISO 18738 weighted	Fades in the data weighted according to ISO 8100-34 of the three acceleration directions in the three lower graphs.

4.3.3.7.2.2 Calculation Boundaries

The boundaries for calculation according ISO 8100-34 might be displayed into the graph by using the button Show Boundaries.

4.3.3.7.2.3 Filtering the Acceleration Data

To perform high- or low-pass filtering of the acceleration data, please enter the desired cut-off frequency and then select the desired limit frequency and finally select the desired filtering via the button Filter. The filtered curve characteristics of the acceleration data are displayed in the lower three graphs.

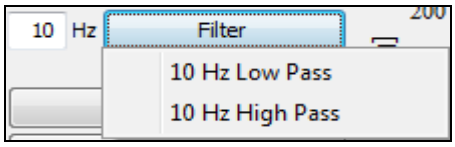


Figure 49: Filtering the Acceleration Data

4.3.3.7.3 Single View Graph

To have a full-screen display of a currently shown graph, double click with the left mouse button in a free area of the desired curve representation. Change back to the combined curve representation is the same as with a double-click in the single view.

Figure 50: Change in the individual view of a graph

4.3.3.7.4 Frequency Analysis

The tools of frequency analysis are only available in the single view of the graphs. In this condition, the button Frequency analysis can be used.

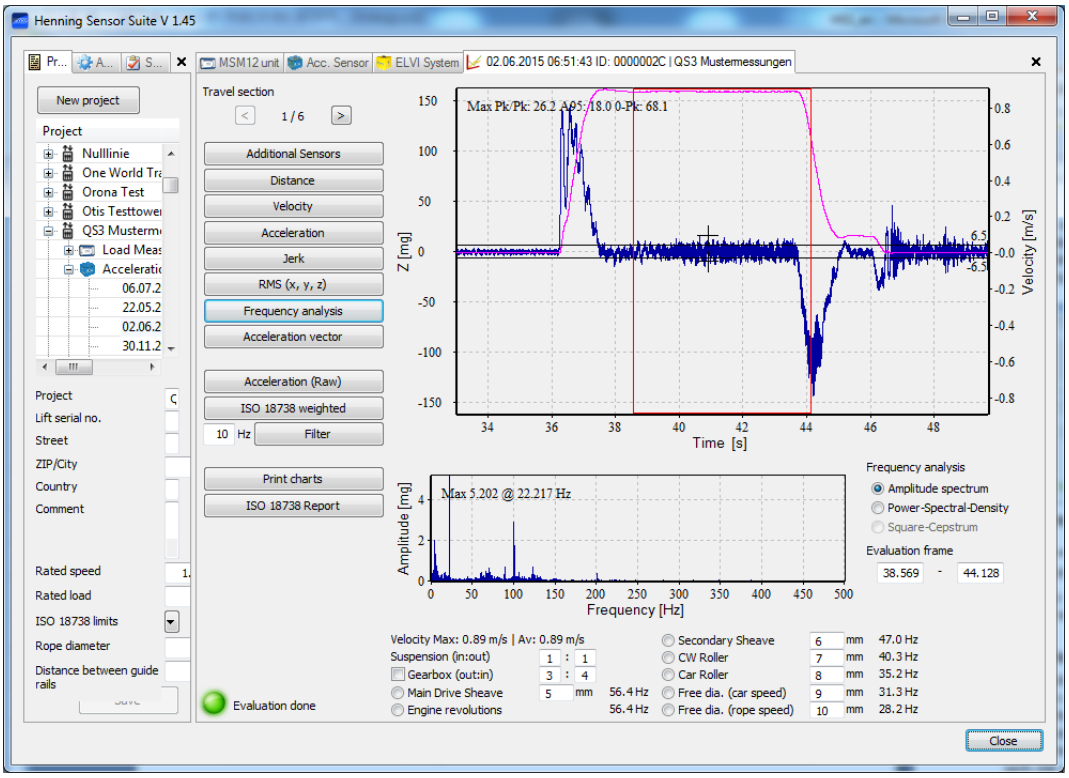


Figure 51: Single view with an active frequency analysis

The screen contents subsequently form anew. In the original graph the additional velocity characteristic (if available) is faded in and below it a new diagram appears with a bar view of amplitudes over the frequency. This frequency chart is determined from the data in the red-marked window of the original graph. The window can be moved with the mouse over other areas and changed in size temporarily. Both actions thus change the temporal evaluation area that can also be changed manually.

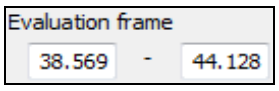


Figure 52: Manual Change of the Processing Area

In addition you can specify what type of frequency analysis should be performed. Available for selection are:

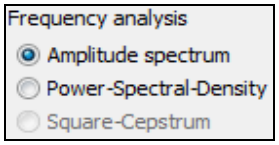


Figure 53: Types of frequency analysis

For the spectrum three different analysis methods can be used.
The power density spectrum generates a frequency spectrum of power in the acceleration characteristics.

The amplitude spectrum gives information about the real amplitudes of different frequencies. The amplitude spectrum in particular highlights small power components and is therefore sometimes preferred.
The square cepstrum is the spectrum of a signal that is a function of the variable frequency. The cepstrum is the inverse of the Fourier transformation (“Analysis”) of the unilateral auto-power spectrum logarithmised by division with a reference quantity G0 made dimensionless. Within the Henning Sensor Suite, this function is available only as an option and must be enabled separately (see chapter 4.3.4).

In the frequency chart a practical tool for advanced error analysis connects - the frequency computer.
Thus, after input of several basic data of the elevator, frequencies affecting individual modules can be determined, which are the cause of poor smooth-running or audible and perceptible vibrations.

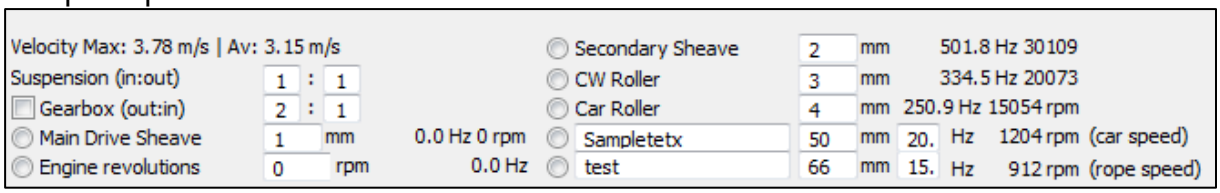


Figure 54: Frequency computer for error analysis

The calculated frequencies can be shown in the frequency diagram marked in orange. This requires the appropriate marking with the mouse in front of the desired component.

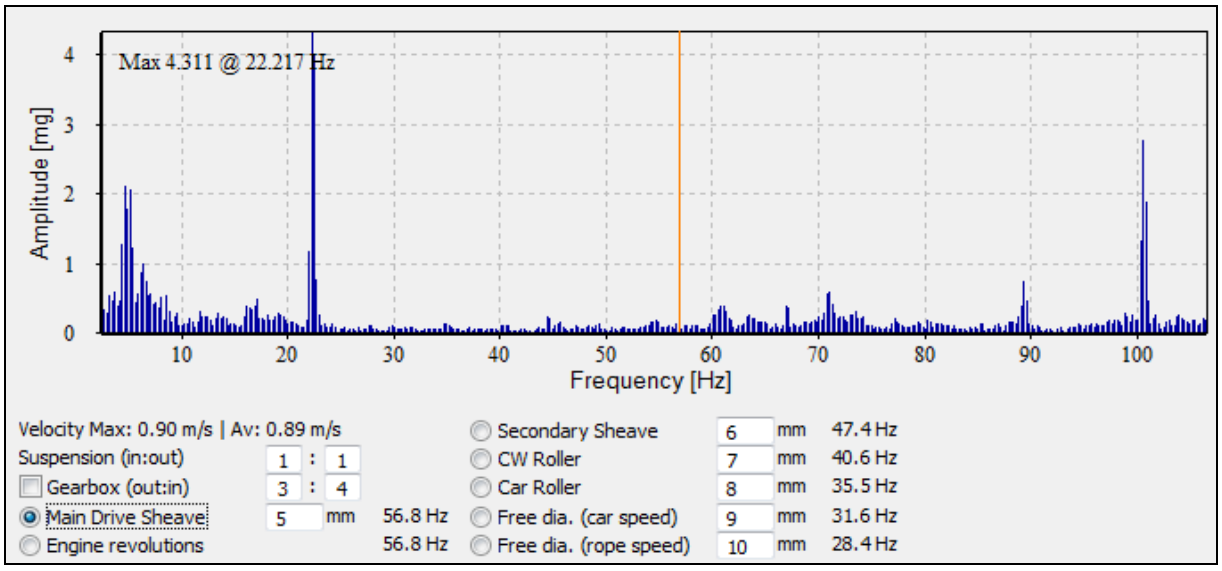


Figure 55: Frequency computer with superimposed frequency of the “cabin roller guide”

4.3.3.7.5 Print Curve Characteristics

To print the current view of the curve characteristics in the combined or also of the individual to print view, the button will be Print charts used.

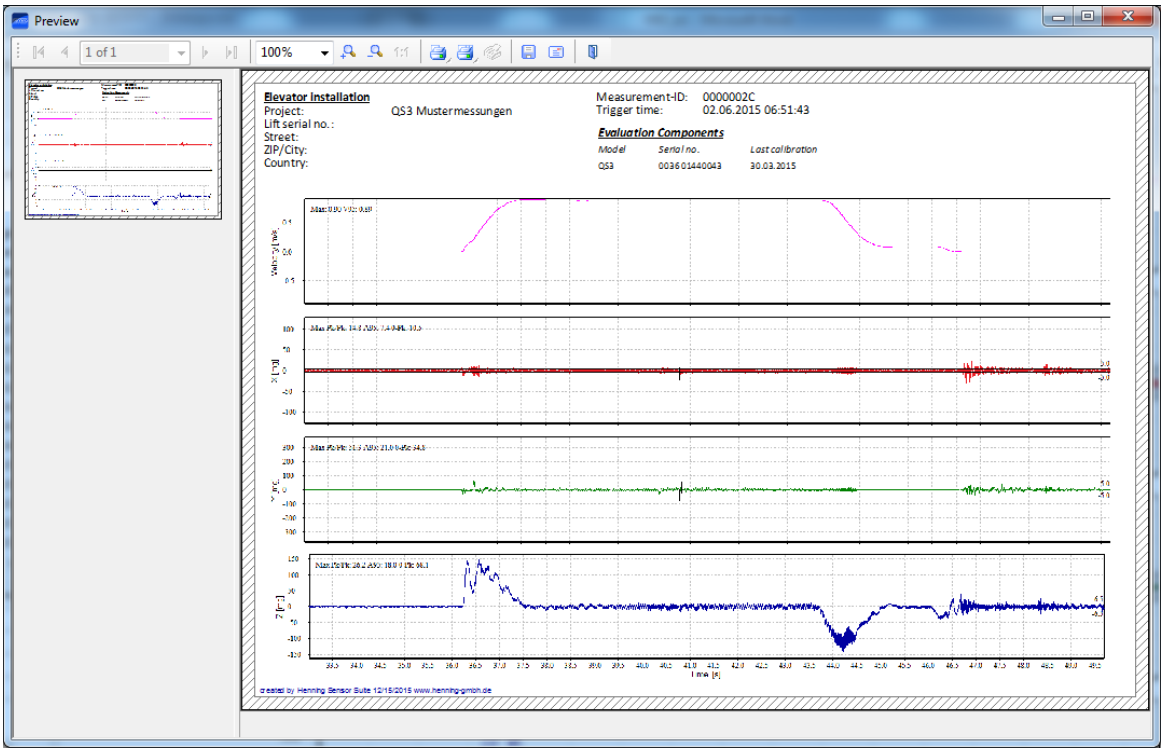


Figure 56: Curves print view

4.3.3.7.6 Create Report According to ISO 8100-34 part 1

The button ISO 18738 Report that opens the print view of the report according to ISO 8100-34 is started. Per measured travel section a page is created in the report. Detail information for handling the report generator is found in Chapter 6.4

For the settings (see Chapter 4.2.3), additional pages can be generated with the mean values of the upward and downward travel.

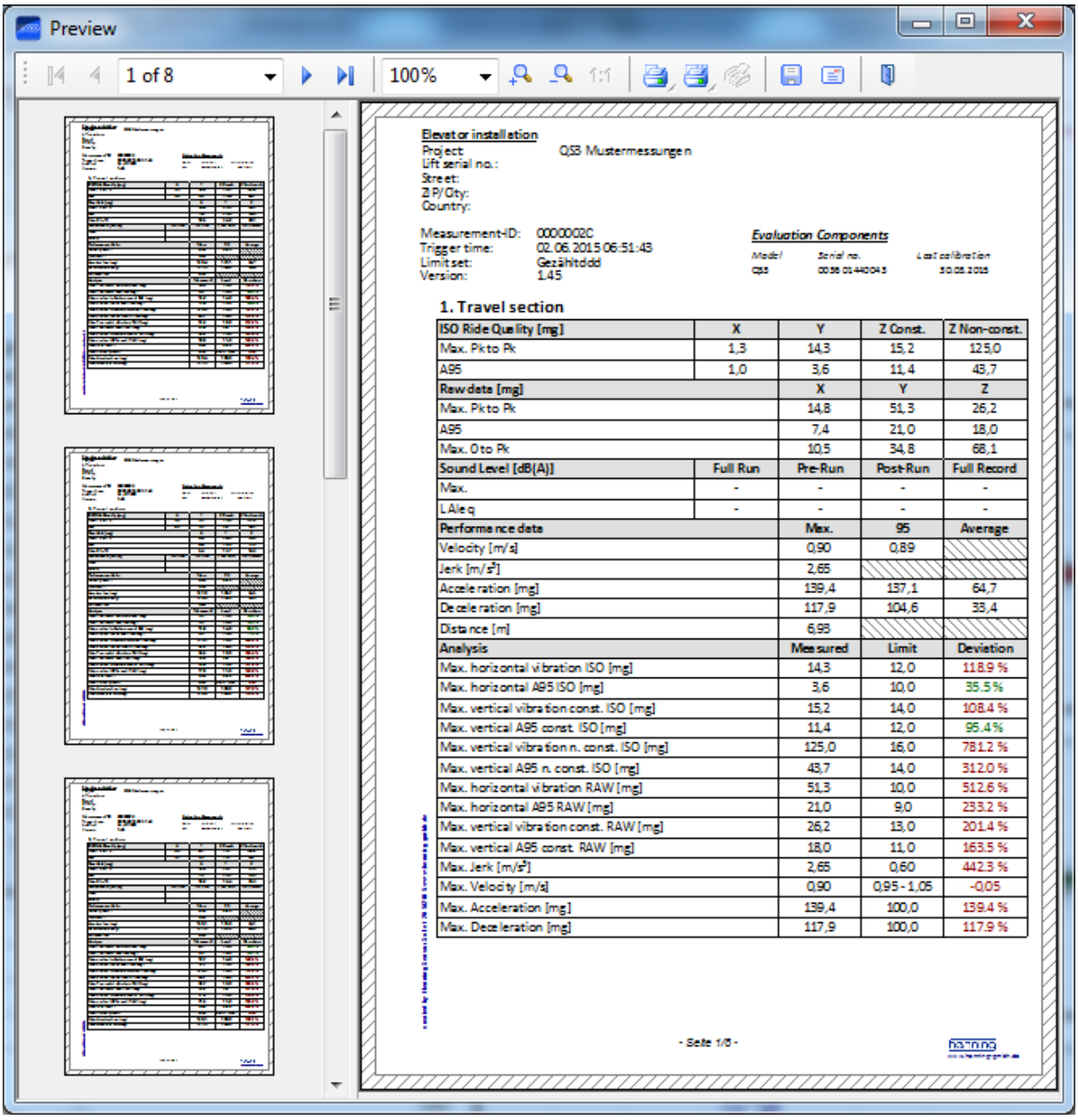
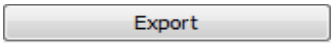
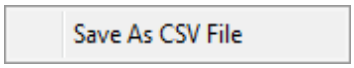


Figure 57: ISO8100-34 Report View

4.3.3.7.7 Export

By pressing the button 

the export of the data is initiated . The data and required format can be selected in a drop-down menu.



After pressing this button, the raw data of the acceleration sensors will be stored in a CSV file, which then may be further processed with other software solutions, like Microsoft Excel for example.

4.3.3.8 Performing an Elevator Ride Quality Measurement acc. ISO 8100-34 part 1

The measurement must be taken in accordance with ISO 8100-34 part 1 paragraph 7 “Measurement and reporting”.
The sensor must be in sufficient contact with the elevator cabin. Ensure this by using the provided measuring plate as a sensor mount.
The mount must be placed horizontally in the middle of the standing area of the cabin. It is necessary to ensure that during the measurement, no external vibrations occur (e.g. up and down movement inside the cabin, external machine vibrations in the individual floors etc).
The axes of the sensor must be aligned in accordance with the following figure relative to the cabin door and floor (X towards the door, Z upwards).
The grey circle indicates the installation surface of the sensor in the middle of the cabin floor.

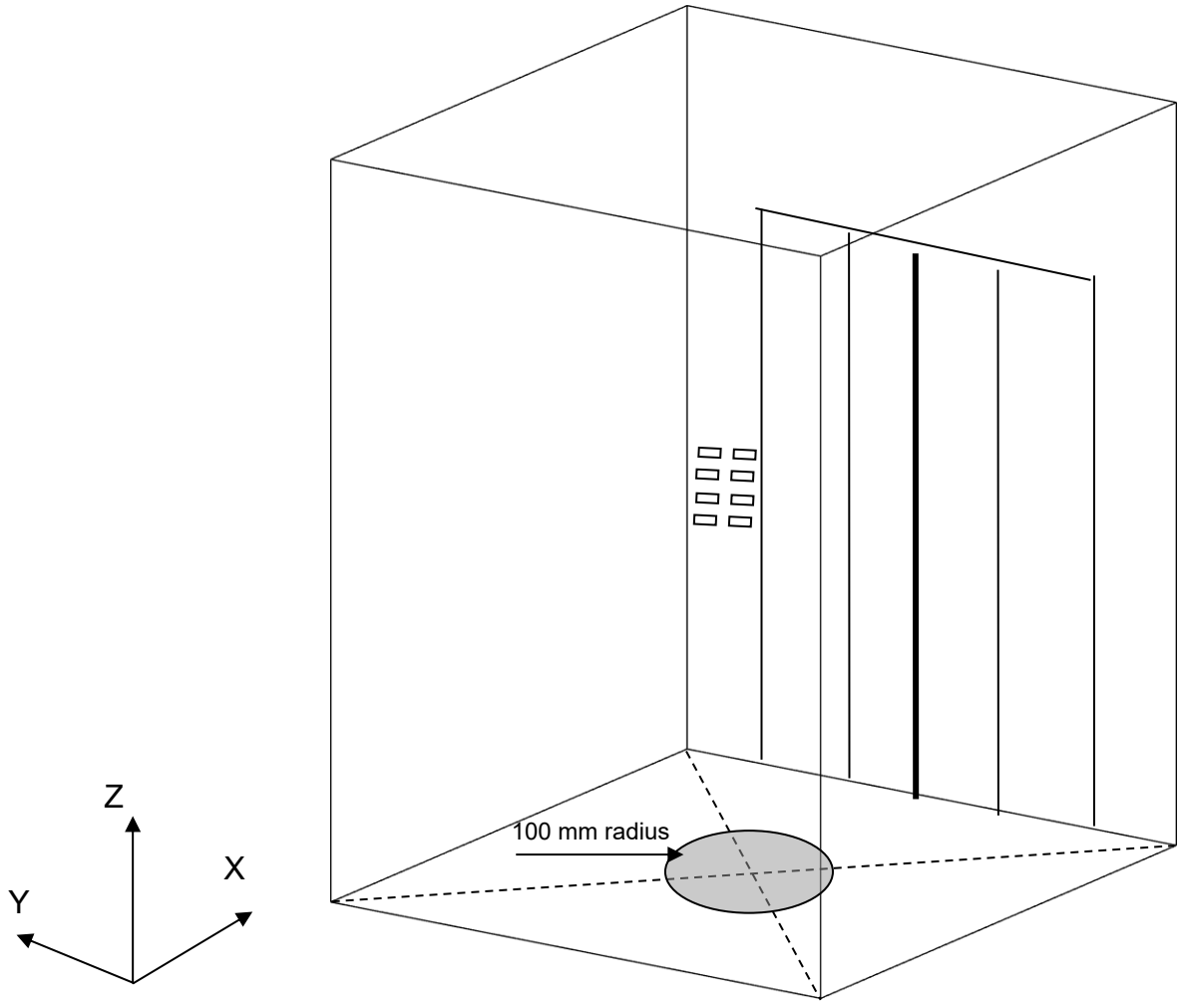


Figure 58: Installation sketch

As soon as you have set up the sensor according to the instructions, you can start the measuring process

4.3.3.8.1 Operation of the Sensor QS3

4.3.3.8.1.1 Safety and Shipping Instructions

The acceleration sensor QS 3 is equipped with internal lithium ion batteries.

Safety Instructions

- Lithium cells react very violently with water (especially charged)
- Do not keep li-ion batteries in proximity of combustible material.
- Do not overcharge li-ion batteries
- Li-ion batteries must never be short-circuited
- Li-ion batteries are mechanically sensitive. Due to internal short circuit and

in the event of contact with air, they can ignite (up to 30 minutes after short circuiting)

Shipping Information

The batteries in the acceleration sensor conform to UN number 3481, lithium-ion batteries contained in equipment (UN rules for shipping lithium batteries as from 01.01.2009). Please note possible shipping restrictions, especially in air freight, or get information from your logistics partner before shipment.

General Information

Protect your acceleration sensor QS 3 against dirt, water and minor impact.

4.3.3.8.1.2 Control Elements

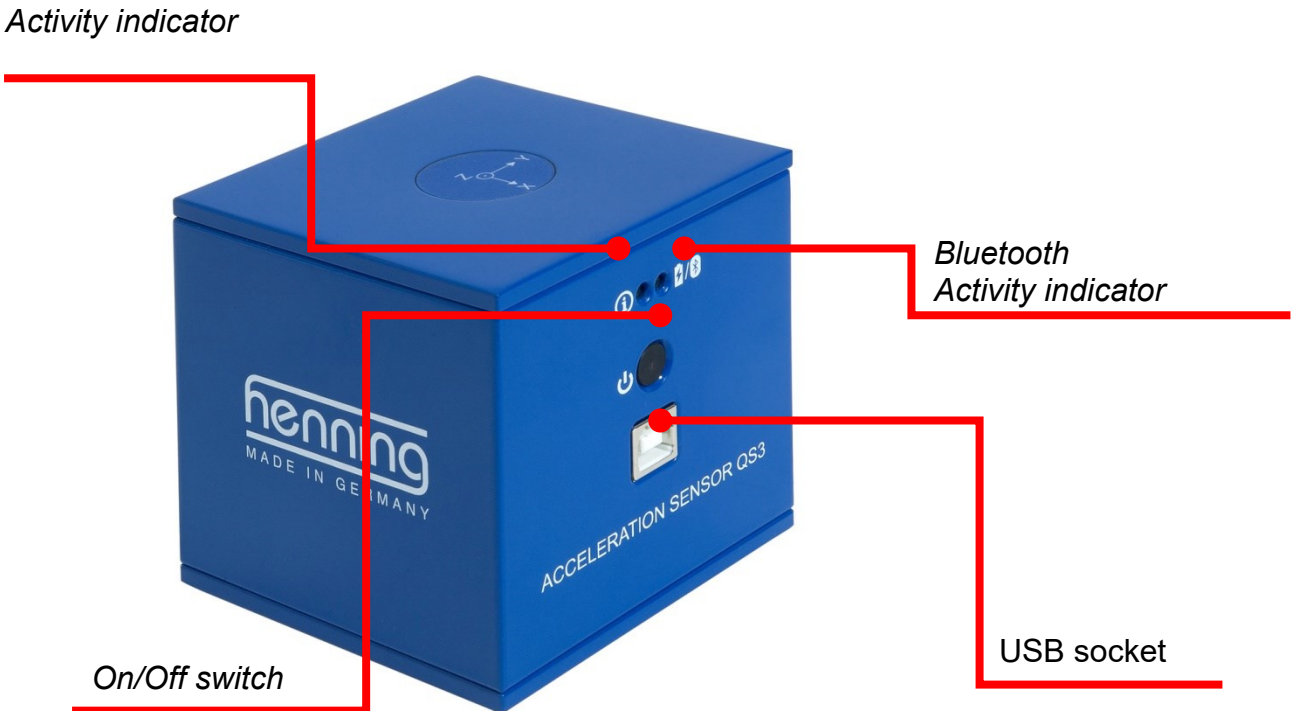


Figure 59: Controls Elements QS3

4.3.3.8.1.3 LED operation

Activity indicator:

QS3 on	**green**, flashing slowly
Measurement running	**green**, continuous light
Trigger mode	**green**, flashing rapidly
Low battery	**red,** flashing
Internal memory full	**red**, continuous light

Bluetooth activity display:

Charging process	**red**, continuous light
Bluetooth Data Transfer	**blue**, continuous light

4.3.3.8.1.4 Charging the batteries

At the latest when the battery indicator flashes red, the battery should be charged. During the charging process, the battery charge warning light changes to continuous red light.

Turn off the device during the charging process if possible, otherwise a large part of the charging current is used for the operation of the device.

4.3.3.8.1.5 USB Adapter

Connect the QS3 with the help of the USB cable to the USB charging adapter and plug the USB charging adapter into a power outlet. The charging process takes about 9 h for a completely discharged battery.

4.3.3.8.1.6 Qi-Charging

To charge using QI-interface, connect the QI-charging station with a socket outlet. Position the QS 3 in the middle on the charging station. For this the display must be turned away from the charging station. When correctly positioned, the status LED of the charging station switches over into the active state and the activity indicator lights up after approx. 2 seconds.
The charging process for a completely discharged battery is approximately 5 h.

4.3.3.8.1.7 Switching on the Device

To switch on the acceleration sensor QS3, please press on the on/off switch for at least 3 seconds. The Bluetooth LED indicator will illuminate and the QS3 goes into the operating state (activity indicator flashes slowly).
To switch it off, please press again the on/off switch for at least 3 seconds. The device switches off, the activity indicator goes off. The QS 3 switches off automatically when the batteries are exhausted.

4.3.3.8.1.8 Start Measurement

There are two options to start measurement with the QS3 sensor: Either one starts an “Online” measurement (cf. Chapter 4.2.1.5 Online) or a stand-alone measurement, that stores the data in the internal memory of the QS3.

Currently, combined measurement of noise and acceleration are only possible with the online measurement.

4.3.3.8.1.9 Stand-alone Measurement with QS3

4.3.3.8.1.9.1 Start Measurement

As soon as the QS 3 is in the operating state, press the On/Off switch and the activity display starts to flash green briefly. The display then changes to a steady green light, this is the moment at which the measurement starts.

4.3.3.8.1.9.2 Stop Measuring

The measurement is stopped by pressing the on/off switch. The display changes from a steady **green** light to blinking **green**, which indicates the normal operating state.

4.3.3.8.1.10 Measurement with Mobile Devices

For a free Android App for starting and stopping measurement via your mobile phone or tablet computer, see the Google play store. This App allows you to assign an individual ID for your measurement (max. 16 digits). Please download the App here:

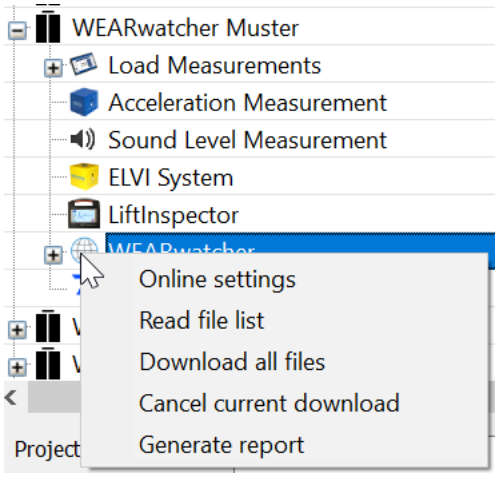
https://play.google.com/store/apps/details?id=de.qs3.remotecontrol

4.3.4 WEARwatcher Remote Connection

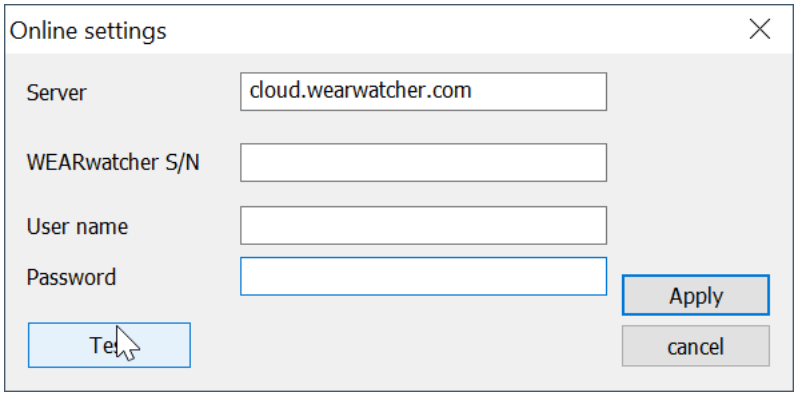
With the help of the Henning Sensor Suite (HSS) it is possible to establish an online connection to the monitoring and predictive maintenance device WEARwatcher. This requires a corresponding internet connection both on the mounted WEAR-watcher on the elevator system and on the side of the Henning Sensor Suite.
The communication between HSS and WEARwatcher is not direct, but via the Henning WEARwatcher cloud. More information about the WEARwatcher and the cloud is available here www.wearwatcher.com.

4.3.4.1 Set up connection

In order to establish the connection, a new project needs to be created in the HSS (see chapter 4.2.1.2) or, if the elevator system already exists as a project, the project in question is opened in the HSS.
After clicking with the right mouse button on the "WEARwatcher" entry, the following context menu opens:



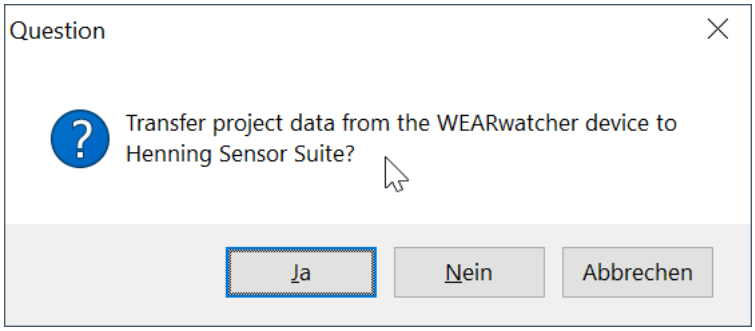
To set up the connection, the entry "Online settings" is selected, whereupon the following dialog opens:



If the WEARwatcher device is connected to the European instance of the Henning WEARwatcher Cloud, the following address must be entered as "Server":

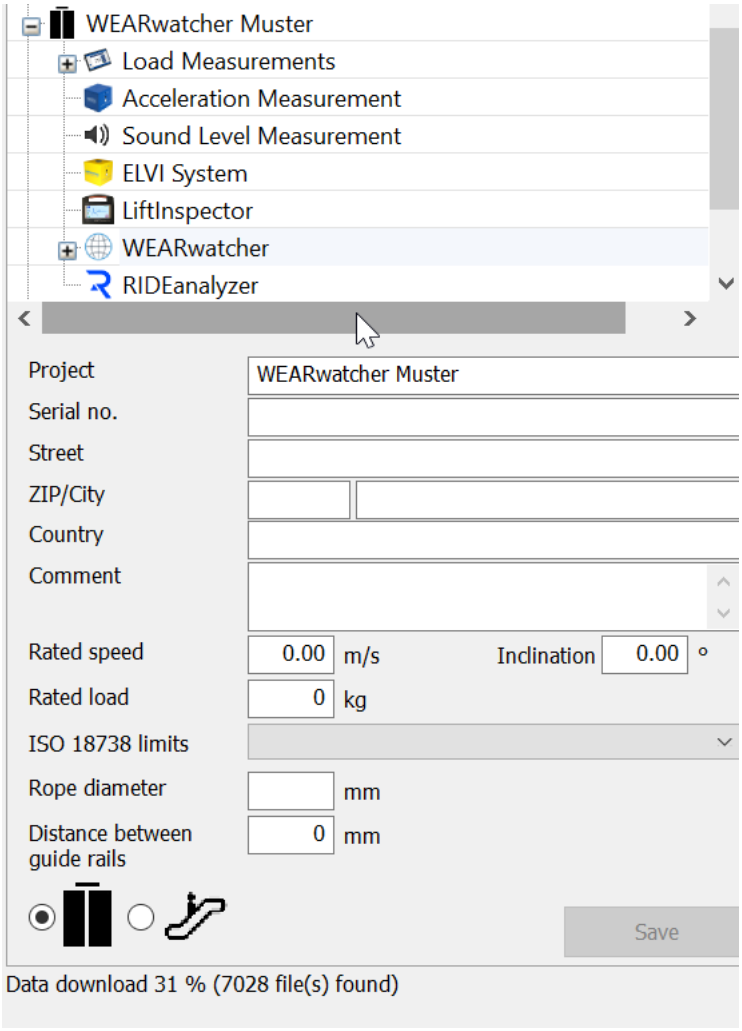
cloud.wearwachter.com

For cloud instances outside Europe, the server address must be requested from the responsible distributor of Henning products.
The "WEARwatcher S / N" is the serial number of the installed WEARwatcher device, user name and password are identical to the access data for the cloud dashboard of the user concerned.
Remote access is NOT enabled for users by default. Appropriate activation must be requested from Henning or the responsible distributor.
As soon as all data has been entered, the "Test" button can be used to test access to the device (via the cloud as a relay station). After a successful test and using the "Apply" button, there is the option of transferring the remote system data to the HSS project data if the subsequent dialog is confirmed with "Yes":

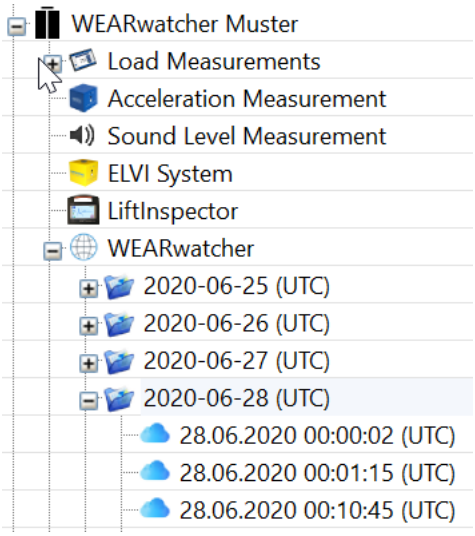


4.3.4.2 Download measurement data

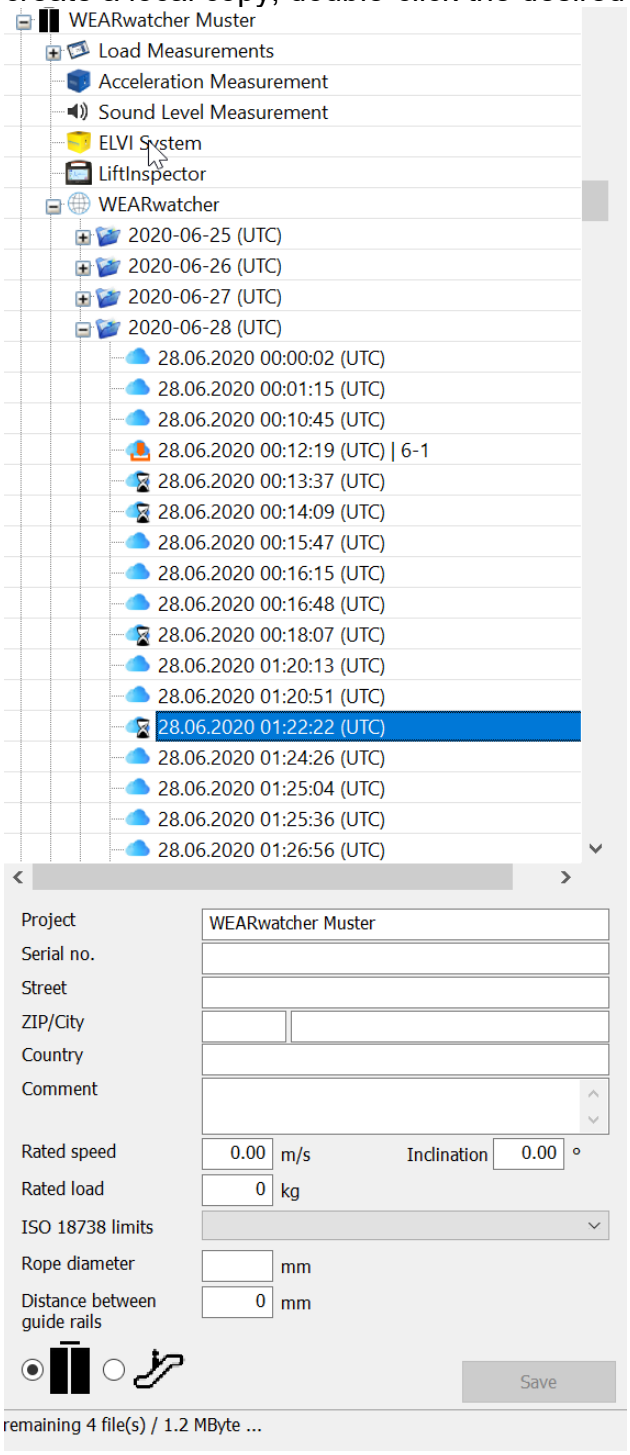
In order to download the sensor data of individual elevator journeys for a detailed analysis, the list of elevator journeys currently stored on the WEARwatcher device needs to be downloaded first.
To do this, the entry "Read file list" is selected from the WEARwatcher context menu. The Henning Sensor Suite now downloads a list of all available trips. During the download, the progress is shown in the lower left corner of the main window of the HSS:



As soon as this process is completed, you can branch to the "WEARwatcher" entry in the project list. All elevator journeys saved in the WEARwatcher are now shown sorted by date and time:



It should be noted that both the date and the time are output in UTC (Universal Time Co-dinated). Depending on your own time zone, the times are to be considered accordingly.
The ☁ symbol indicates that the corresponding elevator journey has not yet been stored on your own PC, but is still stored remotely on the WEARwatcher device. To create a local copy, double-click the desired entry to mark it for download.



As soon as the entry has been marked for download, the symbol changes to and the download is started. An already successful downloaded ride is marked with the symbol.
During the download process, the current status of the remaining files including the total amount of outstanding data is displayed in the lower left corner of the main HSS window.

4.3.4.3 Display and evaluate sensor data

A double click with the left mouse button on a locally saved WEARwatcher elevator ride (marked with) opens the standard view including all evaluation aids for acceleration measurements in the Henning Sensor Suite, as is also available for measurements with the QS3 acceleration sensor (see chapter 4.3.3).

Note: The raw data of all sensors connected to the WEARwatcher can also be shown using the "Additional sensors" button in the view mentioned.

4.3.4.4 Generate WEARwatcher Report

Note: The WEARwatcher Report is currently only available in English! The data of the report are accessed and processed online via the cloud. This burdens both the data transfer volume and the number of so-called API accesses to the cloud and can lead to additional costs depending on the selected hosting contract.

The WEARwatcher report compares the determined data from any two time periods. The processed data are divided into the following categories and, in addition to the preparation of statistical monitoring data, also include significant error messages, traffic load and both safety and maintenance-related defects and critical situations:

- Usage profile
- Maintenance related performance data
- Elevator performance data
- Weekly usage statistics
- Door movement statistics
- Leveling evaluation
- Suspension means evaluation
- Load, floor and direction-related mislevelings
- Security and / or maintenance related alarms

In order to create a WEARwatcher report, the entry "Generate report" is selected from the context menu (see WEARwatcher context menu).
In the dialog that opens, you have to select two time periods that are compared in the report. In addition, the user can select whether load data and data from the absolute positioning system should also be evaluated.
The button "Generate report" starts the function, depending on the selected period and the local internet connection, the creation of the report can take several minutes. As soon as the creation has been completed, the report display opens automatically (for operation of the report display see chapter 7).

WEARwatcher Period Report

Aufzugsinstallation	WEARwatcher Muster
Fabriknummer	
Straße	
PLZ/Ort	
Land	

WEARwatcher serial	011400000001
Date of report	07.07.2020
Version	1.88

Report period: 01.05.2020 - 31.05.2020 (UTC)

Speed not within allowed range of contract speed. (95% - 105%)

Comparison period: 01.06.2020 - 30.06.2020 (UTC)

Speed not within allowed range of contract speed. (95% - 105%)

Elevator Usage Profile

Trips	16457	↘	Trips	16800	
Milage	296668	m →	Milage	301422	m
Door cycles	15822	→	Door cycles	16097	
Duty cycle	15,5	% ↘	Duty cycle	16,3	%
Avg. Trips per day	528,7	↘	Avg. Trips per day	559,1	
Avg. Load per trip	58,7	kg ↘	Avg. Load per trip	61,4	kg
Trips with empty car	13,8	% ↘	Trips with empty car	14,3	%
Trips with rated load	0,0	% ↑	Trips with rated load	0,0	%
Trips with overload	0,0	%	Trips with overload	0,0	%

Maintenance related Performance

Shaft efficiency	89,4	% →	Shaft efficiency	90,2	%
Rope tension difference	16,5	% ↘	Rope tension difference	17,0	%
Avg. Energy loss per floor	0,4	Wh ↑	Avg. Energy loss per floor	0,4	Wh

Rope life time could be extended by at least 17,9 %
Die Lebensdauerberechnung erfolgt nach der Gleichung von Prof. Feyrer. Die Seilbiegeleistung kann durch die erfolgte Seileinstellung bis zu dem o.g. Wert gesteigert werden. Dieses Verbesserungspotential gilt unter Beibehaltung aller anderen relevanten Seil-Parameter, wie z.B. der Seilschmierung.

WEARwatcher - Lifting elevators into the cloud! - www.wearwatcher.com - 07.07.2020

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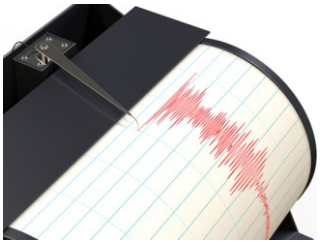
4.3.5 Vibration Analysis (AddOn)



The vibration analysis serves to evaluate vibration measurement data which have been measured using an activated sensor QS3.
The vibration analysis “listens” into the machine. Every component oscillates differently, generating a characteristic sound which leaves a typical fingerprint in the spectrum. If there is damage, a pattern emerges from the background noise. From this, a specialist will be able to recognise for example, if there is an imbalance, an alignment problem or a damaged bearing. Apart from a reliable diagnostic, it can normally also be estimated whether prompt action is required or if it can wait until the next planned revision.

Obvious Advantages For Lift Operators And Maintenance Personnel:

- Identification of machine errors
- Information about error causes
- Localisation of components affected
- Optimisation of spare parts inventory
- Planning of maintenance

The characteristic A95, PktoPK and 0toPK values are specifically determined on the three spatial axes in accordance with ISO8100-34, with the highest amplitudes and corresponding frequencies measured in the three directions of acceleration.
Furthermore, the function of a square Cepstrum is included.
Prerequisite: Measuring system LiftPC mobile diagnosis (Art. No. 450010)

4.3.5.1 Activating The Function

In order to activate the function please contact your distributor, who will be glad to supply the corresponding license file to you.
The activation itself is done via the Henning Sensor Suite and the sensor QS3 being connected to your PC (cf. Chapter 4.3.3.4**Fehler! Verweisquelle konnte nicht gefunden werden.**).

Activation is subject to the individual sensor QS3. The activated function is available only for measurements, which have been carried out using this particular sensor.

4.3.5.2 Carrying Out Vibration Measurements

In order to carry out measurement, the sensor QS3 is attached to a component of the machine in a suitable position. While doing so, pay attention to a good connection of the sensor to the component. In many cases, the use of the supplied magnetic base, providing an optimal contact through its magnetic surface, provides the easiest solution.

In any case, make sure that the mass of the sensor is low in comparison to the oscillating component and that the sensor cannot move and/or vibrate independently of the component.
The actual recording of measuring results is done by the sensor QS3 in the usual way (cf. Chapter4.3.3.8.1).

4.3.5.3 Using The Vibration Analysis

Reading out the measured data from the sensor QS3 is also done in the usual way via the Henning Sensor Suite (cf. Chapter 4.3.3.5).
Double clicking the left mouse button on a measurement stored in a project will open it in the usual curve presentation.

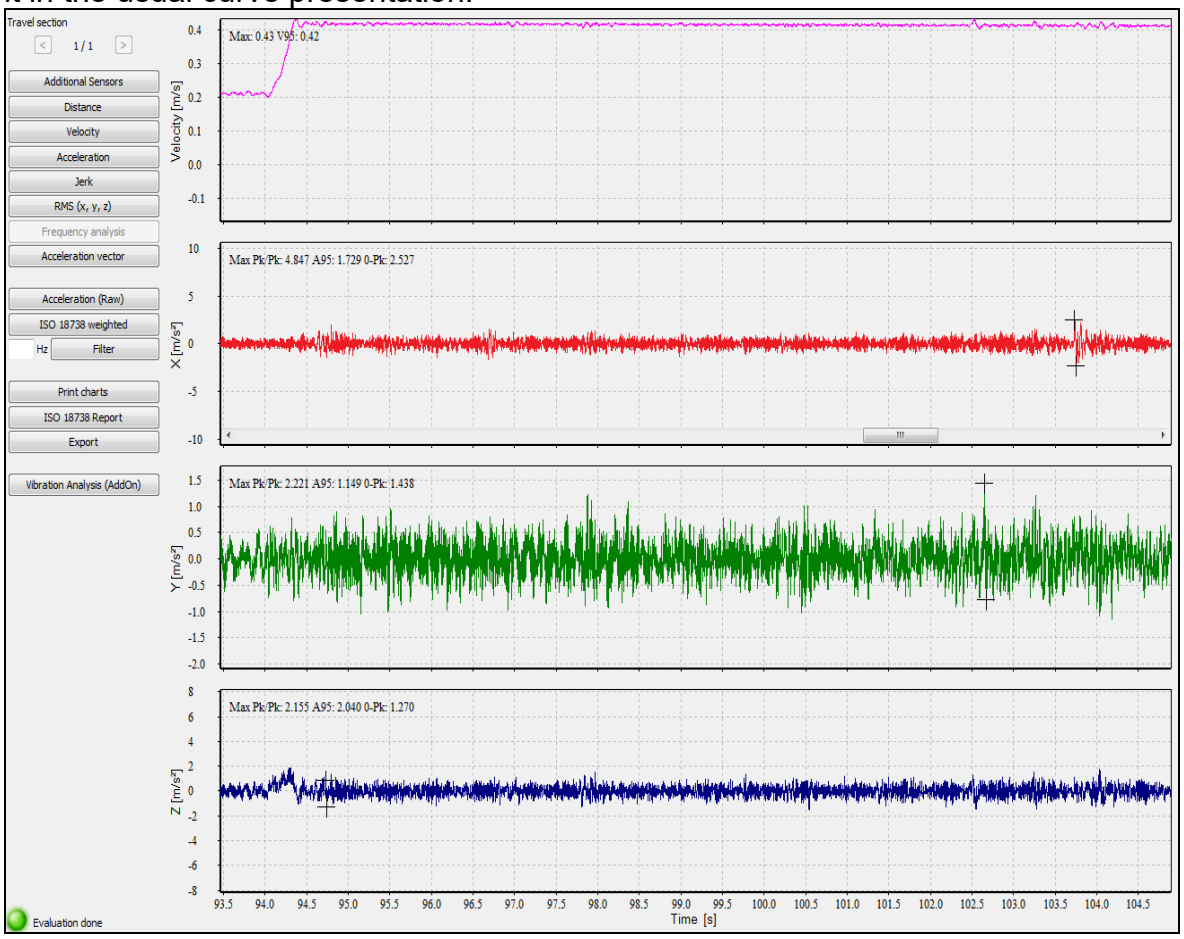
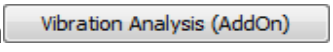


Illustration 60: Curve presentation of a vibration measurement

The actual vibration analysis is started by pressing the button 

.
As soon as the calculations are finished, the vibration analysis report will automatically open (cf. Chapter 4.3.5.4.1).

4.3.5.4 Section Analysis

If only a sub-section and not the whole measurement shall be evaluated, the following procedure has to be performed:

Double clicking the right mouse button within the time range of the curve view will mark the start position for a new analysis. In the curve view, this is indicated by the “Start” marking, which is highlighted in yellow. The next double click using the right mouse button will set the end index of the time range, and the analysis will automatically start again over the chosen range.

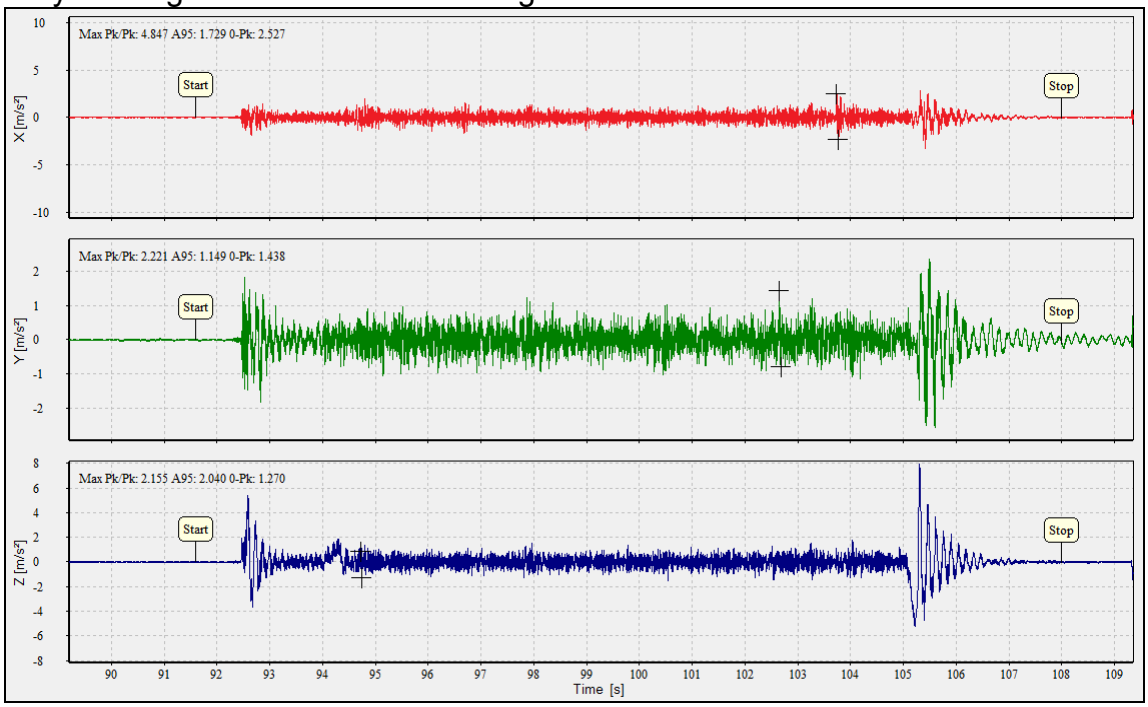
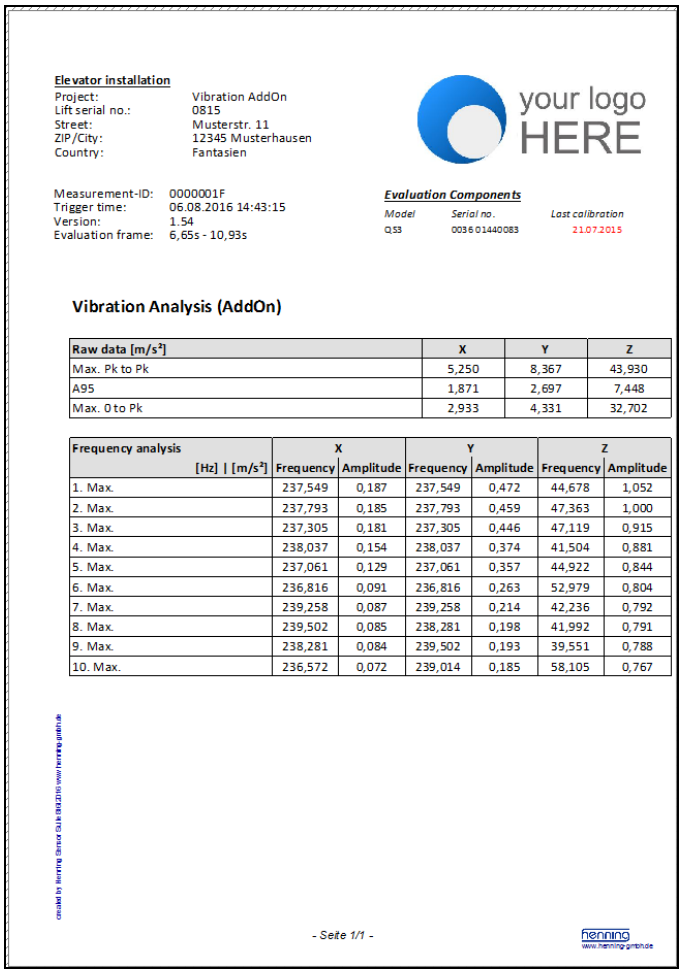


Illustration 61: Curve view with section evaluation markings

4.3.5.4.1 Report Output

The characteristic A95, PktoPK and 0toPK values are specifically determined on the three spatial axes in accordance with ISO8100-34, with the highest amplitudes and corresponding frequencies measured in the three directions of acceleration.
A description of the individual functions and possibilities of the report display can be found in Chapter 7.



Elevator installation

Project: Vibration AddOn
Lift serial no.: 0815
Street: Musterstr. 11
ZIP/City: 12345 Musterhausen
Country: Fantasien

your logo HERE

Measurement-ID: 0000001F
Trigger time: 06.08.2016 14:43:15
Version: 1.54
Evaluation frame: 6,65s - 10,93s

Evaluation Components

Model	Serial no.	Last calibration
Q53	0036 01440083	21.07.2015

Vibration Analysis (AddOn)

Raw data [m/s²]	X	Y	Z
Max. Pk to Pk	5,250	8,367	43,930
A95	1,871	2,697	7,448
Max. 0 to Pk	2,933	4,331	32,702

Frequency analysis	X		Y		Z	
[Hz] | [m/s²]	Frequency	Amplitude	Frequency	Amplitude	Frequency	Amplitude
1. Max.	237,549	0,187	237,549	0,472	44,678	1,052
2. Max.	237,793	0,185	237,793	0,459	47,363	1,000
3. Max.	237,305	0,181	237,305	0,446	47,119	0,915
4. Max.	238,037	0,154	238,037	0,374	41,504	0,881
5. Max.	237,061	0,129	237,061	0,357	44,922	0,844
6. Max.	236,816	0,091	236,816	0,263	52,979	0,804
7. Max.	239,258	0,087	239,258	0,214	42,236	0,792
8. Max.	239,502	0,085	238,281	0,198	41,992	0,791
9. Max.	238,281	0,084	239,502	0,193	39,551	0,788
10. Max.	236,572	0,072	239,014	0,185	58,105	0,767

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Illustration 62: Sample report of vibration analysis

4.3.5.4.2 Cepstrum-Function

The Cepstrum function is an exclusive component of the vibration analysis AddOn.
The Cepstrum is the most important tool to analyse gear vibrations as well as harmonics and modulations. It highlights the harmonic structure of tooth vibrations and makes it possible to analyse periodic oscillations. This is achieved by means of a second fourier-transformation which uses the values of the spectrum as an input signal.
Even under normal conditions, gears show relatively strong vibrations. Damages are often noticeable due to an increase in harmonic oscillations, which not be detected with a normal evaluation. The Cepstrum presentation represents an easy possibility to the reduce data to the bare essentials.
Handling of the Cepstrum data depends on the concrete objectives:

- For trend analyses, it makes sense to save the values obtained and to present their development over long time periods.
- For automatic machine monitoring, a classification into configurable thresholds or limits is advisable.

The tools of frequency analysis and thus the Cepstrum function are only available in the single view of the curve diagrams (cf. Chapter 4.3.3.7.3). In this mode, the button Frequency analysis may be used.

Select the squared-Cepstrum in the frequency analysis.

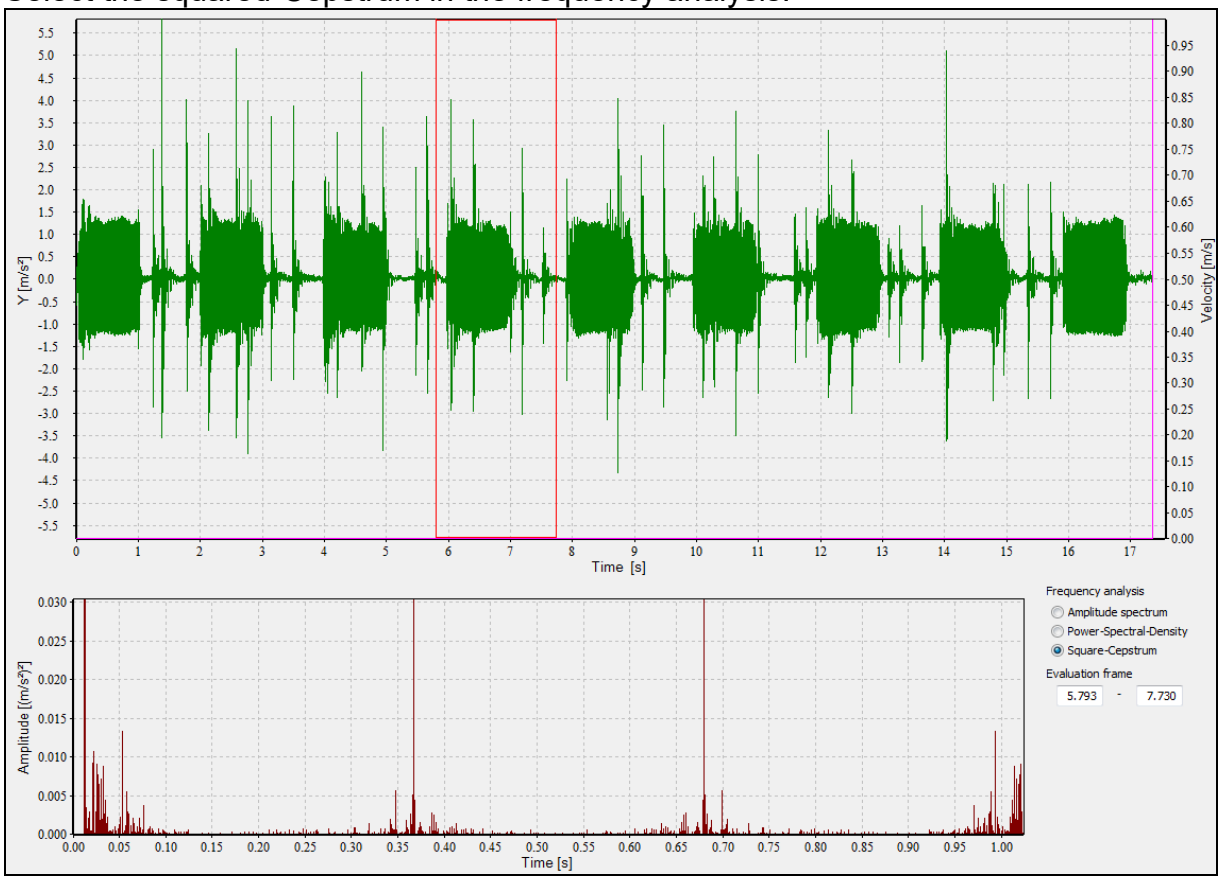


Illustration 63: Display of the square Cepstrum in the lower third of the screenshot

Using the individual tools of the frequency analysis is done the usual way (cf. Chapter).

4.3.6 Drive Comfort Measurement Of Escalators / Moving Walks According To ISO 18738, Part 2 (AddOn)

Evaluation of vibration data which have been measured using a correctly activated sensor QS3 according to ISO 18738 Part 2, in order to determine the drive quality of escalators and moving walks.
The software add-on evaluates the measurements on the load supports/steps as well as on the handrails and records the sound pressure levels measured according to ISO 18738, Part 2.
The presentation of the results is shown in the form of a report output which is in conformity with ISO18738-2.

4.3.6.1 Activating the Function

In order to activate the function please contact your distributor, who will be glad to supply the corresponding license file to you.
The activation itself is done via the Henning Sensor Suite and the sensor QS3 being connected to your PC (cf. Chapter 4.3.3.4).

Activation is subject to the individual sensor QS3. The activated function is available only for measurements, which have been carried out using this particular sensor.

4.3.6.2 Creating Project Data

Creating project data is done as usual (cf. Chapter4.2.1.2). When choosing a project type, escalator or moving walk has to be selected.

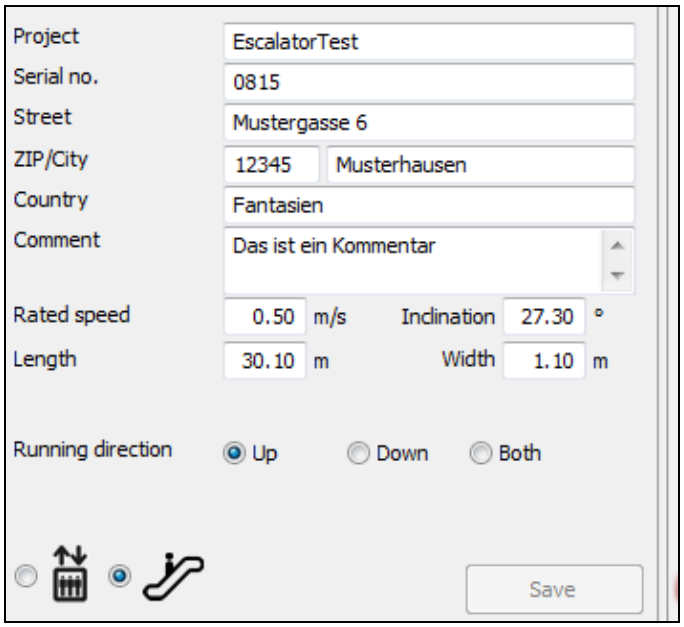


Illustration 64: Escalator / moving walk project data

Nominal speed is defined as the speed of the so-called “load carrying unit”. It is required by ISO 18738 and contains the speed of the escalator steps.
If escalators are operated only in one direction, this has to be selected as direction of movement. Otherwise, “Both” has to be chosen.
As length of the escalator, ISO 18738 defines the „horizontal projection of the inclined part“ of the escalator.

4.3.6.2.1 Erstellung einer Messkampagne

Any number of measuring campaigns may be created within an existing project. To do so, click the project name using the right mouse button and select New Measurement
Following that, a new measuring campaign with three subentries is created as an additional branch of the project.

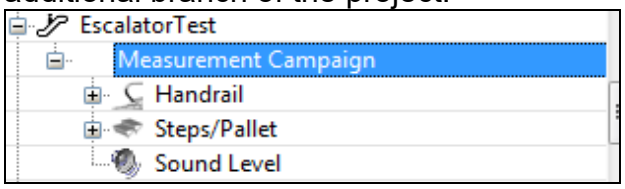


Illustration 65: Measuring campaign in project view

The measurements to be carried out will later be filed into these subentries. This will apply for both sound level and vibration measurements.

4.3.6.3 Performing The Measurements

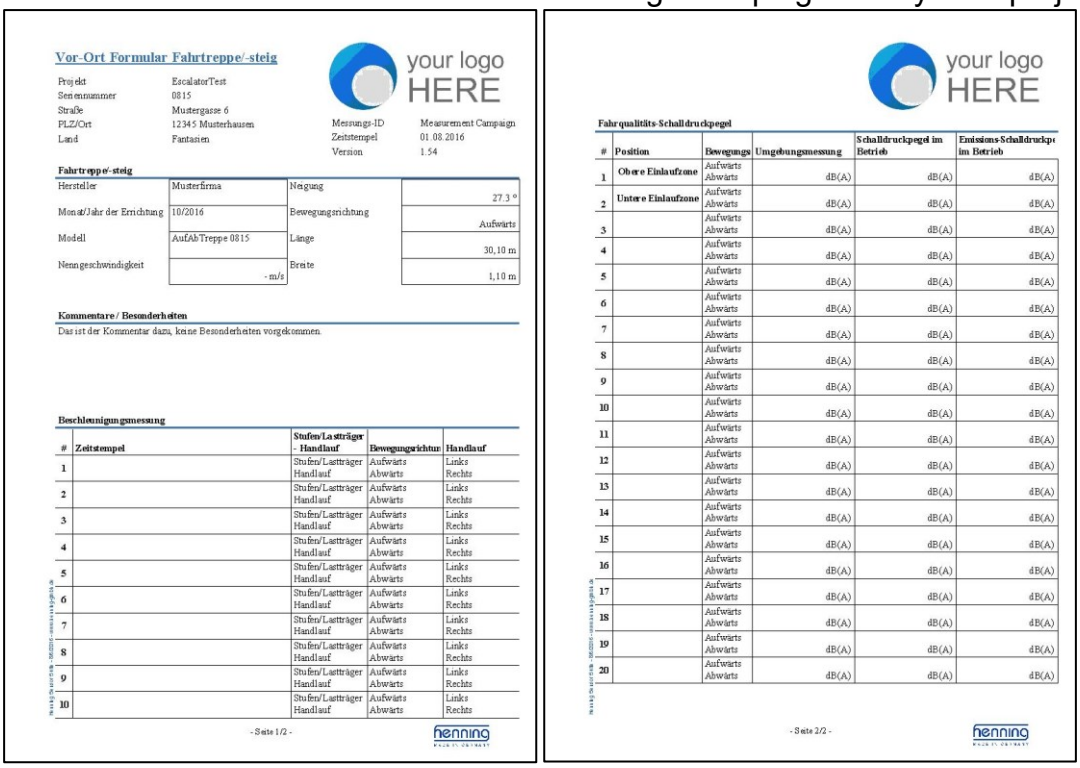
The escalator should be measured in both directions of movement, unless it is an installation which is actually operated in one direction only. Only in such a case it is sufficient to measure in one direction of movement only.
Prior to performing measurements, make sure that the following conditions are met:

- The escalator is installed completely, has been adjusted correctly and is working in accordance with the operating instructions
- The escalator has reached the normal operating temperature
- The escalator is not loaded
- The escalator operates with normal nominal speed. Landings shall not be measured. If the escalator is operated in various speeds while carrying passengers, the measurements shall be carried out at various speeds too according to ISO 18738.

4.3.6.3.1 On Site Form

As the QS3 sensor is normally operated as a stand-alone device and the sound level measurements are carried out using other measuring devices, the software offers the possibility to print out a measuring form into which measured results and notes may be entered by hand. These notes can be manually transferred into the Henning Sensor Suite in order to generate the report according to ISO 18738.

The form may be printed via the button In situ form. The button is located in the measuring campaign dialog which may be accessed via a double click with the left mouse button on the measuring campaign entry in project view.


Vor-Ort Formular Fahrtreppe/-steig

your logo HERE

Projekt	EscalatorTest
Seriennummer	0815
Straße	Mustergasse 6
PLZ/Ort	12345 Musterhausen
Land	Fantasien

Messungs-ID: Measurement Campaign
Zeitstempel: 01.08.2016
Version: 1.54

Fahrtreppe/-steig

Hersteller	Musterfirma	Neigung	27.3 °
Monat/Jahr der Errichtung	10/2016	Bewegungsrichtung	Aufwärts
Modell	Auf&AbTreppe 0815	Länge	30,10 m
Nenngeschwindigkeit	- m/s	Breite	1,10 m

Kommentare / Besonderheiten

Das ist der Kommentar dazu, keine Besonderheiten vorgekommen.

Beschleunigungsmessung

#	Zeitstempel	Stufen/Lastträger - Handlauf	Bewegungsrichtung	Handlauf
1		Stufen/Lastträger	Aufwärts	Links
		Handlauf	Abwärts	Rechts
2		Stufen/Lastträger	Aufwärts	Links
		Handlauf	Abwärts	Rechts
3		Stufen/Lastträger	Aufwärts	Links
		Handlauf	Abwärts	Rechts
4		Stufen/Lastträger	Aufwärts	Links
		Handlauf	Abwärts	Rechts
5		Stufen/Lastträger	Aufwärts	Links
		Handlauf	Abwärts	Rechts
6		Stufen/Lastträger	Aufwärts	Links
		Handlauf	Abwärts	Rechts
7		Stufen/Lastträger	Aufwärts	Links
		Handlauf	Abwärts	Rechts
8		Stufen/Lastträger	Aufwärts	Links
		Handlauf	Abwärts	Rechts
9		Stufen/Lastträger	Aufwärts	Links
		Handlauf	Abwärts	Rechts
10		Stufen/Lastträger	Aufwärts	Links
		Handlauf	Abwärts	Rechts

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your logo HERE

Fahrqualitäts-Schalldruckpegel

#	Position	Bewegungs	Umgebungsmessung	Schalldruckpegel im Betrieb	Emissions-Schalldruckpe im Betrieb
1	Obere Einlaufzone	Aufwärts Abwärts	dB(A)	dB(A)	dB(A)
2	Untere Einlaufzone	Aufwärts Abwärts	dB(A)	dB(A)	dB(A)
3		Aufwärts Abwärts	dB(A)	dB(A)	dB(A)
4		Aufwärts Abwärts	dB(A)	dB(A)	dB(A)
5		Aufwärts Abwärts	dB(A)	dB(A)	dB(A)
6		Aufwärts Abwärts	dB(A)	dB(A)	dB(A)
7		Aufwärts Abwärts	dB(A)	dB(A)	dB(A)
8		Aufwärts Abwärts	dB(A)	dB(A)	dB(A)
9		Aufwärts Abwärts	dB(A)	dB(A)	dB(A)
10		Aufwärts Abwärts	dB(A)	dB(A)	dB(A)
11		Aufwärts Abwärts	dB(A)	dB(A)	dB(A)
12		Aufwärts Abwärts	dB(A)	dB(A)	dB(A)
13		Aufwärts Abwärts	dB(A)	dB(A)	dB(A)
14		Aufwärts Abwärts	dB(A)	dB(A)	dB(A)
15		Aufwärts Abwärts	dB(A)	dB(A)	dB(A)
16		Aufwärts Abwärts	dB(A)	dB(A)	dB(A)
17		Aufwärts Abwärts	dB(A)	dB(A)	dB(A)
18		Aufwärts Abwärts	dB(A)	dB(A)	dB(A)
19		Aufwärts Abwärts	dB(A)	dB(A)	dB(A)
20		Aufwärts Abwärts	dB(A)	dB(A)	dB(A)

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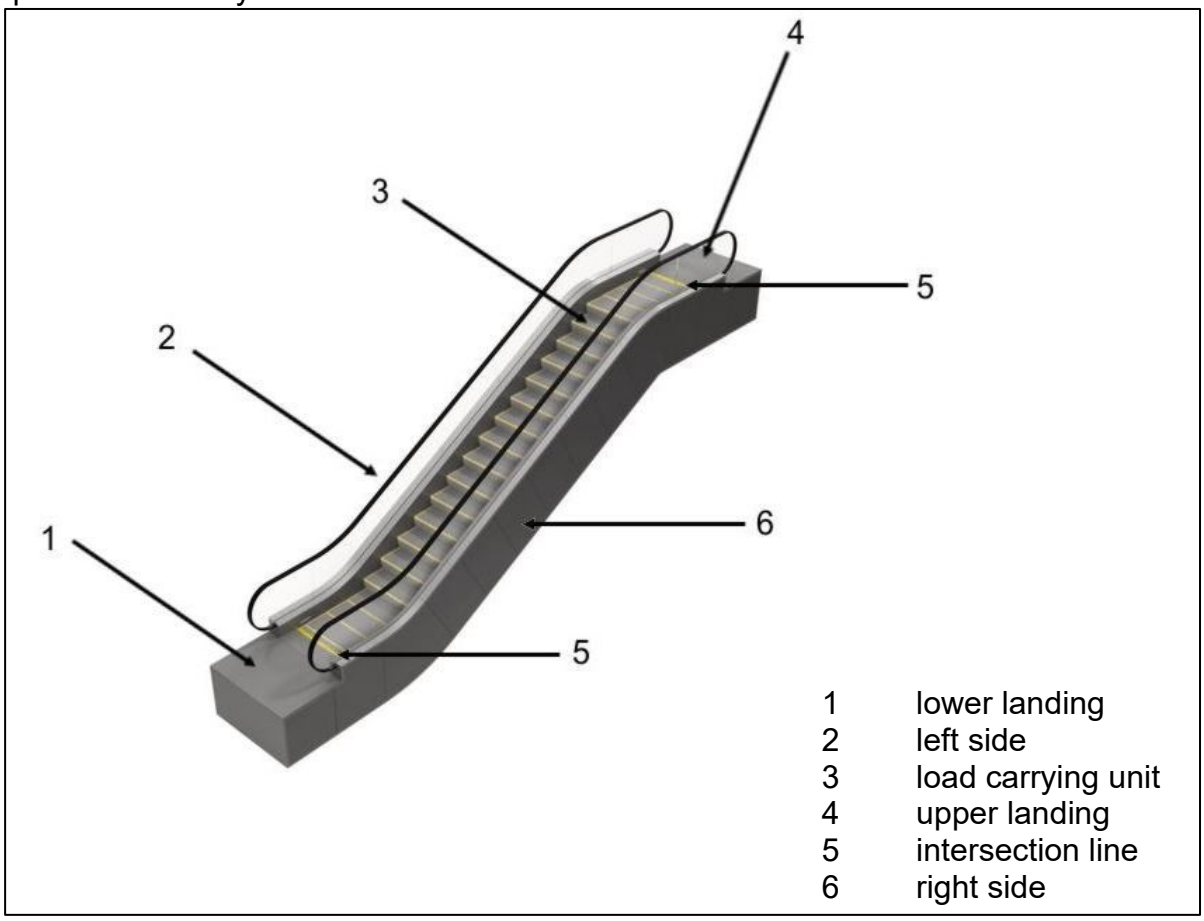
Illustration 66: In situ form for capturing measured data

4.3.6.3.2 Vibration Measurements

Vibrations from the surroundings which do not result from the escalator should not distort the measurements. This is the reason why all disturbing sources of vibration have to be switched off. If this is not possible, reference measurements on the load

carrying unit and the handrails have to be carried out while the escalator is at stand still.
The coupling of the QS3 sensor to the escalator must not affect the results in the frequencies used by the filters of ISO 8041.



1	lower landing
2	left side
3	load carrying unit
4	upper landing
5	intersection line
6	right side

Illustration 67:Terminology

4.3.6.3.2.1 Measurement On The Load Carrying Unit

The QS3 sensor should be attached in the middle of the load carrying unit (usually on a step) directly at the step outlet of the moving escalator. The positioning of the QS3 sensor should be carried out according to the following illustration. The contact pressure between sensor and escalator should be at least 60 kPa (cf. ISO 18738:2003, Chapter 7.2.2). Ensure this by using the designated measuring block as the receptacle for the sensor.
The operator has to stand on the next step, directly behind the sensor. In case of a moving walk, a distance of at least 300 mm between operator and sensor is required.
With a horizontal moving walk, the measurement can be started immediately. With an escalator or an inclined moving walk, the measurement may only be started at the beginning of the inclination.
With horizontal escalators, the measurement is stopped immediately in front of the step inlet. In case of moving walks or escalators, a measurement is finished immediately in front of the end of the inclination.

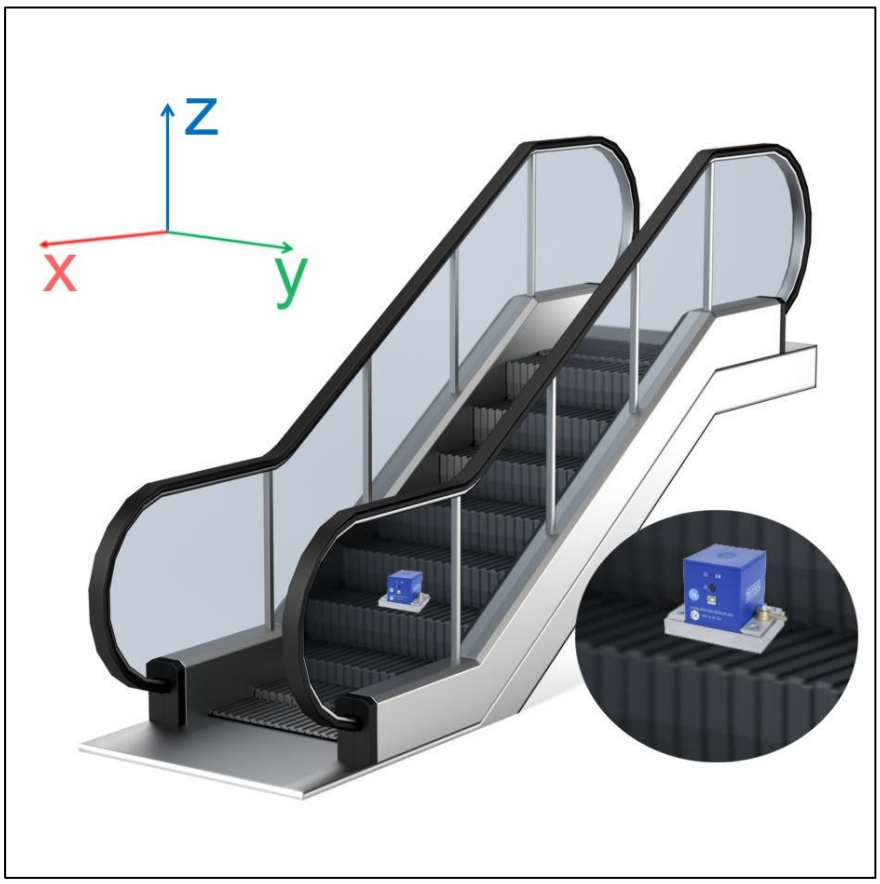


Illustration 68: Alignment and positioning of the sensor QS3 for the measurement of load carrying units

4.3.6.3.2.2 Measurement On The Handrail

To measure the handrails, the sensor QS3 is attached to the same and held on by hand. Measurement is carried out in succession on handrails and in both directions of movement if required.
The positioning of the QS3 sensor should be carried out according to the following illustration
With a horizontal moving walk, the measurement can be started immediately. With an escalator or an inclined moving walk, the measurement may only be started at the beginning of the inclination.
With horizontal escalators, the measurement is stopped immediately in front of the step inlet. In case of moving walks or escalators, a measurement is finished immediately in front of the end of the inclination.

Illustration 69: Orientation And Positioning Of The Sensor QS3 On The Handrail

4.3.6.3.3 Sound Measurement

The sound level measurement describes in the following determine the sound aspect of the drive quality as perceived by the passenger.
During the process, the sound level measured is the sum of

- the escalator's sound emission
- the background noise
- the acoustic characteristics of the room in which the escalator is installed
- and the acoustic reflection of the surfaces in the area surrounding the escalator

The following procedures should make it possible to determine the actual sound level generated by the escalator.
As far as possible, all sources of sound shall which do not serve to operate the escalator should be switched off.

4.3.6.3.3.1 Positioning Of The Microphone

All sound measurements should be performed at a height of 1.55 m ± 0.075 m above the load carrying unit of the escalator.
While doing so, ISO 18738 calls for different positions of the microphone:

1. Upper landing - 1 m in front of the step inlet or outlet
2. Lower landing - 1 m in front of the step outlet or inlet
3. Measuring positions in the inclined part of the escalator/moving walk or in the horizontal course of the moving walk

The number and exact spot of the measuring positions of point 3 can be selected in such a way that noises caused by the drive part of the installation may be identified straight away.

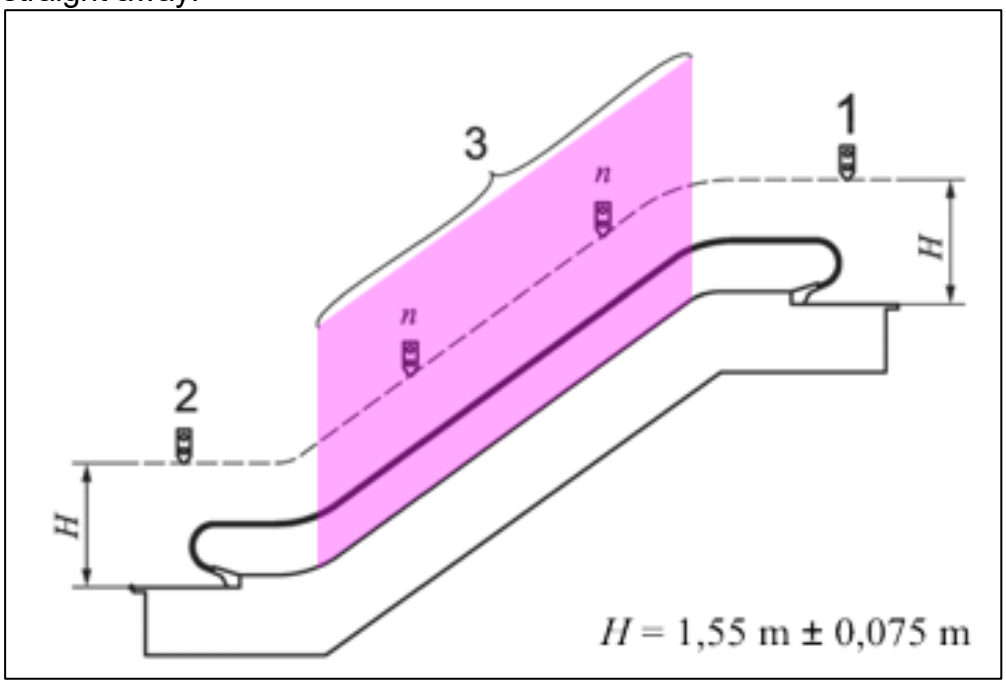


Illustration 70: Microphone positions along the escalator

The sound pressure level measurement is used to determine the drive quality of the installation.
The sound pressure emission measurement is used to determine the proportion , which the system contributes to the total sound pressure level. ISO 11201 or ISO 11205, utilizing accuracy class 2 of ISO 11200 are used for this. The aforementioned measuring methods are used only if an accuracy better than 5 dB is required.

4.3.6.3.3.2 Sound Level Measurement For Drive Quality

First, the background noises at the above mentioned microphone positions are measured as sound pressure level in dB(A) while the escalator is being switched off.
Then, the sound pressure level in dB(A) is determined at the same positions while the escalator is being operated. If the system is intended for operation in both directions of movement, the measurements are carried out for both directions.
ISO 18738, Part 2, Annex A states a method of suppressing ambient noises as far as possible via correction factors. These correction values can be detected, but not determined by the Henning Sensor Suite.

4.3.6.3.3.3 Sound Emission Measurement

If the sound emission measurement is to be carried out according to ISO 11200, the background sound pressure level in dB(A) and the sound pressure level in dB(A) too are to be determined at the above mentioned microphone positions while the escalator is being operated (possibly in both directions of movement).
Depending on the difference between the background sound pressure level and the sound pressure level when operating the installation as well as the environmental factor $K_{2A,}$ ISO 11201 or ISO 11205 may be used. The Henning Sensor Suite will support you in selecting the right method.

4.3.6.4 Reading Out The Results Of Measurements

4.3.6.4.1 Reading Out The Results Of Vibration Measurements

The vibration measurements are read out in the usual way from the sensor QS3.
However, in this case the measuring campaign entry in the project view serves as the “Drag&Drop” target. (cf. Chapter 4.3.3.5).
Once a measurement from sensor QS3 has been dragged onto the relevant subentry of the measuring campaign, the following dialog box will appear in which further details about the measuring position have to be entered.

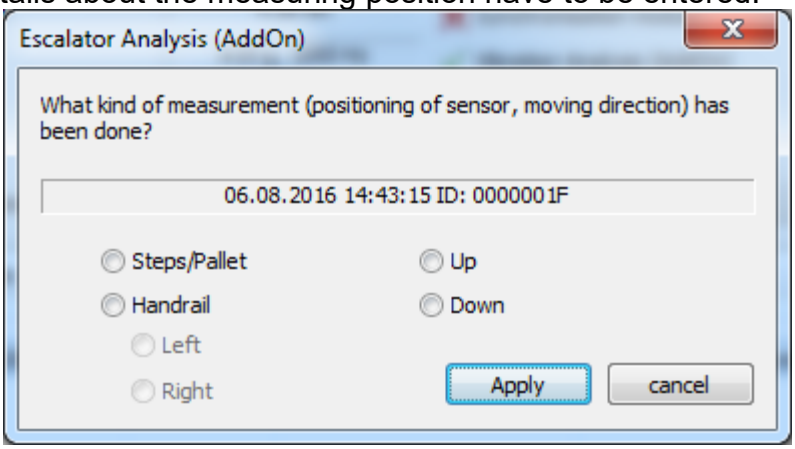


Illustration 71: Specifying The Measuring Position And Direction Of Movement

Once a measurement has been stored in the measuring campaign, it will appear as another subentry:

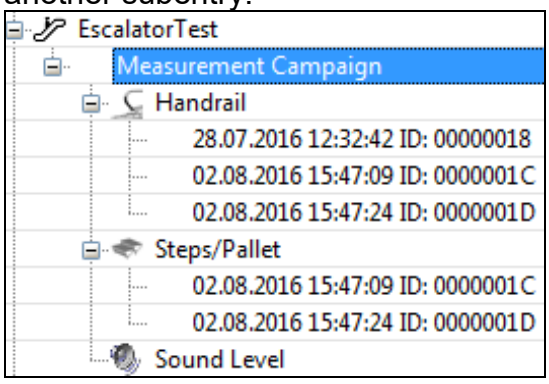


Illustration 72: Assigned vibration measurements

4.3.6.4.2 Transferring The Sound Pressure Levels

Double clicking the left mouse button on the entry Sound Level in the relevant measuring campaign will open the following dialog box, into which the sound pressure level measurements can be inserted.

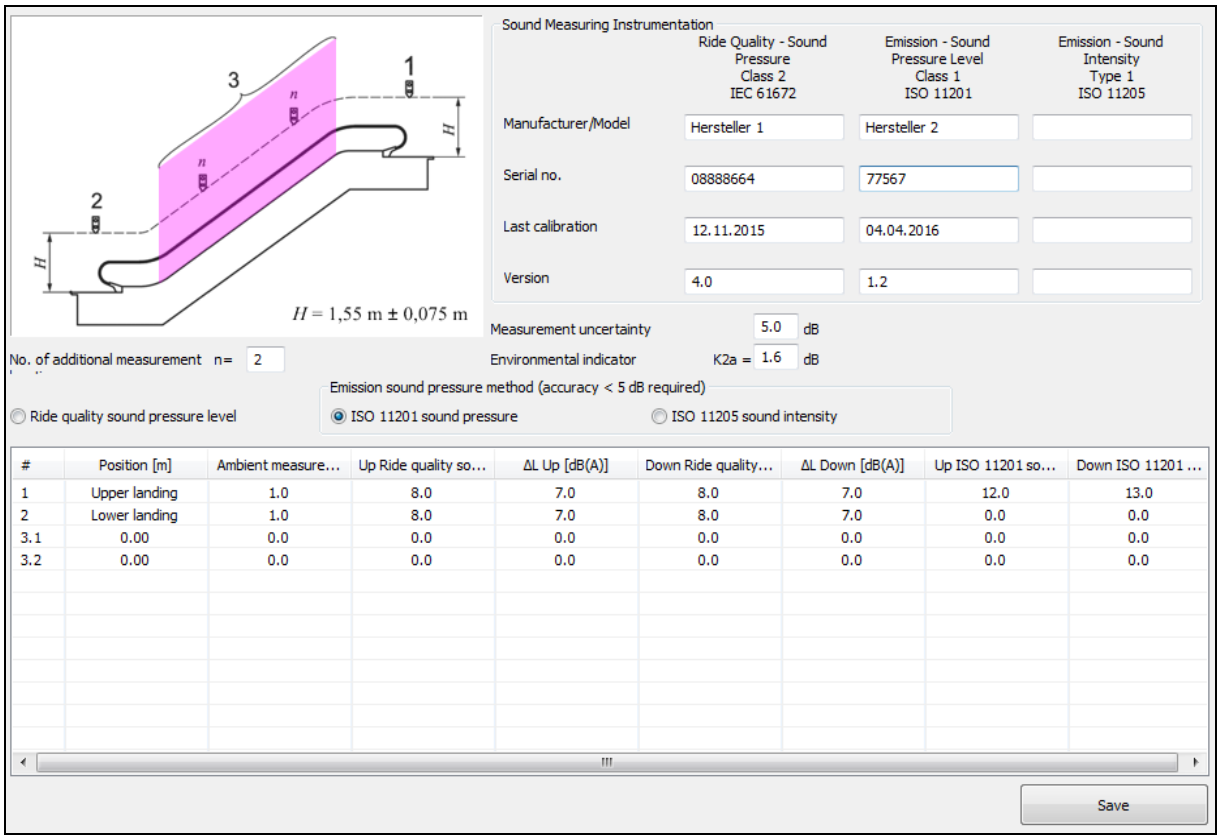


Illustration 73: Dialog box "sound level measurement "

Values inside the table may be modified by carrying out a double click on the relevant entry.

Please note that modifications will be saved only, if the button Save is used.

4.3.6.5 Evaluating The Measurements

As soon as all measured data have been imported and/or entered, evaluation of the data can be effected. To do so, a double click on the actual measuring campaign in project view is carried out. This will open the following depiction:

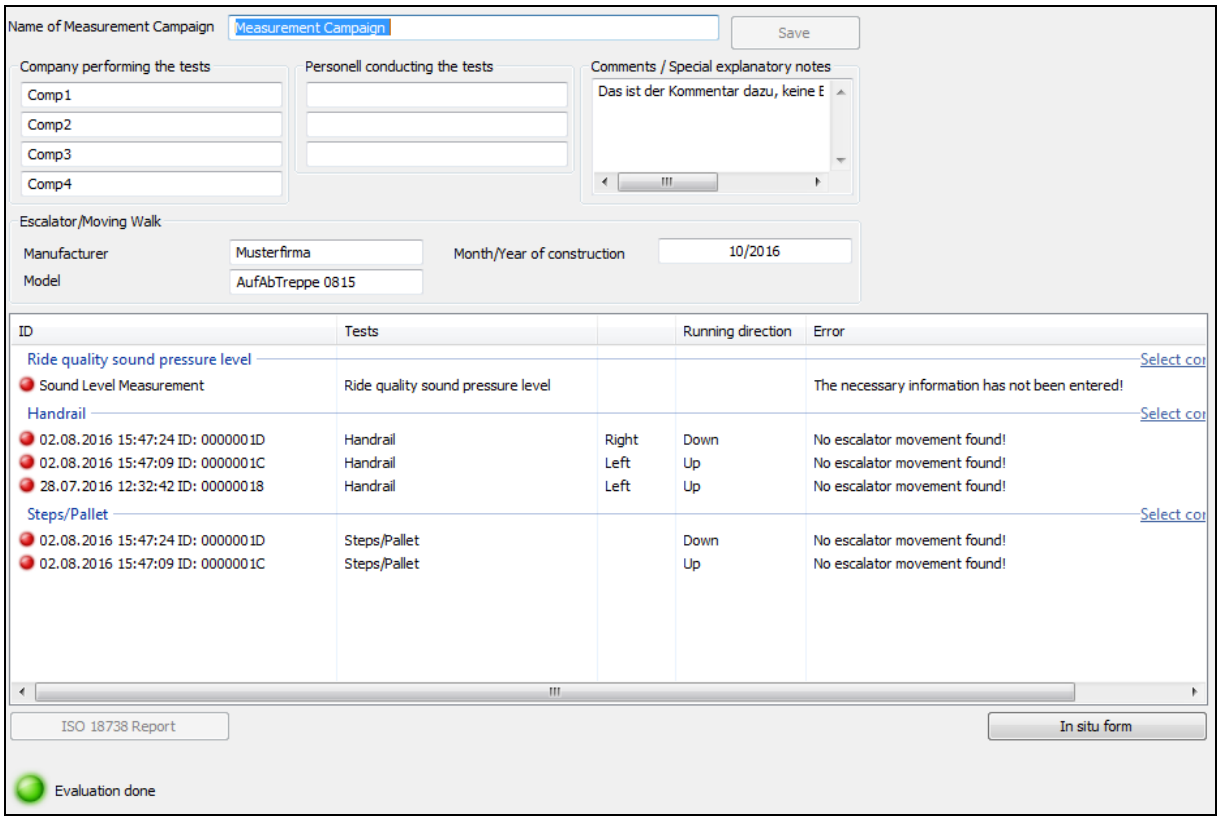
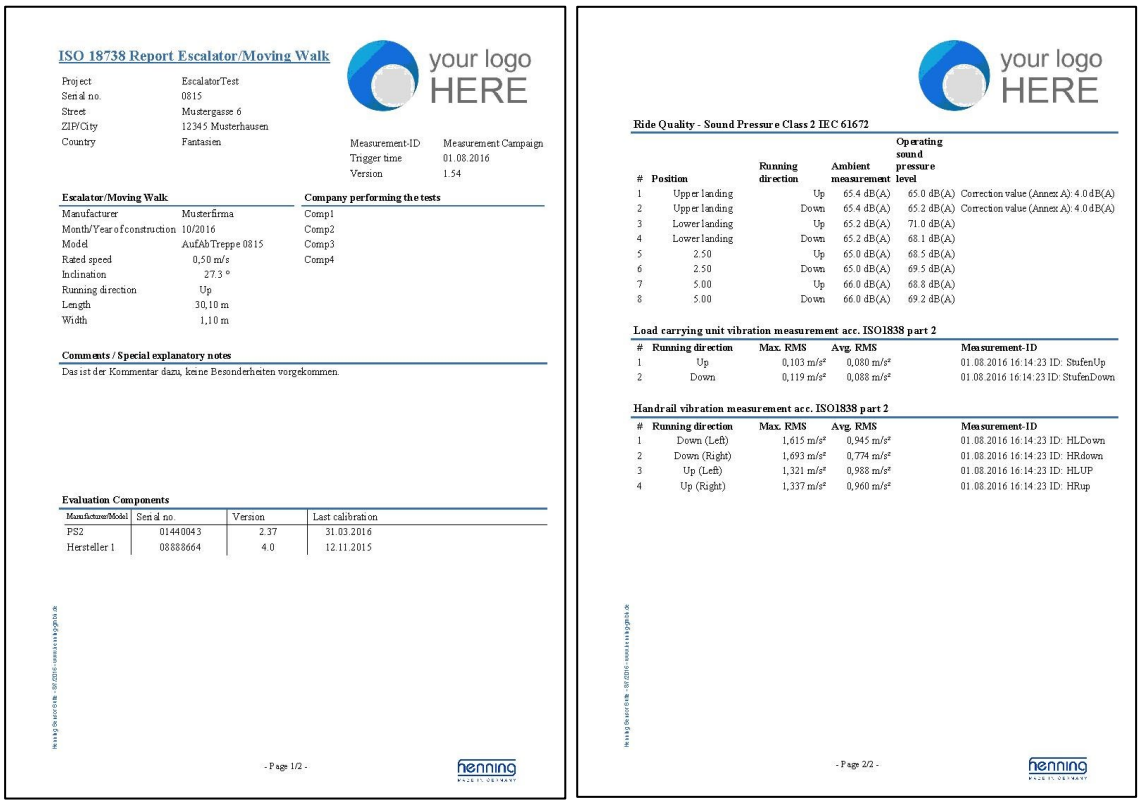


Illustration 74: Depiction Of A Measuring Campaign

Evaluation will start automatically. In the list view, the individual measurements with their evaluation status and potential error messages are listed.

4.3.6.6 Reportausgabe

Via this button, the report output will be started.
A description of the individual functions and possibilities of the report views can be found in Chapter 7.



ISO 18738 Report Escalator/Moving Walk

your logo HERE

Project	EscalatorTest
Serial no.	0815
Street	Mustergasse 6
ZIP/City	12345 Musterhausen
Country	Fantasien

Measurement-ID	Measurement Campaign
Trigger time	01.08.2016
Version	1.54

Escalator/Moving Walk

Manufacturer	Musterfirma
Month/Year of construction	10/2016
Model	AufAbTreppe 0815
Rated speed	0,50 m/s
Inclination	27.3 °
Running direction	Up
Length	30,10 m
Width	1,10 m

Company performing the tests

Comp1
Comp2
Comp3
Comp4

Comments / Special explanatory notes

Das ist der Kommentar dazu, keine Besonderheiten vorgekommen.

Evaluation Components

Manufacturer/Model	Serial no.	Version	Last calibration
PS2	01440043	2.37	31.03.2016
Hersteller 1	08888664	4.0	12.11.2015

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your logo HERE

Ride Quality - Sound Pressure Class 2 IEC 61672

#	Position	Running direction	Ambient measurement	Operating sound pressure level	
1	Upper landing	Up	65.4 dB(A)	65.0 dB(A)	Correction value (Annex A): 4.0 dB(A)
2	Upper landing	Down	65.4 dB(A)	65.2 dB(A)	Correction value (Annex A): 4.0 dB(A)
3	Lower landing	Up	65.2 dB(A)	71.0 dB(A)	
4	Lower landing	Down	65.2 dB(A)	68.1 dB(A)	
5	2.50	Up	65.0 dB(A)	68.5 dB(A)	
6	2.50	Down	65.0 dB(A)	69.5 dB(A)	
7	5.00	Up	66.0 dB(A)	68.8 dB(A)	
8	5.00	Down	66.0 dB(A)	69.2 dB(A)	

Load carrying unit vibration measurement acc. ISO1838 part 2

#	Running direction	Max. RMS	Avg. RMS	Measurement-ID
1	Up	0,103 m/s²	0,080 m/s²	01.08.2016 16:14:23 ID: StufenUp
2	Down	0,119 m/s²	0,088 m/s²	01.08.2016 16:14:23 ID: StufenDown

Handrail vibration measurement acc. ISO1838 part 2

#	Running direction	Max. RMS	Avg. RMS	Measurement-ID
1	Down (Left)	1,615 m/s²	0,945 m/s²	01.08.2016 16:14:23 ID: HLDown
2	Down (Right)	1,693 m/s²	0,774 m/s²	01.08.2016 16:14:23 ID: HRdown
3	Up (Left)	1,321 m/s²	0,988 m/s²	01.08.2016 16:14:23 ID: HLUP
4	Up (Right)	1,337 m/s²	0,960 m/s²	01.08.2016 16:14:23 ID: HRup

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Illustration 75: Escalator/Moving Walk sample report

4.3.6.7 Displaying Measured Vibration Data

The vibration data measured using the sensor QS3 can be visualized by carrying out a double click on the relevant measurement.
After that, the usual curve view will open with the function buttons specific for the evaluation according to ISO 18738, Part 2.
Of course, functions like individual curve view, frequency analysis, section analysis and the vibration AddOn are also available in this view.

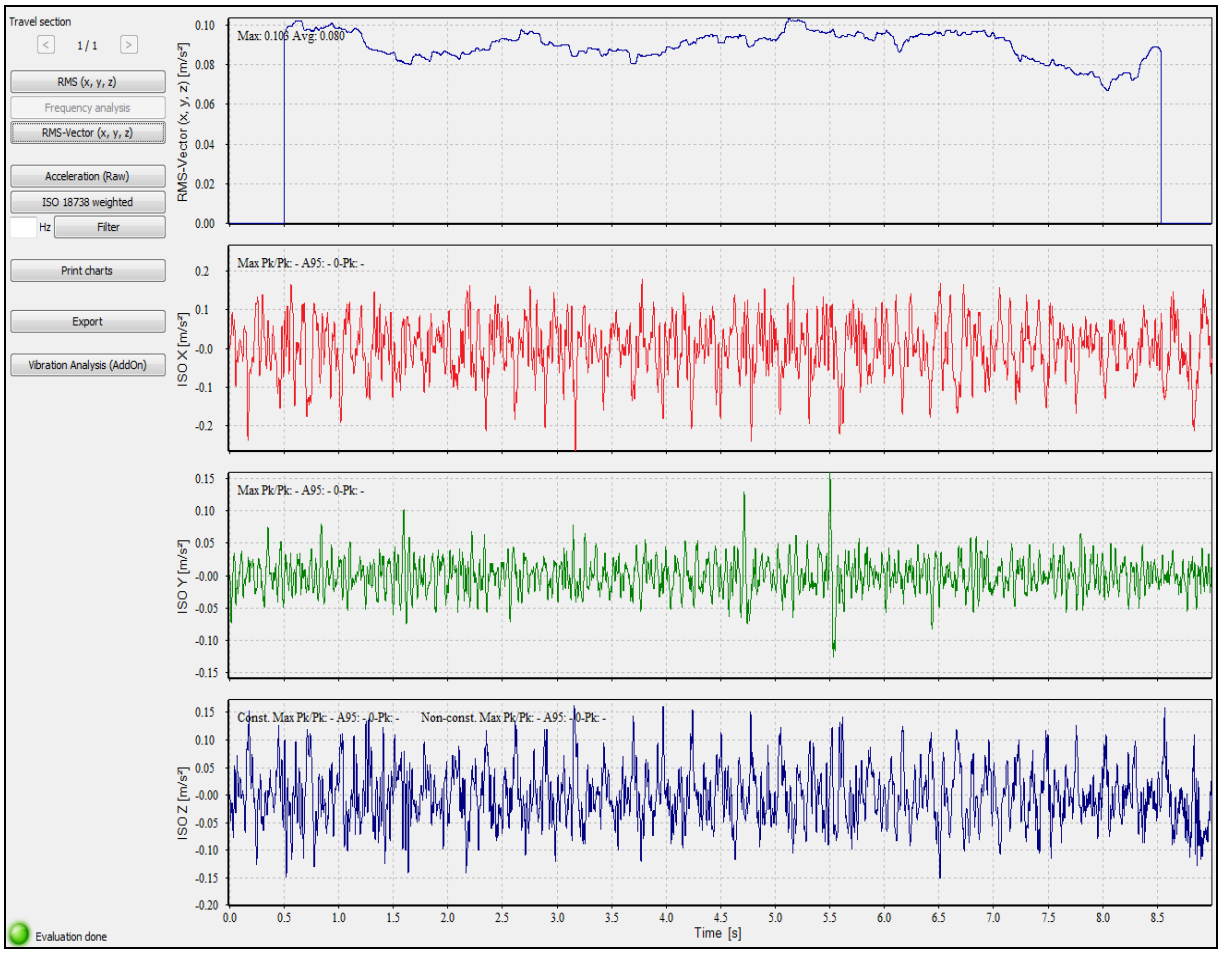
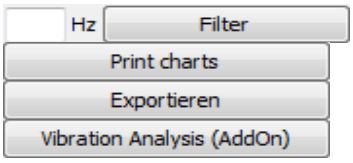


Illustration 76: Vibration data display

RMS (x, y, z)	Displays the RMS curve progression per direction of movement in the three lower curve diagrams for measurements of load carrying units. When measuring one handrail, the RMS progression for the axis only will be displayed. The RMS values are calculated from the frequency-evaluated curve progressions according to ISO 18738.
Frequency analysis	Starts the frequency analysis (in the individual curve view)
RMS-Vector (x, y, z)	Displays the curve progression of the vector sum of the RMS signals into the upper curve diagram. This function is available for load carrying unit measurement only, because the curve progression for handrails is not established according to ISO 18738.
Acceleration (Raw)	Displays the raw data of the three directions of movement into the three lower curve diagrams.
ISO 18738 weighted	Displays the data of the three directions of movement, weighted according to ISO 18738 into the three lower

curve diagrams. For the load carrying units, a “whole body combined” weighting takes place according to ISO 8041, while a “hand arm” weighting according to ISO 8041 is performed for handrails.



Cf. Chapter 4.3.3.7.2.2
Cf. Chapter 4.3.3.7.5
Cf. Chapter 4.3.3.7.7
Cf. Chapter 4.3.4

4.3.7 Emergency Stop Analysis (AddOn)

The emergency stop analysis is used for the evaluation of high-speed operations such as buffer test, tests of the safety-brake, A3 brakes, etc..

Since these operations regard acceleration data which significantly exceed the normal measuring range of the sensor QS3 with + -2g, it is crucial to use a second Z axis with at least + -10g or even + -20g.

The emergency stop analysis evaluates such processes semi-automatically and calculates the following data automatically:

- Braking distance and braking time
- Maximum and average deceleration
- Triggering speed
- Inclination of cabin
- Examination of max. peaks for excess of any acceleration-limit and –duration

Requirements: LiftPC mobile diagnosis (Art.-No. 450010) containing additional Z-axis with increased measuring range (Art.-No. 450014).

4.3.7.1 Unlocking the Function

To unlock the function, please contact your distributor, who will be happy to provide you with the appropriate license file. The enabling is done via the Henning Sensor Suite with connected sensor QS3 (see chapter 4.3.3.4).

The function is connected to a specific sensor QS3 (serial number). The unlocked function is thus only available for measurements taken with this particular sensor.

4.3.7.2 Performig Emergency-Stop Measurements

To carry out the measurement, the sensor QS3 is applied to the load carrier at a suitable location. Ensure a good coupling of the sensor to the component. The simplest solution is to use the magnetic base (supplied), which allows an optimal coupling to magnetic surfaces.

In any case, make sure that the mass of the sensor is low compared to the oscillating component and that the sensor cannot move / vibrate independently of the component.

The actual measured value is recorded using the sensor QS3 in the usual way (see chapter 4.3.3.8.1).

4.3.7.3 Using the Emergency-Stop-Analysis

The reading of measured data from the sensor QS3 is carried out in the usual way via the Henning Sensor Suite (see chapter 4.3.3.5).

A double-click with the left mouse button on the measurement stored in a project opens it in the curve display.

Since this measurement should have been done via the second Z-axis with an extended measuring range, please also select it as a source in the following dialog window:

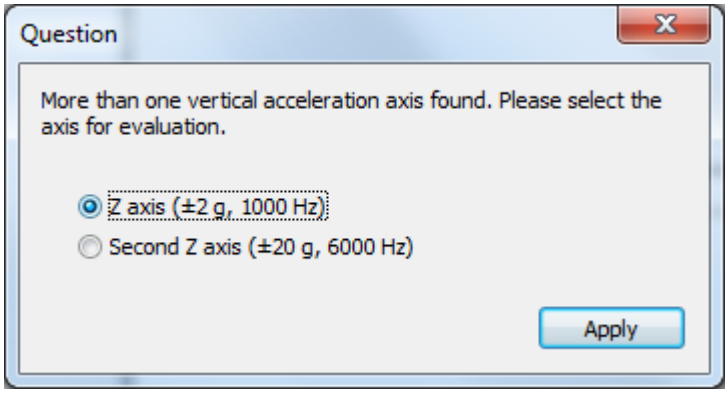


Illustration 77: Selection of the axis with extended measuring range

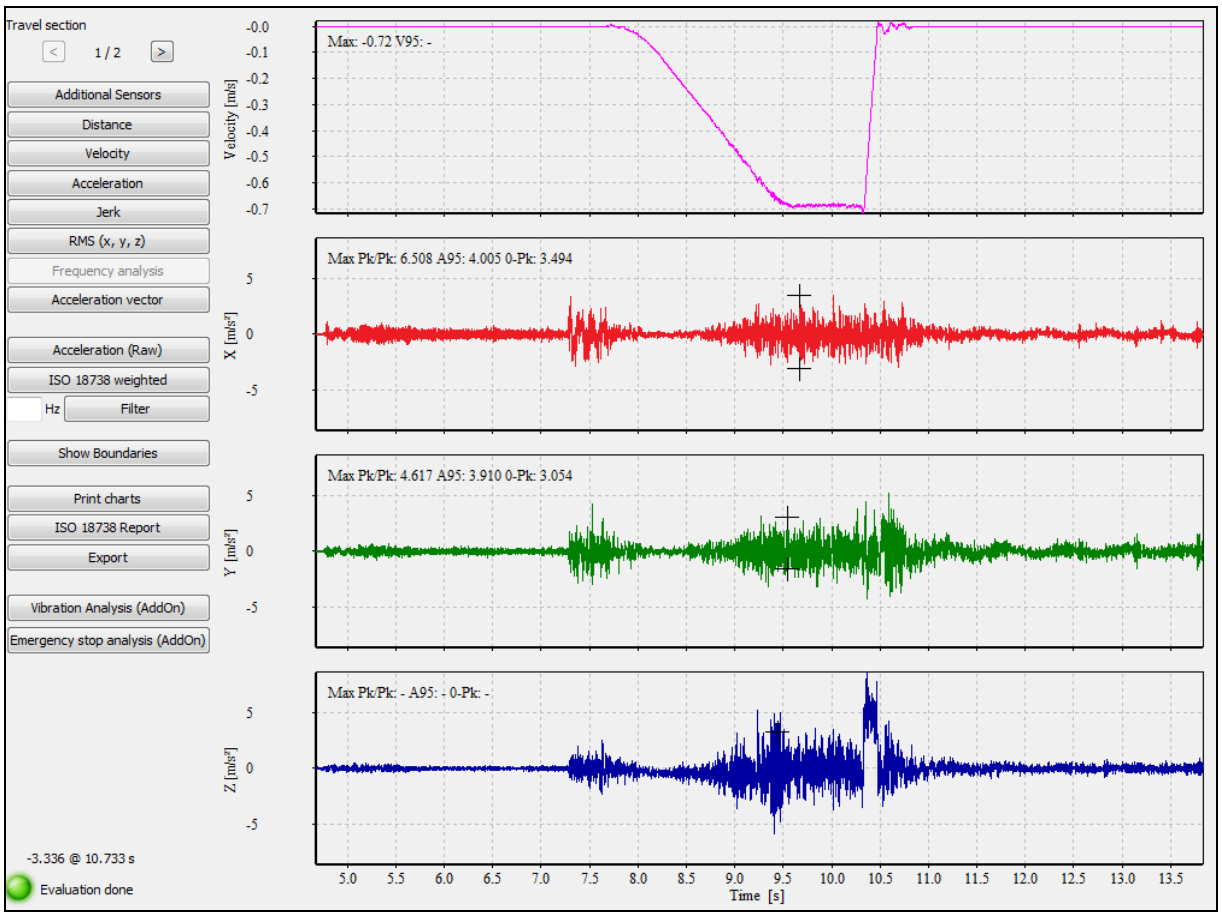
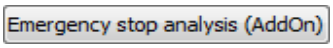


Illustration 78: Curve display of an emergency-stop measurement

The actual emergency stop analysis is started with the button 

As soon as the calculations have been completed, the emergency stop analysis report is opened automatically (see chapter 4.3.4.4.1).

4.3.7.4 Evaluating Subsections of Measurements

If not the entire measurement but only a certain area is to be evaluated, the following procedure needs to be executed:
A double-click with the right mouse button within the time range of the curve view marks the start for a new evaluation. In the curve view, this is indicated by a yellow "Start" mark. The next double-click with the right mouse button establishes the end index of the time range and the evaluation starts again automatically over the relevant range.

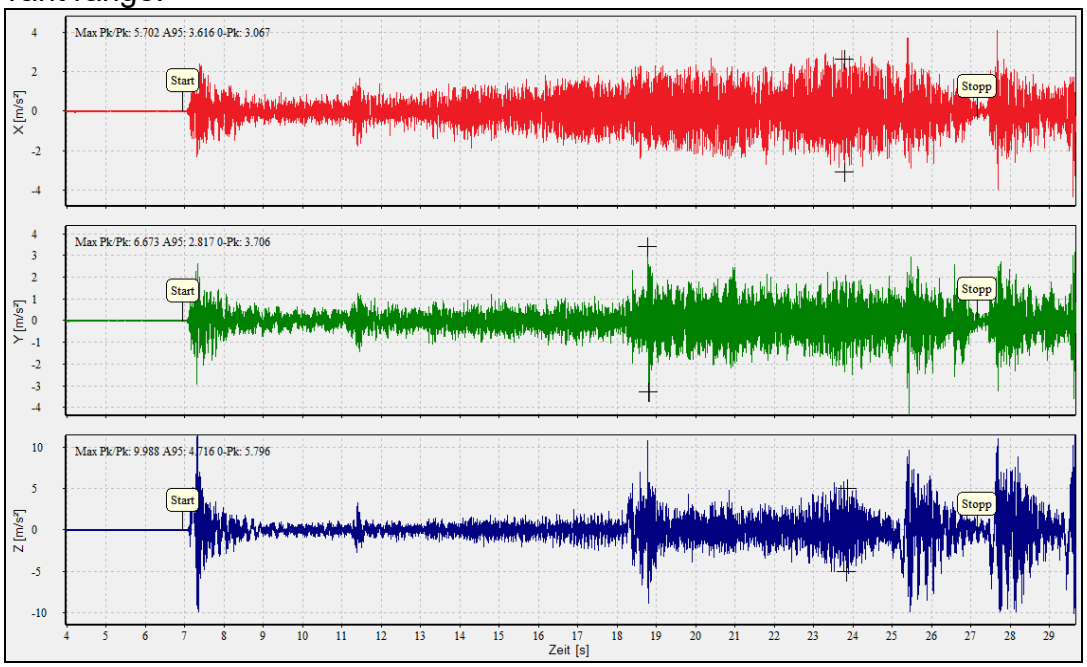


Illustration 79: Curve display with time-range-markers

4.3.7.4.1 Report Output

The emergency stop analysis report has the following appearance and shows the filtered acceleration, speed and travel curves. Below these, the analysis results are shown. The evaluated area is marked with a red window.

You will find the description of the individual functions and possibilities of the report display in chapter 7.

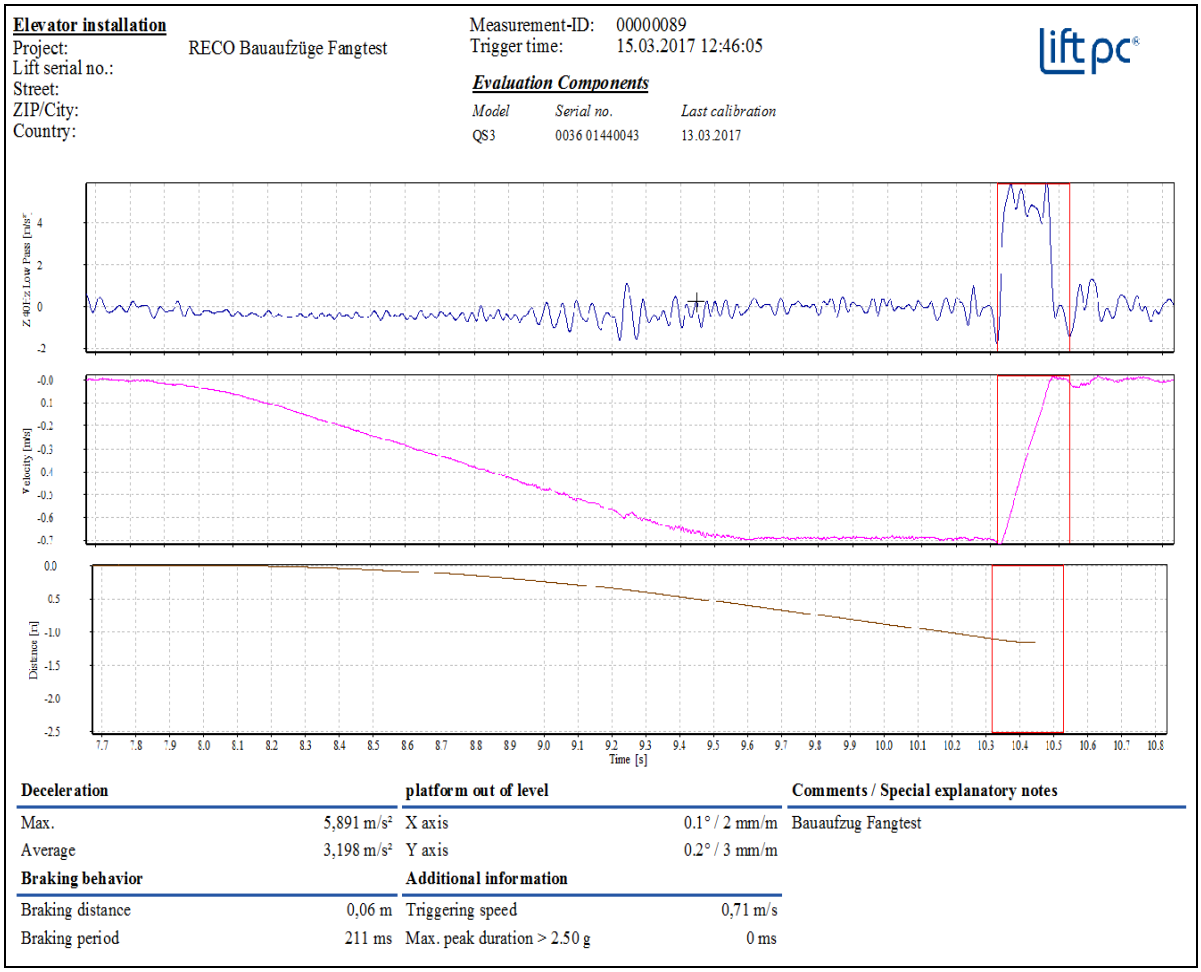


Illustration 80: Sample-report emergency-stop-analysis

4.3.7.5 Establishing the Analysis Area

The area within the red window is automatically selected by the software. It is based on the rules of EN81 for buffer type tests, according to which the analysis range is defined by the absolute minimum before the start of the deceleration and the minimum after the end of the deceleration.

As soon as the report is closed, the normal curve view appears in which the analysis area is again marked with a red window. This window can be moved and adjusted using the mouse.

As soon as the button is used Emergency stop analysis (AddOn) the new analysis area will be applied.

4.3.7.6 Parameterizing the Analysis

In "Settings" (see chapter 4.2.3 Settings) two parameters of the analysis function can be adjusted.

Emergency Stop Analysis (AddOn)

Low-Pass Filter Frequency	Sets the filter frequency used to filter the acceleration data from which the maximum and average deceleration values are determined. Also applies to the peak examination.
Peak-Limit for Determionation of Time Span	Specifies the limit (in g) from which the peaks are examined for the duration of the exceedance of these limits

4.3.8 Evaluation Unit AE12

The following sections refer exclusively to evaluation units AE12 with firmware from version 1.24.

The index card "AE12 unit" is found in the main display area. Here, evaluation units AE12 can be read out and programmed.

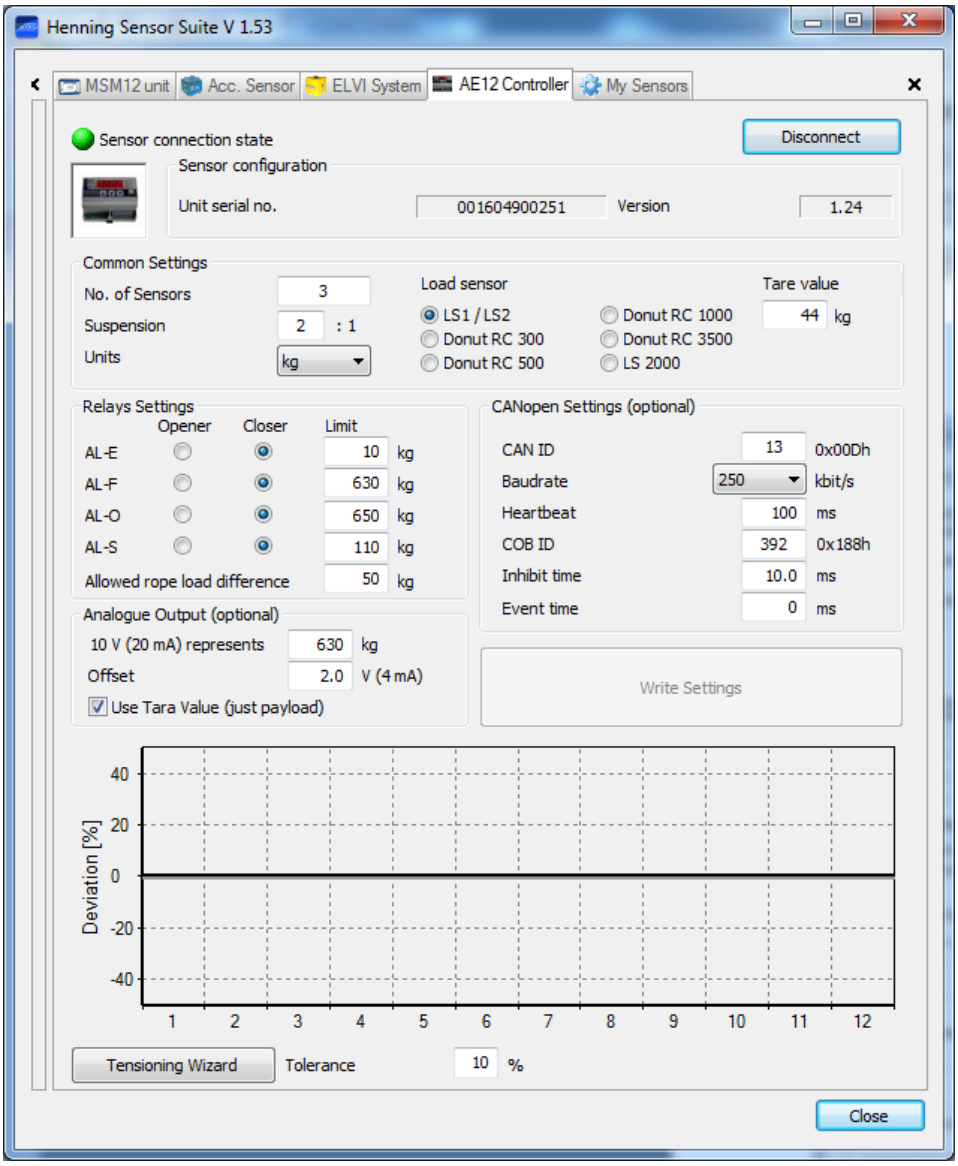


Illustration 81: Administration of the evaluation unit AE12

4.3.8.1 Connecting the Evaluation Unit

To establish a connection with an AE12 the following steps have to be performed:

1. Connect the AE12 to a power supply and wait for the booting process
2. Connect the AE12 with a PC utilizing an USB-cable (Installation of drivers please see chapter 3.3 Hardware Drivers**Fehler! Verweisquelle konnte nicht gefunden werden.**).
3. Click the button 

Once the connection has been established successfully, the "Sensor Connection Status" changes into green mode and the device information is read out.

To disconnect, please click the 

button.

4.3.8.2 Device Settings

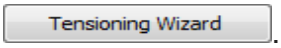
The evaluation unit AE12 features the following changable parameters, which may be set in the unit directly :

Parameter	Description
General Settings	
No. of Sensors	At this point, the number of sensors connected to the AE12 has to be set.
Suspension	Specify the suspension ratio of the installation. The rope loads will be automatically converted by the AE12.
Units	At this point you may specifiy, which units the AE12 will be showing when indicating loads.
Load sensor	Select the model of sensor beeing connected to the AE12. This setting is required for the correct interpretation of the measurements.
Tare Value	At this point a tare value (empty car load, for example) may be set. The AE12 will subtract this value from the total weight.
Relay Settings	
Opener/Closer	Choose for each of the four relays if it will be operated as an opener or a close
AL-E limit	The load limit value, beyond which a change of state of the relay will be effected (usually empty car load).
AL-F limit	The load limit value, beyond which a change of state of the relay will be effected (usually full car load).
AL-O limit	The load limit value, beyond which a change of state of the relay will be effected (usually overload).
AL-S limit	The load limit value, below which a change of state of the relay will be effected.
Allowed rope load difference	Change of state of relay AL-S, if at least one rope load differs by the preset load value from the average load of the rope set.

CANopen Settings (optional)	
CAN ID	At this point, the CAN-ID of the AE12 may be set in decimal notation.
Baudrate	Sets the baudrate, at which the AE12 communicates on teh CAN-bus.
Heartbeat	Here, the time interval between heartbeats in milliseconds is set.
COB ID	At this point, the COB-ID of the PDOs is set in decimal notation. The standard value of 392 should not be changed..
Inhibit time	Sets the time interval between two PDOs in milliseconds.
Event time	Sets the time interval between two telegrams. „0“ will disable this function.
Analogue Output (optional)	
10V (20mA) represents	Here the load is set, at which the analogue output should provide the maximum of 10 V or 20 mA.
Offset	At this point the alive-ofset is adjusted, i.e. the voltage which corresponds to a load of “0”
Use Tare Value	At this point you determine, if just the payload will be emitted by the analogue output (utilizing this function at the AE12 or having a tare value entered is required). If this option is enabled, only the payload is given via the analogue output. If the option is switched off, the analogue output corresponds to the sum of empty car and payload.

4.3.8.3 Rope Compensation Wizard

The evaluation unit AE12 may be used for quick and easy adjustment of the support means, to prevent unnecessary wear of the ropes. With a deviation of 20% between the rope loads, the rope life will almost be halved. A good rope setting and regular monitoring will therefore help you saving money.

To start the rope compensation Wizard, use the button 

. The desired tolerance between the individual rope tensions is set in this field: 

A soon as the rope tension wizard has been started, the percentage deviation from the optimal load of each suspension element is shown by means of a colored bar.

A bar above the center line means, that the support mean in question bears too much load, a bar below the center line indicates too little load.

If any one of the support means is set within the desired tolerance, the bar color changes from red to green.

With the tension wizard each support mean has to be set only once.

For one of the support means no colored bar will be shown. It will be selected by default as the reference by the software, and when setting the remaining suspension means, the one element in question will automatically be adjusted to the optimal load.

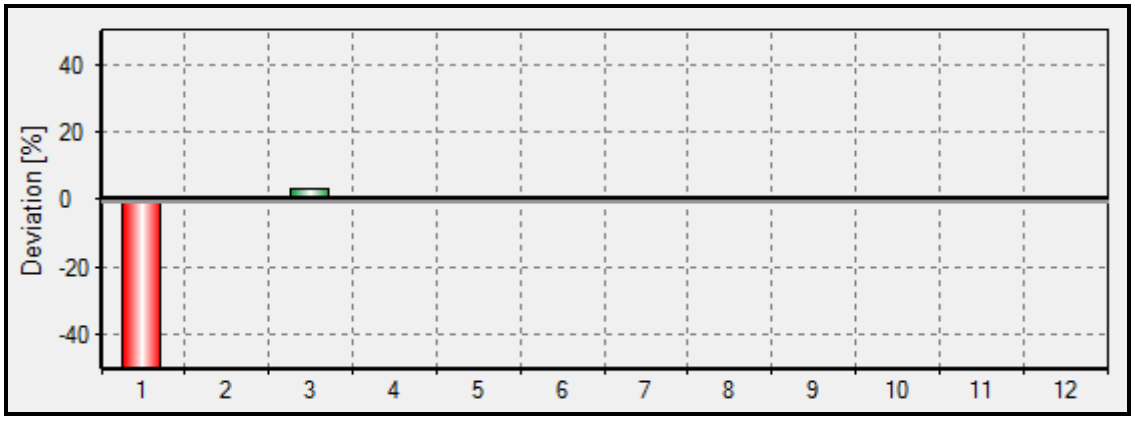


***Illustration 82:** View of the rope tension wizard. The tension of support mean No. 1 is too small, suspension mean No. 2 is the reference and does not have to be set, suspension mean No. 3 carries a bit too much load, but is within the specified tolerance.*

5 ELVI System (Henning Testing Systems PlugIn)

This chapter is the intellectual property of Henning Testing Systems GmbH, Loher Str. 4, 58332 Schwelm

Copyright

Warranty

This description has been drawn up by **Henning testing systems GmbH** to the best of their knowledge. All technical statements have been carefully established and checked. They correspond to the state of the art. Changes and errors accepted.

Our application engineering recommendations – spoken and written – will support your own work. It is regarded as an indication without obligation – also with regard to possible third party industrial property rights – and does not relieve you of the responsibility to carry out appropriate testing of the products regarding their suitability for the intended application.

Product descriptions do not contain statements about the liability for possible damages. However, should a liability be involved, it would be limited for all damages to the value of the goods supplied and used.

We are welcoming your suggestions and comments.

Henning testing systems GmbH

Loher Str. 4
58332 Schwelm
Deutschland

PHONE: +49 2336 9298 – 0
FAX: +49 2336 9298 – 100

e-Mail: info@henning-ts.de
URL: http://www.henning-ts.de/

Subject to technical changes.

5.1 General Instructions

5.1.1 How to use this operating manual

In order to use the system in the correct way, it is important to read the entire manual before starting to perform measurements for the elevators. Particularly important information, such as warnings and cautions, are designated with a warning symbol and a highlighted text.

5.1.2 General safety and work instructions

The Elvl-system is a measuring tool exclusively for elevator experts. The system cannot replace your expertise, but will support you during the elevator checks. In order to use the full scope of the system operations and record the measurements, both theoretical background knowledge of elevators and understanding of the Elvl-system operation are required. The instructions in the manual have to be strictly observed.

Please observe the instructions in the operation manual for the correct and safe operation of the system.

5.1.3 Maintenance and calibration

The sensors and modules have been developed to be applied at the elevators on a daily basis and have already proved to be successful in practice.
The sensors are very precise measuring instruments which have to be treated very carefully. If the sensors were exposed to excessive mechanical influences or electric shocks, the correct function of the sensors should be verified.

We recommend a service check of the electronic components at least once per year, which can be carried out for you by Henning testing systems GmbH. Annual calibration of the readings recorder is also recommended.

5.1.4 Application in explosion-proof facilities

The ***Elvl System*** has no approval for the application in explosion-proof environments. Please observe the relevant regulations.

5.1.5 Liability and consequential damage

Henning testing systems GmbH is not liable for the damages caused by ignoring the instructions of this manual or other protection rules or rules for protection of accidents. The provisions of warranty and liability according to the licence agreement for the ***Elvl System*** are applicable.

As far as permitted by law, Henning testing systems GmbH excludes any warranty for fitness and suitability for a particular purpose, whether expressly stipulated or implied. Henning testing systems GmbH is not liable for any damages including loss of profit or lost information, interruption of business or other financial losses.

Please make sure that the system is only applied by expert personnel who understands the consequences of the application. All applicable safety requirements have to be carefully observed.

5.2 Acceleration Sensor PS2

5.2.1 Safety and Shipping Instruction

The acceleration-sensor PS 2 has been equipped with Lithium-Ion Batteries.

Safety Instructions

- Lithium-ion batteries react violently when coming into contact with water (fully charged ones in particular)
  Do not store Li-Ion batteries near combustible material

Do not overcharge Li-Ion batteries
Do not short-circuit Li-Ion batteries
Li-Ion batteries are sensitive to mechanical damage. After internal short-circuiting and contact with air they may be highly combustible (even 30 minutes after the actual short circuiting).

Shipping Instructions

The batteries contained in the evaluation units MSM 12 comply with UN 3481, li-ion batteries contained in equipment (UN-regulations governing the shipment of lithium batteries of 1st January 2009). Please observe special restrictions in connection with li-ion batteries, especially regarding airfreight and / or request appropriate information from your logistics partner before shipping.

Generel Safety Instructions

Protect the acceleration-sensor PS 2 from dirt, water splashes and knocks..

5.2.2 Operation

The acceleration sensor PS2 measures acceleration in the z-axis and y-axis of. The data is obtained by a silicon acceleration sensor whose output signal is converted by a 16 bit analogue to digital converter. The measuring range of each acceleration sensor is digitized into 65,536 steps.

5.2.3 LED Operating Mode Indicators

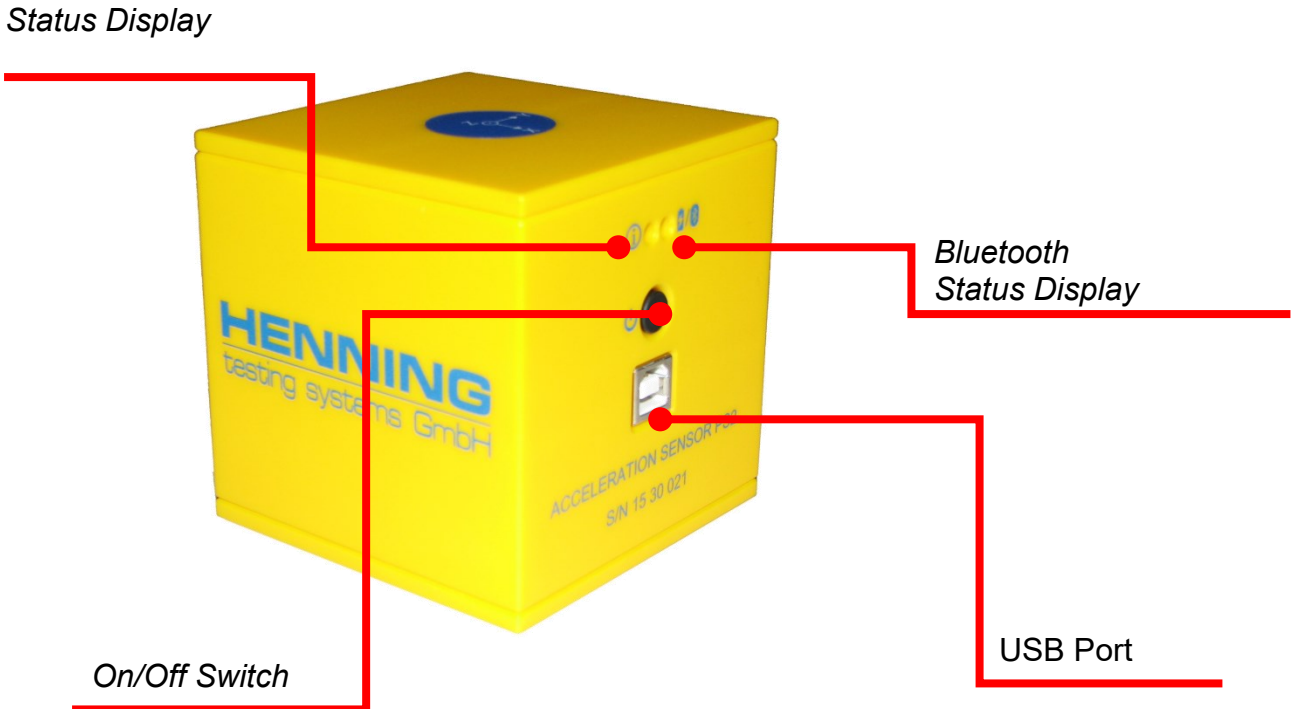


Illustration 83: Operating Mode Indicators PS2

5.2.4 Operating Mode Indicators

Status Display:

PS2 switched on	**green**, slow flashing
Initialising	**yellow**, slow flashing
Measurement running	**green**, continuous
Battery low	**red**, flashing
Memory full	**red**, continuous

Bluetooth Status Display:

Charging Process	**red**, continuous
Bluetooth Data Transfer	**blue**, continuous

5.2.5 Charging the Batteries

When switched on, the charging indicator shows the battery's current state of charge. Please charge the battery as soon as the reading changes to red status. During charging, the charge control changes to continuously red light.

We recommend to switch off the device while charging the battery, as a large part of the charging current will be consumed for the operation of the device.

5.2.5.1 USB Adapter

For charging via USB-connection, please connect the PS2 with the USB-cable to the charging adapter and connect the adapter to the main power supply. Charging will take, depending on the state of the batteries, roughly 9 hours.

5.2.5.2 Qi-Charging

For charging via Qi-interface, please connect the Qi-charger to the main power supply. Place the PS2 onto the centre of the charger. If positioned correctly, the charge control will change into active mode and the Qi-charge indicator will be activated after ca. 2 seconds. Charging will take up to 5 hours.

5.2.6 Switching The Device On

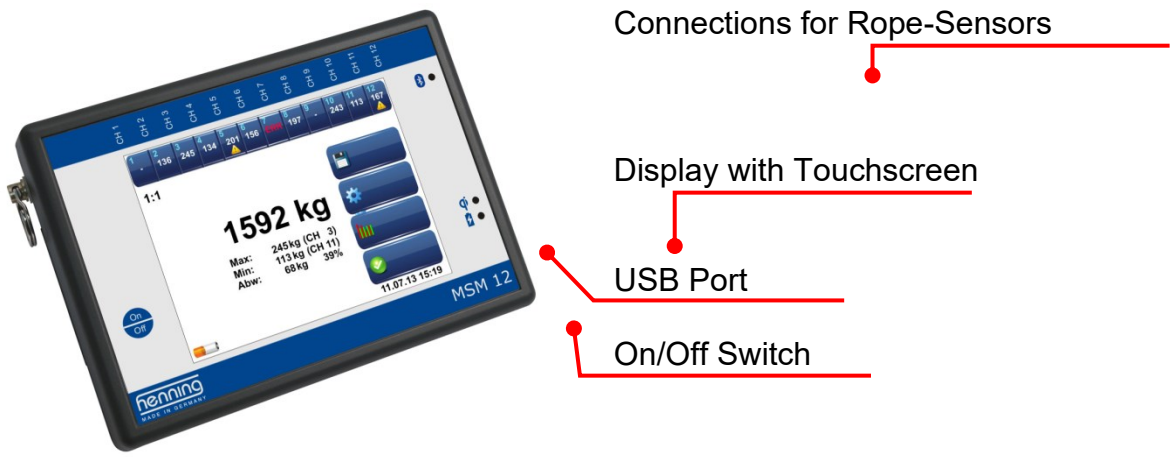
In order to switch on the PS2 please press the on/off switch for at least 3 seconds. The Bluetooth LED will flash and the PS2 will enter the idle mode while initializing (operating mode indicator flashing slowly yellow). After Initializing, the PS2 will go into operating mode (operating mode indicator flashing slowly green).
To switch off please press the on/off switch for at least 3 seconds until the red operating mode indicator turns off. If the batteries are run-down, the QS3 switches off automatically.

5.2.7 Handling

The acceleration sensor PS2 is a sensitive measuring instrument and must be treated accordingly. Mechanical or electrical influences may cause damage to the sensor. Also, make sure that the socket is not soiled by dust or liquids, as otherwise the electrical connection may be compromised.

If the magnetic base is used to mount the acceleration sensor, mount the magnetic base first and then put the sensor on; otherwise, the large forces generated by the air gap between magnet and mounting location may damage the sensor.

5.3 Evaluation Unit MSM12



5.3.1 Controls

The rope load evaluation MSM12 features an On/Off switch at the front. To turn the device on, the switch must be kept pressed for at least 3 seconds. The display shows the total weight of all the connected rope load sensors LSM and the status of connections. When touching the screen, the backlight, which had been switched off to extend the battery life will be switched on again.

5.3.2 Mode of Operation

The evaluation unit MSM12 adds the individual weights measured by the rope sensors LSM and shows the total weight on the display. It will also show for each connection, if a sensor has been connected or if the sensor is faulty (Er1) or if the sensor has been subjected to overload (Err2). The evaluation unit may be connected to a PC via USB- or Bluetooth-connection.

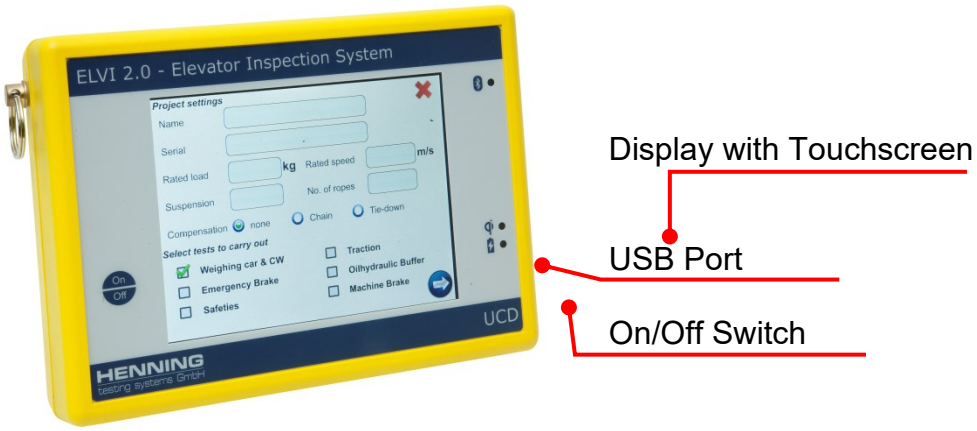
5.3.3 Connections

The evaluation unit MSM12 features 12 connections for sensors LSM at the top. On the right side, there is an USB-port, to connect the unit with a PC. If the unit has been connected via the USB-port, no data will be transferred via the Bluetootch connection, although the Bluetooth connection will be maintained.

5.3.4 Operation

Please make sure that all socket are kept clean, as otherwise the connection may be compromised. When using the MSM12, no special instructions have to be observed. However, please make sure, that no “Err” appears on the display for any of the connected sensors. For further information concerning the handling and the standard functions of MSM12, other than those concerning the ELVI system, please see the corresponding manual of Henning GmbH & Co. KG.

5.4 User Control Device UCD



5.4.1 Mode of Operation

Utilizing the UCD the user carries out the entire testing process. All inputs regarding the technical data as well as the time stamps are being stored in the device. The acceleration sensor as well as the rope-evaluation unit may be controlled remotely with the UCD, to start, stop, synchronize the micro-controllers and read out the weights measured by the MSM12.

5.4.2 Controls

The user control device UCD features an On/Off switch at the front. To turn the device on, the switch must be kept pressed for at least 3 seconds. When touching the screen, the backlight, which had been switched off to extend the battery life will be switched on again.

After starting the UCD, the main menu will open:

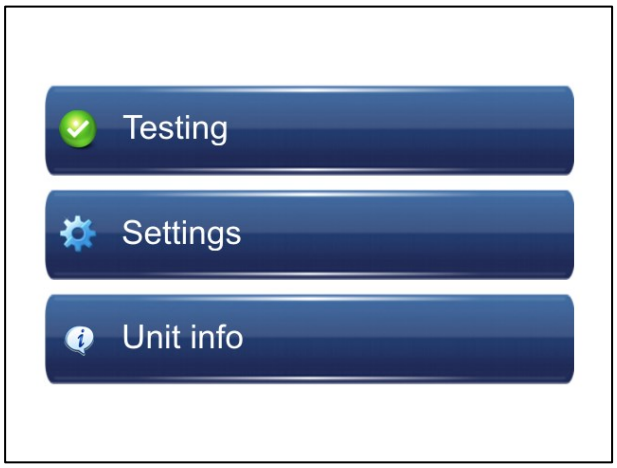


Illustration 84: Main Menu of the UCD

5.4.3 Settings Menu

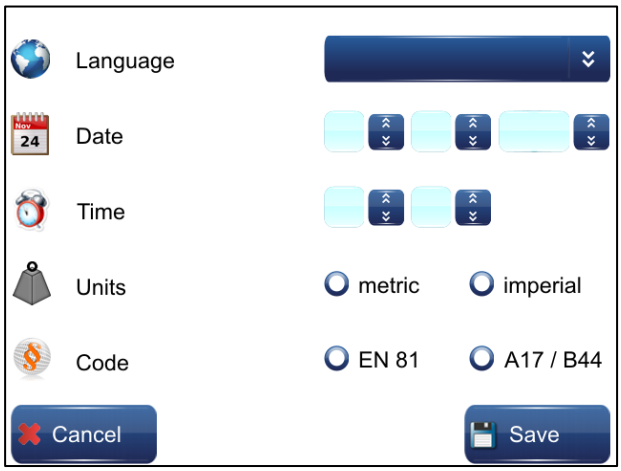


Illustration 85: Settings Menu

In this submenu the UCD's basic settings such as the Ad-conversations and the date and time are set. Furthermore, there is a possibility to choose between metric and imperial units. When selecting metric units, all inputs and outputs will be in kilograms, meters and millimetres; if imperial has been selected instead, it will be pounds, feet, and inches. Please also select, according to which standard the tests should be carried out, the European EN81 or the North American A17 / B44.

The choice of applicable standard has an effect on both the test procedures as well as the subsequent evaluation.

5.4.4 Menu Device Information

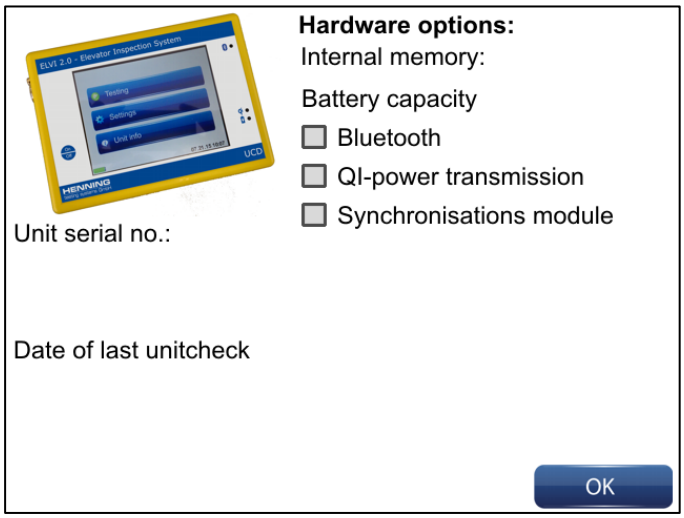
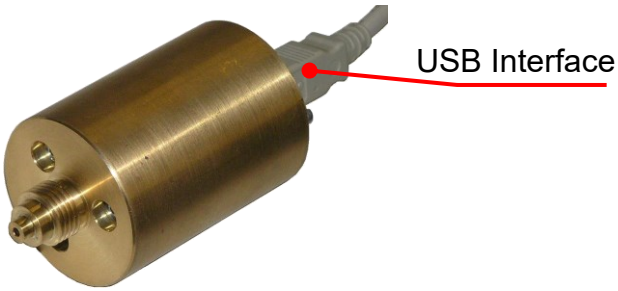


Illustration 86: Menu Device Information

In this submenu the serial number and date of last Service check as well as the hardware options are shown.

5.5 Pressure sensor HS1



5.5.1 Functions

The hydraulic sensor HS1 measures different kinds of pressure with a high precision and sampling rate. A silicon pressure sensor performs measurement value acquisition; its output signal is converted by a 16 Bite analogue digital converter. During this process, the measurement range of the sensor will be digitized in 65536 steps, each step equates 5mbar. The measurement system receives measured values via an USB connection.

5.5.2 Connection

The hydraulic sensor has a standard USB-B interface. This USB-B socket is used to connect the hydraulic sensor to a PC.

5.5.3 Handling

The hydraulic sensor is a sensitive measurement device and should be handled carefully. Mechanical or electric influences could result in damaging the sensor. Please make sure that the connection sockets are free from dust, dirt and liquids to provide contact successfully.

5.5.4 Technical Data

Measuring pressure:	0 – 250 bar absolute pressure
Band width:	1,000Hz
Sampling rate:	2,000Hz
Resolution:	5mbar (16 bit)
Precision:	1% FSR
Temperature range:	0 – 50 C
Interface:	USB V1.1
Quick-action coupling:	also for mounting at operating pressure

5.6 Execution of test Procedures

This chapter is extremely important for obtaining correct measurements. Please read with extra special attention!

We do recommend to execute the measurements in the order in which they are shown here, to be able to perform them in the shortest possible time span.

If the tests are to be carried out according to A17, section 5.7 "Course of testing" will be especially interesting to you. This chapter has been prepared in collaboration with TSSA, Ontario, Canada.

5.6.1 Preparing the Measuring Equipment

Before carrying out measurements, please make sure that:

- The sensors feature a valid calibration
- The sensors' mechanics or electronics have not been damaged since the last usage
- The batteries are fully charged
- All accessories are complete and in good working order

5.6.2 Input of Project Data

During the first few steps when conduction tests one only needs the user control device UCD. Start he unit and select „Performing Tests"

The following dialog for putting in the project data will open:

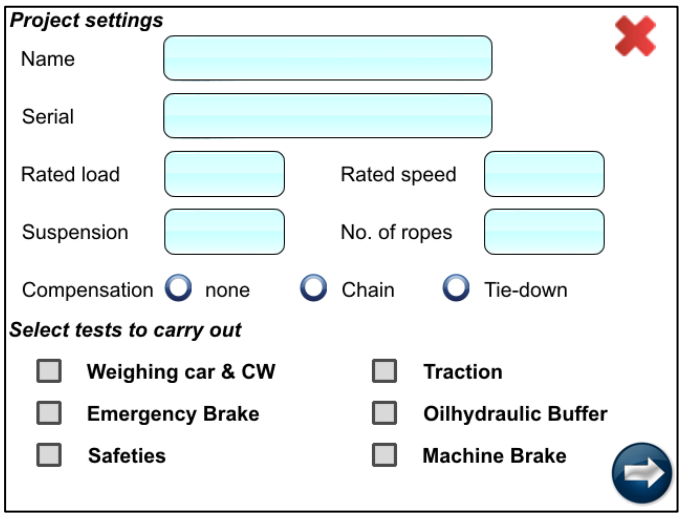


Illustration 87: Input of Project Data

Apart from the serial number, all fields must be filled in this project data menu. The dialogue may be left only if the necessary entries have been made by pressing the button "NEXT".

Name — Enter a name (16 digits max.) for the project. The name will appear in the Henning Sensor Suite.

Serial-Number — Enter the installation's serial number (16 digits max.)

Rated Load — Enter the rated load in the pre-selected units

Rated Speed — Enter the rated speed in the pre-selected units

Suspension — Enter the suspension ratio as X:X

No. Of Ropes — Enter the number of ropes of the installation

Compensation — Select, if the installation has compensation, and if so, what kind

Tests — The following selection determines, which measurements are to be carried out. If this test is marked, the ELVI system expects the objective measurement of the car and counterweight. If this step is not selected, manual entries of the weights are required following this dialogue. Please read the chapter on weight determination.

Emergency Brakes	If emergency brakes are to be tested, select this step
Safeties	If safety brakes are to be tested, select this step
Traction	If traction is to be tested too, select this step
Oil hydraulic Buffer	The North American standard requires the testing of oil hydraulic buffers. If you would like to perform this, please activate this step.
Machine Brake	If this entry is selected, the ELVI system expects the examination of the machine brake

In many elevators, the weight in the technical documentation does not match the actual weights! Only correct weights will lead to correctly calculated results! Therefore you must determine the current weight following this system and its procedures. Do this even when choosing to manually enter weights during setup.

5.6.2.1 Information on Rope Parameters

In the subsequent dialog, the properties of the suspension means have to be filled in; i.e. the diameter for ropes and the appropriate type for belts.

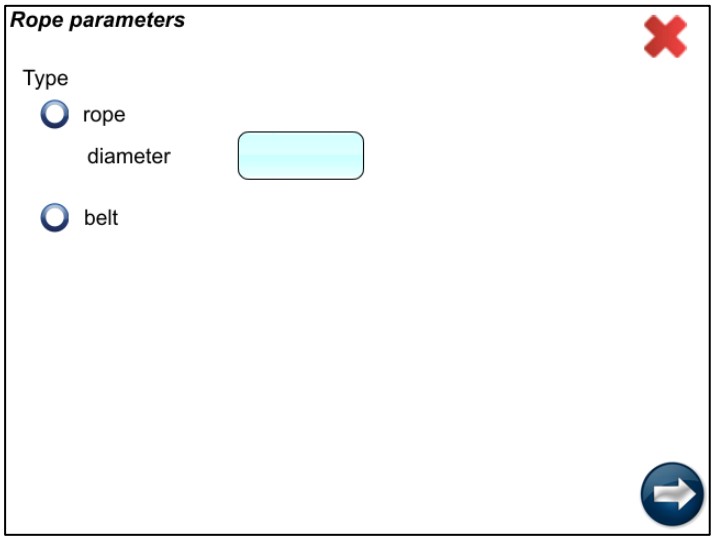


Illustration 88: Rope Parameters

5.6.2.2 Compensation

The following two dialogs will appear only if the respective compensation method is selected. If the installation has no compensation, this step will be skipped.

5.6.2.2.1 Compensation Chain

If a chain used for compensation, the weight per length-unit and the lifting height of the lift have to be entered. Standard chains may be selected via the dropdown menu.

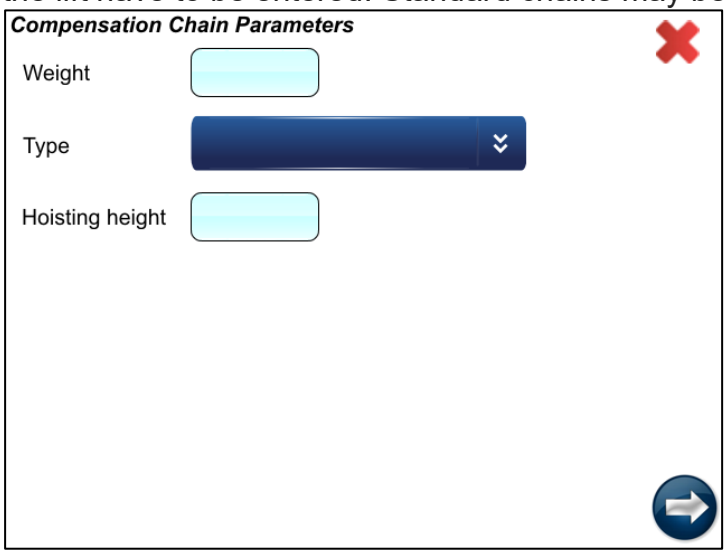


Illustration 89: Compensation Chain

5.6.2.2.2 Tie-Compensation

If tie-down ropes are used, the number of ropes and their diameter has to be filled in.

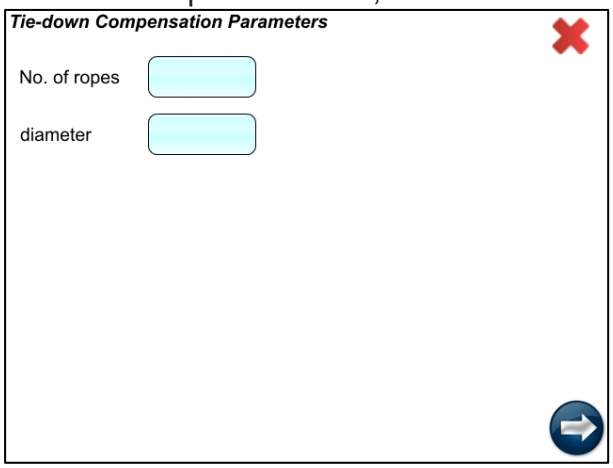


Illustration 90: Tie-Down Rope

5.6.2.3 Entering Weights Manually

If you have chosen to enter the weight manually (because you are absolutely sure you have the correct weights), the following dialog box in which the weights are to be entered appears.

In many elevators, the weight in the technical documentation does not match the actual weights! Only correct weights will lead to correct results to be calculated! We therefore recommend to determine the actual weight instead of entering it manually.

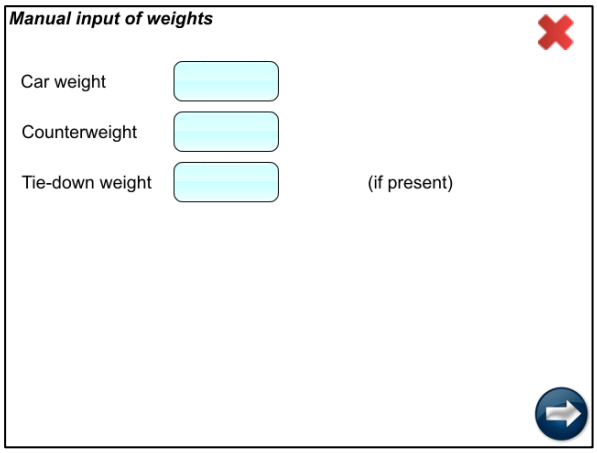


Illustration 91: Entering Weights Manually

The tie-down weight has to be entered only if the installation does feature them.

5.6.2.4 Emergency Brake

If you selected this step, the type of emergency brake has to be entered.

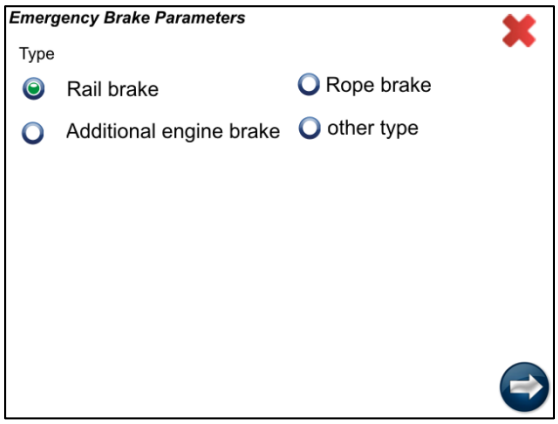


Illustration 92: Emergency Brake

5.6.2.5 Safety Gear

This information is only required, if the North American standard has been selected (see chapter 5.4.3 Settings Menu).

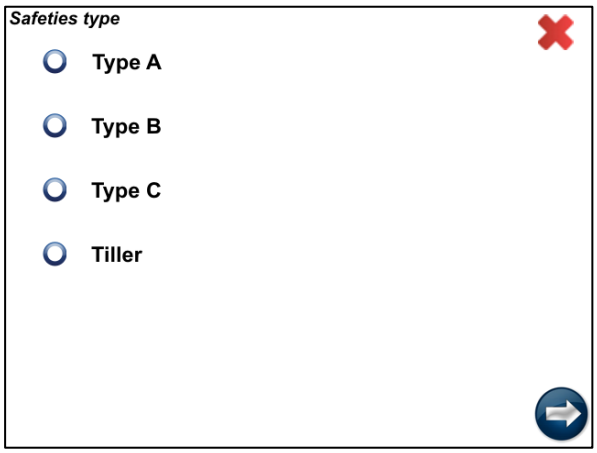


Illustration 93: Safety Gear

5.6.3 Determining Actual Weights

If the step “weight determination” has been selected, you will be guided through recording of the weights for the cabin, the counterweight and possibly the tie-down cable.

In many elevators, the weight in the technical documentation does not match the actual weights! Only correct weights will lead to correct results to be calculated! Determine the statistically accurate actual weight as part of this testing process even when the choice is to enter it manually.

The dialogs for the measurements all follow the same Structure:

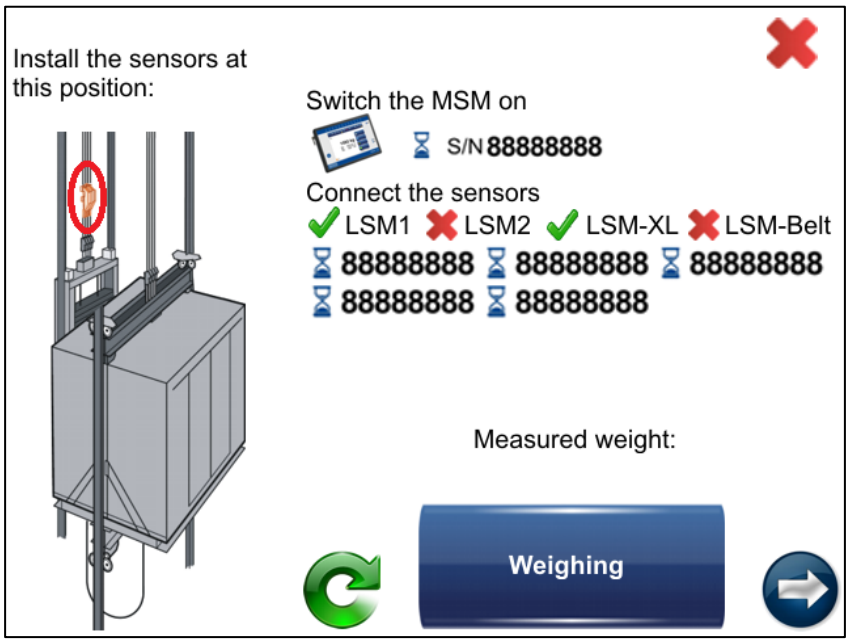


Illustration 94: Weight Determination

The UCD will search actively for MSM12 units, which have been switched on. As soon as one is found, the serial number and the calibration status are being read out and displayed. Also, serial numbers and calibration status of all connected sensors will be displayed. If the hourglass symbol is shown, the search is ongoing. A green check mark indicates that the device in question was found and the calibration status is positive. A red check mark indicates an expired calibration, or that the rope sensors are of a type which is not suitable for the support means. Above the serial numbers of the sensors there is an indication (green check mark = suitable, red cross= not suitable), which types of sensors are suitable for the support means. On the left side you will find a schematic illustration of where the rope sensors should be positioned on the ropes. The button with the green circular arrow triggers a new search for an MSM12 and may be used when an MSM12 was found and read out before the sensors had been connected. If all sensors have been found, a measurement can be started be pressing the “weighing” button. The load on all sensor is (taking the suspension ratio into account) displayed directly above the “weighing” button. After the weighing process you may change into the next dialog by pressing the blue arrow.

Please adhere to the manufacturer’s instructions on proper measurement implementation. Particularly important: If the counterweight or the car is “stuck” in the guide rails, the measured weight may differ from the actual weight. In such cases, please measure during a constant drive (no matter at what speed), to eliminate the friction forces

5.6.3.1 Counterweight

The illustration shows the possible positioning of the load sensors above the counterweight depending on the current configuration. The cabin should be moved to a point at around half the hoisting height. At such a point, the ropes above the counterweight can be reached easily in order to mount the sensors. During the measurement, the user may stay on the car's roof, without compromising the measurement.

Please adhere to the manufacturer's instructions on proper handling of the sensors

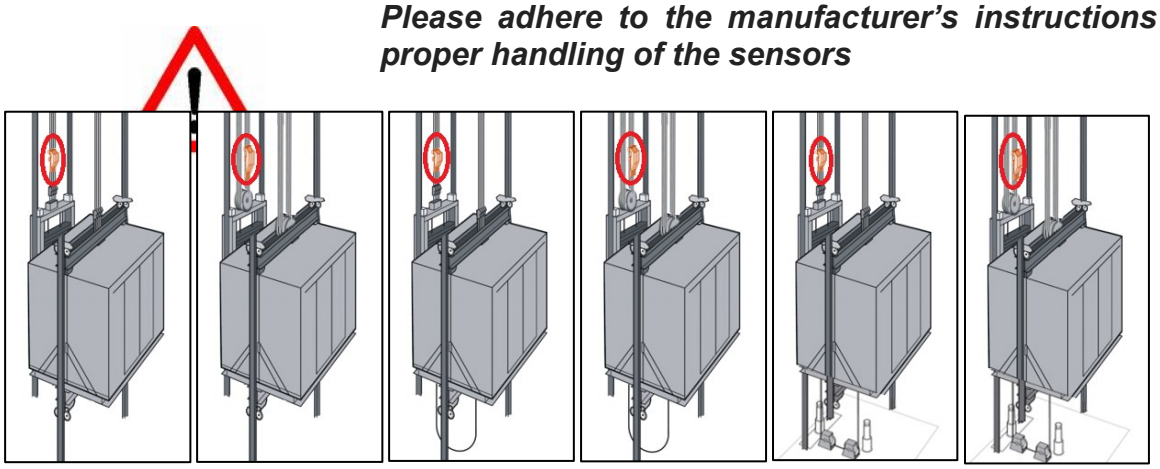


Illustration 95: Positioning of Sensors above Counterweight

5.6.3.2 Tie-Down Ropes (optional)

This dialog appears only, if the installation features tie-down ropes. The illustration below shows the positioning of the load sensors below the counterweight.

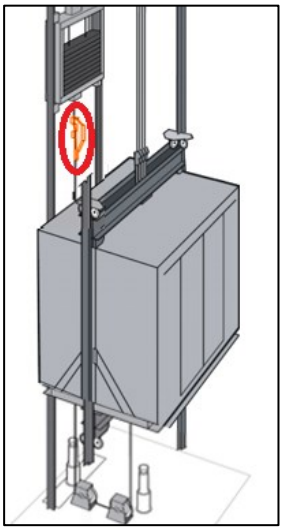


Illustration 96: Positioning of Load Sensors for Measuring Tie-Down Ropes

The cabin should be moved to a point at around half the hoisting height, so the ropes above the counterweight may be reached easily from the top of the car. During the measurement, the user may stay on the car's roof, without compromising the measurement.

Please adhere to the manufacturer's instructions on proper handling of the sensors

5.6.3.3 Car Weight

The illustration shows the possible positioning of the load sensors above the counterweight depending on the current configuration. The cabin should be moved to a point at around half the hoisting height. During the measurement, the user should not remain on the car roof, as the measurement will be compromised.

During measuring the user should not remain on the car top, as the measurement will be compromised. Please adhere to the manufacturer's instructions on proper measurement implementation.

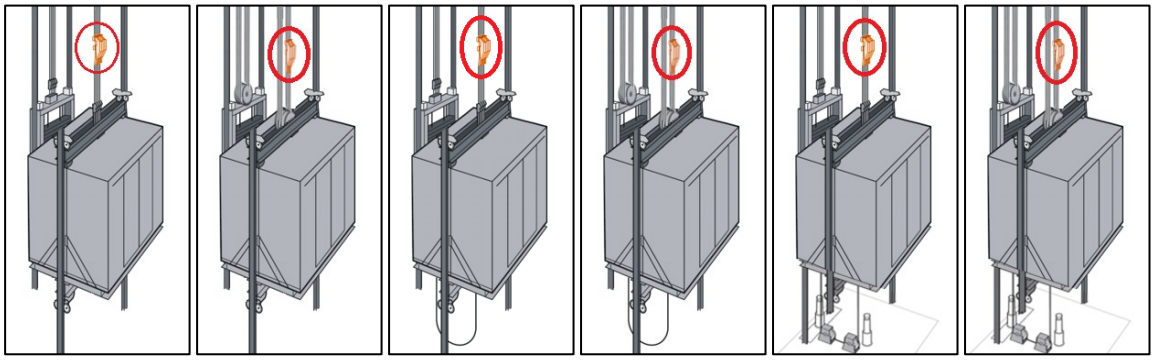


Illustration 97: Positioning of Load Sensors for Measuring the Car Weight

5.6.4 Mounting Sensors

5.6.4.1 Mounting the Acceleration Sensor

When the acceleration sensor PS2 is utilized, it should be mounted as rigidly as possible onto the supporting frame of the cabin.

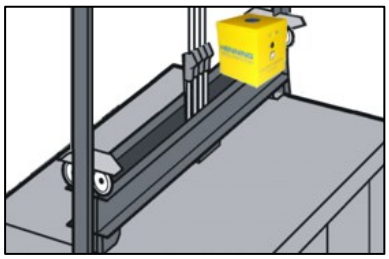


Illustration 98: Positioning of the Acceleration Sensor PS2

The sensor should be placed as far as possible to the outer side of the supporting frame because there it will be closest to the safety brake and there will be as few as possible vibrating elements between the sensor and the brake. The sensor may be mounted either with the magnetic base (supplied by Henning) or any other suitable clamping device.

If the magnetic base is used to mount the acceleration sensor, mount the magnetic base first and then put the sensor on; otherwise, the large forces generated by the air gap between magnet and mounting location may damage the sensor.

5.6.4.2 Installing the Rope Load Sensors

Please adhere to the manufacturer's instructions on proper handling of the sensors

Depending on whether the installation features a 1:1 or a multiple suspension, the rope load sensors and the evaluation unit MSM12 have to be attached at different points.

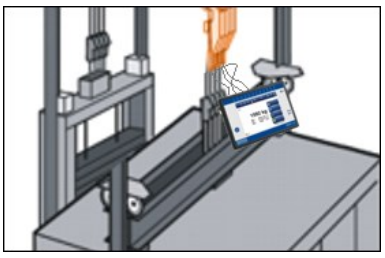


Illustration 99: Positioning of MSM12 and Sensors for 1:1 Suspension

For 1:1 suspensions, the sensors and MSM12 can be mounted directly above the car (usually they are already there from the cabin weight determination).

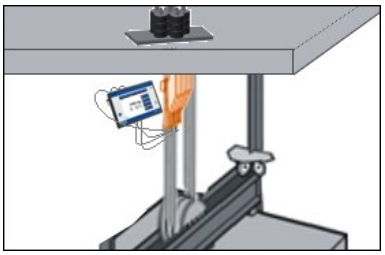


Illustration 100: Positioning of MSM12 and Sensors for multiple Suspension

For multiple suspensions, the sensors and MSM12 must be mounted near the fixing point of the ropes on the cabin side.

For multiple suspensions, please make sure that the sensors are positioned in such a way on the ropes above the diverter pulleys, that they are not damaged while performing the tests. The same applies to any subsequent procedures.

5.6.5 Synchronisation

Having fed all installation-related parameters to the unit, the UCD has changed into the synchronization dialog. Here, dependent on the elevators configuration, the proper positioning for the sensors during the test will be indicated. The UCD will also be actively looking for a switched-on acceleration sensor PS2 or an evaluation unit MSM12. Depending on the selected tests, the USD is searching for a PS2, if at least one of these tests requires an acceleration measurement, or for a MSM12, if the tests require a load measurement. Once the necessary units have been found, the respective serial numbers are read out and displayed and also the calibration status is checked. The latter leads to a warning if the calibration has expired; testing will nevertheless be possible at the users discretion. After synchronization, UCD, PS2 and MSM12 are synchronized. During the subsequent individual tests no communication between the devices will take place, a wireless connection is not maintained. Only after completion of all individual tests a final exchange of data between the devices will take place (see. Section 5.5.7 Completion of the Measurements).

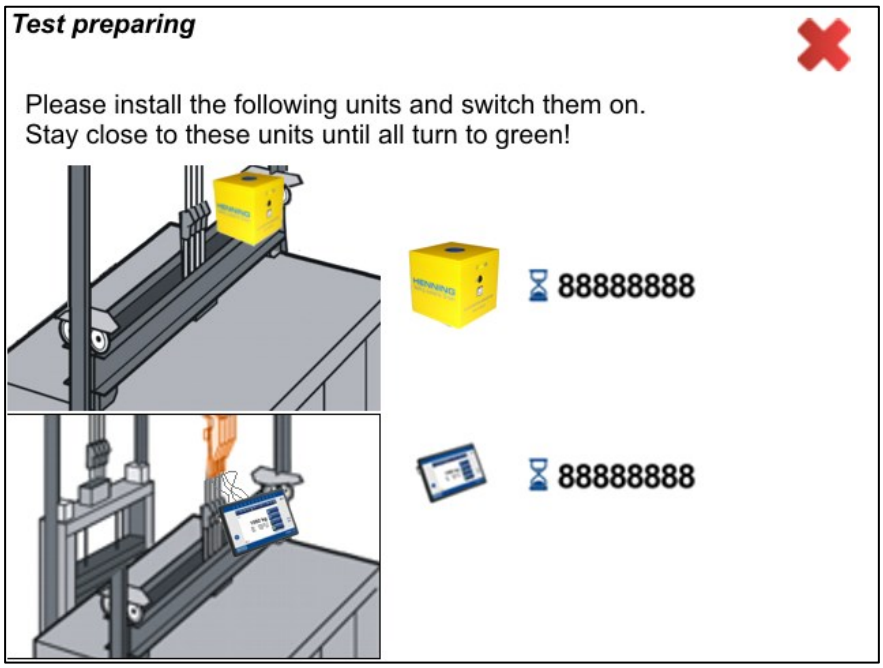


Illustration 101: Synchronisation

Please do not turn off the equipment until the tests are fully completed and the UCD displays the home screen. Otherwise, all measurements will be irretrievably lost.

5.6.6 Performing Individual Tests

With the next dialog on the UCD the required tests are chosen. Multiple single tests during one synchronization setup must not exceed 50.

Total number of individual tests triggered for one synchronization setup of one installation must not exceed 50 (software limit).

Behind every test an arrow symbol is shown. If it is clicked, the UCD will changes into test-mode. Depending on whether rope load sensors and/or an acceleration sensor have been synchronized (see 5.5.2 Input of Project Data) green or red icons will displayed. Only the green arrow icons are usable. Before each test, a padlock icon is displayed. If it is shown closed, at least one corresponding test was performed and

has been finally synchronised. This only indiocates test triggered and synchronized not an indication of pass/fail.

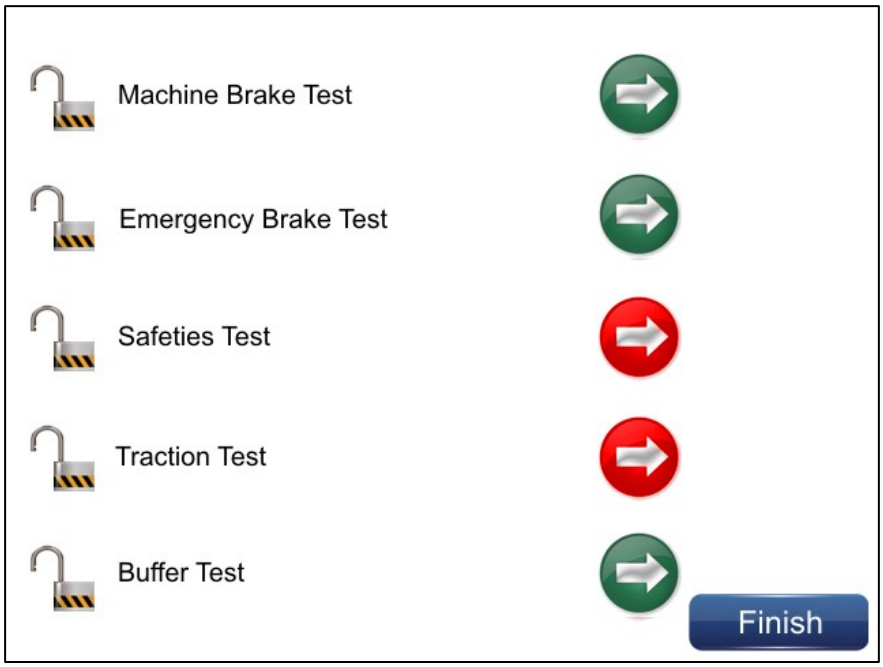


Illustration 102: Dialog Individual Tests

The individual tests feature a similar dialog:

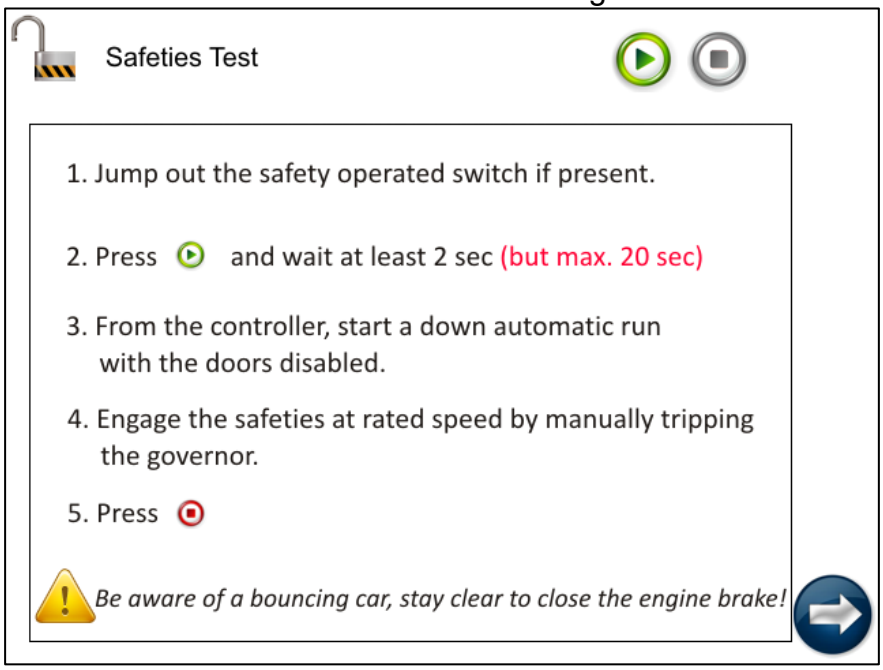


Illustration 103: Dialog Individual Test (in this case Safety Brake)

At the top left you will find the padlock icon again, indicating the current synchroniza-tion status. The individual test is also identified. Below is a brief explanation of how

the relevant test is carried out. At the top right the two buttons can be found for starting and stopping the test.
To start the measurement and testing, the green button will be-exploited.
The end of the measurement or test is indicated by the button.
If the verification step is completed, the blue arrow button is used to return to the previous dialogue back and select the next exam.

When all the desired individual tests were conducted, the dialog with the “Finish” button is left. Subsequently, the final synchronization occurs (see. Section 5.5.7 completion of the measurements).

To start the test or measurement, press the  button.

The end of the test is initiated by pressing the  button. If the verification step has been completed, the blue arrow button is used to return to the previous dialogue and select the next test.

When al required individual tests have been conducted, the dialog with the “Finish” button is left. Subsequently, the final synchronization is carried out (see Chapter 5.5.7 Completion of Measurements).

5.6.6.1 Machine Brake

Depending on the standard, which has been applied for the examination, more than one machine-brake test has to be carried out. There is no need to leave the dialogue; individual tests may be started and terminated here. In principle, the minimum braking force of the machine brake and the deceleration as well as the braking distance in an overload situation are calculated from the acceleration values of the empty car in the upwards direction. For measuring the machine brake the car is moved into the bottom station. All sensors remain in their position from previous measurements. To check the machine brake, an upwards travel with empty car has to be measured. If the test is carried out according to EN81, each brake circuit has to be measured separately. For a standard brake an upwards travel with empty car testing both brake shoes, the left brake shoe and the right brake shoe has to be preformed

Make sure that no other brake is in operation during the machine-brake test

The procedure for performing the machine-brake test is as follows:

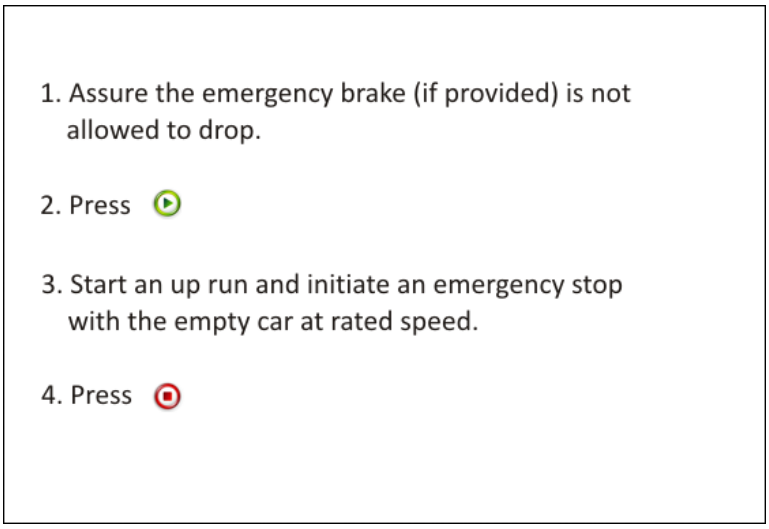


Figure 104: Machine-Brake Test

5.6.6.2 Emergency-Brake

The individual test of the emergency brake is similar to the test for the machine-brake. The measuring principle as well as the procedure are identical.

Make sure that no other brake is in operation during the emergency-brake test

The procedure for performing the emergency-brake test is as follows:

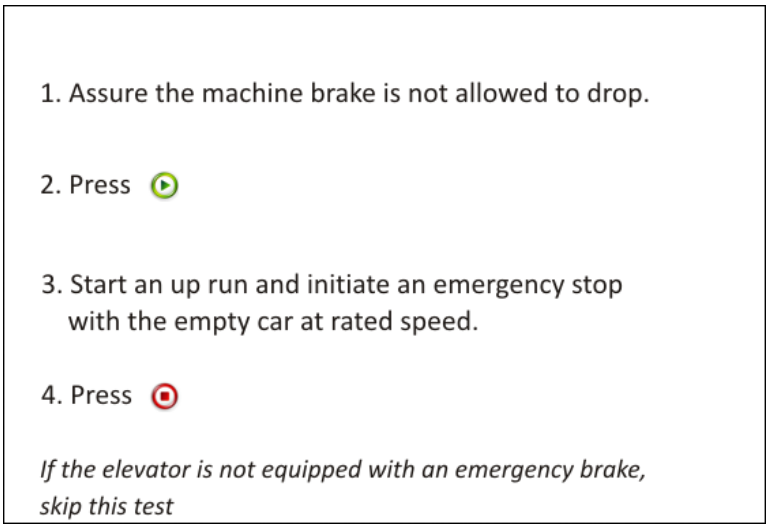


Illustration 105: Emergency-Brake Test

5.6.6.3 Safety Brake

The procedure for performing the safeties test is as follows:

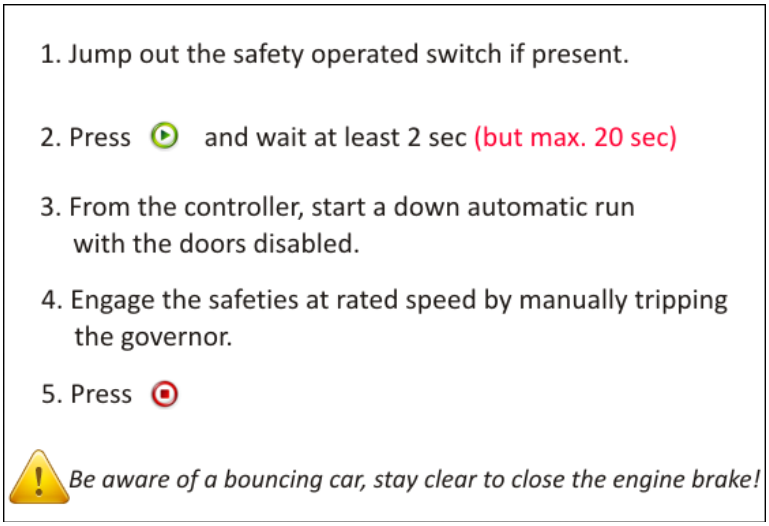


Illustration 106: Safety Test

Be alert and prepared to activate the machine-brake, if the counterweight reverses and pulls the car out of the safeties and starts upward travel.

5.6.6.3.1 Safeties Test

The examination of the safety brake is done using a patented process. Despite measuring with an empty car, the physical conditions of loaded cabin are in effect. Influences of counterweight and machine are accurately determined, so no assumptions have to be made about their behavior, and there is no effect on the accuracy of the measuring results.

5.6.6.3.2 Free Fall

The method of testing the safety brake with a loaded car generally does not permit a clear statement as to whether the applicable technical rules are met. In this conventional examination, the influences of counterweight, motor inertia and ropes remain in effect, so that no conclusion about freefall can be made. Even if acceleration measurements are recorded during the full-load emergency stop, the influence of the above mentioned components remain uncertain, as the counterweight does not always jump at the crucial moment and thus does not support the safeties. The method of ELVI, simultaneously measuring acceleration and rope forces, allows a sure statement about whether the safety device in question is demonstrably able to stop a free-falling elevator.

5.6.6.3.3 Machine Break during Emergency Stop

It is advisable to keep the engine brake open during the safety test, because only in this case the emergency stop will be unaffected by the brake. This will be the case,

when the over-speed governor already triggers before the governor rope is blocked. Therefore it is recommended to bridge the corresponding contacts in the control during safety test.

5.6.6.3.4 Emergency Stop with Empty Car

A safety test with an empty car usually leads to deceleration of more than 1g. During normal operation, the safety may be triggered at any time; therefore, all components must be designed to withstand such deceleration. It is recommended to test the emergency stop in the upper part of the shaft, because the large cable length between the drive pulley and the counterweight somewhat dampens the load on the motor.

5.6.6.3.5 Car is being Pulled free of Engaged Safety Gear

Even if after the emergency stop, the safety gear is not actuated because of a jumping counterweight (the safeties have been “pulled” free) the ELVI system can process the measurement and report correct results. In this case the safety gear has been working properly and was only pulled free after the actual emergency stop. This part of the measurement is irrelevant to the analysis.

5.6.6.4 Traction

Immediately after the safety gear test, the safety is normally still engaged, and the cabin is held by the safeties. This test was formerly conducted after the safeties test but we now recommend doing it before safeties and/or buffer testing as these two tests present some possibility of disengaging one or more suspension mean sensors.
Engaged the safeties by hand at inspection speed.
For the traction test the motor has to be operated in the downward direction until the ropes slip over the traction sheave or the machine torques while the brake is still applied. This must be kept up for about 2 seconds.
The basic procedure for carrying out the traction test is as follows:

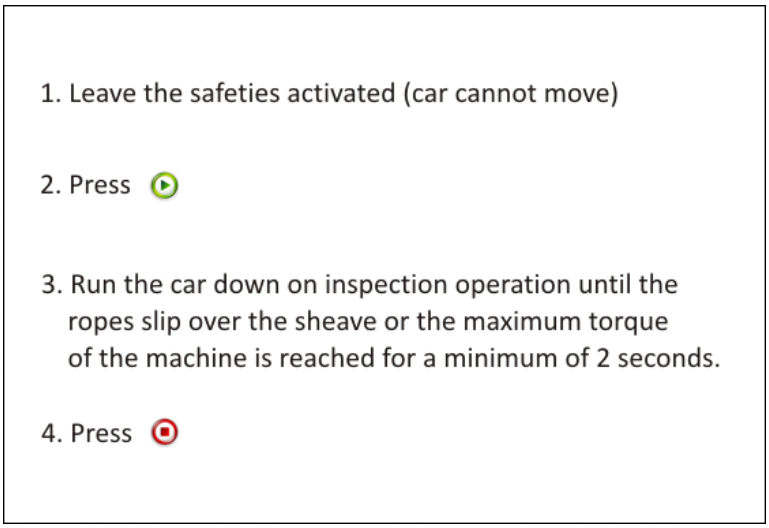


Illustration 107: Traction Test

5.6.6.5 Hydraulic Buffers

Since buffers according to EN 81 are only type-tested/non-recurring tested, this sub-chapter refers only to A17.1 / B44 requirements.

Both direct measurements and calculations of the impact of a car onto an hydraulic buffer leads to understanding, that the cabin load and the deceleration upon impact with the buffer bear the following relationships:

• The greater the weight of the car, the smaller the maximum peaks are in the deceleration of the car through the buffer
• The greater the weight of the car, the longer the buffer has to delay the car with a higher average deceleration.

The A17.1 / B44: 2013 requires (as well as other examinations for the type test) for hydraulic buffers that any deceleration above 2.5 g does not last for more than 40ms. Since the highest delays occur with an empty car, this criterion is best checked with an empty car.

The Category 5 Test for oil hydraulic buffer provides for two examinations:

1. The buffer has to go back to its initial position within 90 seconds after compression. This has to be visually observed and recorded according to A17.1/B44 Category 5 requirements.
2. The buffer has to survive a test with rated load unscathed.

The 1st requirement could be checked with an unloaded car manually by visual inspection without any alternative testing system.
Requirement 2 is verified in the A17.1 / B44: 2013 by a preceding baseline test with test weights. However, this case leads to the following thoughts as to why this is considered necessary:

• The buffer is type tested and has thus already proven that it can withstand the mechanical stress of the impact of a fully loaded car.
• In addition to the type test it has already proved during the technical acceptance of the elevator that it can withstand the mechanical stress of the impact of a fully loaded car and also is of appropriate design regarding mass, speed etc. for the respective elevator.
• Because of the maintenance control program it is assured, that the buffer is in good working condition (oil quality, oil level, etc) at any time. This supposed, a buffer features no wear parts that may cause the buffer not to withstand the mechanical stress of the impact of a fully loaded car if it is still able to survive the impact of an unloaded car.

The buffer test in ELVI system is carried out with an empty car at rated speed. The test is recorded with an acceleration sensor (6 kHz sampling rate), and filtered with a 100 Hz low pass filter, which corresponds to an averaging at each point for about

10ms. The resulting data will be used to determine the impact speed of the car to the buffer, but above all, to evaluate deceleration of above 2.5 g and their duration.

The procedure for performing the buffer test is as follows:

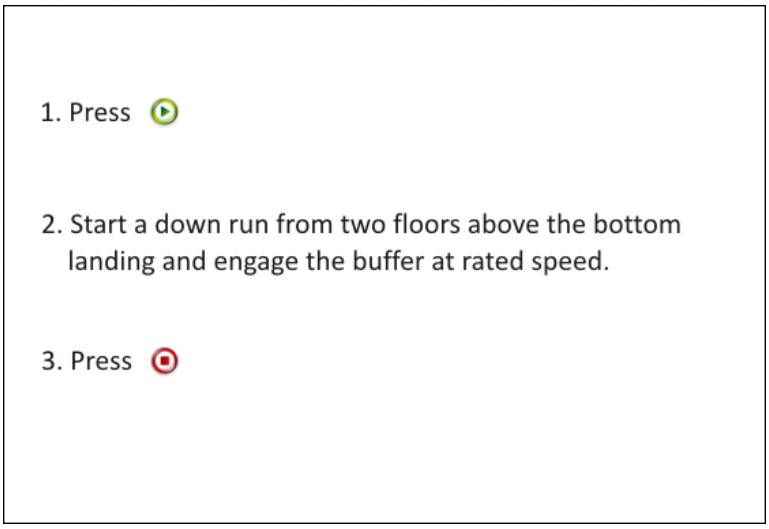


Illustration 108: Buffer Test

5.6.7 Concluding the Measurements

If all individual tests have been carried out, unit verification dialog (See Illustration 73: Dialog Individual Tests) is left with the “Finish” button. The UCD then switches to the final synchronization dialog.

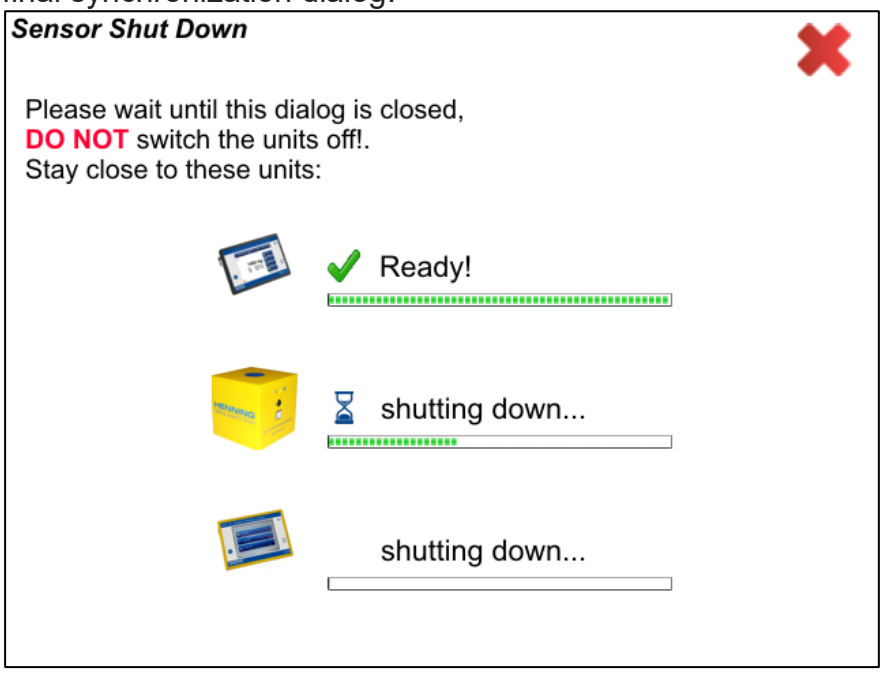


Illustration 109: Final Synchronization Dialog

At this point, the microcontrollers of the UCD, the PS2 and the MSM12 are again synchronized.

Do <u>not</u> turn off (or allow to power down) any of the devices before the UCD has returned to the home-screen (See Illustration 55: Main Menu of the UCD). Otherwise, all measurements and tests will be lost.

When UCD has returned to the main menu, all devices may be turned off and removed. The measurements of the individual tests are now permanently stored in the devices and can only be deleted via the PC software.

5.7 Output of Test Results

The PC-software developed for ELVI System PC software is available as a plug-in for the Henning sensor suite from Henning GmbH & Co. KG. Please install the software according to the instructions of the manufacturer. The ELVI System plug-in can be found after installation under the index tab “ELVI System”.

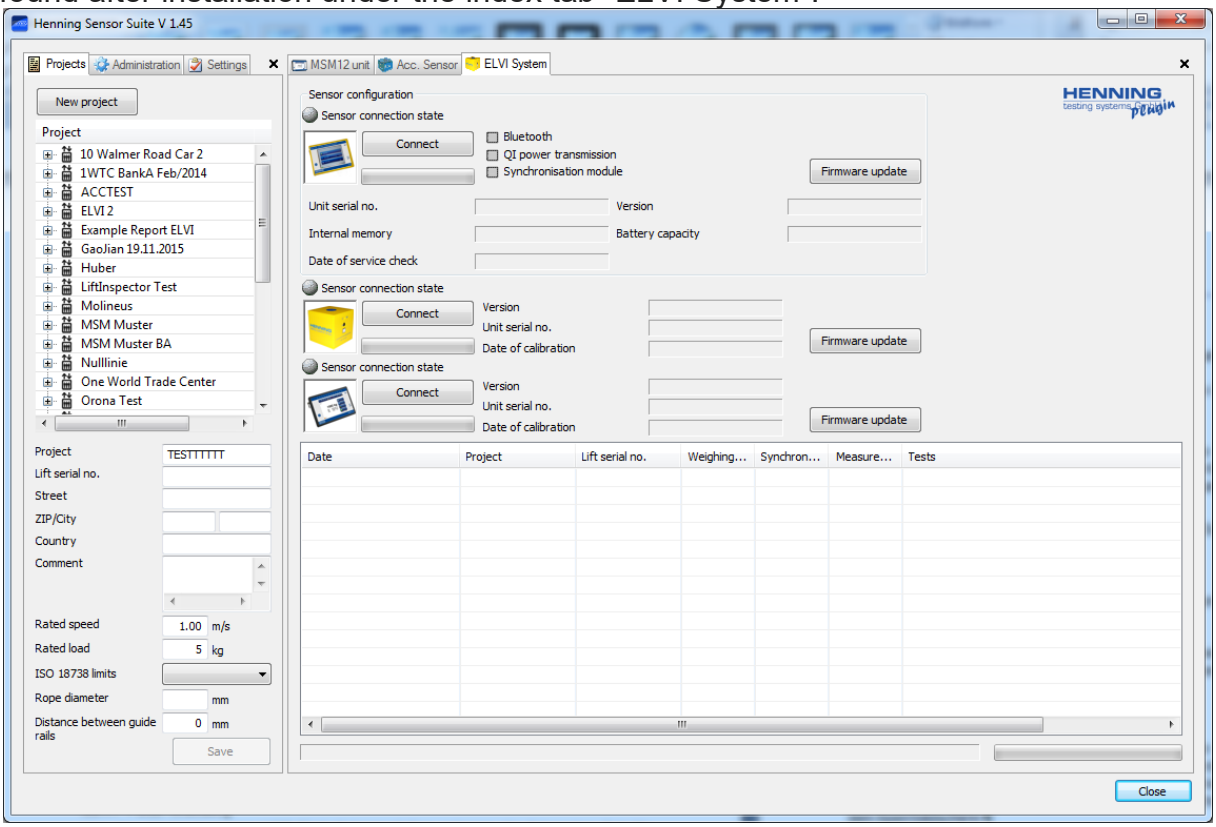


Illustration 110: Index Tab “ELVI-System”

5.7.1 Connections Devices with the PC

5.7.1.1 Connecting UCD

To build up a connection to the UCD the following steps have to be performed:

1. Switch on UCD and wait for the booting
2. Connect UCD and PC via an USB-cable
3. Press the Connect button

Once the connection is established successfully the sensor connection status changes to green and the device information is being read out. During an active connection to the computer, the UCD unit should not be used.

To terminate the connection, press the button Disconnect

In the same way, connections can be established over the Bluetooth interface (if available). Please note that the devices are initially paired with the computer (see section3.43.4).

5.7.1.2 Connecting PS2

To build up a connection to the PS2 the following steps have to be performed:

1. Switch on the PS2 and wait for the booting (status display flashing green)
2. Connect PS2 and PC via an USB-cable
3. Press the Connect button

Once the connection is established successfully the sensor connection status changes to green and the device information is being read out. During an active connection to the computer, the PS2 unit should not be used.

To terminate the connection, press the button Disconnect

In the same way, connections can be established over the Bluetooth interface (if available). Please note that the devices are initially paired with the computer (see section3.43.4).

5.7.1.3 Connecting MSM12

To build up a connection to the MSM12 the following steps have to be performed:

1. Switch on MSM12 and wait for the booting
2. Connect MSM12 and PC via an USB-cable
3. Press the Connect button

Once the connection is established successfully the sensor connection status changes to green and the device information is being read out. During an active connection to the computer, the MSM12 unit should not be used. The display will change automatically to the following lock-screen:

Illustration 111: Lock-Screen MSM12

To terminate the connection, press the button Disconnect

In the same way, connections can be established over the Bluetooth interface (if available). Please note that the devices are initially paired with the computer (see section3.43.4).

5.7.2 Device Information

Once the connection between the PC software and the corresponding unit is established, the device information is read out and displayed.

5.7.2.1 UCD

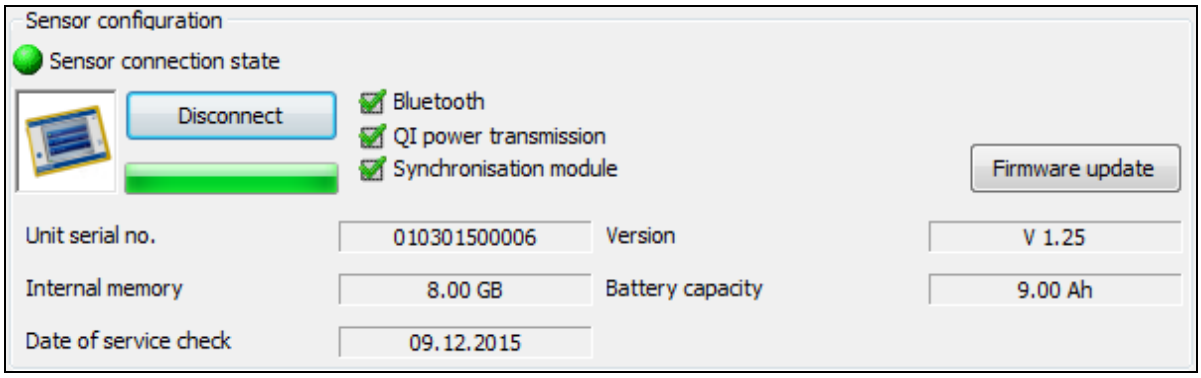


Illustration 112: Device Information UCD

Once the UCD has been connected to the PC software, serial number, date of the last service check, software version and the installed hardware options are read out and displayed. If the review date is highlighted in red, the recommended service interval has been exceeded. If the software version is displayed in red, a new firmware for the UCD (see chapter. 5.6.3 Firmware Update). is available, which should be installed.

5.7.2.2 PS2

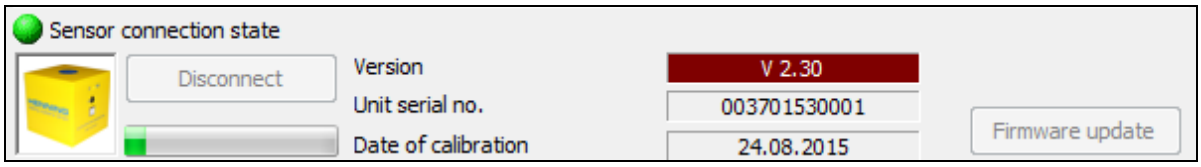


Illustration 113: Device Information PS2

Once the PS2 has been connected to the PC software, serial number, date of the last calibration and the software version are read out and displayed. If the calibration date is highlighted in red, the recommended calibration interval has been exceeded. If the software version is displayed in red, a new firmware for the PS2 (see chapter. 5.6.3 Firmware Update) is available, which should be installed.

5.7.2.3 MSM12

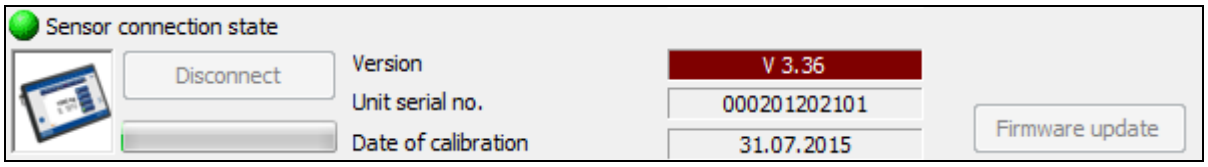
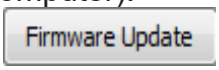


Illustration 114: Device Information MSM12

Once the MSM12 has been connected to the PC software, serial number, date of the last calibration and the software version are read out and displayed. If the calibration date is highlighted in red, the recommended calibration interval has been exceeded. If the software version is displayed in red, a new firmware for the MSM12 (see chapter. 5.6.3 Firmware Update) is available, which should be installed.

5.7.3 Firmware Update

The firmware update works the same way for all three devices. To perform a firmware update, the device has to be connected to the PC software (see Chapter 5.6.1 Connection Device to the Computer).

After that, press the button 

If a new firmware is available for installation, the process with be launched with the following message:

The firmware update can now be performed. Please do not switch of the device during the update! Please make sure, the batteries are sufficiently charged.

Once the warning has been confirmed positive, start the firmware update. This process must not be interrupted under any circumstances. During the process the progress is visualized at the bottom of the display. After the firmware update has been completed the following message appears and the device reboots:

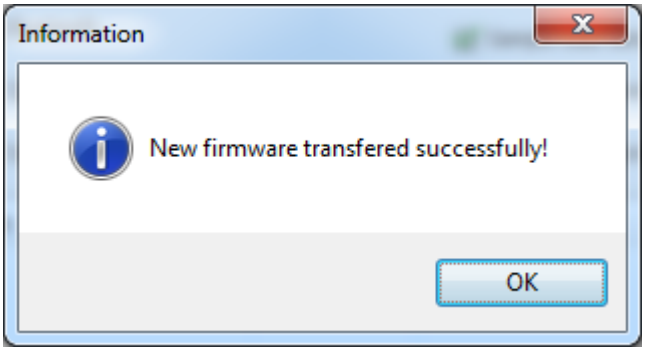


Illustration 115: Firmware-Update Completed Successfully

If the update process has been interrupted, there is possibility, that the device is no longer is in a state to be used (booting process has not finished). In this case the device must be sent back to the manufacturers to successfully complete the firmware update.

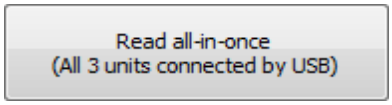
5.7.4 Reading out Measurements

The measurements are read out in stages:

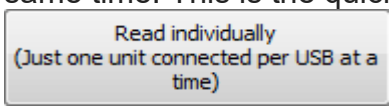
1. First, the protect-data and time stamps are read from the UCD.
2. Subsequently, the PC-software checks on the PS2 and MSM12 for corresponding measurements and reads them out.
3. In the last step the PC-software synchronizes the measurements temporal.

The MSM12 and the PS2 both have to be connected with the PC at the same time. The UCD has to be connected for the first step only.

Once the project data has been read from the UCD, an entry will be created in the list in the lower half of the dialog. This entry contains three fields marked weight data, synchronization data and metrics. These include a percentage progress bar, which is used during the read-out operations. Only if all three fields show 100%, the entire test project is fully transferred (weight data displays an empty box when the plant weights were not measured but entered manually).
As of version 1.61, the following two buttons may be used to simplify reading out the data:



If all three devices have been connected to the computer at the same time via USB interfaces (e.g., a USB hub), this function may be used to read out all data at the same time. This is the quickest and easiest way to do it.



If the computer in question features an USB interface only, this function is useful. The computer will prompt you to physically connect the devices through the USB interface. Some devices may have to be connected several times. *Note: If you have two USB ports, connect the PS2 or the MSM12 via the second interface, which speeds up the readout process.*

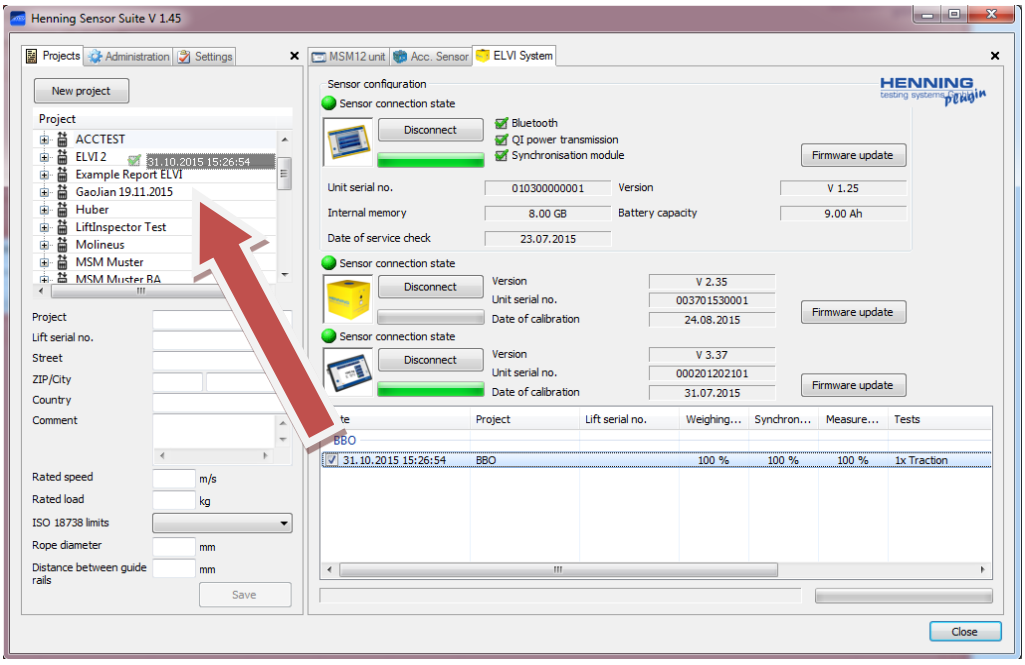


Illustration 116: Reading out measurements

The measurements are now assigned to the related projects by marking the required measurements and then moving them with pressed left mouse-key to the relevant project. As soon as the left mouse-key is released, the measurements are added to the project. Depending on the current software settings, measurements are being deleted or retained from the unit during this process.

If the data stored in the software do not match the project data created in the UCD, the following dialog appears:

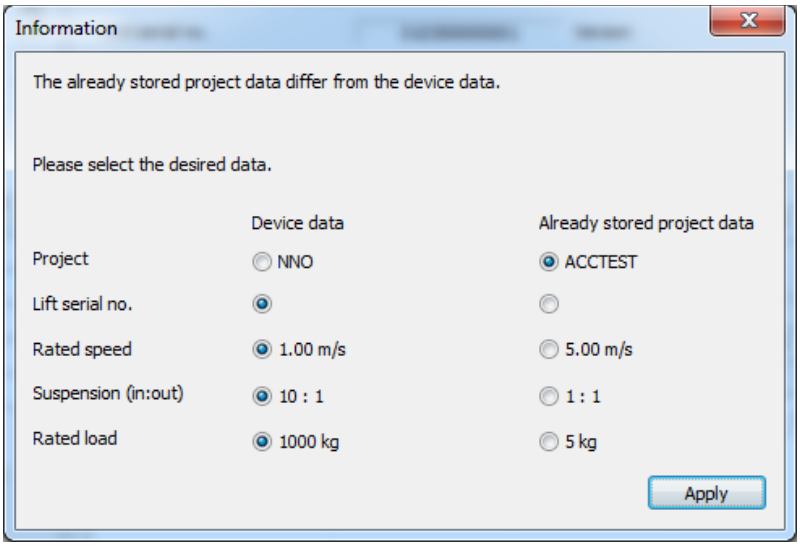


Illustration 117: Checking Project Data

You can select which of the individual project data you would like to transfer into the software.

5.7.5 Deleting Measurements

To delete measurements from the devices without prior assignment a project, the measurements in question has to be marked with a check mark in the associated selection box and the “Delete”-key on the keyboard has to be pressed. After another security question the measurements are then removed from the devices permanently.

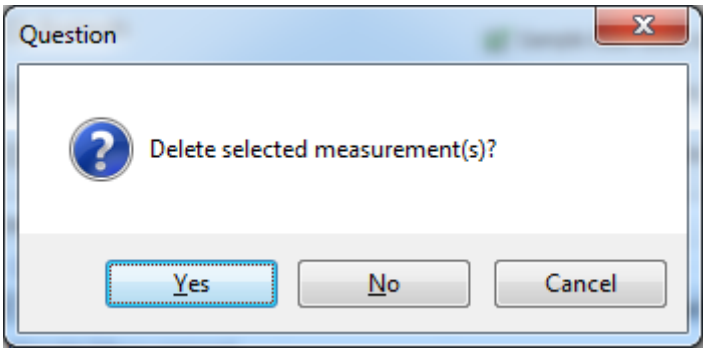


Illustration 118: Security Question “Delete selected measurement(s)?”

This process is irrevocable!

5.7.6 Displaying Measurements

Once a complete test is stored in a project, it may be displayed. For this purpose, the project in question and the subcategory “ELVI system” have to be opened and the required examination has to be selected with a double click of the left mouse key.

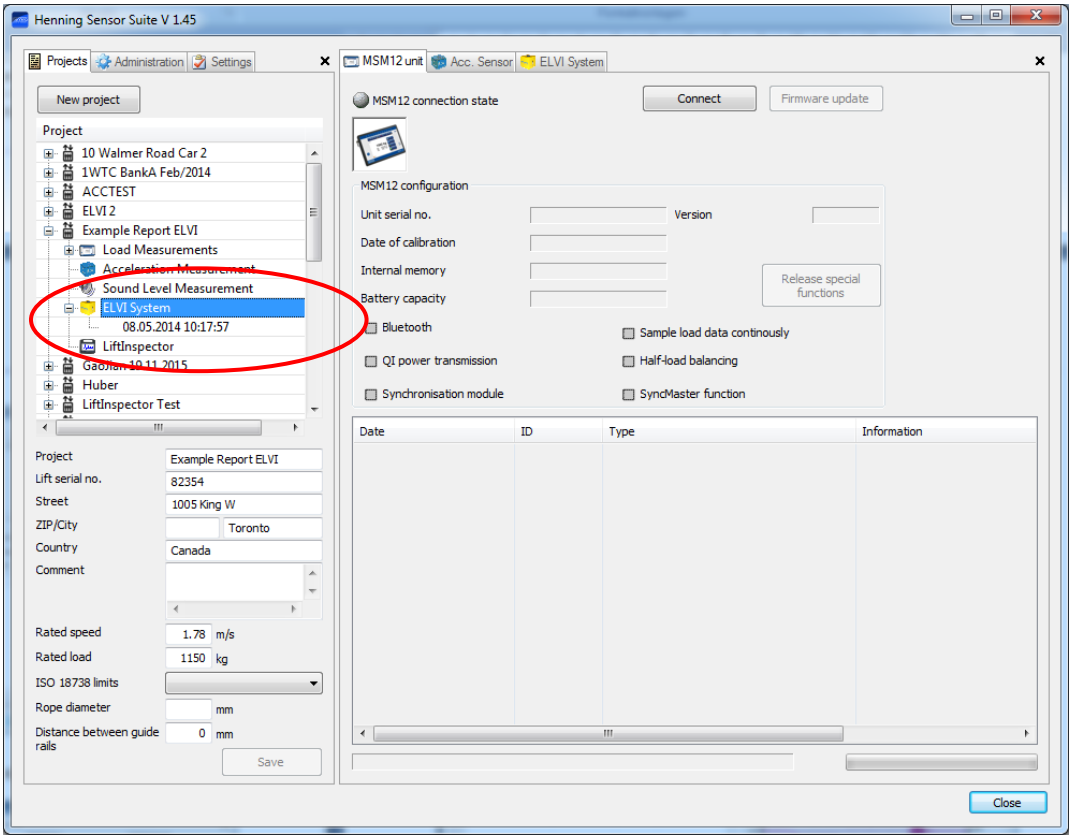


Illustration 119: Opening an Examination

The test in question opens in a new tab on the main display area:

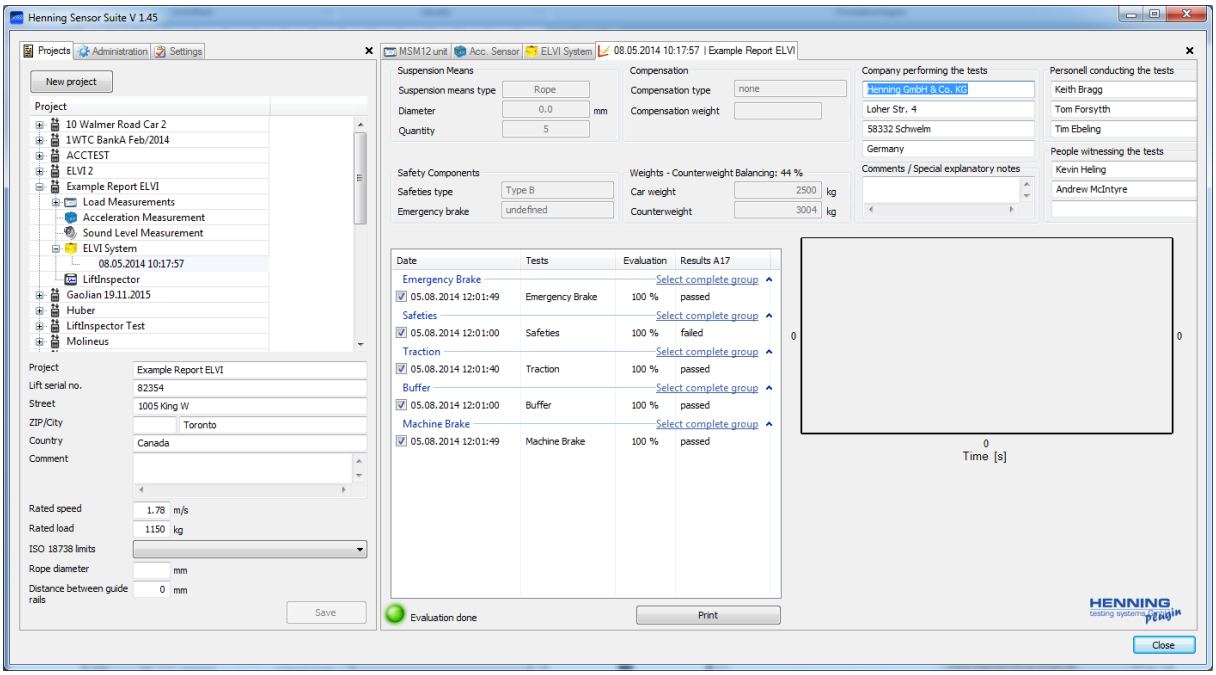


Illustration 120: Elevator Test, Individual Examinations Displayed

In the upper third of the dialog you can find the elevator data, as they have been entered in the UCD. To the right you will find fields for entering your comments. These will be taken later in the printed report. On the lower left is a list of all individual tests which have been carried out, the evaluation condition and the indication of whether the applied standard has been met with these tests or not. Right beside the list you will find a graph which is shows a single test from the list once you double click on the list entry.
A double-click into the graph maximize it as much as possible.

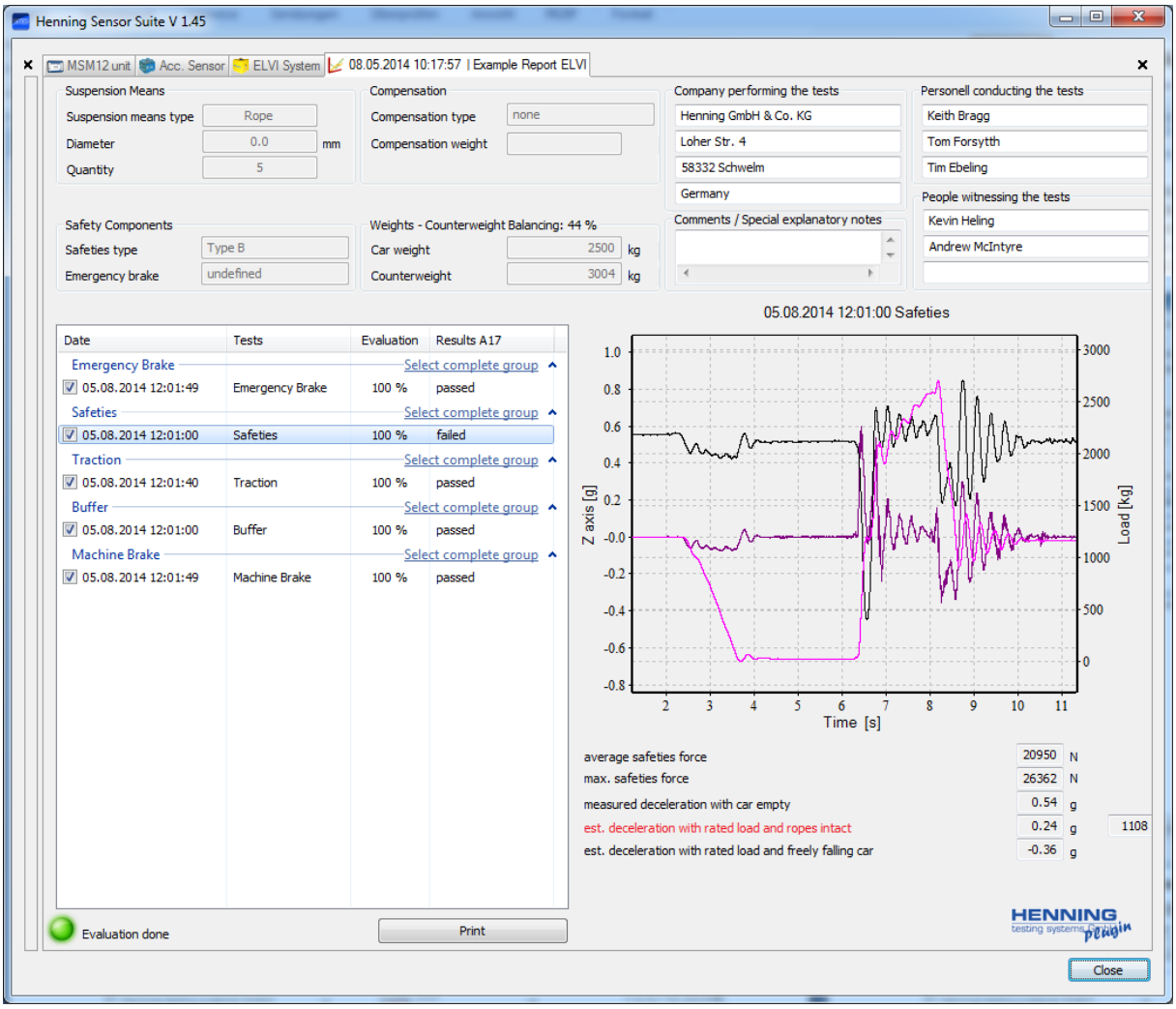


Illustration 121: Curve-Display of an Individual Test

5.7.6.1 Individual Tests

5.7.6.1.1 Printing Individual Tests in the Report

In front of each individual test you will find a check-mark. So marked individual tests are displayed in the report as soon as the button Print is pressed.

5.7.6.1.2 Deleting Individual Tests

To delete a individual test click it with the right mouse button and select in the subsequently opening context menu the entry "Delete".

The individual test is then permanently deleted after a security question.

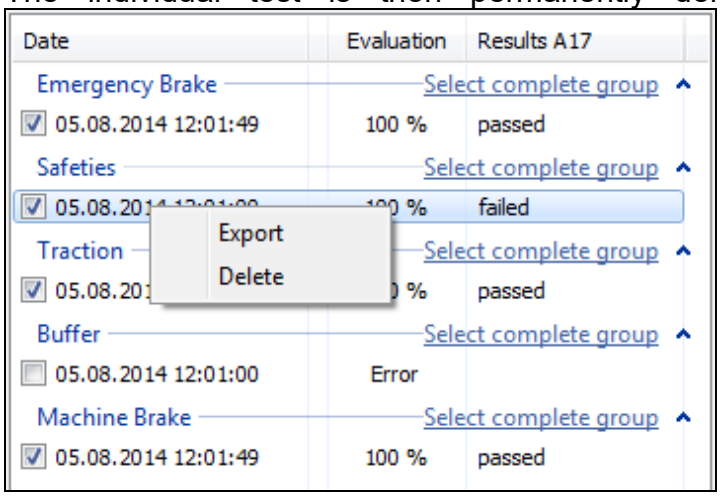


Illustration 122: Context menu for an individual test

5.7.6.1.3 Exporting the Measurement Data for an Individual Test

To export the raw data of a individual test into the CSV format (compatible MS Excel), mark the item with the right mouse button and select in the subsequently opening context menu the entry "Export".
Then a dialog box will be opened to specify the location of the export.

5.7.6.2 Evaluating the Safety Gear Test

As a result of the evaluated safety gear measurement the following values will be returned. You will also find these values in the report.

Results, which have not met the applied standard will appear red.

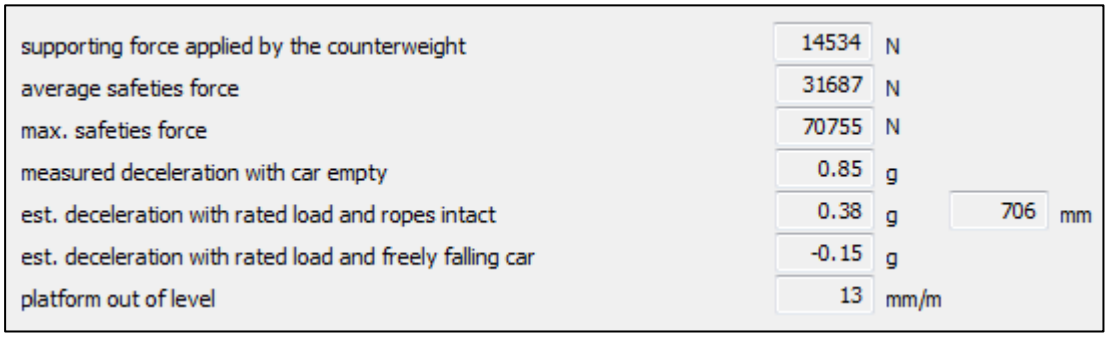


Illustration 123: Results of Safety Gear Test

Supporting force applied by the counterweight

This is the averaged amount of force which was exerted by the counterweight during the safeties test, supporting the safeties by decelerating the car.

Average Safety Brake Force
The average safety brake force is the arithmetic average of the force, which has been applied throughout the braking until the car finally came to a full stop.

Maximum Safety Brake Force
The maximum braking force is the highest force which has occurred during braking.

Measured Deceleration with Empty Car
This value is the average deceleration which has occurred during the braking. It has been measured with an empty car.

Expected Deceleration at 100% Load and Intact Ropes
This shows the deceleration a fully loaded car with intact ropes (counterweight in effect) would experience if delayed with the safety brake. Apart from deceleration, the theoretical sliding distance will be given.

Expected Deceleration at 100% Load and a Free Fall
This shows the deceleration a fully loaded car with without ropes (counterweight not in effect) would experience if delayed with the safety brake. If this value is negative, the safety brake would not be able to stop the car, which would accelerate further (with the calculated delay). If a negative value has been calculates, the safety gear has not deployed its full potential (possibly because the car was to slow or to light) or the safety brake is not sufficient for the installation.

Cabin Skew
With an additional acceleration in the horizontal Y-direction, ELVI system determines the angle to which the car has shifted during the safety gear test relative to its initial position and gives this value in vertical deflection per horizontal distance unit. If the project data of the installation includes the shaft gauge on-the gauge, the absolute vertical deflection is also shown.

5.7.6.2.1 According to EN81

Characteristics	Tested for
Average Safety Brake Force	-
Maximum Safety Brake Force	-
Measured deceleration with empty car	*With safety Brake:* Deceleration of between 0,2g and 1,0g
Expected deceleration at 100% load and intact ropes	*With instantaneous safety gear:* Deceleration greater than 0
Sliding distance	-
Expected deceleration at 100% load and free fall	*With safety Brake:* Deceleration of between 0,2g and 1,0g
Cabin Skew	-
Absolute deflection	-

5.7.6.2.2 According to A17

Characteristics	Tested for
Average Safety Brake Force	-
Maximum Safety Brake Force	-
Measured deceleration with empty car	-
Expected deceleration at 100% load and intact ropes	*With safety gear type A or C and Tiller safeties:* Deceleration greater than 0
Sliding distance	*With safety gear type B:* Review according to table 2.29.2(b) of ASME A17.2-2017
Expected deceleration at 100% load and intact ropes	-
Cabin Skew	*With safety gear type A or B and Tiller safeties:* Review according to 2.17.9.2 of ASME A17.1-2013/CSA B44-13, that the value is not greater than 30 mm per meter
Absolute deflection	*With safety gear type C:* Review according to 2.17.8.2.6 of ASME A17.1-2013/CSA B44-13, that the value is not greater than 13 mm per meter

5.7.6.2.3 According to SS550

Characteristics	Tested for
Average Safety Brake Force	-
Maximum Safety Brake Force	-
Measured deceleration with empty car	-
Expected deceleration at 100% load and intact ropes	*With instantaneous safety gears:* Deceleration greater than 0
Sliding distance	*With progressive safety gears:* Review according to table 2 of SS550 : 2009
Expected deceleration at 100% load and intact ropes	-
Cabin Skew	-
Absolute deflection	-

5.7.6.2.4 Error Outputs

If errors have been made during the test execution, or if other unforeseen events have occurred which are recognized by the plausibility algorithms, the following error outputs are possible, which are also output in the report:

Acceleration sensor exceeded its range!
The measuring range of the acceleration sensor PS2 was exceeded during the safeties test. Thus, the acceleration data could not be recorded valid, all of the results of the evaluation might be wrong!

Other brakes were acting during safeties test - repeat with brakes open
During the safeties test not all other brakes (engine brake, rope brake, etc.) were apparently kept open. As a result, the safeties may not be fully engaged because part of the deceleration has been effected by other brakes. The results obtained are therefore not based on the maximum possible force of the safeties and are therefore only conditionally conclusive. The test should be repeated with open brakes to eliminate its influence.

Too much suspension support- repeat at higher level
During the safeties test, the suspension means made up a considerable part of the car's deceleration. This is often due to the stiffness of the suspension mean. The results obtained are therefore not based on the maximum possible force of the safeties and are therefore only conditionally conclusive. The test should be repeated in a higher position in the hoistway in order to reduce the influence of the suspension means.

Test speed << rated speed - Repeat at higher speed
The safeties test was not performed at rated speed. As a result, the safeties may not be fully engaged. The results obtained are therefore not based on the maximum possible force of the safeties and are therefore only conditionally conclusive.

5.7.6.3 Evaluating Traction

For traction, the following results are displayed. These results described the maximum driving ability for both the quasi-static (non-accelerated), as well as the dynamic case (e.g. traction during emergency stop). The dynamic case is dependent on the speed; for the calculations the nominal speed, which you have entered into the project data is used.

Illustration 124: Result of Traction Test

Traction
The actual driving ability is defined as the ratio of two masses (counter-weight / cabin) to each other, the greater mass being in the numerator of the ratio. The result is the measured ratio of the masses, which can drive the system

Maximum Load Capacity
The maximum load capacity is calculated from the nominal load, the car's weight, the counterweight and the above mentioned traction. It is the maximum load that may be loaded into the car without it slipping, or the motor losing its ability to drive.

5.7.6.3.1 According to EN81

Characteristics	Tested for
Static Traction	a) The car should not slip if held with 0% of the rated load in the station. b) The car should not slip if held with 125% of the rated load in the station. c) It should not be possible to lift the empty car, if the counterweight is rested on the buffers and the motor turns in the upwards direction.
Dynamic Traction	a) Driving ability is given at an emergency stop with empty car at the rated speed. b Driving ability is given at an emergency stop with 125% of the rated load at the rated speed.

5.7.6.3.2 According to A17

Characteristics	Tested for
Static traction	a) The car should not slip if held with 0% of the rated load in the station. b) The car should not slip if held with 125% of the rated load in the station. c) It should not be possible to lift the empty car, if the counterweight is rested on the buffers and the motor turns in the upwards direction.
Dynamic traction	a) Driving ability is given at an emergency stop with empty car at the rated speed. b Driving ability is given at an emergency stop with 125% of the rated load at the rated speed.

5.7.6.3.3 According to SS550

Characteristics	Tested for
Static Traction	a) The car should not slip if held with 0% of the rated load in the station. b) The car should not slip if held with 125% of the rated load in the station. c) It should not be possible to lift the empty car, if the counterweight is rested on the buffers and the motor turns in the upwards direction.
Dynamic Traction	a) Driving ability is given at an emergency stop with empty car at the rated speed. b Driving ability is given at an emergency stop with 125% of the rated load at the rated speed.

5.7.6.4 Evaluating the Machine Brake

For the machine brake, the following values are displayed:

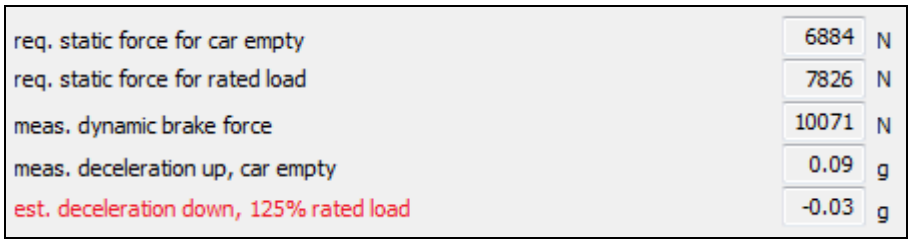


Illustration 125: Result of Machine Brake Test

Required Holding Force for Empty Car
This value is the force that has to be applied by the brake to maintain the empty car static in the station.

Required Holding Force for Loaded Car
This value is the force that has to be applied by the brake to maintain the car loaded with the rated load static in the station.

Measured Braking Force
This is the minimum braking force measured by the ELVI-system.

Measured Deceleration of Empty Car Upwards
This is the average deceleration, which has occurred during braking. This value has been measured during the test in the upwards direction (with empty car).

Expected Deceleration at 125% Downwards
This deceleration would occur, if the car with a load of 125% of the rated load going downwards at the rated speed would be stopped by the brake.

5.7.6.4.1 According to EN81

Characteristics	Tested for
Required holding force for empty car	-
Required holding force for fully loaded car	-
Measured breaking force	-
Measured deceleration for empty car upwards	-
Expected deceleration at 125% of rated load downwards	Deceleration has to be greater than 0

5.7.6.4.2 According to A17

Characteristics	Tested for
Required holding force for empty car	-
Required holding force for fully loaded car	-
Measured breaking force	Static braking force has to be at least 85% of the required holding force for empty and loaded car
Measured deceleration for empty car upwards	-
Expected deceleration at 125% of rated load downwards	Deceleration has to be greater than 0

5.7.6.4.3 According to SS550

Characteristics	Tested for
Required holding force for empty car	-
Required holding force for fully loaded car	-
Measured breaking force	-
Measured deceleration for empty car upwards	-
Expected deceleration at 125% of rated load downwards	Deceleration has to be greater than 0

5.7.6.5 Evaluating the Emergency Brake

For the machine brake, the following values analogous to the machine brake, are displayed:

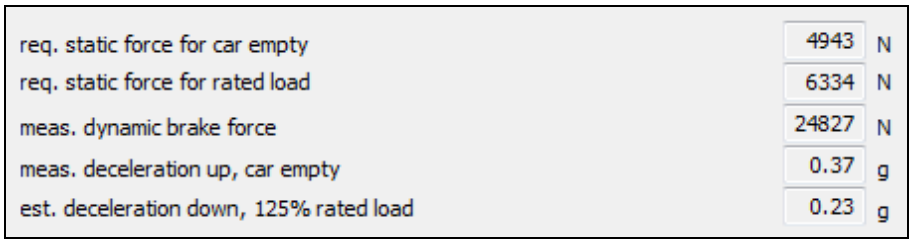


Illustration 126: Results of the Test of the Emergency Brake

Required Holding Force for Empty Car
This value is the force that has to be applied by the brake to maintain the empty car static in the station.

Required Holding Force for Loaded Car
This value is the force that has to be applied by the brake to maintain the car loaded with the rated load static in the station.

Measured Braking Force
This is the minimum braking force measured by the ELVI-system.

Measured Deceleration of Empty Car Upwards
This is the average deceleration, which has occurred during braking. This value has been measured during the test in the upwards direction (with empty car).

5.7.6.5.1 According to EN81

Characteristics	Tested for
Required holding force for empty car	-
Required holding force for fully loaded car	-
Measured breaking force	-
Measured deceleration for empty car upwards	-
Expected deceleration at 125% of rated load downwards	Deceleration has to be greater than 0

5.7.6.5.2 According to A17

Characteristics	Tested for
Required holding force for empty car	-
Required holding force for fully loaded car	-
Measured breaking force	Static braking force has to be at least 85% of the required holding force for empty and loaded car
Measured deceleration for empty car upwards	-
Expected deceleration at 125% of rated load downwards	Deceleration has to be greater than 0

5.7.6.5.3 According to SS550

Characteristics	Tested for
Required holding force for empty car	-
Required holding force for fully loaded car	-
Measured breaking force	-
Measured deceleration for empty car upwards	-
Expected deceleration at 125% of rated load downwards	Deceleration has to be greater than 0

5.7.6.6 Evaluation of Buffers

For the individual test of the buffers the following values are displayed:

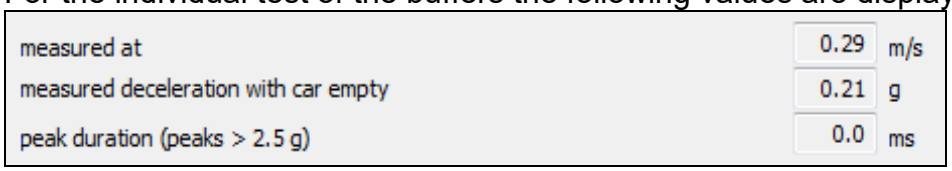


Illustration 127: Result of the Buffer Test

Measured at
The measured speed, with which the empty car has hit the buffer
Measured Deceleration with empty Car
This is the average deceleration, which has been measured during the actual impact. This value represents the deceleration measured during the test (with empty car).
Peak Duration (Peaks. > 2,5g)
This is the longest duration of the longest-lasting peak over 2.5 g deceleration signal.

5.7.6.6.1 According to EN81

Characteristics	Tested for
Measured at	-
Measured deceleration wit empty car	Deceleration has to be smaller than or equal to 9,81 m/s².
Peak Duration (Peaks > 2,5g)	The maximum duration for peaks above 2,5 g should be no longer than 40 ms.

5.7.6.6.2 According to A17

Characteristics	Tested for
Measured at	-
Measured deceleration wit empty car	Deceleration has to be smaller than or equal to 9,81 m/s².
Peak Duration (Peaks > 2,5g)	The maximum duration for peaks above 2,5 g

should be no longer than 40 ms.

5.7.6.6.3 According to SS550

Characteristics	Tested for
Measured at	-
Measured deceleration wit empty car	Deceleration has to be smaller than or equal to 9,81 m/s².
Peak Duration (Peaks > 2,5g)	The maximum duration for peaks above 2,5 g should be no longer than 40 ms.

5.7.7 Creating the Report

Each individual test may be marked with a check mar in the list. Marked test will be printed out in the report when the button „Print” is pressed.

The report consists of a cover page, showing the technical data of the installation as well as information regarding the examination. The following pages show the individual test with the evaluation results. The results are displayed exactly like in the software interface and include the curve display.

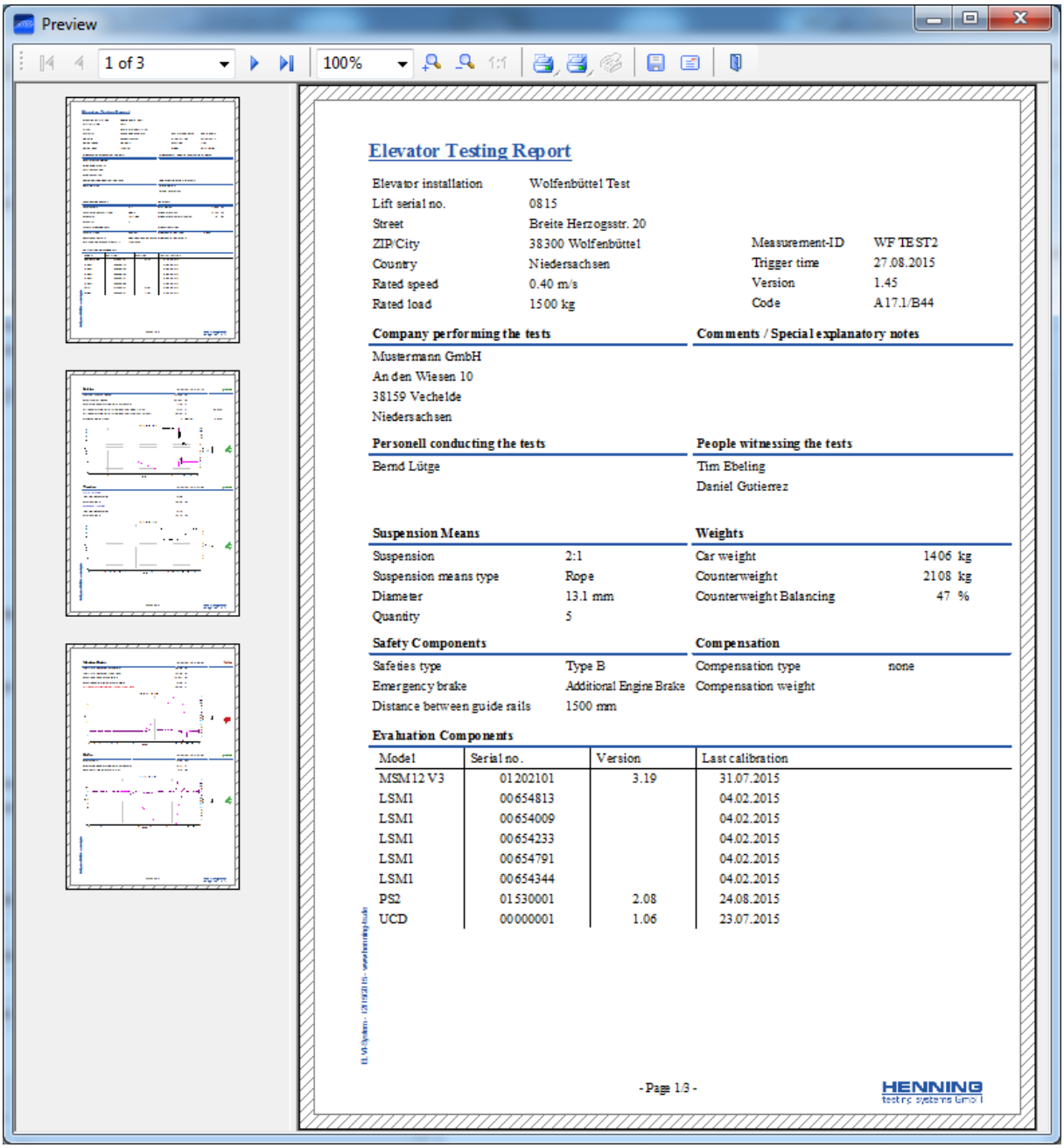


Illustration 128: Test Report Cover Sheet

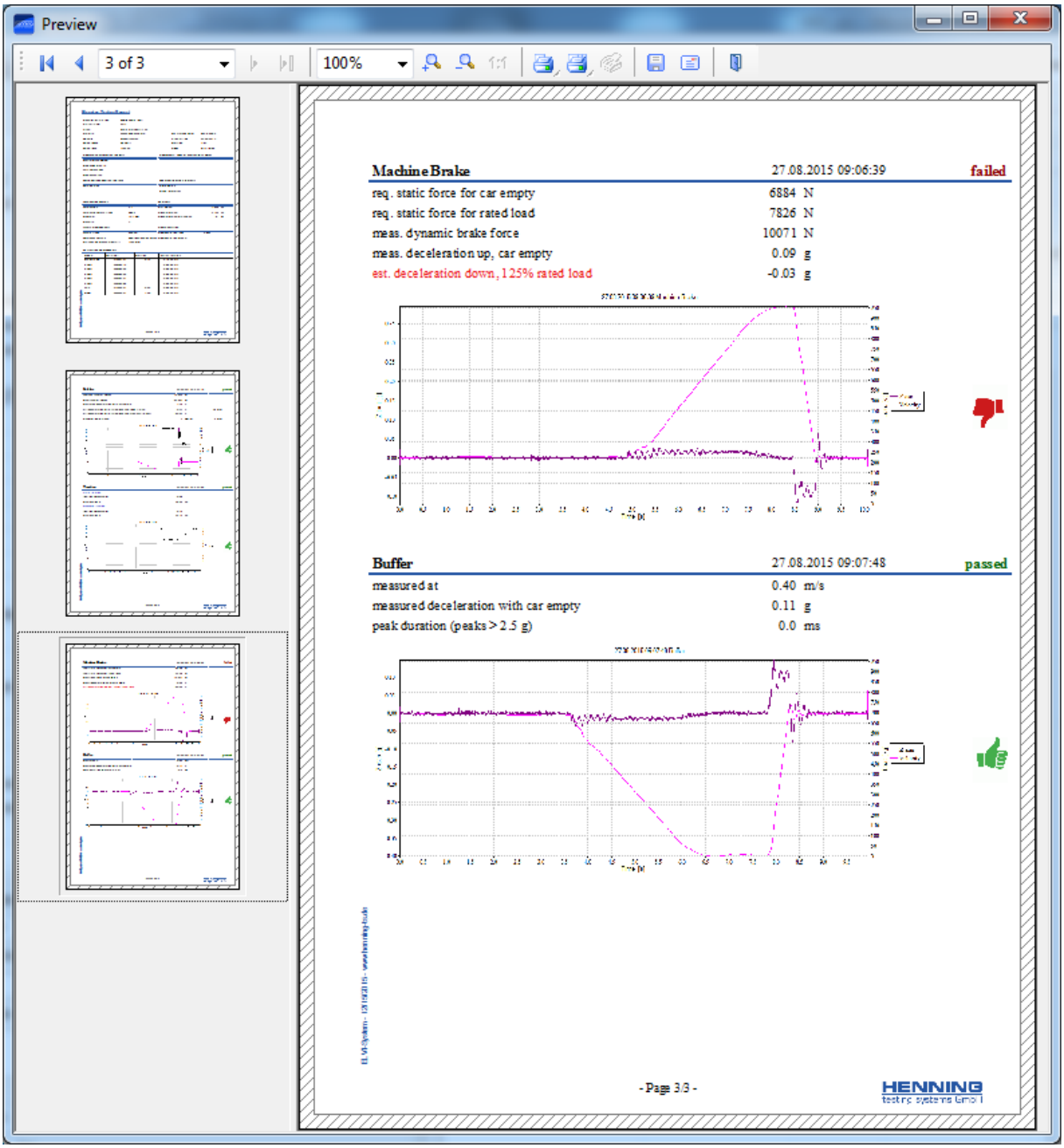


Illustration 129: Test Report Individual Tests

5.8 Course of Testing

Course of testing with the ELVI system 25.10.2014
Initial testing, completing and establishing the baseline report Rev. 1.7
for Electric Elevators

1. Counterweight Weight Measurement

Conditi-ons:

	required	suggested	be aware of
Machine Brake	normal operation		
Emergency Brake	normal operation		
Safeties	unset		
Positioning of car		Place the car a little bit above half-way, to easily access the ropes above the counterweight and above the car	If the elevator has compensation chains/cables, insert their weight/pull-force below the counterweight at the current position into the counterweight “correction” input field in the software
Car moving direction	not moving		
Speed	zero		
Car load	empty		

Actions to perform the test:

1. Access the top of the car, run the car down to the midpoint of the hoist way where the shackles on the counterweight and car are accessible.
2. Install the rope sensors on the counterweight ropes according the procedures in the manual.
3. Verify the sensors are providing an output into the program.
4. Verify the sensors are within the tolerance of the rope tension sensors.
5. Save the measurements in the system.
6. Remove the sensors from the counterweight ropes and move to the car ropes.

Actions based on test results:
None.

2. Car Weight Measurement

Conditions:

	required	suggested	be aware of
Machine Brake	normal operation		
Emergency Brake	normal operation		
Safeties	unset		
Positioning of car	car at bottom to weigh car		Consider significant contribution of Tie-down-compensation, insert the weights into input field in the software. See further information on assuring accurate weights in footnote below
Car moving direction	not moving		guide shoe friction1
Speed	zero		
Car load	empty		

Actions to perform the test:

1. Install the rope sensors on the car ropes according the procedures in the system manual.
2. Verify the sensors are providing an output into the program.
3. Verify the sensors are within the tolerance of the rope tension sensors.
4. Save the measurement in system software.
5. Remove the sensors from the counterweight ropes and move to the car ropes.

Actions based on test results:

None.

Caution: In the case of 2 to 1 or greater roping arrangements, take extra special care that the sensors are not overrun during the measuring travel!

Relative to accurate weights, system users will find that the rope sensors are the most efficient and accurate method when processes and methods are understood and followed. Refer to Quick Reference Guide and Video Training Tutorial provided by Wurtec and Henning. A useful method for accurate weights in systems with tie-down compensation is to measure the force of the compensation assembly on the compensation ropes (from top of car when it is at bottom). There is an equal force below the car – which can be subtracted from the Henning rope sensor measured car weight. Questions? Contact Wurtec.

[1] If there is **significant friction between the car or counterweight and their guide rails, the measured weight may be affected. In such a case, it is best to measure the weight during inspection operation while running. This effect is found more likely in the case of slide guide shoes (not as likely with roller guides).**
If possible, clamp the sensors onto the rope at least 8 in (200 mm) directly above the load to be measured and run the car up a short distance at inspection speed. If there is no difference between the measured load during the constant travel and while standing still, there is no friction to speak of in the guides and it will not be necessary to carry out the measurement during travel. If there is a significant difference between the travel and the standstill value, make a note of the value measured during the upward travel and then run the car down with constant speed. Make a note of this value too. The average of the readings obtained during upward and downward travel is the real weight without friction. By this method of running upwards and downwards and the subsequent determination of an average value you have eliminated the dynamic and static friction of the elevator from the measurements.

3. Weight Balance Measurement

This is an automatically generated value, just informative.

Conditions:
None.

Actions to perform the test:
None.

Actions based on test results:
None.

Important reminder: If you make any change e.g. weight balance, you must repeat measurements.

4. Machine Brake Test without weights

Conditi-ons:

	Required	suggested	be aware of
Machine Brake	energized then dropped at rated speed	With the accelerometer sensor installed and the rope sensors in place, run the car up from the controller at rated speed, open a stop switch to create an emergency stop.	1 - Inadequate braking force not allowing car to stop moving. 2 – Loss of traction not allowing car to stop moving.
Emergency Brake	energized and kept open while machine brake is tested	Either with a jumper or a mechanical blocking device, hold the emergency brake open	In the event the machine brake does not stop the car, drop the emergency brake if provided.
Safeties	normal operation		
Positioning of car		start three landings below top landing	Limit the amount of room the car has to accelerate in case brake fails to decelerate the car.
Car moving direction	Up		
Speed	rated speed		
Car load	Empty		

Actions to perform the test:

1. Leave the acceleration sensor (blue cube) in place for the duration of the test.
2. For 1:1 suspension, leave the rope sensors above the car
   For 2:1 suspension or higher, install the rope sensors at the rope fixing point on car side.
   Verify the sensors are all providing an output.
3. Assure the emergency brake (if provided) is not allowed to drop.
4. Select Brake Test on the recording device of the top of the car. Start recording.
5. Start an up run and initiate an emergency stop with the car at rated speed.
6. Access the top of the car and stop the recording.

Actions based on test results:

Passed: Verifies the brake is capable to fulfil the demands of A17.1-2013/B44-13
Failed: Adjust the brake force and repeat the test.

5. Emergency Brake Test without weights

Conditions:	required	Suggested	be aware of
Machine Brake	energized and kept open while emergency brake is tested	Either with a jumper or a mechanical blocking device, hold the machine brake open	In the event the emergency brake does not stop the car, drop the machine brake.
Emergency Brake	energized then dropped at rated speed	With the accelerometer sensor installed and the rope sensors in place, run the car up from the controller at rated speed, open a stop switch to create an emergency stop.	1 - Inadequate braking force not allowing car to stop moving. 2 – Loss of traction not allowing car to stop moving.
Safeties	normal operation		
Positioning of car		start three landings below top landing	Limit the amount of room the car has to accelerate if the brake fails to decelerate the car.
Car moving direction	up		
Speed	rated speed		
Car load	empty		

Actions to perform the test:

1. If the elevator is not equipped with an emergency brake, go to Safety Test.
2. Leave the acceleration sensor and rope sensors on the car ropes in place for the duration of the test.
3. Assure the machine brake is not allowed to drop.
4. Select Emergency Brake Test on the recording device of the top of the car. Start recording.
5. Start an up run and initiate an emergency stop with the car at rated speed.
6. Access the top of the car and stop the recording.

Actions based on test results:

Passed: Verify the emergency brake stops with a minimum of 125% braking force. No further action required. Once completed, seal the brake adjustment per code requirements.

Failed: If less than 125%, adjust the brake force and repeat the test.

Important reminder: If you change anything at the emergency brake and you already did this brake test with weights, you have to re-do this brake test. This assures you have a valid baseline.

6. Safety Test without weights

Conditi-ons:

	Required	sugges-ted	be aware of
Machine Brake	normal operation	kept open	Message “Review” in the report indicates that brake was not held open.
Emergency Brake	normal operation	kept open	Message “Review” in the report indicates that brake was not held open.
Safeties	1 - governor tripped while car moves down at rated speed 2 - jump the safety operated switch		
Position-ing of car		start at upper floor	
Car mo-ving di-rection	Down		
Speed	rated speed		
Car load	Empty		

Actions to perform the test:

1. Leave the acceleration sensor and rope sensors on the car ropes in place for the duration of the test
2. Select the type of safety being tested, Type A, B, or C.
3. Jump out the safety operated switch if present.
4. Start the recording software on the laptop on top of the car.
5. From the controller, start a down automatic run with the doors disabled.
6. Engage the safeties at rated speed by manually tripping the governor.
7. Complete the Traction Test before retrieving the laptop from the top of the car and stopping the recording.

Actions based on the test result:

Passed: Verify the test result displays “Passed”

Failed: If “Failed” is displayed, adjust the safeties and repeat the test

Note: The system compares for Type B safeties the est. slide length to table 2.17.3 A17.1-2013/B44-13. For Type A and Type C Safeties, if the “deceleration with rated load and ropes intact” is greater or equal to zero, “passed” is displayed indicating the car was stopped. If the “deceleration with rated load and ropes intact” less than zero “failed” is displayed indicating the car will not stop.

Note: The system can detect the added stopping force of the brake. If the brake assisted and the slide length was not within the min/max stopping distances, the soft-

ware will display “**Review, repeat test with brake open**”. If the brake did not assist and the slide length was not within the min/max stopping distances, the software will display “**Failed**”.
Important reminder: If you change anything at the safeties und you already did the safeties test with weights, you have to re-do the safeties test. This assures you have a valid baseline.

7. Traction Test without weights

Conditions:

	required	suggested	be aware of
Machine Brake	normal operation		the test must be run for a minimum of 2 seconds, the system is recording on the top of the car
Emergency Brake	normal operation		
Safeties	engaged	immediately after the safety set, be prepared to run the machine while still set to cause sheave to slip traction	
Positioning of car	where the car stopped on safety		
Car moving direction	down		
Speed	ropes slipping over the sheave on inspection speed		
Car load	empty		

Actions to perform the test:

1. Leave the safeties activated (car cannot move).
2. Run the car down on inspection operation until the ropes slip over the sheave or the maximum torque of the machine is reached for a minimum of 2 seconds.
3. Run the car up to release the safety.
4. Access the recording device and stop recording.

Actions based on test results:

Passed: Verify the display shows a value.
Failed: Increase traction and repeat the test
Note: The traction value should be above 1.00 on the ELVI report.
Important reminder: If you change anything at the elevator e.g. weight balance to increase traction and you already did the traction alternative test, you have to re-do the traction test. This assures a valid baseline.

8. Machine Brake Test with weights
Actions to perform the test:

1. Do the acceptance test acc. A17.1-2013/B44-13 Section 8.10

Important reminder: If you adjust anything relative to this step and you already did the alternative test without weights, you have to re-do the alternative test.
At acceptance testing confirm a pass result. Cat 5 Testing, no load required if prior baseline was done.

9. Emergency Brake Test with weights
Actions to perform the test:

1. Do the acceptance test acc. A17.1-2013/B44-13 Section 8.10

Important reminder: If you change anything with the emergency brake and you already did the alternative test without weights, you have to re-do the alternative test.
At acceptance testing confirm a pass result. Cat 5 Testing, no load required if prior baseline was done.

10. Safety Test with weights
Actions to perform the test:

1. Do the acceptance test acc. A17.1-2013/B44-13 Section 8.10

Important reminder: If you change anything with the safeties and you already did the alternative test without weights, you have to re-do the alternative test.
At acceptance testing confirm a pass result. Cat 5 Testing, no load required if prior baseline was done.

11. Buffer Test with weights
Actions to perform the test:

1. Do the acceptance test acc. A17.1-2013/B44-13 Section 8.10

Important reminder: If you change anything with the buffer and you already did the alternative test without weights, you have to re-do the alternative test.
At acceptance testing confirm a pass result. Cat 5 Testing, no load required if prior baseline was done.

12. Establishing the Buffer Baseline without weights

Conditions:

	required	Suggested	be aware of
Machine Brake	normal operation		Go ahead and do item 11 first
Emergency Brake	normal operation		
Safeties	normal operation		
Positioning of car		car at second landing	
Car moving direction	down		
Speed	Any at acceptance; but at Cat 5 it must be repeated at the same speed as acceptance	Inspection speed	
Car load	empty		

Actions to perform the test:

1. Leave the acceleration sensor in place for the duration of the test.
2. Select Buffer Test on the recording device of the top of the car. Start recording.
3. Start a down run from two floors above the bottom landing and engage the buffer at rated speed.
4. Access the top of the car and stop the recording.

Actions based on test results:

Passed: Verify the test “Passed”.

Failed: Inspect/maintain the buffer and repeat the test.

Note: The system compares the measured accelerations even for the test without weights to the requirements of 2.22.4.2 from A17.1-2013/B44-13. In the sense of it, it creates a “failed” if the deceleration was higher than 1 g or the maximum peak-time for peaks above 24.5 m/s² or 80.5ft/s² is longer than 40 ms.

Important reminder: If you change anything with the buffers and you already did the buffer test with weights, you have to re-do the buffer test with weights.

REFERENCE ITEM 11 TO THIS PROCEDURE.

5.9 Measuring and testing hydraulic elevators

The pressure sensor HS1 is used for measurements on hydraulically operated elevator systems. Its measured values are recorded via a direct USB connection to the computer.

5.9.1 Creating a project

In order to carry out measurements on a hydraulically operated elevators, the elevator must be installed as a project in the Henning Sensor Suite (see chapter 5.7.4) and a hydraulic ELVI measurement must be added. The latter is done by opening the project tree of the relevant project and selecting the "Create new hydraulic test" function from the context menu of the "ELVI System" entry.
The context menu opens by clicking with the right mouse button on the project branch "ELVI-System".

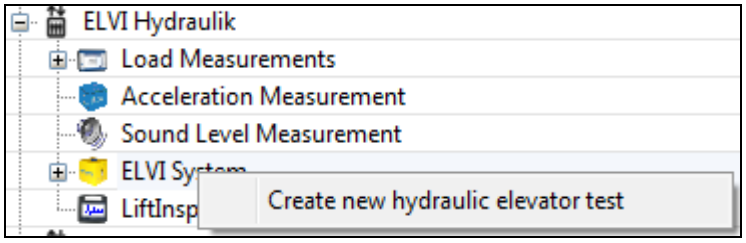


Illustration 130: Create new hydraulic elevator test

For the hydraulic test, the following dialog box opens, which is also opened after opening existing measurements on hydraulic elevators:

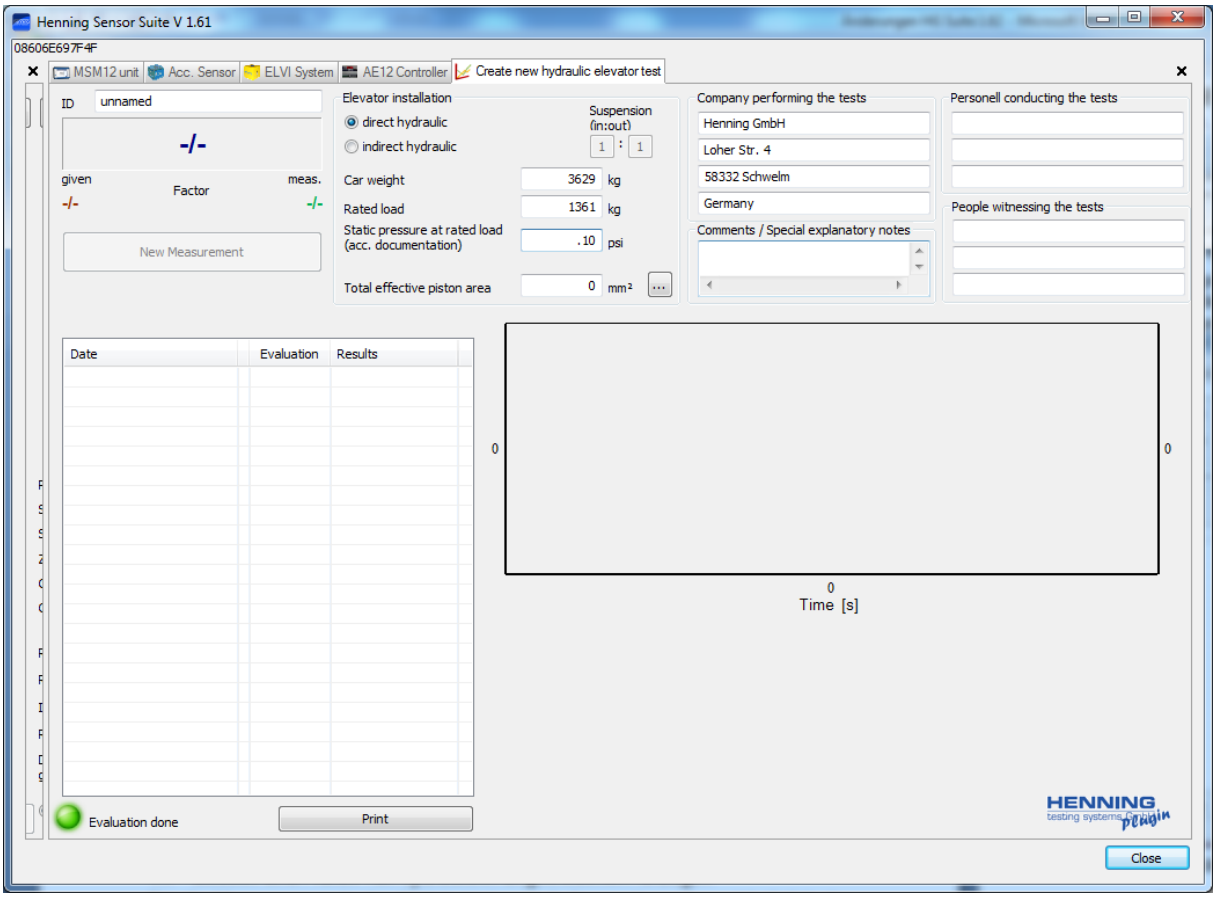


Illustration 131: Dialog box for measuring hydraulic elevators

5.9.1.1 Entering project data

An ID may be assigned to each individual test of a hydraulically operated elevator can be assigned an **ID** with which enables the user to retrieve the test from the project tree.

The software requires the information, whether the installation it is a **direct hydraulic**, or an **indirect hydraulic** lift. In the case of the latter, the suspension ratio (drive to output) is to be entered. As a rule, this is 1: 2 for indirectly hydraulic elevators.

In addition to the **car weight**, the **nominal load** is also a necessary project parameter.

For many of the hydraulic tests the **static pressure at rated load** is an important factor. If this is not known, the software can determine this value by means of a special measurement (see chapter 5.9.3.10) if the **total effective piston area** has been specified.

For this, a fill-in aid exists in the form of a calculator, which opens when the button [...] is used. Among other things, a list of current jack-types with their effective piston surface areas are shown, which may be selected from the list.

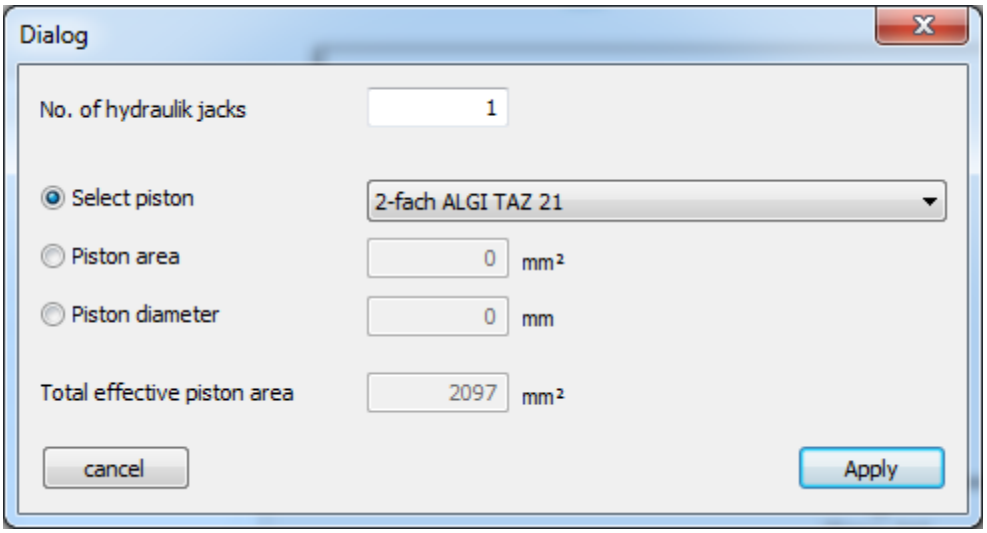


Illustration 132: Calculator for effective piston surface area

Once the necessary parameters have been filled, the measurement can be carried out with the pressure sensor HS 1. (See chapter0). The pressure currently measured by the pressure sensor HS1 is shown in the dialog field. The prerequisite for this is, that the pressure sensor is connected to the computer and the corresponding drivers have been installed. The pressure is shown just below the ID in the preselected unit.

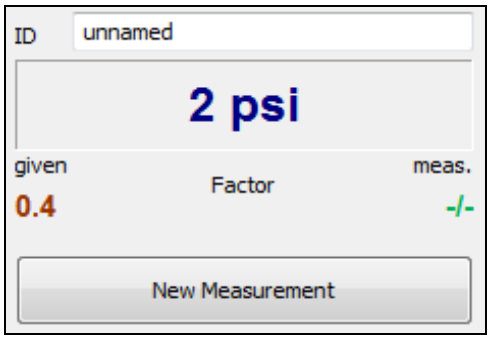
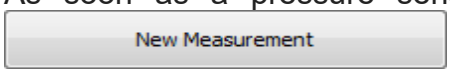


Illustration 133: Reading out the pressure sensor HS1

Below the displayed value, two factors are output:
The "entered factor" is the ratio between the pressure entered as "static pressure at nominal load" and the current measured value; the "measured factor" is the correspondent value with the self-measured static pressure at nominal load.
(see chapter 5.9.3.10).

5.9.2 Carrying out the individual measurements

As soon as a pressure sensor HS1 is available in the software, the button 

will be released. A click on this opens a submenu in which the current measurement task may be selected. Depending on which measurement task is selected, various evaluation functions are executed after the measurement has ended.

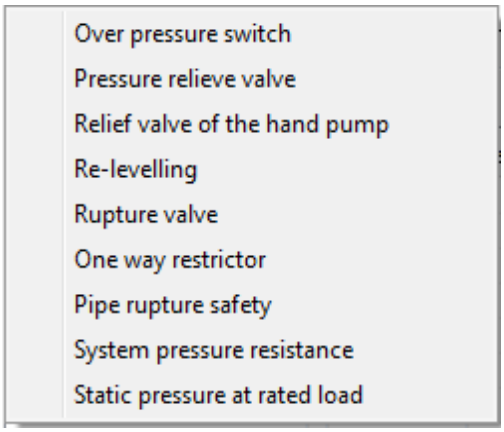


Illustration 134: Selecting measurement task upon starting a measurement

As soon as a measurement has been started, the current pressure profile (including the factors for the static pressure at nominal load) is displayed in a diagram. It should be noted that only a part of the measured data is displayed, since the high sampling rate would prevent a fluent online display.

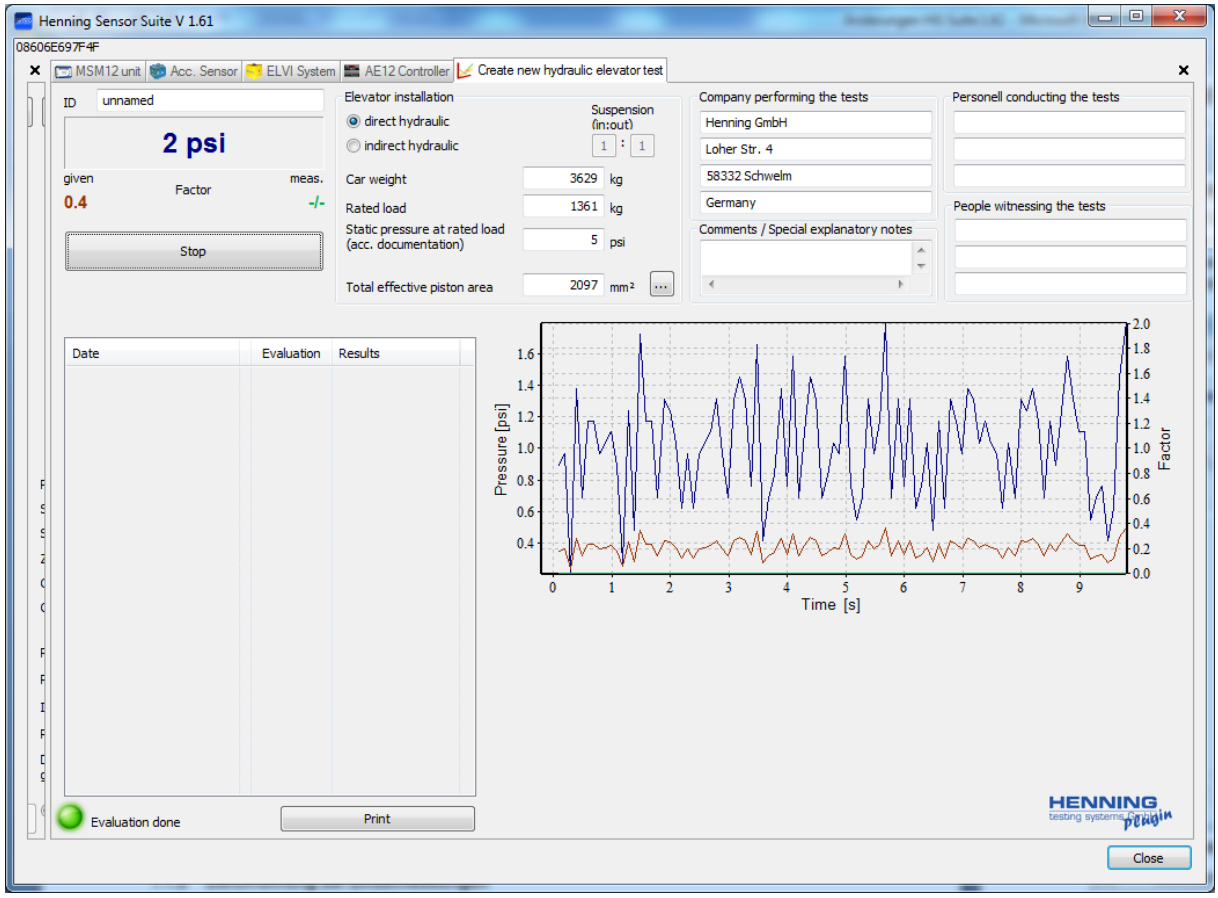
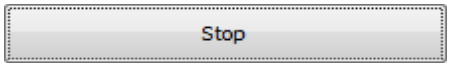


Illustration 135: Curve display when measurement has been started

The measurement can be terminated with a click on the button 

As soon as this is done, the measurement is dis-

played in the list view, with the corresponding measurement task, the date and time, and the evaluation is started.

5.9.3 Reading out measurement data

5.9.3.1 Individual test

5.9.3.1.1 Opening an individual test

To display the pressure distribution of a measurement, the corresponding entry in the list is double-clicked. This displays both the pressure profile (and also the course of the factors) over time in the diagram view, as well as the evaluation results below the diagram.

5.9.3.1.2 Report individual tests

In front of each individual test you will find a check-mark. So marked individual tests are displayed in the report as soon as the button Print is pressed.

5.9.3.1.3 Deleting individual tests

To delete a individual test click it with the right mouse button and select in the subsequently opening context menu the entry "Delete".
The individual test is then permanently deleted after a security question.

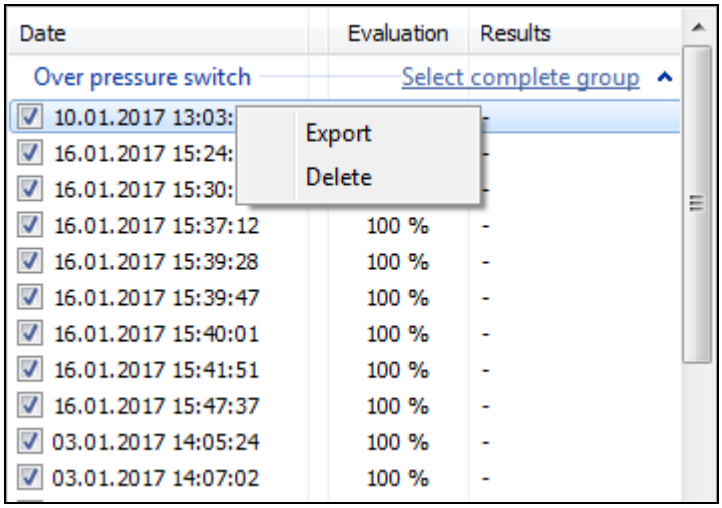


Illustration 136: Context menu for an individual test

5.9.3.1.4 Exporting the Measurement Data for an Individual Test

To export the raw data of a individual test into the CSV format (compatible MS Excel), mark the item with the right mouse button and select in the subsequently opening context menu the entry "Export".
Then a dialog box will be opened to specify the location of the export.

5.9.3.2 Measuring the over pressure switch

For this measurement, technical experts are required to check, at which pressure the over pressure switch is activated.

For this purpose, technical experts should perform the following steps during the current pressure measurement carried out by the HS1 sensor:

- Close stop valve
- Build up pressure
- Wait till the over pressure switch is activated.

The software of the inspection system automatically determines the maximum pressure reached and makes it available to the expert. Subsequently, the expert must evaluate this display reading and decide, whether the check was successful.

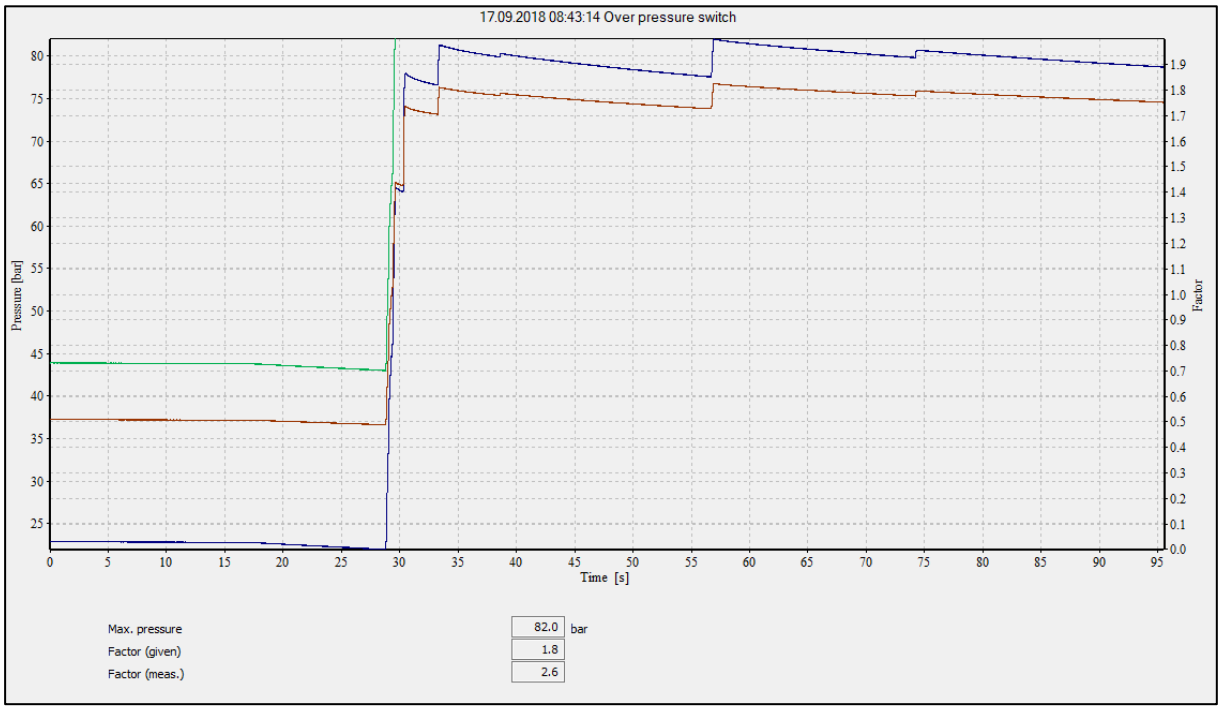


Illustration 137: Sample measurement of an over pressure switch

5.9.3.3 Measuring the pressure relief valve

For this measurement, technical experts are required to check that the pressure relief valve responds at the latest to 1.4 times static pressure (static pressure at payload)
The experts can measure the pressure progression during a time period using the hydraulic sensor HS1 and store for documentation. The software analyses the pressure progression and automatically defines max. pressure.
Technical experts should perform the following steps during the current pressure measurement:

- Bridge the bridge switch in the switch caret
- Drive the elevator up
- In doing so, close the stop sluice valve slowly.

The pressure relief valve will be activated at some point of time. The software defines the max. pressure achieved, and the experts can observe if this pressure value is

less than 1.4 fold static pressure at payload, and decide, whether the check was successful.

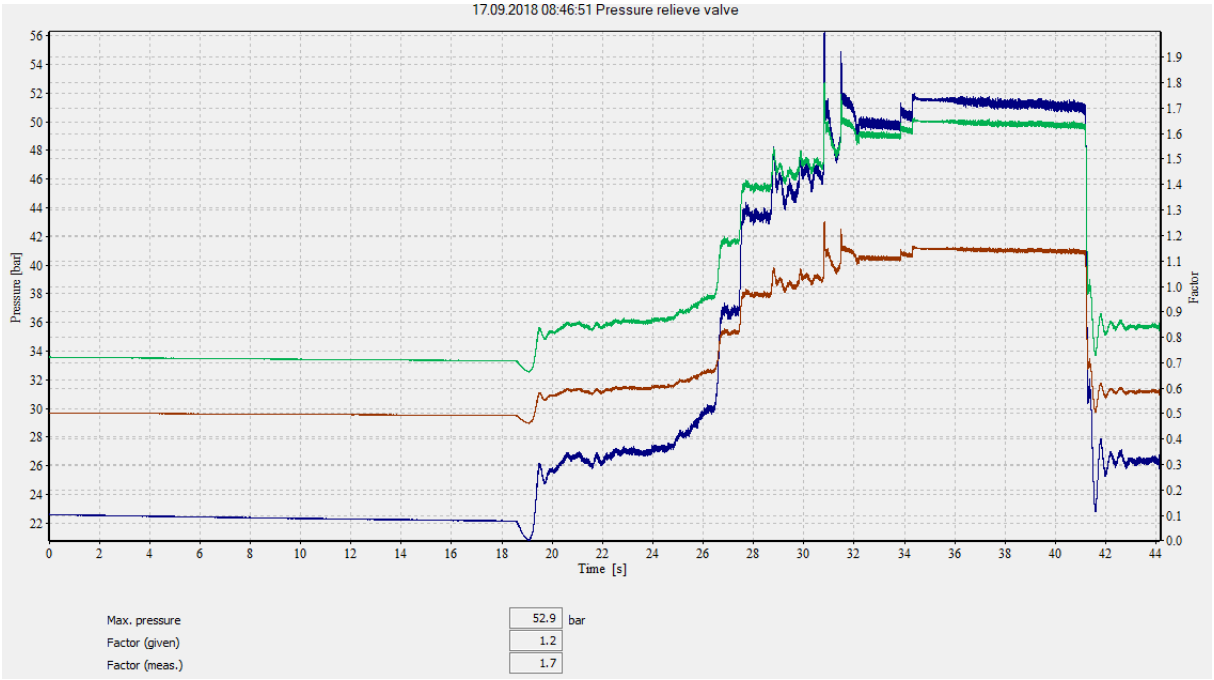


Illustration 138: Sample measurement of a pressure relief valve

5.9.3.4 Measuring the pressure relief valve of the hand pump

For this measurement, technical experts are required to check that pressure relief valve responds to the given pressure limit (max. 2,3 times static pressure at payload).
The experts can measure the pressure progression during a time period using the hydraulic sensor HS1 and store for documentation. The software analyses the pressure progression and automatically defines max. pressure limit.
Technical experts should perform the following steps during the current pressure measurement:

- Close the stop valve
- Press the hand pump till max. pressure is achieved.

The pressure relief valve will be activated at some point of time. The software defines the max. pressure achieved, and the experts can and decide, whether the check was successful at this pressure value.

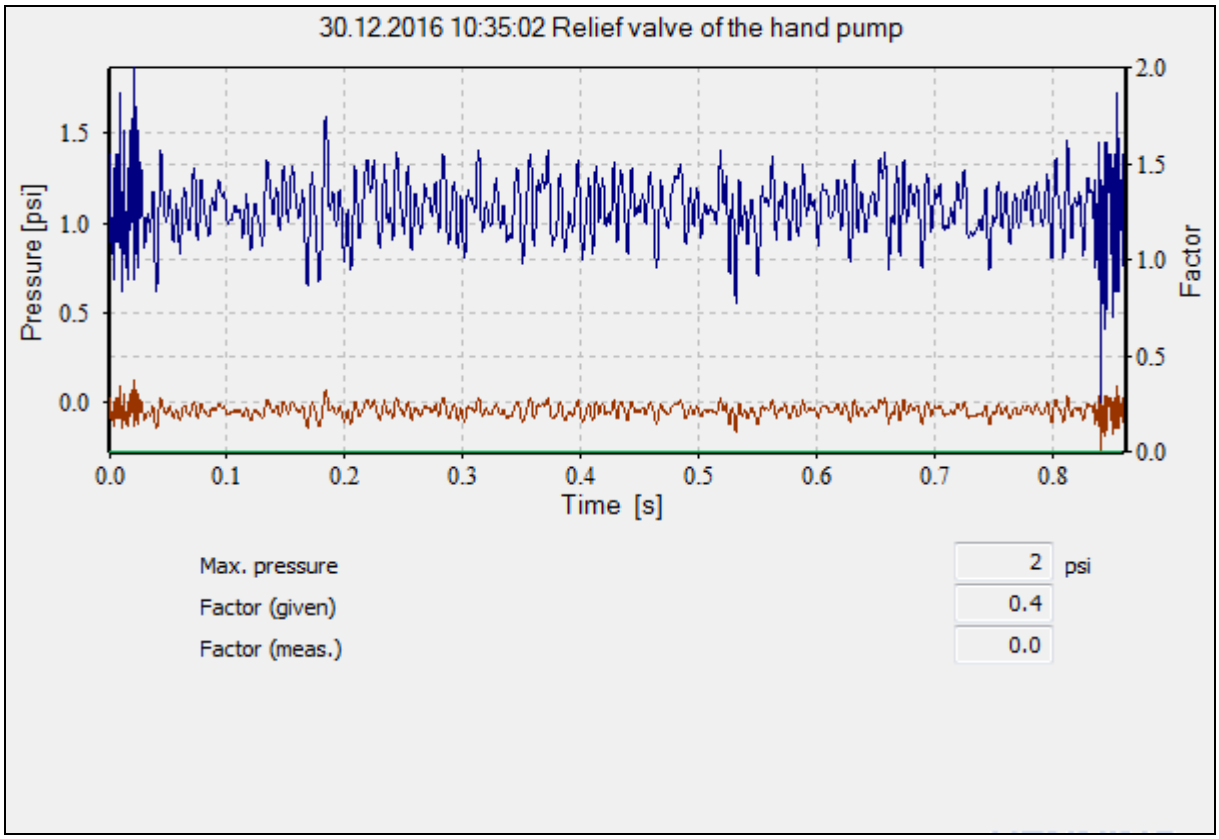


Illustration 139: Sample Measurement of the relief valve of the hand pump

5.9.3.5 Measuring the re-levelling

5.9.3.5.1 Checking the functionality of the re-levelling

The function and the effectiveness of the re-levelling switch are manually checked by technical experts without the software support.
Technical experts should perform the following steps:

- The unloaded car is travelled from the lowest to the top landing, stopping at every single floor.
- Emergency lowering will be performed at every floor to check the electrical functionality of the re-levelling.

5.9.3.5.2 Effectiveness of the re-levelling

The functionality of the re-levelling will be checked by technical experts. Technical experts should perform the following steps:

- The unloaded elevator is run till the piston end stop.

The sensor HS1 will measure the pressure. The software defines the max. pressure achieved, and the experts can observe if this pressure value corresponds with min. 1.4 times static pressure at payload, and decide, whether the check was successful.

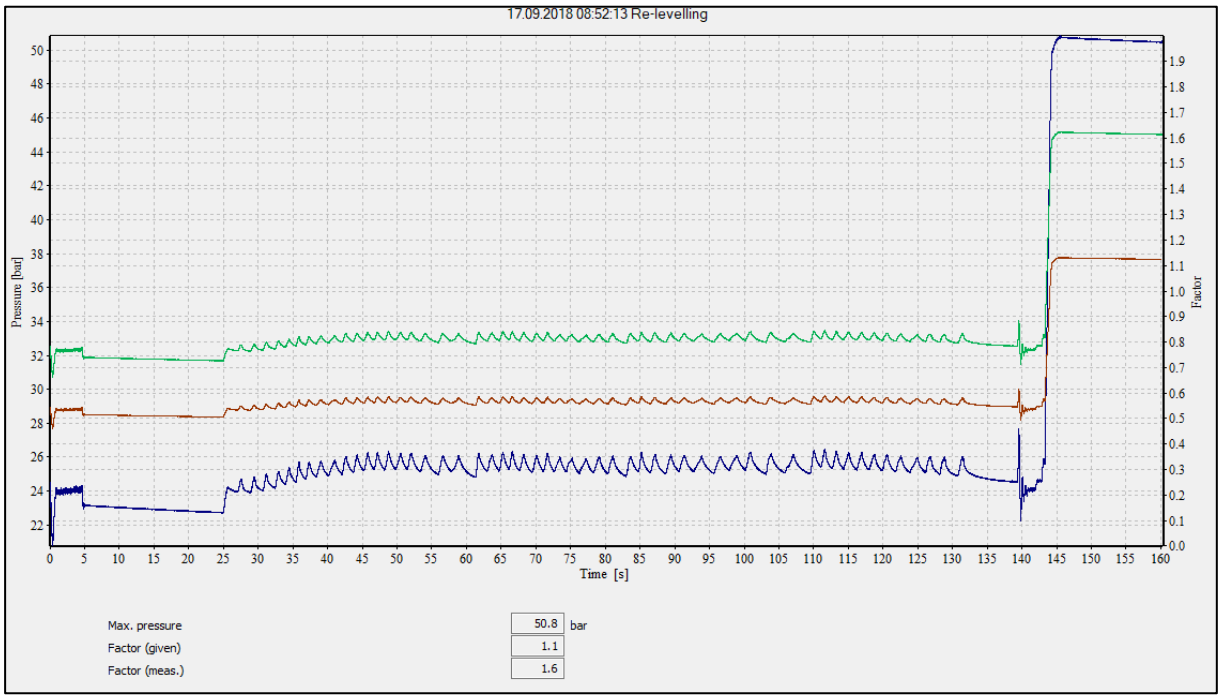


Illustration 140: Sample measurement of the re-levelling function

5.9.3.6 Measuring the rupture valve

For a proper functioning of the rupture valve it is necessary to prove if the valve is activated during the down run of the elevator, when the necessary flow volume is provided.
During the down run of the elevator, please activate the manual device that provides the above mentioned flow amount. The sensor HS1 will measure the pressure for this elevator run.
By observing the displayed pressure progression and discovering the pressure drop on the graph, the expert defines whether the rupture valve was activated.

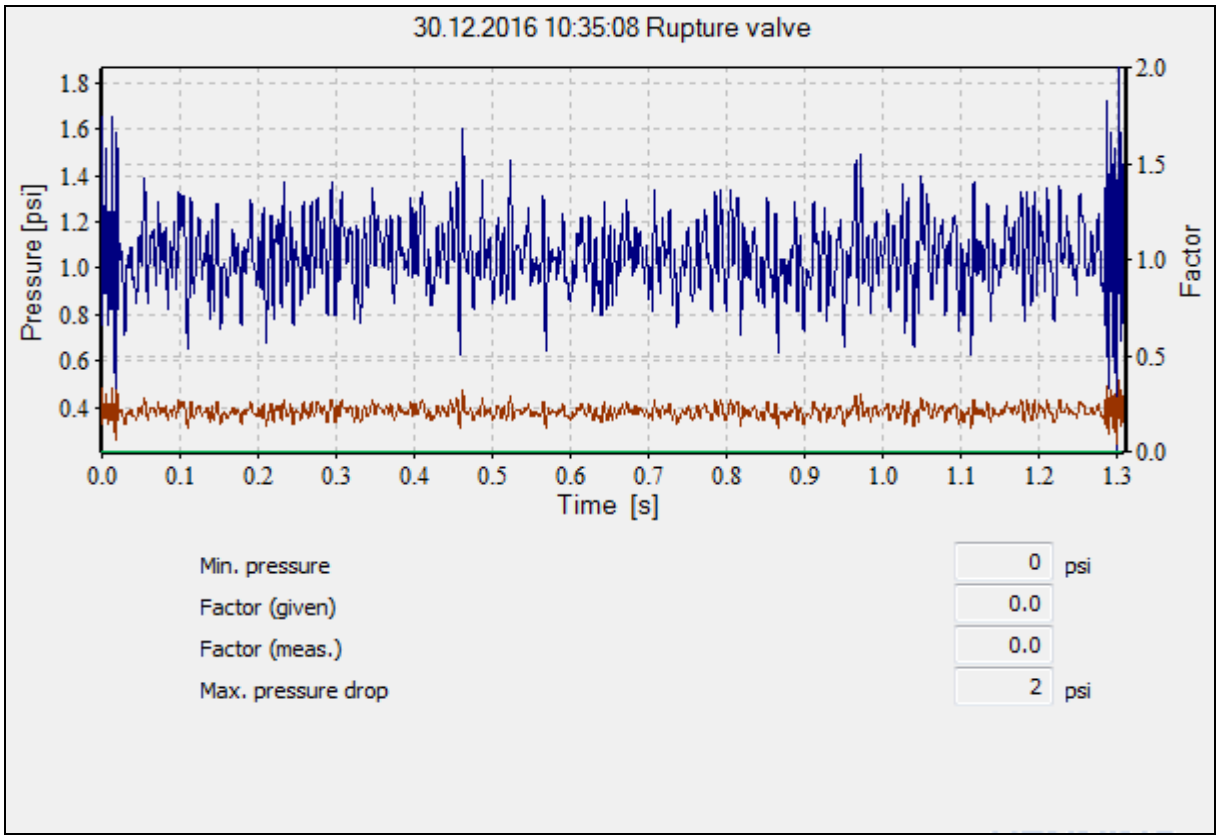


Illustration 141: Sample measurement of the rupture valve

5.9.3.7 Measuring the one way restrictor

For a proper functioning of the one way restrictor it is necessary to prove if the valve is activated during the down run of the elevator, when the necessary flow volume is provided.
During the down run of the elevator please activate the manual device that provides the above mentioned flow amount. The sensor HS1 will measure the pressure for this elevator run.
By observing the displayed pressure progression and discovering the pressure drop on the graph, the expert defines whether the one way restrictor was activated.

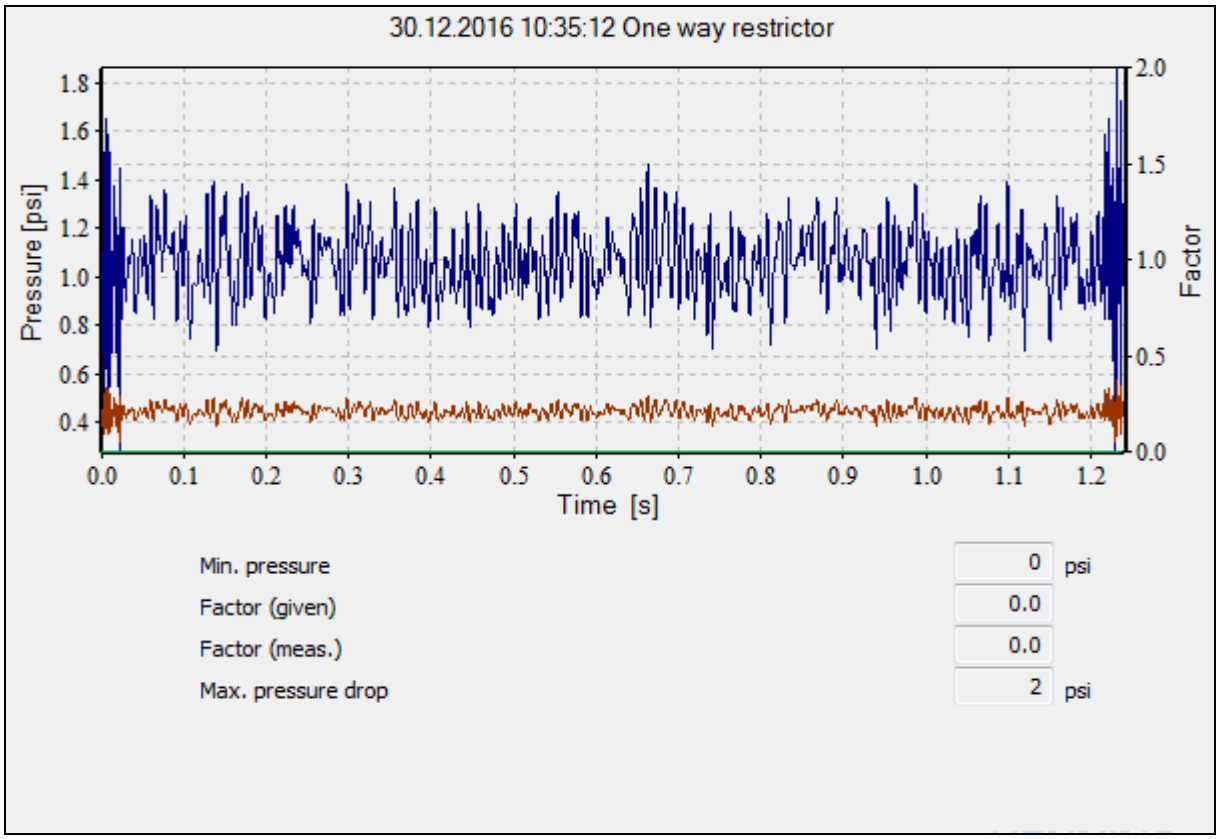


Illustration 142: Sample measurement of the one way restrictor

5.9.3.8 Measurement of the pipe rupture safety

The effectiveness of the pipe fracture protection or of the line break valve is given when the car is immediately stopped and held down as soon as the downward nominal speed is exceeded by 0.3 m/s.
The expert performs a downward travel and, during this, releases the manually actuated device, Flow rate in the line break valve / pipe breakage protection. From the recorded pressure profile, the expert determines whether the tube breakage arrestor has tripped by searching for a corresponding pressure drop in the curve. In addition, it is also recommended to carry out a measurement with the acceleration sensor PS2 in order to check compliance with any delay limits. The software of the test system can record the max. reached speed, the average delay and the duration of delays greater than 2.5g. On the basis of these values, the expert can check whether the test has been passed.

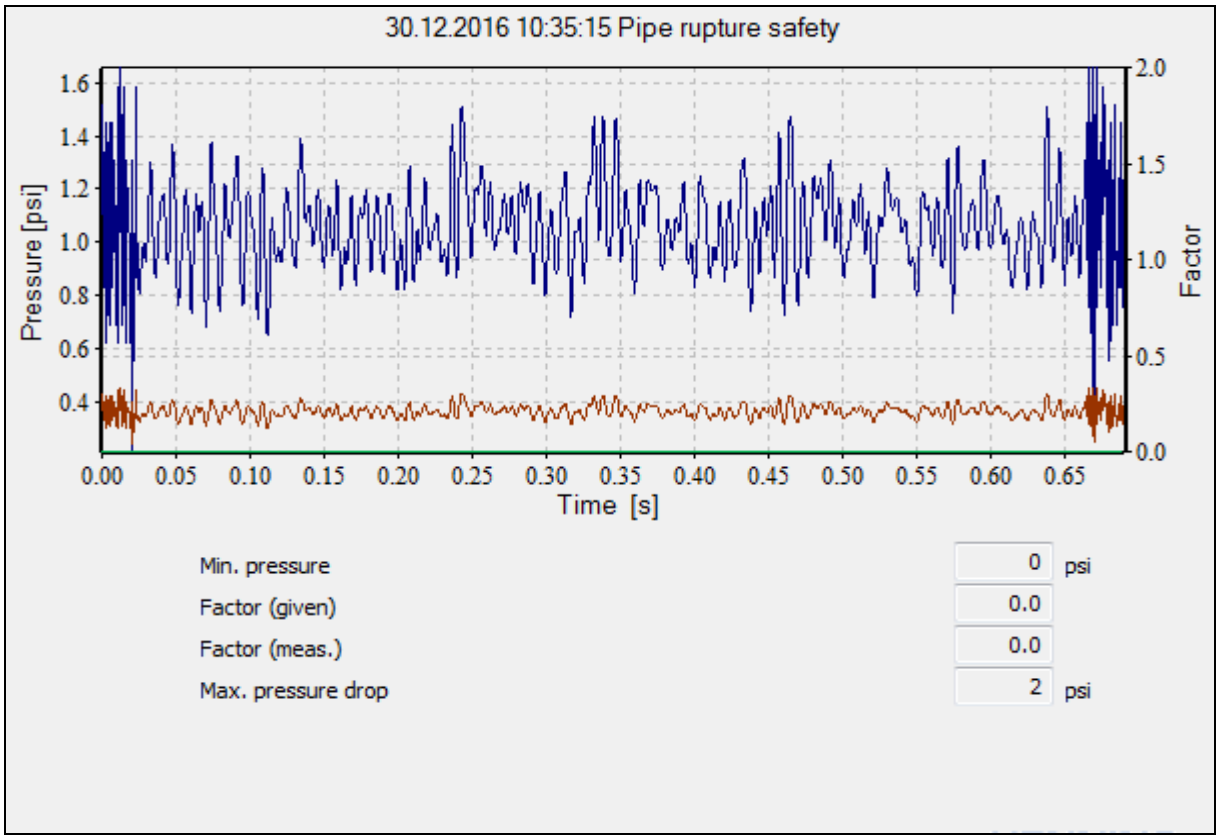


Illustration 143: Sample measurement of a pipe rupture safety

5.9.3.9 Measuring the system pressure resistance

This check is defined for tests prior to the commissioning in the standard. For commissioning, the car loaded with the rated load is travelled to the top landing. Afterwards, it is to be tested that, within 10min, the car does not descend by more than 10mm. After commissioning, the test result is manually transferred by the expert into the protocol.

In order to check the system pressure resistance by repeated inspections without rated load, immediately after the test for effectiveness of the re-levelling the car is left standing with at least that pressure which is reached at rated load in the piston stop area for minimum 10min, while the pressure measurement with the hydraulic sensor HS1 is continued.

At the end of the 10min the pressure measurement is finished, and the pressure drop within the 10min is determined by the expert from the pressure pattern. In addition, the expert determines by how many millimetres the car has lowered within the 10min. From these two results the expert decides on the test result of the system pressure resistance. This check at the time of commissioning must be carried out as described in the standard, by verifying that “the car loaded with rated load standing in the top landing does not sink by more than 10 mm in 10 minutes“

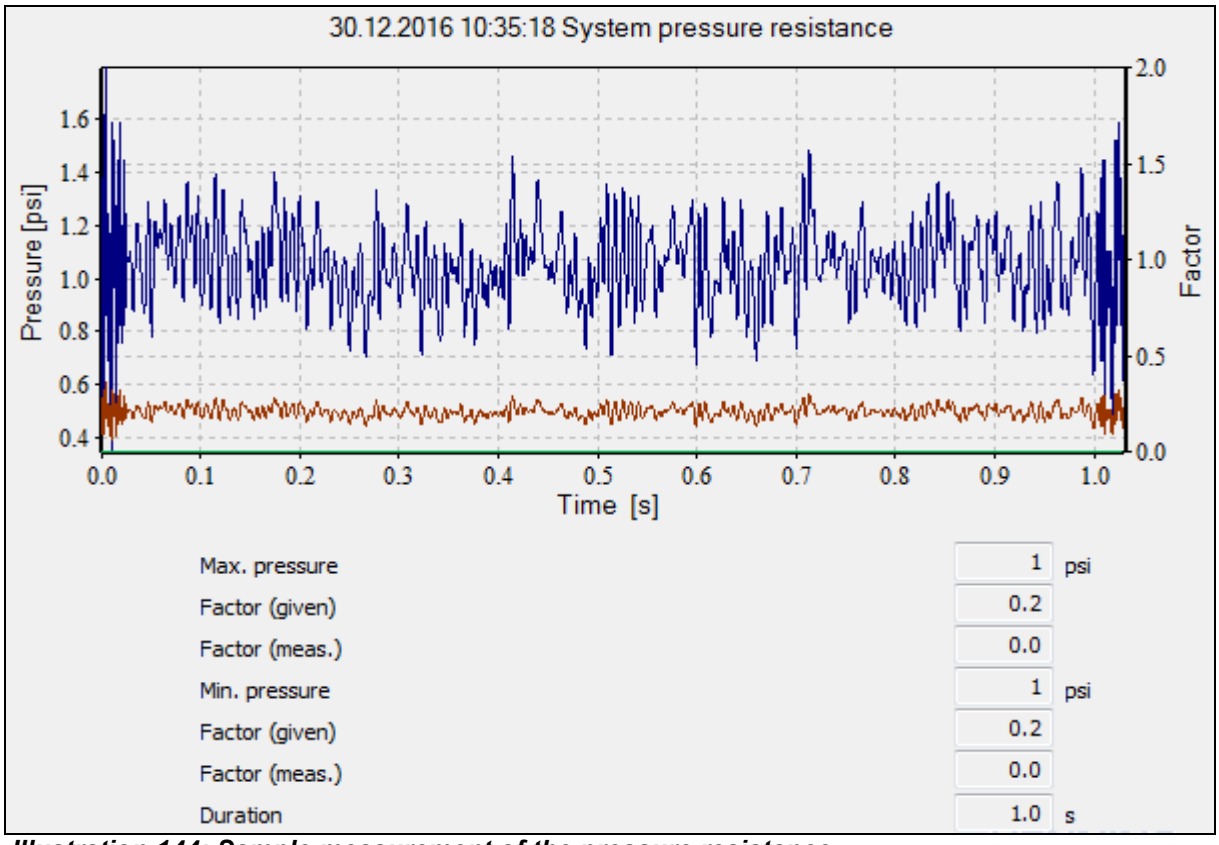


Illustration 144: Sample measurement of the pressure resistance

5.9.3.10 Measurement of the static pressure at payload

In order to calculate the static pressure at rated load, when rated load is not available, the analytic algorithms should have data about the static pressure of the elevator at no load.
For this purpose, the expert conducts the full run of the elevator, arriving at each stopping point once during the up run and once during the down run.

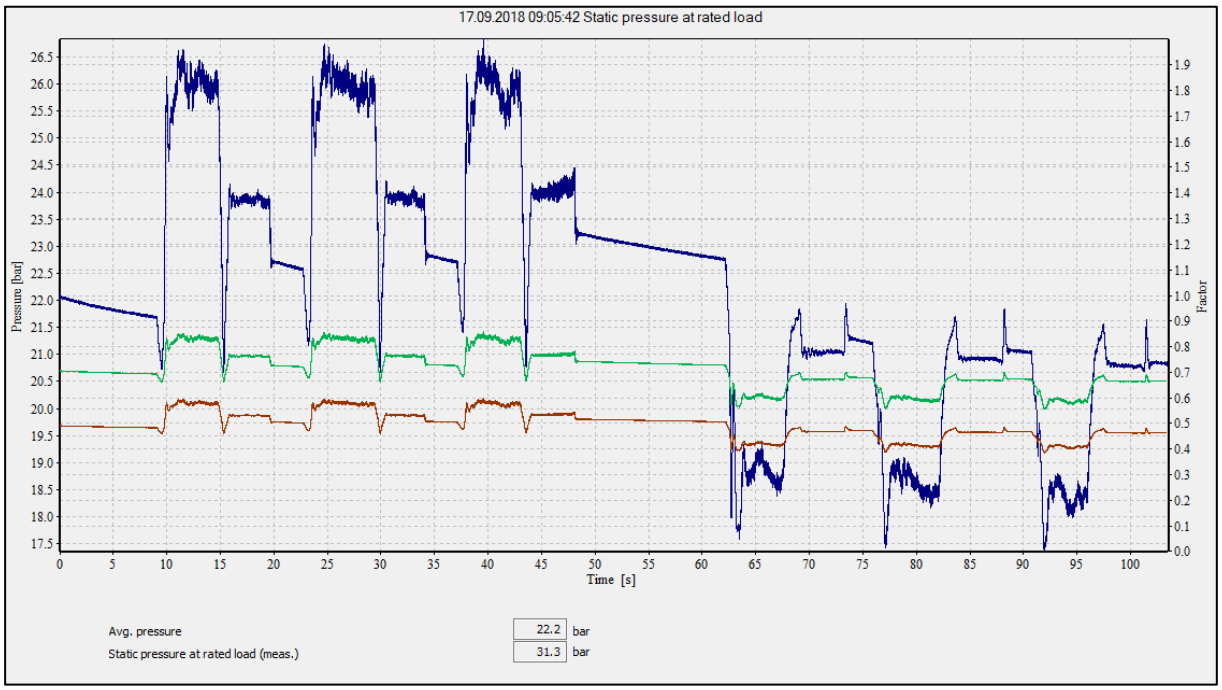


Illustration 145: Sample measurement of the static pressure at rated load

5.9.4 Creating the Report

Each individual test may be marked with a check mar in the list. Marked test will be printed out in the report when the button „Print" is pressed.

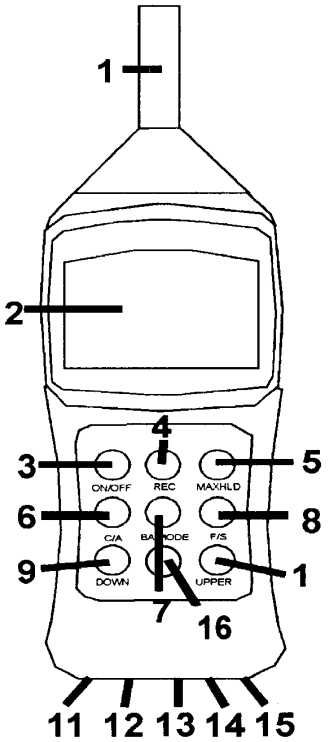
The report consists of a cover page, showing the technical data of the installation as well as information regarding the examination. The following pages show the individual test with the evaluation results. The results are displayed exactly like in the software interface and include the curve display.

6 Digital Sound Level Meter Model 8921/8922

The digital sound level meter has an automatic and a manual measuring range selection with six measuring ranges from 30 dB to 130 dB with a resolution of 0.1 dB. The device meets the standards ANSI S1.4 and IEC 651 Type 2.
A special feature is the possibility to compensate the background level by key depression and to assess deliberately noise sources in the foreground. By means of two assessment filters (A or C) the sound level can be weighted according to IEC standard. Furthermore, it is possible to determine the maximum and minimum value for one measuring period.
The sound level meter is fitted with female connectors for the supply of external components, an audio outlet, an envelope curve outlet as well as a digital RS232 interface for the data transfer to a computer.

6.1 Description front view

1. **Microphone**
2. **LCD Display**
3. **ON/OFF - On/off key**
4. **REC - Measurement value recording**
5. **MAXHLD - Maximum value storage**
6. **C/A - IEC assessment filter**
7. **BA MODE - Background clipping**
8. **F/S - Measuring interval setting**
9. **DOWN - Measuring range selection**
10. **UPPER - Measuring range selection**
11. **DC 9V - External power supply**
12. **CAL - Calibration**
13. **AC OUT - Audio outlet**
14. **DC OUT - Envelope curve outlet**
15. **RS232 - RS 232 interface**
16. **BACKLIT - Display light (only Type 8922)**



6.2 Sound level measurement

Press ON/OFF to switch on the meter. When switched on the unit briefly goes into a self diagnosis mode and all segments on the display are switched on. An initialization phase follows in which the meter counts down on the display.
Now, actuate the DOWN key until the value 30 appears on the left side besides the bar display and the measuring mode (on the left side below the bar display) has changed from AUTO to MANU. Only then will the meter start to measure the current level values. Direct the microphone towards the noise source to be measured.
The sound level is represented both numerically in a seven segment display and graphically in a bar display. The numerical value is updated every 160 ms. Every 40 ms the bar display shows the current level values.

6.3 Sound Level Measurement with Henning Sensor Suite

Connect the “RS232” output (15) of the sound level meter with the USB adapter cable (Item No. 450301) and the USB-A connector of the cable to the PC. Then follow the instructions in Section 4.1.1.4 to measure the sound level curve with the Henning sensor suite. Please also observe the instructions for installation for the USB adapter cable’s driver.

6.4 Selection of A or C weighting

After switching-on, the meter is in the measuring mode with the assessment filter type A. In this operating mode the signal spectrum is assessed according to the feeling of the human ear.
The assessment filter type A should be used in the case of environmental measurements or for measurements at the workplace. In particular, this filter should be used if sound level measurements in the scope of the legal noise control regulations are carried out.
The assessment filter, type C, is above all advantageous for the lower measuring ranges. The signal spectrum is linearly assessed. The assessment filter C is for example suitable for the sound analysis of motors and machines.
To change over between these two assessment filters the C/A key is used. The current assessment filter is displayed by an A or C on the right side of the display.

6.5 Selection of the rise time

Using the **F/S** key the response time of the display can be changed over from fast to slow behaviour. The selected operating mode is displayed on the right side of the display.
After switching-on the meter is in the fast mode.

6.6 Storage of the maximum sound level

Actuate the key **MAXHLD** during the measurement in order to save the measured maximum value on the display. In the lower area of the display the operating mode **MAX HOLD** is displayed. This brings up the maximum measured sound level value on the numerical display. The bar display continues representing the current values of the sound level.

In order to exit this mode, once again actuate the key **MAXHLD.**

6.7 Determination of minimum and maximum sound level

Switch on the meter.
Afterwards actuate the **REC** key. In the lower area of the display the indication **REC** appears. The meter now starts to determine the maximum and the minimum sound level value.
Afterwards once again actuate **REC**. On the display the indication **MIN** appears and on the numerical display the minimum measured value is displayed. The evaluation is interrupted. The bar display continues representing the current measurement value.
Now press **REC** a second time, then the maximum sound level is displayed on the numerical display, as well as the indication **MAX**. On the seven-segment display the meter now shows the maximum measured value. However, the bar display continues to show the current data in an analogue form.
If you actuate the **REC** key for about 5 seconds, the recording is interrupted and the meter is again in the normal measuring mode. If you press **REC** again, you can start a new evaluation.

6.8 Suppression of the background sound level

With the help of this special function it is possible to determine the sound level of individual machines, even while in the background a latent noise level exists.
Press **ON/OFF** in order to switch your meter on.
Actuate the **MAXHLD** key. This will be confirmed on the display.
Afterwards actuate the key **BA MODE**. On the display appears **F** besides the indication **SPL** and the display **MAX HOLD** goes out. Now, on the display the sound level of the background noises is displayed.
Now, actuate the key **MAXHLD** again. On the display appears again **MAX HOLD** for confirmation and the meter is ready to assess the sound source in the foreground.

Now switch on the machine the sound level of which you want to measure. The value shown in the display corresponds to the sound level generated by the machine alone, i. e., without the background noises. If the display does not change, the ambient noises are louder than the those of the sound source to be assessed. In order to exit the measuring mode “Background suppression” actuate the key **MAXHLD** and then **BA MODE**. Afterwards the meter is in the normal measuring mode.

6.9 Display light (only for type 8922)

With key **Backlit** the display can be illuminated for about 5 seconds in order to facilitate the reading in the case of poor lighting conditions.

6.10 Automatic or manual measuring range selection

The instrument has six measuring ranges of 10 dB steps: 30~80 dB, 40~90 dB, 50~100 dB, 60~110 dB, 70~120 dB, 80~130 dB.

After switching-on the measuring instrument is in the mode “Automatic range selection”. This is shown on the left side of the display (**AUTO**).
The current measuring range can be recognized by means of the two digits at the left side above the bar display. It is also possible to determine the measuring range manually. This can be helpful in order to prevent a change-over of the display during measurement.
For the manual setting the keys **DOWN** and **UPPER** are used. In the “manual mode” **MANU** appears on the display. The current range is represented by the figures below the bar display.
If the **DOWN** or **UPPER** key is pressed for 2 seconds the instrument switches back to “Automatic range selection”.
In the mode “Manual range selection” the indication **UNDER** appears on the display, if the measured sound levels are too low for the selected measuring range. When exceeding the measuring range the indication **UPPER** appears on the display. In both cases you have to select the measuring range once more in order to obtain valid values.

6.11 Auto-Off function

After 20 minutes operating time the measuring instrument automatically switches off because of the energy saver function. This can be changed when switching-on the instrument: First switch off the instrument. Press the **MAXHLD** key and keep it pressed while switching-on the instrument. As soon as an **n** appears on the display you may release the **MAXHLD** key. Hereby the auto-off function is deactivated and the instrument can only be switched-off using the **ON/OFF** key.
For measurements taking more time we recommend the use of an external power supply unit. When the instrument is next switched-on the auto-off function is reactivated.

6.12 Replacement of battery

When the display blinks and the message **BAT** appears, the 9 Volt battery is run-down and should be exchanged as soon as possible. Unscrew the cover of the battery chamber on the rear side of the instrument using a screw driver. Insert a new battery and replace the cover.

6.13 Serial interface

The output of the measurement values is made as a continuous ASCII string in the unit of measurement chosen on the instrument. Line closing is made with CR and LF.

Interface parameter: 2400BD8N1
Output: N:044.5dB <0D, 0A>
Interface parameter : 2400BD8N1
Output: N:044.5dB <0D, 0A>

6.14 Technical data

Standards	IEC 651 Type 2 ANSI S1.4 Type 2
Evaluated frequency spectrum	31.5 Hz ~ 8 kHz
Accuracy	± 1.5 dB
Evaluation filter A measuring range	30 dB ~ 130 dB
Evaluation filter C measuring range	35 dB ~ 130 dB
Measuring ranges	6 ranges in 10 dB steps: 30~80 dB, 40~90 dB, 50~100 dB, 60~110 dB, 70~120 dB, 80~130 dB
Automatic measuring range selection	30~130 dB
Weighting	fast or slow
Measuring span	50 dB per measuring range
Digital display	3 ½ digit LCD 0.1 dB resolution updated every 160 ms

Quasi-analogue bar display	1 dB display step 50 dB display range updated every 40 ms
Microphone	6 mm Electret condenser microphone
Analogue output	AC: 0.707 V_{rms}; DC: 10 mV DC/dB
Serial interface	2400BD8N1 N:044.5dB <0D, 0A>
Dimensions	80 mm x 256 mm x 38 mm
Weight	240 g
Operating conditions	4 ~ 50° C, 10 ~ 90% RH
Storage temperature	-20° ~ 60° C
Power supply	9 V Battery Alkali
Operating time using 9 V alkali battery	approx. 20 hours
Scope of delivery	User instructions, battery and carrying case
Extras	Software PCLOG with Interface cable, power supply unit 9 V stabilized

7 Reports

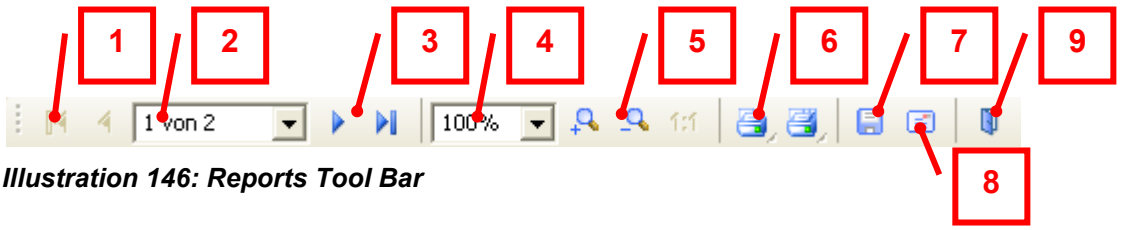


Illustration 146: Reports Tool Bar

[1] Prev Page
Use this button to browse backward in the preview. The button is blocked, if you are on the first page of the report.

[2] Page number
This indication shows the number of the page you are just viewing.

[3] Next Page
Use this button to browse forward in the preview. The button is blocked, if you are already on the last page of the report.

[4] Zoom

Here you can directly enter the zoom percentage.

[5] Zoom in and Zoom out
If you find the representation of the report too large or too small, you can zoom in the view of the displayed page in steps. As soon as you have reached the maximum display size, the button will be represented as blocked.

[6] Print
With this function you can immediately print out the diagnosis report. The print-out always comprises the total report and bears the current date.

[7] To store as a PDF document
Using this function, you can store the report as a PDF document.

[8] To send by e-mail
With this function you automatically create a PDF document from the report and send it by e-mail.

[9] Close
Please, use this button in order to terminate the report preview and return to the normal software interface.

8 History of Versions

Date	Version	Changes
28.08.2022	1.96	Import of WEARwatcher-TML-files, UIM tests supported for the ELVI-system, new firmware UCD (V1.40)
02.05.2022	1.95	Internal version
06.01.2022	1.94	Fixed bug that one could not delete more than one test on the UCD at the same time. New WEARwatcher file formats are supported now.
01.10.2021	1.93	Russian language added
07.05.2021	1.92	ELVI reports enriched
04.01.2021	1.91	New firmware QS3 and PS2 (V2.42)
23.10.2020	1.90	Some minor improvements (e.g. est. breaking distance for machine brake tests)
10.09.2020	1.89	New firmware MSM12 (V3.66) incl. traction measurement
20.07.2020	1.88	Chinese language for UCD added
22.06.2020	1.87	New firmware MSM12 (V3.65) with different touch-handling
30.03.2020	1.86	Internal version

29.12.2019	1.85	New UCD version 1.38 with wait screen before synchro-nisation
15.11.2019	1.84	Bug in brake force calculation removed
01.11.2019	1.83	Internal version
20.10.2019	1.82	Continuous load measurement for AE12 added, some bugs solved
31.05.2019	1.81	Bug for measurement data read-out of PS2 solved
24.05.2019	1.80	New firmware UCD (V1.37), eliminating when entering a chain weight in lbs/ft with a decimal point
16.04.2019	1.79	WEARwatcher cloud connection and RIDEanalyzer de-vice included
28.03.2019	1.78	New firmware MSM12 (V3.64)
09.02.2019	1.77	Slovak language added, MSM12 V 3.63
07.02.2019	1.76	New firmware UCD (V1.36), rope tensions included into ELVI report, New firmware MSM12 (V3.62)
13.10.2018	1.75	Bugfixes
17.09.2018	1.74	New firmware MSM12 (V3.59), report routines updated
05.04.2018	1.73	Bugfixes and OPTO4 device for escalators included
18.01.2017	1.62	Integration of pressure sensor HS1
	1.61	Internal version
29.11.2016	1.60	Drivers for AE12 and sound level meter re-newed
	1.58 – 1.59	Internal version
26.05.2016	1.52	Import and Export for complete projects
21.04.2016	1.51	new firmware MSM12 (V3.46)
23.03.2016	1.50	Export of acceleration data, new firmware UCD (V1.30), MSM12 (V3.45), standard deviation analysis deselected
22.02.2016	1.49	New MSM12 firmware (V 3.43)
29.01.2016	1.48	New download-handling for QS3, new firmware QS3 (V2.37), PS2 (V2.37), MSM12 (V3.41) and UCD (V1.27) for optimized bluetooth-connectivity
05.01.2016	1.46	New functions LIFTinspector added
03.12.2015	1.45	Manual and driver for sound level meter added to setup, new firmware QS3 (V2.35), PS2 (V2.35)
20.11.2015	1.44	Bug in displayed distance of ride quality report fixed, new firmware MSM (V3.37), QS3 (V2.34), PS2 (V2.34) und UCD (V1.25)
16.11.2015	1.43	Bug in displayed load data ELVI fixed
09.11.2015	1.42	Bug in rope tension calculation fixed
02.11.2015	1.41	New firmware MSM (V 3.35) und UCD (V 1.24)
29.10.2015	1.40	New firmware MSM (V 3.33), QS3 (V 2.30) and PS2 (V 2.30)
05.10.2015	1.39	Bug in mouse usage in the FFT-display fixed
25.09.2015	1.38	“Calculating optimal rope-load” within the curve storage of the individual rope loads added
18.08.2015	1.37	Schindler belts added to UCD

	1.36 – 1.27	New firmware MSM (V 3.30)
18.06.2015	1.26	ELVI added
	1.25	Internal version, not published
27.04.2015	1.24	New firmware MSM (V 3.13)
	1.23	Internal version, not published
16.01.2015	1.22	Bug in the date display of the project list fixed
08.12.2014	1.21	Internal version, not published
06.12.2014	1.20	New firmware MSM (V 3.12) und QS3 (V 1.08)
	1.19 – 1.16	New firmware QS3 (V 1.06)
09.10.2014	1.15	New firmware QS3 (V 1.05), ID-Vergabe über Bluetooth
05.08.2014	1.14	Internal version, not published
30.07.2014	1.13	New firmware QS3 (V 1.02)
	1.12	Revised cryptography functions
02.06.2014	1.11	Context menu in project directory added
09.05.2014	1.10	Languages Chinese and Japanese added
10.04.2014	1.09	New firmware QS3 (V 1.01) und MSM (V 3.09)
03.04.2014	1.08	Internal version, not published
02.04.2014	1.07	Bug in data display (overflow after 655 sec) fixed
06.03.2014	1.06	New firmware MSM (V 3.07)
14.03.2014	1.05	Intefration QS3 Sensor
11.03.2014	1.04	Menu settings added
03.03.2014	1.03	Bug firmware-update MSM fixed
27.02.2014	1.02	Chinese reports revised
25.03.2014	1.01	Average-tool added
24.02.2014	1.00	Turkish language added

Henning GmbH & Co. KG
Loher Str. 4
58332 Schwelm
Deutschland

FON: +49 2336 / 9 29 8 – 0
FAX: +49 2336 / 9 29 8 – 100

eMail: info@henning-gmbh.de
URL : http://www.henning-gmbh.de/

Service-Hotline: +49 2336 / 9 29 8 - 232