

325-2810-011 US16



**Operating Manual**

Software  
CoboSafe-Vision

Operating manual: CoboSafe-Vision  
Document version: 325-2810-011 US16  
– Translation from German –

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This operating manual describes how to use the CoboSafe-Vision software. The software is part of a system and complements the following products:

- CoboSafe-CBSF
- CoboSafe-CBSF-XS
- CoboSafe-Scan
- CoboSafe-Tek



**Before beginning work of any kind, read this manual and the general safety instructions. Keep for later use!**

Read this documentation carefully and familiarize yourself with the product before using it.

Pay special attention to the associated document "General Safety Instructions" and the safety instructions and warnings in this document in order to prevent injuries and product damage. Keep this documentation at hand so that you can look it up if necessary. Share this documentation with future users of the product.

Part of this manual is also the document:

- CoboSafe – General Safety Instructions

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## 1 About this Manual

This manual describes how to use the CoboSafe-Vision software. The software is part of a system and may be used only in conjunction with the following components:

- CoboSafe-CBSF
- CoboSafe-CBSF-XS
- CoboSafe-Scan
- CoboSafe-Tek

Carefully and thoroughly read this document and the documentation for all of the components to be used to become familiar with the product before using it.

To prevent injury and damage to the product, pay particular attention to the associated document "General Safety Instructions" as well as to the safety and warning notes in this document. Keep this documentation nearby to serve as a reference when needed. Pass the documentation along to later users of the product.

	<ul style="list-style-type: none"><li>■ The operating manual with safety instructions is a component of the measuring system and has to be stored near the measuring system, ensuring that it is readily accessible to personnel at all times.</li><li>■ Operating personnel must read the entire manual and be familiar with the product before beginning any work.</li><li>■ The fundamental requirement for working safely is consideration of all of the safety and warning notes as well as following the instructions in this and all related CoboSafe manuals.</li><li>■ In addition, the local accident prevention regulations and general safety regulations apply to the area of application of the measuring system.</li></ul>
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The illustrations in this manual are intended to aid in fundamental understanding of the product. They may deviate from the actual model.

### 1.1 Symbols and Warnings in this Manual

#### 1.1.1 Warnings








Safety and warning notes in this manual are indicated by symbols. The safety and warning notes are preceded by signal words indicating the extent of the hazard.

To prevent accidents, personal injury and property damage, comply with the safety and warning notes and proceed with caution.

<b>Warnings</b>	
 <b>DANGER</b>	This combination of symbol and signal word indicates an immediately dangerous situation which will lead to death or severe injuries if it is not avoided.
 <b>WARNING</b>	This combination of symbol and signal word indicates a possibly dangerous situation that could lead to death or severe injuries if not avoided.
 <b>CAUTION</b>	This combination of symbol and signal word indicates a possibly dangerous situation that could lead to minor injuries if not avoided.
<b>NOTICE</b>	This signal word indicates a possibly dangerous situation that could lead to property damage if not avoided.

### 1.1.2 Explanation of Symbols

The following symbols are used in this manual to emphasize instructions, results, lists, notes and other elements:

<b>Symbol</b>	<b>Explanation</b>
	Introductory information relevant to safety
	Helpful tips and recommendations as well as information to ensure efficient and uninterrupted use
	Precedes instructions
	Step-by-step instructions. The instructions are numbered in the order of the respective steps.
	Results of steps
	References to sections of this manual and to other applicable documents
	Lists with no specific order

1.2 Appearance of Instructions

The initial requirements in regard to personnel qualifications, personal protective equipment (PPE), special tools and materials are different for each step/process.



It is imperative that the specified requirements for all instructions are met.

The following illustration shows an example of how a set of instructions is structured.

1.

2.

4.

6.

7.

8.

► **Inspect and clean CoboSafe CBSF-XS**

Personnel	Personal Protective Equipment
<ul style="list-style-type: none"><li>■ Laboratory scientist</li><li>■ System integrator</li><li>■ Certified service personnel</li></ul>	<ul style="list-style-type: none"><li>■ Protective gloves</li><li>■ Safety shoes</li></ul>

Special tools	Materials
<ul style="list-style-type: none"><li>■ Set of Allen keys</li></ul>	<ul style="list-style-type: none"><li>■ Cleaning agent</li><li>■ Soft, lint-free cloth</li></ul>

To provide reliable measured data, the measuring system has to be regularly cleaned and inspected for external damage.

**1** ► Place the measuring system on a free, flat surface.

► The measuring system rests securely and cannot fall off.

**2** ►

3.

5.

Fig. 1: Example of instructions



**Explanations to the figure "Example instructions"**

1. A triangle precedes the title of instructions or a step to be performed.
  2. Indicates the qualification required of personnel to be able to safely perform the action described. In the above example, the person performing the task has to be a laboratory scientist or a system integrator. For a description of the personnel qualifications, refer to ☞ chapter "Requirements of Personnel" in the general safety instructions."
  3. List of Personal Protective Equipment (PPE) required. In the above example, protective gloves and safety shoes have to be worn; ☞ chapter "Personal Protective Equipment" in the general safety instructions.
  4. If necessary: List of special tools required. A set of Allen keys is needed to check and clean the device.
  5. If necessary: List of consumables required. In the example above, a cleaning agent and a soft, lint-free cloth is needed.
  6. Introductory note on why action is required and what has to be kept in mind.
  7. Step in the set of instructions. Always perform the steps one after the other and as described.
  8. Result of the previous step.
- ▷ Always verify that the result is the same as what is described here.

**2 For your Safety**

The separate document ☞ "CoboSafe – General Safety Instructions" provides users with further information and must also be observed.

**2.1 Intended Use**

The CoboSafe-Vision software is used to visualize, evaluate, process and archive the force and pressure measurements recorded by the measuring devices. The measuring method is used to determine the impact and clamping forces on collaborating robots according to the underlying standards and publications (Read the related document 'CoboSafe – General Safety Instructions', chapter 'Underlying standards and information publications'). It may only be used for this purpose.

**2.2 Qualification Required of Personnel**

Only qualified personnel may work with the measuring and test system to avoid serious physical injury or considerable damage to property. Qualified are persons who are familiar with the commissioning and operation of robots. They must have the appropriate qualifications. They must be able to assess the work assigned to them, identify possible sources of danger and take appropriate safety measures.

### 3 Brief Description

The software allows a structured setup for the execution and logging of the required measurements on an application by creating a project. The program can calculate and create a measurement plan for the required measurements based on the created setup and specification of the body areas to be measured, including specification of the available measuring equipment. The software determines the required configuration from spring constant  $K_2$  and additional damping element  $K_1$  by selecting the relevant body measuring points. This is done under consideration of the existing measuring instruments CoboSafe-CBSF.

**Attention!**

A measurement may only be carried out using the specified measuring equipment.  
A measurement must not be carried out with a different configuration.

The software checks the measuring equipment for the pressure measurement for functionality, imports and calculates the pressure images.

The project can be subsequently edited and individually extended by robots or motion sequences.

Furthermore, a complete documentation can be created as a conclusion.

The software checks whether new features or software updates are available. These can be downloaded immediately. The updated user manual is then also available in the options.


## 4 Licensing

The purchase of the software includes the license to operate a system with the following measuring instruments:

Force Gauge	Pressure Measurement Method
<ul style="list-style-type: none"> <li>■ CBSF-10</li> <li>■ CBSF-25</li> <li>■ CBSF-30</li> <li>■ CBSF-35</li> <li>■ CBSF-40</li> <li>■ CBSF-50</li> <li>■ CBSF-60</li> <li>■ CBSF-75</li> <li>■ CBSF-150</li> <li>■ CBSF-Basic</li> <li>■ CBSF-XS</li> <li>■ CBSF-75 Gripper</li> </ul>	<ul style="list-style-type: none"> <li>■ CoboSafe-Scan</li> <li>■ CoboSafe-Tek</li> </ul>

Additional software must be purchased for additional measuring systems or individual devices. Updates due to product improvements are usually free of charge. Adjustments due to normative changes may be subject to a charge in individual cases. The software may be installed on a maximum of 10 computers/stations.

## 5 PC-Requirements

	<p><b>PC or laptop with Internet connection</b></p> <p>For the evaluation of the measurement results, a Windows PC or laptop (hereinafter also referred to as "PC") is required on which the "CoboSafe-Vision" software must be installed. Software updates require an Internet connection of the PC used, which can result in connection costs.</p> <p>Only use a PC that is protected against malware by up-to-date anti-virus software and regular operating system updates.</p>
---	---

### PC-requirements:


- Operating System : Windows 10 or higher
- Processor (CPU): Intel I5 or equivalent
- RAM: 8 GB
- Hard Drive Space: 500 GB
- Internet connection: yes
- Wireless- connection: yes
- USB: from 2.0
- Graphics card resolution: 1920\*1080
- Microsoft Word
- PDF Creator etc.

## 6 Scope of Delivery

The CoboSafe-Vision software is supplied on a USB stick which contains the program and installation files and the operating manual in pdf format.

The USB stick is placed in the case 'CoboSafe-CBSF' (standard) or 'CoboSafe-Scan' or 'Cobo-Safe-Tek' depending on the scope of delivery of the system.

## 7 Significance of the Measurement Results

Please note the same chapter in the related document  'CoboSafe – General Safety Instructions'.

## 8 Testing Specification

The measurements are evaluated in accordance with the requirements of the standards, guidelines and information documents specified in the 'Testing specification' boxes (Fig. 2).

Example:



Fig. 2: Testing specification

Country-specific and local requirements are not taken into account if they are not explicitly listed in the specification.

If the correct test specification is not available, consultation with the manufacturer is required.

## 9 Updates und Upgrades



The updating and further development of peripherals and software is necessary due to normative adaptations. These changes are offered in the form of upgrades and updates from the manufacturer.

In order to maintain full functionality, updating to the latest version is necessary and must be ensured. When the PC software „CoboSafe-Vision“ is started, the version status is automatically queried online. If a more recent version is available, a window opens with the option of downloading the version.

### 9.1 Current Operating Manual

After the software update, the operating manual for the new version is also available. Select options next Manual. The Windows Explorer opens and displays the operating manuals. Print

out the operating manuals and replace existing documents.

	<p><b>Current instructions for use</b></p> <p>The documentation must be available in printed form (note the related document 'General Safety Instructions').</p>
	<p><b>No internet connection</b></p> <p>If no Internet connection is available or the automatic notification is deactivated, the operator is obliged to carry out the version check manually at intervals of not more than 1 month or if a normative change is known.</p> <p>For this purpose, a temporary connection to the Internet can be activated and the query for available updates can be started manually.</p>

## 9.2 Software Update

If an Internet connection is established and a newer version is available, the update window opens automatically (Fig. 3).

The download can be started directly via the buttons. Follow the instructions.

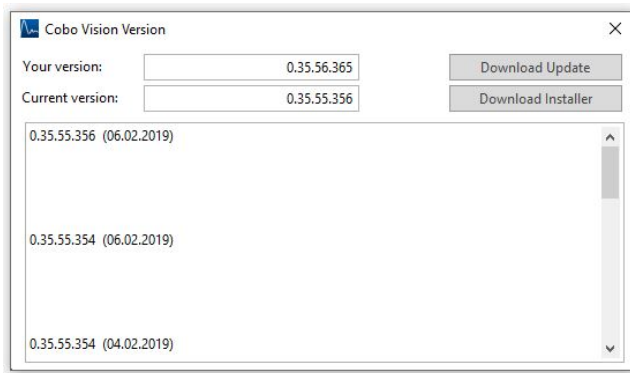
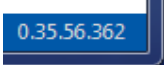


Fig. 2: CoboSafe-Vision Version

The automatic notification can be deactivated in the settings. However, the user is obliged to check regularly whether new updates are available.

The version check uses port 443.

	<p>Click on the version number in the lower right corner to open the software update window. (🔗 Chapter 12 User Interface)</p>
---	--

## 10 Installation and Configuration

Personnel	
<ul style="list-style-type: none"> <li>■ Laboratory scientist</li> <li>■ System integrator</li> </ul>	

- 1 ►** First download the installation file 'CoboSafe-Vision Installer xxx.zip' to your computer.
  - 2 ►** Unpack the ZIP file of the software (CoboSafe-Vision Installer xxx.zip) on your data carrier.
  - 3 ►** Change to the directory and start the installation
  - 4 ►** Start "Setup.exe"
  - 5 ►** Follow the installation instructions and install the software completely.
  - 6 ►** You may be prompted to install additional drivers. Follow the instructions.
  - 7 ►** If required, connect a CBSF device to the PC using the supplied USB cable.
  - 8 ►** Restart the computer.
- ⇒ To start the program, you will find shortcuts on the desktop and in the start menu.

After installation, the software is configured for operation. Further settings are not required. We recommend that you do not change the default settings. The test specification is pre-set to DIN ISO/TS 15066 in connection with the information leaflet of the "DGUV - Deutsche Gesetzliche Unfallversicherung" (German Social Accident Insurance). The calculation basis can be changed as required in the window for importing force and pressure measurements or in the test basis (project).

## 11 Launch Software

The following shortcuts were set during installation to launch the software:

- Desktop Icon 'CoboSafe-Vision'
- Start menu\all programs\CoboVision\CoboVision.exe

A window is opening, where you can

- Select a language
- choose between public and private
- select a directory for save.

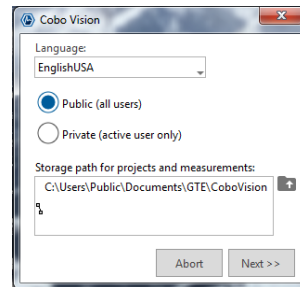


Fig. 3: CoboSafe-Vision first start

## 12 User Interface (GUI)

The GUI (Fig. 4) is divided into several areas:

1. Menu bar
2. Explorer for imported measurements with toolbar (2a)
3. Explorer for created projects with toolbar (3a)
4. Display area
5. Query version status and software update

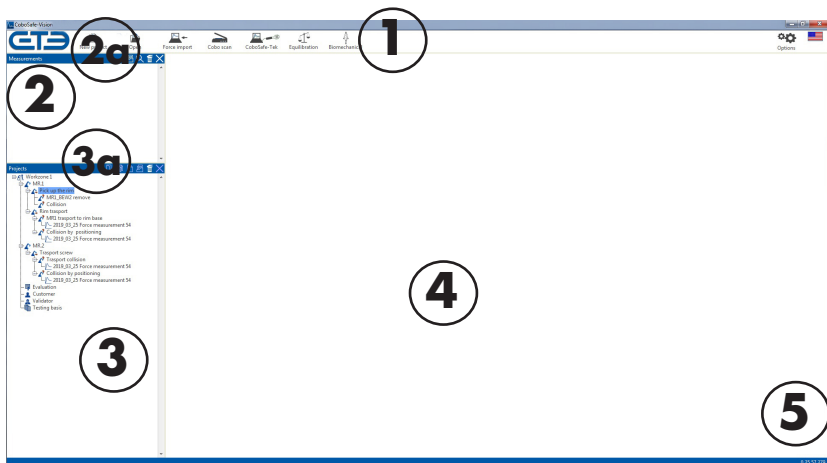


Fig. 4: CoboSafe-Vision user interface

### 12.1 Main Menu Bar

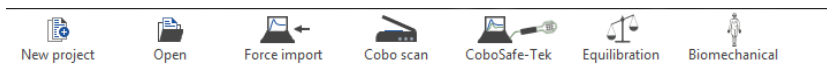


Fig. 5: Main menu bar

### **Button "New Project"**

'New project' button starts a wizard that supports the creation of a project. Fill in the boxes according to your naming. The windows can be called up again after the project has been created and edited further.

### **Button "Open"**

The menu allows you to open the following already saved objects:

- projects
- force measurements
- pressure measurements
- force-pressure measurement (combination)
- archived measurements

Click the 'Open' button to access all directories. In Windows Explorer, select the desired directory and file.

Press one of the submenus to directly access the stored measurements in the standard directory. If you have selected a different file storage, please open the Windows Explorer via the corresponding button. The Explorer search box can be used to search for a specific file.

### **Button "Force Import"**

'Force Import' button starts a wizard that supports importing the measurements stored in the force gauge. Select in the windows under the displayed options and fill in the boxes. The measurement is imported, displayed and saved. It can be called up at a later point.

See chapter 16.2 'Importing a Force Measurement' for more information.

### **Button "CoboSafe-Scan"**

Button 'CoboSafe-Scan' starts a wizard that supports the import of the pressure image.

Select in the windows under the displayed options and fill in the boxes. The measurement is imported, displayed and saved. It can be called up at a later point.

See chapter 16.3 'Importing a Pressure Measurement with CoboSafe-Scan' for more information.

### **Button "CoboSafe-Tek"**

Button 'CoboSafe-Tek' starts a wizard that supports the pressure measurement method.

Select in the windows under the displayed options and fill in the boxes. The measurement is imported, displayed and saved. It can be called up at a later point. See chapter 16.4 'Importing a Pressure Measurement with CoboSafe-Tek' for more information.

### **Button "Equilibration"**

Button 'Equilibration' starts the menu for equilibrating the pressure measuring films System CoboSafe-Tek. See chapter 15 'Equilibration' for more information.



### Button "Biomechanical"

The button 'biomechanical' launches the menu for supporting single measurements, where the required spring rate is to be determined in advance via the previous selection of hazardous areas of the body. This menu is informative and has no influence on the calculation in a project. See chapter 13 Menu 'Biomechanical' for more information.

## 12.2 Service Menu Bar



Fig. 6: Service menu bar

### Button "Options"

The button 'Options' opens the options window, where general program settings such as time, units, storage locations, dates and times can be set. See chapter 14 Menu 'Options' for more information.

### Button "Language"

The button indicates the current language selection by means of a flag icon. Via the button a language change is possible.

## 12.3 Buttons in Diagrams



Fig. 7: Buttons in diagrams

The functions are only available to a limited extent in some diagrams.

1. Direct positioning of the cursor to the maximum values or automatic scanning of the force curve.
2. Switch to force curve, pressure curve or force-pressure curve (only for force-pressure measurements with the CoboSafe-Tek system).
3. Cursor can be moved
4. Zoom functions:



Zoom into a selected area of the graph

Zoom into the X range of the graph

Zoom into the Y range of the graph

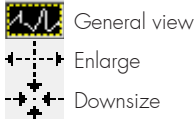


Fig. 8: Zoom functions

5. The diagram can be moved. Click in the diagram, hold down the mouse button and move the view.

## 12.4 Operation Icons

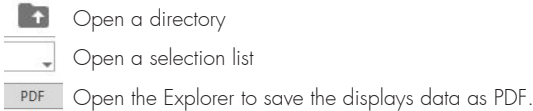


Fig. 9: Zoom functions

## 12.5 Window 'Explorer for imported measurement'

1. Button "Archive"
2. Button "Magnifier"
3. Button "Trashcan"
4. Button "Close"



Fig. 10: Window measurement

This window displays imported measurements that have not yet been assigned to a project. These measurements can be combined to a force-pressure measurement and added to the project positions by drag-and-drop. See [Chapter 16.3.7 'Combine Force and Pressure Measurement to one Measurement File'](#)

The toolbar offers the following options:

- The button 'Magnifier' opens the measurement files of a certain period of time. Use the calendar by clicking on the button next to the input field.
- ▷ The measurement files are listed in the 'Measurements' window.
- The 'Trashcan' button deletes the selected measurement file from the hard disk.
- Use the 'Close' button to close the selected measurement. The measurement is saved automatically and can be opened again.

## 12.6 Window "Explorer for created projects"



Fig. 11: Window projects

This window displays open projects.

The toolbar offers the following options:

- ① Open a Report
- ② Creates a protocol from the marked project or from the marked main folder, which can be edited afterwards.
- ③ Creates a measurement plan from the marked project or from the marked main folder.
- ④ Archives the selected project including the image files and documents in the form of a compressed file (.zip).
- ⑤ Deletes the selected project from the hard disk. To do this, close the open windows of the project before deleting.
- ⑥ Closes the selected project. The project is saved and can be reopened.

See  Chapter 18 „Projects“ for more information.



Main folder application



Robots



Motion segment



Collision



Combination force-pressure measurement



Individual pressure measurement



Individual force measurement



1. Test specification
2. Body model for selecting the contact points
3. List for selection of contact points
4. Test equipment display

More Information in ↗ Chapter 16.1 "Preparing for Measurement"

## 14 Menu "Options"

General settings can be made in this menu.

### Submenu "General information"

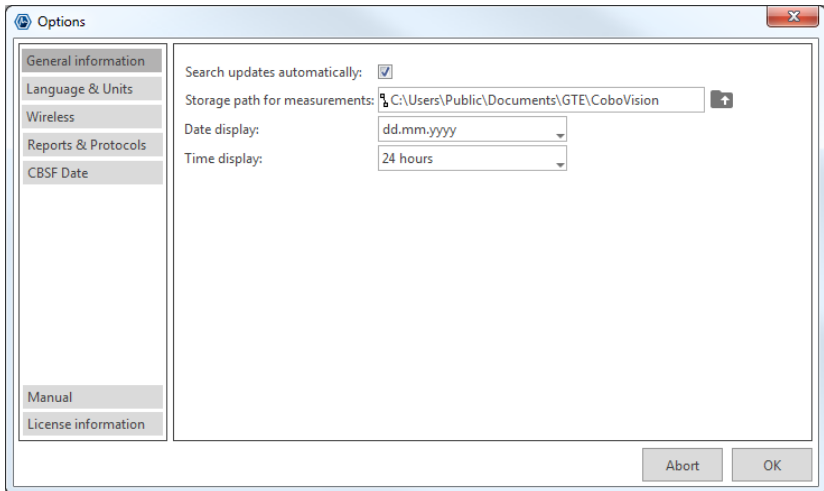


Fig. 13: Options

- Specify whether to automatically check for software updates.
- Change the location setting for saved files.
- Change the date display format.
- Change the format of the time display.

### Submenu "Language & Units"

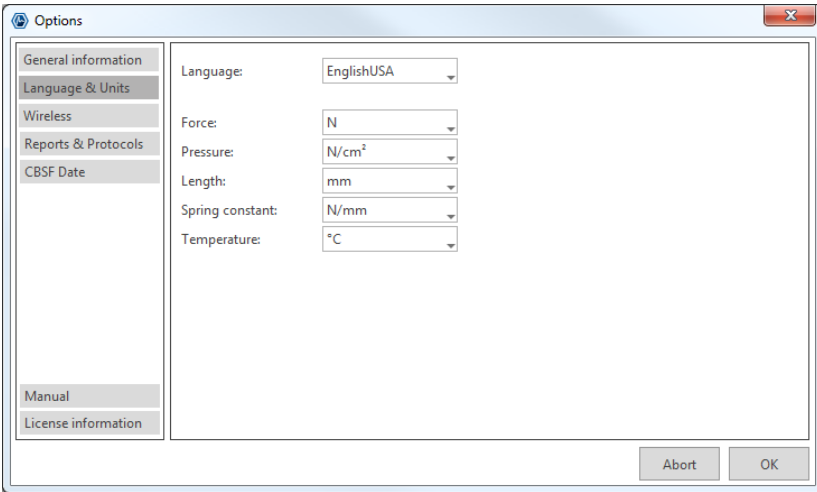


Fig. 14: Language & units

- Change the language of the program.
- Change physical units. Only the units displayed in the selection menu are available.

### Submenu "Wireless"

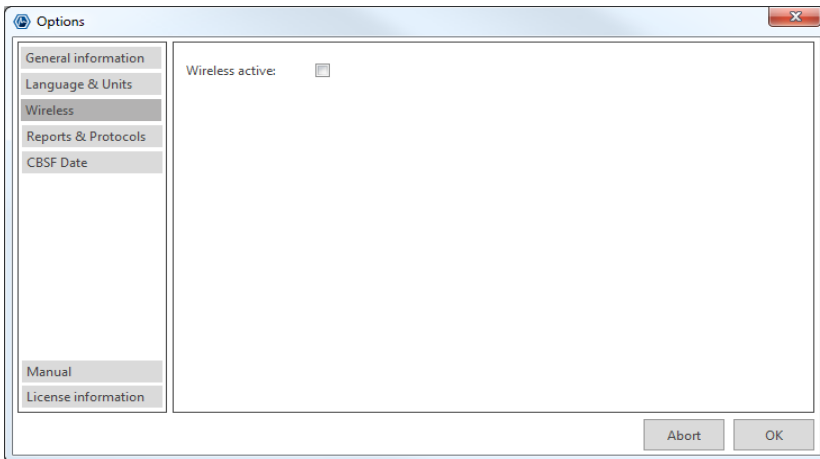


Fig. 15: Wireless setting

- Activate or deactivate the wireless connection

Submenu "Report & Protocols"

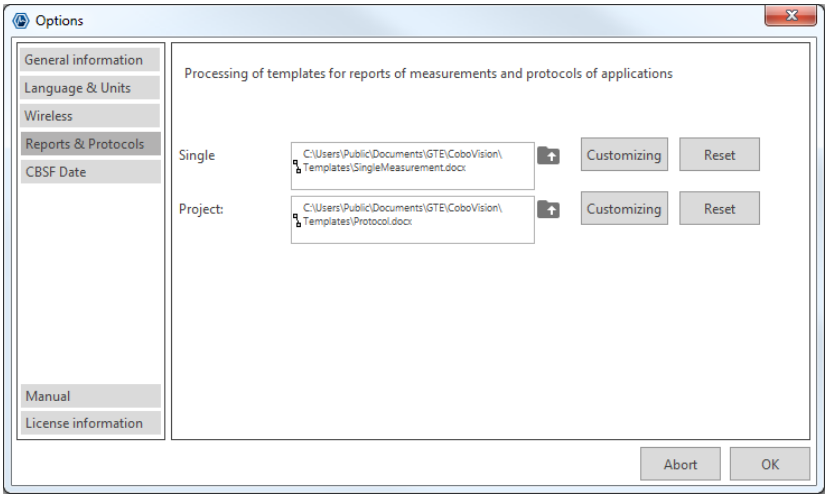


Fig. 16: Reports & protocols

The reports depict individual measurements, protocols document projects. The reports are generated as Microsoft Word documents. This menu allows you to adjust the templates for a single measurement or a project individually. By inserting or deleting bookmarks, you can control which measurement data you want to have displayed.

Place your company logo and address data in the template. Add text such as instructions on how to perform the measurement and format the template. An overview of the possible bookmarks and their names can be found in the appendix.

**i**

Please inform yourself about setting and managing bookmarks via the Microsoft Word help menu.

▷ **Select template, adjust and reset template**

Personnel	
■ System integrator	

The Word file selected in the Single Measurement or Project fields are the basis for the report or protocol.

### Choose a template

- 1 ►** Use the "Open a directory" button to open the directory in which the templates are stored.
- 2 ►** Select the desired template and confirm with "OK"
  - ⇒ The selected file is the template for the single measurement report or for the project protocol.

### Adjust a template

- 1 ►** Select the template you want to customize if it does not already appear in the form.
- 2 ►** Click on the "Customize" button.
  - ⇒ The template opens for editing in the document editing program.
- 3 ►** Make the desired changes.
- 5 ►** Save the template under a known name.
  - ⇒ You have customized the existing template.

### Create a template

- 1 ►** Open an existing template.
- 2 ►** Save the template with a new name.
- 3 ►** Make the desired changes and save them.
  - ⇒ You have created the new template.

## "CBSF" submenu

In this menu the date and time can be synchronized and the license key can be entered.

### **CBSF: Date and Time**

In the submenu "CBSF" the factory setting of date and time of all connected CoboSafe CBSF devices can be synchronized. This adjustment should be made before using the CoboSafe CBSF for the first time.

- 1 ►** Connect the CoboSafe-CBSF to the PC via the USB cable.
- 2 ►** Click the "CBSF" button under "Options".
- 3 ►** Click the "Set" button.
  - ⇒ Date and time of all connected CoboSafe-CBSF are synchronized.



### CBSF: Entering the license key

The license can be changed by entering a new valid license key. The license key can be obtained from the GTE Service.

The following licenses are available:

-Activation for CBSF Calibration Tool (only for third countries)

- 1 ►** Connect the CoboSafe-CBSF via USB cable.
- 2 ►** Select the serial number of the device.
  - ⇒ The checkbox indicates by a tick whether your device is already activated.
- 3 ►** If there is no activation available, enter the new license key in the field and press the "Write" button.
  - ⇒ The license key is changed. The display updates automatically.



Enter only valid license keys, otherwise the programming is faulty and the CoboSafe CBSF device becomes inoperative. In this case, a new license key must be requested for a fee via the GTE Service.

## 15 Menu "Equilibration"

The individual sensors of a film sensor do not all work the same. For this reason, the films must be equilibrated.

Equilibrating requires the application of a very even pressure distribution over the entire surface of the film sensor. The software determines a scaling factor for each individual measuring cell, so that the digital value is equal to the mean value of all loaded measuring cells. The mean value itself remains unaffected by the equilibration. Sensor cells with a low DO value (digital out) receive a high gain value and cells with a high DO are reduced. The result is digital compensation of individual cells. In this way, manufacturing tolerances and aging of the sensors can be compensated.

The menu 'Equilibration' offers the possibility to import and examine data sets of supplied film sensors. In addition, an equilibration can be carried out with an existing equilibration station.



The data is stored in an equilibration data record that is supplied with each film by the manufacturer. This file must be saved in the 'Equilibration data' folder that you select or create during installation. To do this, choose the Import function.

When the sensor is in use, the sensitivity of the sensor may decrease in the mainly stressed

area due to the regular load. Typically, the region on the sensor that has not been loaded retains its initial sensitivity, while the region with the constant load changes can develop a lower sensitivity. A new equilibration can then be performed to compensate for this difference. Thus, the service life of the sensor can be extended in this way. Defective cells can also be identified in this way.

If the sensors are used regularly, it makes economic sense to purchase an equilibration station. Please ask for an offer in this case.

Alternatively, GTE offers the equilibration of the sensors as a service. This equilibration should be combined with the calibration of the force gauges at a favorable time.

**i**

Equilibrating the sensor is strongly recommended for the most accurate measurements. It is recommended to re-equilibrate the film sensors after multiple use, at regular intervals of 1 year, in case of visible damage or suspicion of a defect.

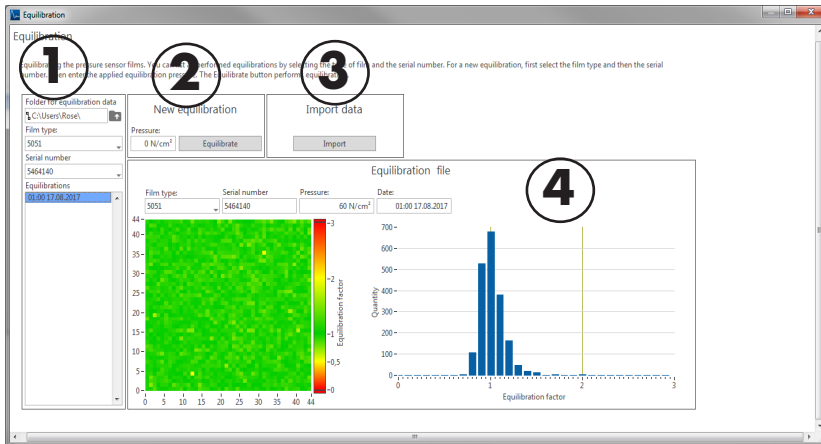


Fig.: 17 Equilibration

- 1** Specify the folder in which the equilibration files will be stored. Select the sensor film and the serial number to display the available equilibrations by date. Click on a date to call up the corresponding equilibration.
- 2** New equilibration: Start an equilibration.
- 3** File Import: Import a supplied equilibration file.
- 4** Equilibration file: shows the quality of the film sensor.

The displayed pressure image shows the cells and their scaling factor. The histogram provides information about the number of the one used scaling factors. The more values there are by factor 1, the better the condition of the sensor is. Cells should have scaling factors around value 1. This is an indication that the cell operates with small tolerances over the pressure range. If more cells with higher or very low factors occur, the sensor must be replaced. Individual cells will not have a relevant effect on the measurement result.

Example:

Partially longer stressed sensor after renewed equilibration. Sensor still functional, but high factors and wear are already visible in the relevant measuring range.

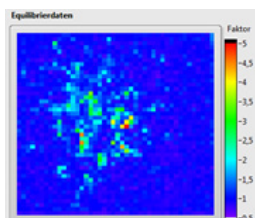


Fig. 18: Equilibration files

Sensor with a wider distribution and a higher proportion of scaled cells. Sensor functional, as predominantly scaling factors by factor 1.

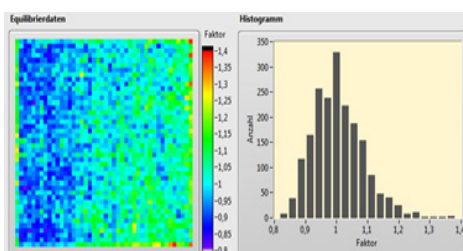


Fig.: 19 Equilibration files with histogram

## 15.1 Import Equilibration File

- Click on the 'Import file' button.
- In Windows Explorer, select the folder and the file to be imported with the extension \*.ceq or \*.equ.
- Press 'Import'.
- The file is imported. For this purpose, a directory of the sensor type and a subdirectory of the serial number are created. The imported file is stored there.
- The most recent file is automatically used when selecting the sensor and serial number for pressure measurement.

## 15.2 Create Equilibration File

To perform an equilibration, you need the optional equilibration station. The compressed air operated Equilibration Station 0-100 PSI generates a constant pressure on the sensor cells. The equilibration station consists of the control unit and the equilibration device. The set pressure can be read off in different units on the pressure gauge.

The equilibration station consists of:

1. Control unit
2. Equilibrating device with pressure manometer

Conversion:  
 $60\text{N/cm}^2 = 6\text{ Bar} = 87\text{ PSI}$



Fig. 20: Equilibration station

### ▷ Preparation

- 1 ▶ Prepare the equilibration station for measurement. Connect the compressed air.
  - 2 ▶ Set the lever on the control unit [1] to 'Vacuum' = Unload.
  - 3 ▶ Turn on the pressure gauge and press 'Zero' to set it to 0.
  - 4 ▶ Set the lever on the control unit to 'Pressure' = load.
  - 5 ▶ Set the correct pressure to 6 bar with the 'Pressure Regulator' rotary knob.
  - 6 ▶ Set the lever on the control unit to 'Vacuum'.
  - 7 ▶ Connect the CoboSafe-Tek measuring devices to the PC. Use high quality USB cables.
- ⇒ You have completed the preparation of the equilibration station.

▷ **Preparing the film sensor:**

- 1 ▶ Remove the protective film from the film sensor.
  - 2 ▶ Load and unload the sensor several times.
  - 3 ▶ Push the sensor carefully and centrally into the insertion slot of the equilibrating device. Make sure that no particles or dirt get onto the sensor.
  - 4 ▶ If small air inclusions occur (crackling audible), puncture air inclusions with a pointed needle. The air inclusions can occur during production.
- ⇒ You have completed the preparation of the film sensor.

▷ **Execution of the Equilibration:**

- 1 ▶ Insert the sensor into the handle. Ensure proper contact (LED).
  - 2 ▶ Push the sensor carefully and centrally into the insertion slot of the equilibrating device. Make sure that no particles or dirt get onto the sensor.
  - 3 ▶ Start the CoboSafe-Vision software.
  - 4 ▶ Start the 'Equilibration' menu.
  - 5 ▶ Select the sensor used in the 'Film type' box.
  - 6 ▶ Select the serial number of the sensor or enter the serial number of the new sensor.
  - 7 ▶ Load the sensor by switching to 'Pressure'.
  - 8 ▶ In the 'Pressure' box, enter the value displayed on the pressure gauge in N/cm<sup>2</sup>.
  - 9 ▶ Press the 'Equilibrate' button in the software.
- ⇒ The result is displayed. In addition, a data record is generated and displayed in the box 'Equilibrations'.  
The determined factors in the histogram should be between 0.5 and 2. Various individual deviating particles (visible in the printed image) must be evaluated and can be tolerated if necessary, e.g. if they occur in the edge area of the measuring surface.
- 10 ▶ If no acceptable result has been determined, the equilibration should be repeated first. Relieve the load on the sensor, move it a few millimeters if necessary or check it for impurities.
  - 11 ▶ Delete records from the list that are not being used. To do this, select the data record and click on the delete icon (cross).
  - 12 ▶ Unload the sensor (vacuum) and remove it from the equilibrating device.
- ⇒ The equilibration is complete.

## 16 Import and Evaluation of Measurements

This chapter explains how to import and evaluate a force and pressure measurement. They combine the related force and pressure measurement of a measurement for further use in a project.

For correct force and pressure measurement, the measuring equipment must be configured according to the specifications in the 'Biomechanical' menu or according to the measurement plan (Project). Further information on how to perform the measurement can be found in the respective instructions for use of the measuring equipment.

Typical structure e.g. with pressure measuring films from the CoboSafe-Scan system:

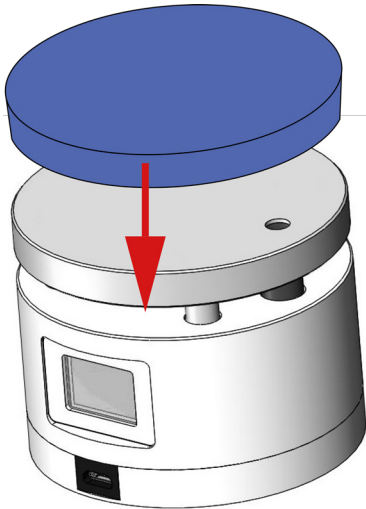


Fig.21: CoboSafe-CBSF with K1 damping element and CoboSafe-Scan

With this measuring setup the force and pressure absorption are realized. Note the measurement number of the force measurement (display) also on the pressure image in order to be able to assign it later.

### 16.1 Preparing for Measurement

To determine the required measurements and limit values, the contact points relevant for the collision must be determined first.

Personal	
■ System integrator	

The selection of body parts affected by a collision can be made by the collision created in the project or via the menu "Biomechanical". When selecting via the project, your existing test equipment is taken into account when determining the measurement.

### ► Select contact points independently of the project

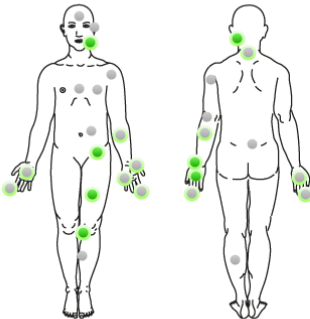
**Biomechanical measurements**

Biomechanical measurement systems and thresholds

Summary of the necessary measurements or the biomechanical configurations with the best possible thresholds. "CRcreate a PDF from your selection by using the button on the top right.

Testing specification: DIN ISO/TS 15066:2017-04 (State: April 2017)  
DGVV FB HM 080 (State: August 2017)

**Contact sections**



- ☐ Skull and forehead
- ☒ Face
- ☒ Nape
- ☐ Back and shoulders
- ☐ Chest
- ☐ Belly
- ☐ Pelvis
- ☒ Upper arm and elbow
- ☒ Underarm and wrist
- ☒ Hand and finger
- ☒ Thigh and knee

Spring: 50 N/mm  
Shore hardness: 70 ° Shore A  
Material thickness: 7 mm

Force: Static: 150 N, Transient: 300 N  
Pressure: Static: 140 N/cm<sup>2</sup>, Transient: 280 N/cm<sup>2</sup>

**measurements**

Measurement	Force [N]		Pressure [N/cm <sup>2</sup> ]	
	Transient	Static	Transient	Static
50 N/mm 30 °ShoreA (blue)	440	220	440	220
75 N/mm 70 °ShoreA (red)	65	0	110	0

Fig. 22 Biomechanical

- **Select contact points project-related**


- 
- 32

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CoboSafe-Vision



- 2 ►** Select the desired collision by double clicking.
  - 3 ►** Select the body parts by clicking on the gray dots on the corresponding body parts in the figure shown or activate the contact area by clicking on the respective boxes in the list.
- ⇒ The selected points are colored green and the required measurements and the relevant limit values with the required test equipment are now displayed for this one measuring point. The test equipment stored in the project is taken into account.

	<p><b>If several spring constants are listed...</b></p> <p>▷ The measurements must be made with these CoboSafe-CBSF configurations at this point of measurement. According to the spring constant, the limits must be observed.</p> <p><b>If the spring constant is not listed...</b></p> <p>▷ The lowest limit values must be met from all those with the harder spring.</p> <p><b>If the spring constant of your test equipment is not listed...</b></p> <p>▷ The measurement cannot be performed.</p>
---	--



## 16.2 Importing a Force Measurement

Personnel	
<ul style="list-style-type: none"> <li>■ System integrator</li> </ul>	

### ▷ Import a force measurement

- 1 ►** Connect your CoboSafe-CBSF force gauge to the PC via USB cable or activate the wireless function on the PC and CoboSafe-CBSF.
- 2 ►** Open the window "Test specification and test equipment selection" in the main menu bar with the "Force import" button.
- 3 ►** Select the testing specification used from the drop-down menu.
- 4 ►** Select your measuring device.

- 5 ►** Click on "Next" to open the window "Import force measurement".
  - ⇒ The serial number of your device is displayed.
- 6 ►** If several devices are connected, select the desired serial number in the drop-down menu.[1]
- 7 ►** Select the desired measurement number from the memory of the CBSF force gauge.[2]
  - ⇒ The force measurement is imported and the force curve is displayed in diagram [3].
- 8 ►** Select the collision type [4]. Select between a transient impact and a clamping situation (static).
- 9 ►** Determine the permissible limit values by selecting the body area [5].
  - ⇒ The limit values and the measurement results are displayed [6].
- 10 ►** Click "Next". Edit the measurement parameters if necessary.
- 11 ►** Click 'Finish' to import the measurements.
  - ⇒ The imported measurements are displayed in the 'Measurements' window.

	Assign a descriptive name that allows an unambiguous assignment to a collision.
	Only a manufacturer-approved shielded USB cable may be used to connect the CoboSafe CBSF to the PC.

### Table parameters

Parameters	Description
Measurement	The current number of the measurement to be imported is displayed.
Prefix	Enter a descriptive prefix. The prefix facilitates the assignment to the collisions.
Assignment	The collision type is specified. The assignment to a project is already possible here.
Threshold	The selected body area is displayed.
Spring	The spring constant of the measuring device is displayed.
Damping elements	The used damping element is displayed or can be selected here.
Microfiber cloth	Here you can select whether a microfiber cloth has been used or not.

Parameters	Description
Date and Time	Displays the date and time of the import.
Temperature	Displays the transferred temperature of the measurement environment.
Humidity	Indicates the relative humidity of the measuring environment.
Note	Enter additional notes for the measurement. Here you can enter e.g. information for the identification or assignment of the measurement, or information for the execution.
More fields	Allow the simultaneous import of several measurements. The parameters of the previous measurement are pre-set.

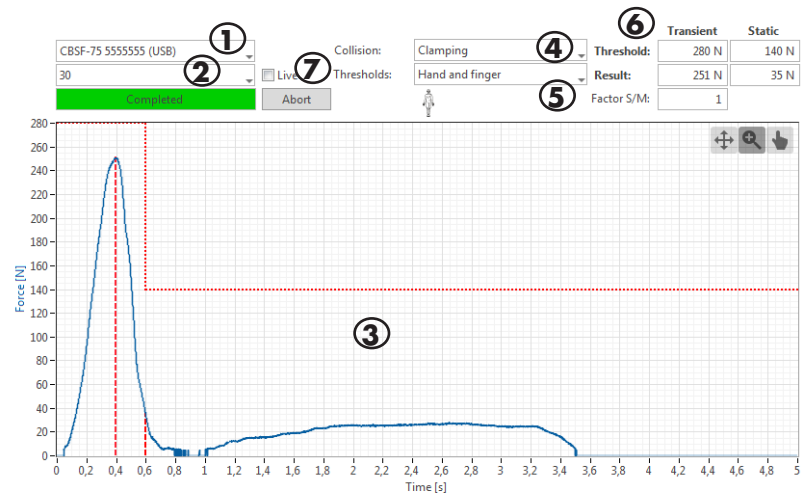


Fig. 24: Measurement curve

### ► Transfer measurements immediately

- 1 ► Perform steps 1 to 6 from the previous instruction "Importing a force measurement".
  - 2 ► Activate the 'Live' function [7] to transmit the last measurement immediately.
  - 3 ► Continue with steps 8 - 11.
- ⇒ The last measurement is transmitted immediately.

<b>i</b>	The CoboSafe-CBSF device must have a connection to the PC via USB cable or wireless. Measurement is transmitted immediately.
----------	--

### 16.2.1 The Force Diagram

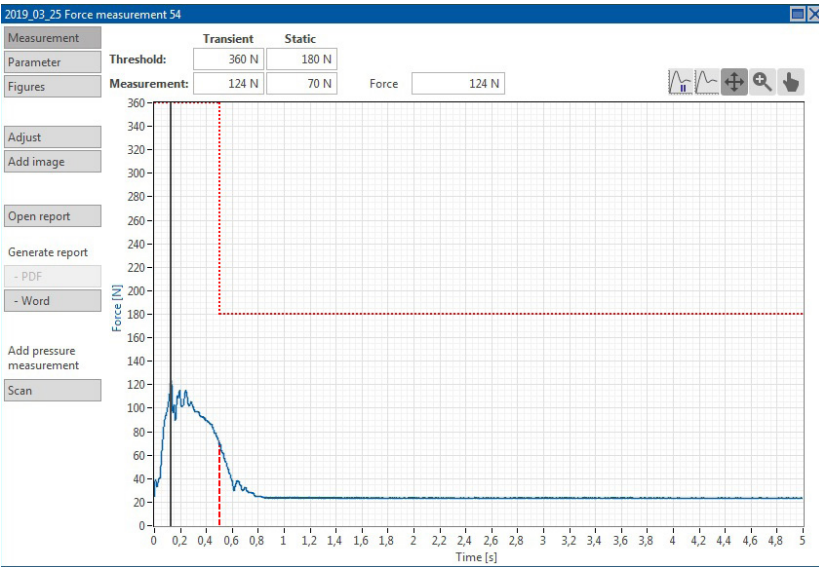


Fig.: 25 Force measurement

Measurement data	Switch back from other menus to the view mode with diagram and measurement data.
Parameter	Here you can add notes and set some new parameters. The measurement data cannot be changed.
Images	If images have been imported, they are displayed here.
Add Image	If you want to add images, you can select and import them in the Explorer.
Open Report	If individual reports have been generated, you can select and open them in the Explorer.
Generate report	Generate a new single report in pdf format or as Microsoft Word document
Limit value	The boxes display the limit values according to the parameters for the measurement.
Measured value	The maximum values of the force measurement are displayed in the boxes.
Force	The current value of the cursor position is displayed in the box.
Diagram	Diagram with force/time axis and force curve.

Cursor	Click on the line and drag the cursor to any position in the force curve.
Limit line	displays the permissible limit values as a line.
Maximum values	the lines indicate the positions of the maximum transient and quasi-static force.

⇒ Edited Force Measurement

### 16.2.2 Import Multiple Force Measurement Simultaneously

#### ▷ Import Multiple Force Measurement Simultaneously

In practice, several measurements are also carried out with the same parameters. The force measurements can then be imported in a single step.

- 1 ►** Perform steps 1 to 6 from the previous instruction "Importing a force measurement"
  - 2 ►** In the Import Force Measurement window, enter other parameters instead of the preset measurement number:
    - e.g. 1-5 for the import of all measurements from measurement number 1 to measurement number 5.
    - e.g. 1,3,5 for the import of measurement numbers 1, 3 and 5.
    - e.g. 1-5,10 for the import of measurement numbers 1 to 5 and measurement number 10.
  - 3 ►** Continue with steps 8 - 11.
- ⇒ Several measurements are transmitted.


<b><i>i</i></b>	It is also possible to import several measurements with different parameters at the same time. To do this, switch to the next column in the Measurements box. The boxes are pre-set with values. Check and correct them. Enter the corresponding measurement numbers.
-----------------	---

### 16.3 Importing a Pressure Measurement with CoboSafe-Scan

This chapter describes the import of a pressure measurement performed with the CoboSafe-Scan system. Further information about this pressure measurement method can be found in the corresponding user manual 'CoboSafe-Scan'.

**Correct parameterization**

The parameters of the measurement must correspond to the belonging force measurement. Only then will the values be calculated correctly.

When importing, you must therefore assign the corresponding force measurement! If this is not possible, the measurement can be subsequently assigned. Please note the  chapter 16.3.7 'Combine Force and Pressure measurement to a file'.

**16.3.1 Source Selection**

- 1 ►** Connect the scanner to the PC and turn it on or activate it.
  - 2 ►** Place the film with the pressure image and the calibration sheet in the scanner according to the instructions in the 'CoboSafe-Scan' user manual.
  - 3 ►** Open the corresponding force measurement and start the import of the pressure measurement here.
  - 4 ►** Alternatively, you can start the import via the button 'CoboSafe-Scan' from the menu bar.
  - 5 ►** Select the connected scanner. Click 'Scan'.
  - 6 ►** If you want to open a pressure image that has already been archived, choose 'From data'. Click 'Next'. Select the desired file in the Explorer.
- ⇒ The scanned image is displayed.

**16.3.2 Evaluation Area**

- 1** Save the scanned image. The file can be loaded and reprocessed at another time.
- 2** This function allows you to selectively cut the relevant pressure area from the scanned image. Hold down the mouse button and select the relevant area.
- 3** The function allows the rectangular excision of the relevant part of the pressure image.
- 4** The function allows the circular excision of the relevant part of the pressure image.

- 5** Check whether the displayed area contains the relevant pressure image or repeat the selection. Click 'Next' for the import.

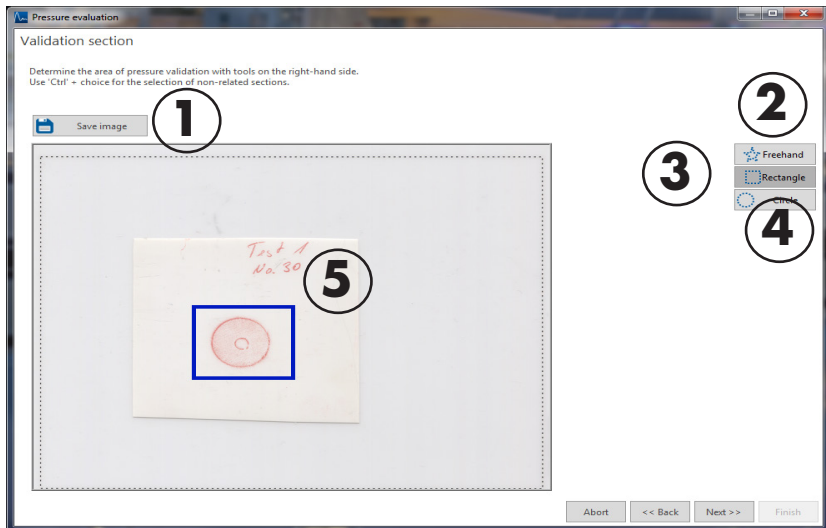


Fig. 26: Pressure analysis



In order to correctly assign the pressure image to a measurement, it is advisable to note the number of the corresponding force measurement on the pressure image.

### 16.3.3 Parameters & Filters

- 1** ▶ Enter the parameters for the measurement here.
  - 2** ▶ Once you have entered the parameters, click 'Next'.
- ⇒ This window displays the evaluated and processed pressure image.

16.3.4 Pressure Distribution

Functions	Description
▷	<b>Finished pressure image.</b>
Limit value	The limit values resulting from the parameters are displayed.
Measured value	The determined and processed measurement values are displayed.
View	Choose between 2D and 3D view from the menu or display the histogram.
Pressure image	Display of the pressure image with color scale and dimensions in mm.
Curser	Click on a dot in the pressure image. The values at the cursor position are displayed.
Add note	Click on any point in the pressure image and open the mouse menu (right mouse button). Select 'Add Note'. The note is placed at this point and can be moved with the mouse. A double-click on the note opens an editor in which a naming can be entered. The information is saved with the pressure image.
⇒	After analysis and editing, click 'Next' for save.

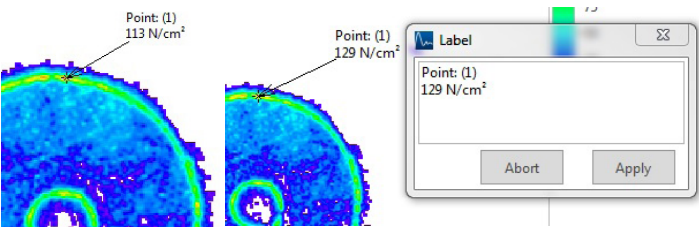


Fig.. 27: Editing pressure image

16.3.5 Description

Here you have the possibility to save the scan in the file format .png, to assign a descriptive name and to add further notes. After completion, the stored measurement opens.

- Combine the saved pressure image directly with the corresponding force measurement afterwards.
- In the force-pressure measurement window, you can also change parameters and add notes.





Assign a descriptive name that allows an unambiguous assignment to a collision.

### 16.3.6 Filtering the Pressure Image

Two filters can be used for pressure evaluation:

- The Gaussian filter is applied to the complete pressure result in order to achieve a smoothing of the pressure image and to level error peaks. When using the filter, the results are changed.
- The pixel filter is only applied to individual pixels. Some pixels can be classified as errors. With the help of the pixel filter these peaks can be leveled. The pressure value is corrected.



#### The Gaussian filter

The use of the Gaussian filter is subject to national approvals. Please contact the responsible institution for further information.

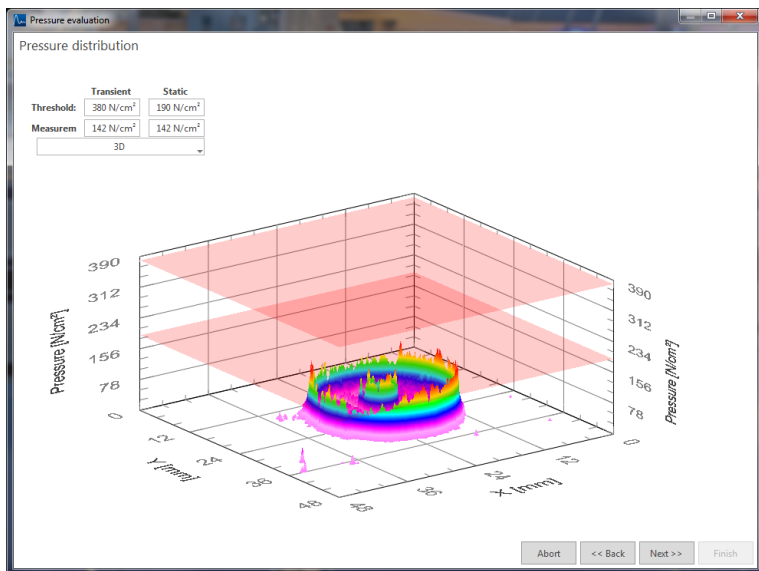


Fig.: 28: Pressure evaluation with Gaussian filter

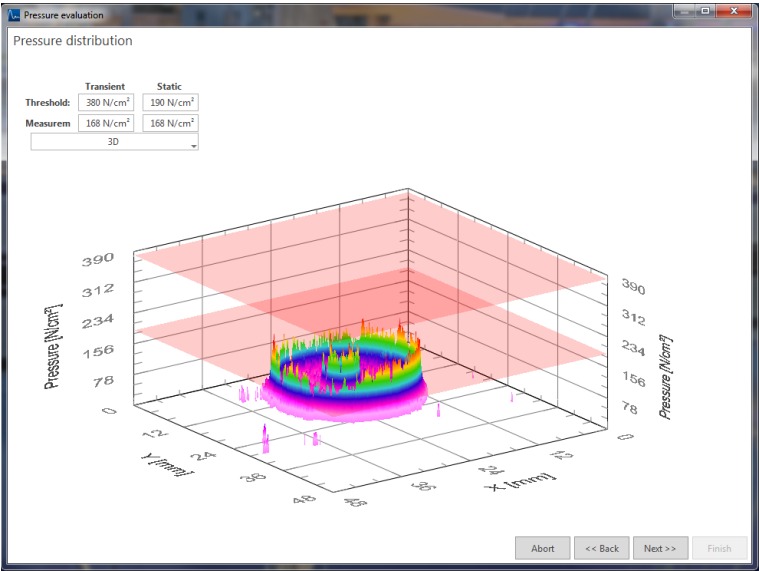


Fig. 29: Pressure evaluation with pixelfilter

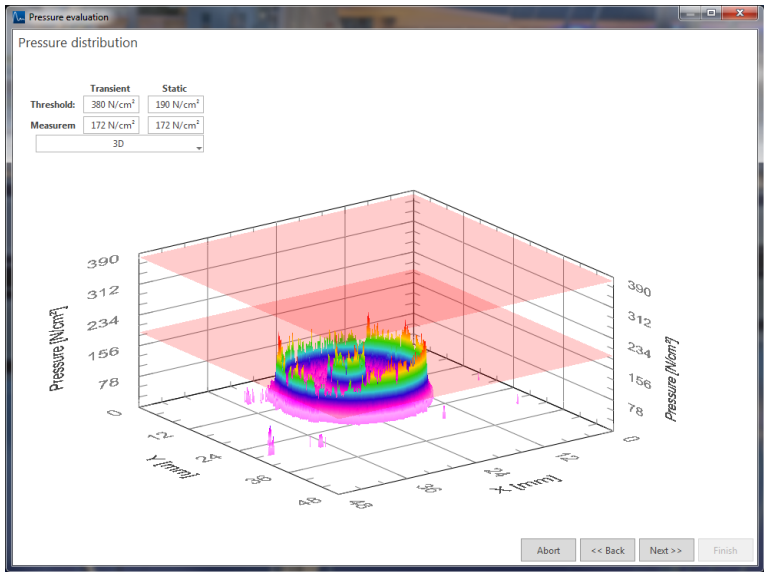


Fig. 30: Pressure evaluation without Gaussian filter

### 16.3.7 Combine Force and Pressure Measurement to one Measurement File

In practice, force and pressure measurement is carried out in a single measurement. The force measurement is stored in the CBSF and the pressure image is available separately. The data is then imported as described above. If the routine is correct, a force-pressure measurement is immediately created as a combination.

It is also possible to import the pressure measurements without prior selection of the corresponding force measurement.

- 1 ►** Search for the force measurement in the Measurements window of the user interface. (It is recommended, for example, to use the measurement number or another descriptive prefix when naming the file).
- 2 ►** Search for the pressure measurement.
- 3 ►** Click on the pressure measurement and drag-and-drop the measurement onto the force measurement.
- ⇒** The new file is added to the end of the list.
- 4 ►** Open the new force-pressure measurement. If necessary, change the file name or add further information.
- 5 ►** Check the parameters of both measurements. In case of unequal parameters, the import of the pressure measurement must be repeated!
- 6 ►** The correct force-pressure measurement can now be assigned to the project or collision.
- ⇒** You have created a force-pressure measurement.



#### Correct Parameters

Note that the same parameters used for force measurement are used when importing the pressure measurement!

If no force measurement is imported, read the temperature and humidity data on the CoboSafe-CBSF display and enter the spring constant K2 and the K1 damping element used.

A force-pressure measurement must have the same setup parameters and hygrometer data!

## 16.4 Importing a Pressure Measurement with CoboSafe-Tek

This chapter describes the import of a pressure measurement performed with the CoboSafe-Tek system. Further information on this pressure measurement method can be found in the corresponding user manual 'CoboSafe-Tek'.

### 16.4.1 Start Measurement

- 1 ►** Connect the measuring equipment to the PC and switch it on. More detailed information can be found in the corresponding manual. Use only high-quality USB cables!
  - ⇒ The measurement is carried out with the connected measuring instruments and transmitted directly.
- 2 ►** Start the menu 'CoboSafe-Tek' from the menu bar.
- 3 ►** Select the test specification used from the drop-down menu.
- 4 ►** Select the force gauge you are using. Click 'Next'.
  - ⇒ You have made the measurement ready to start

### 16.4.2 Source Selection

#### ► Set the parameters of the measurement to be performed

Measuring time	Change of measuring time only possible for F300/1000 devices. Standard measurement time is 5 seconds.
Pressure sensor	Select the sensor type used from the drop-down list. Click on the search function (magnifying glass) if no sensors are displayed. Select the root directory in which all equilibration files are stored.
Sensor Sn	After selecting the sensor type, select the serial number of the film sensor used. The most recent equilibration file is automatically used.
Quality	After selecting the serial number, the quality of the film sensor at the time of the last equilibration is displayed. A homogeneous color distribution with low factors is optimal.
Warning	The warning sign indicates that some cells are out of specification. These are usually visible as red marked pixels or areas and can therefore be localized. If possible, the sensor should not be used and inspected by the manufacturer.
Sensitivity	Here you can set the sensitivity of the sensor. The default value is 29. Increase sensitivity at low pressures. Reduce the sensitivity at high pressures.

Initialize	After restarting the CoboSafe-Vision software, an initialization of the system is always required. Press the button and wait until the initialization is complete.
▶	<b>Click 'Initialize' when all parameters are set.</b>
⇒	You reach the sensor test

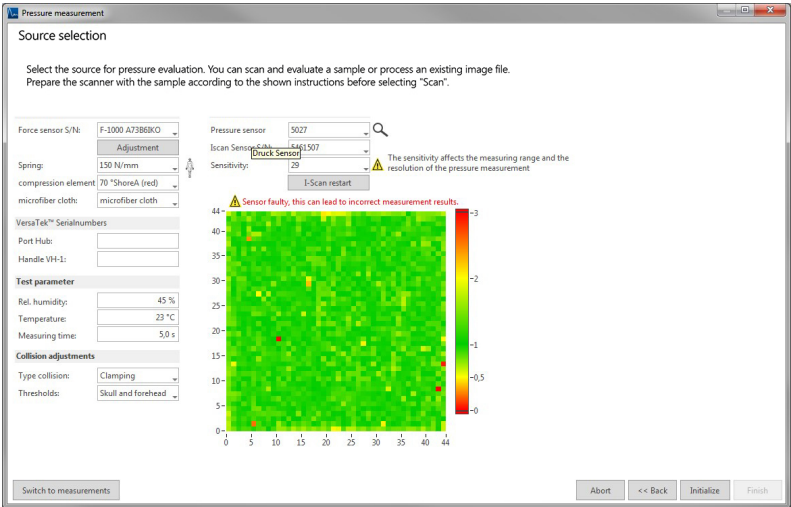


Fig. 31: Pressure measurement with CoboSafe-Tek

### 16.4.3 Sensor Test

After initialization of the system, the film sensor can be tested for functionality.

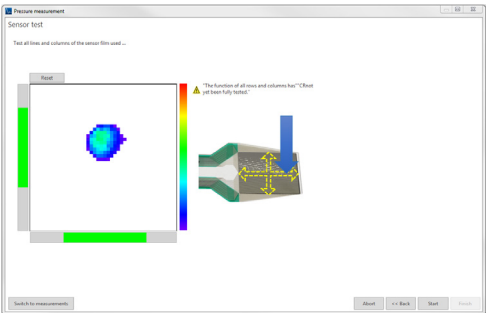


Fig. 32: Sensor test

- 1 ► First, perform a simple pressure test with your finger on the film sensor. The pressure image is currently displayed in view. The sensor is active and working.
  - 2 ► To test the sensor tracks, apply pressure in the X-axis and Y-axis (cross-shaped movement across the sensor). The bars indicate in green which tracks are working. If the film is flawless, the bars are completely green. If this is not the case, contact problems may exist. Insert the sensor again into the handle and perform the test again.
  - 3 ► Observe the warnings.
- ⇒ The measuring system is ready for operation. Click 'Start'.

## 16.4.4 Perform Measurement

After starting the measurement, the measuring equipment is active (running blue measuring bar). The measurement starts with an application of force > 20 N for the set measurement duration.

The progress of the measurement evaluation is displayed. The result is then displayed

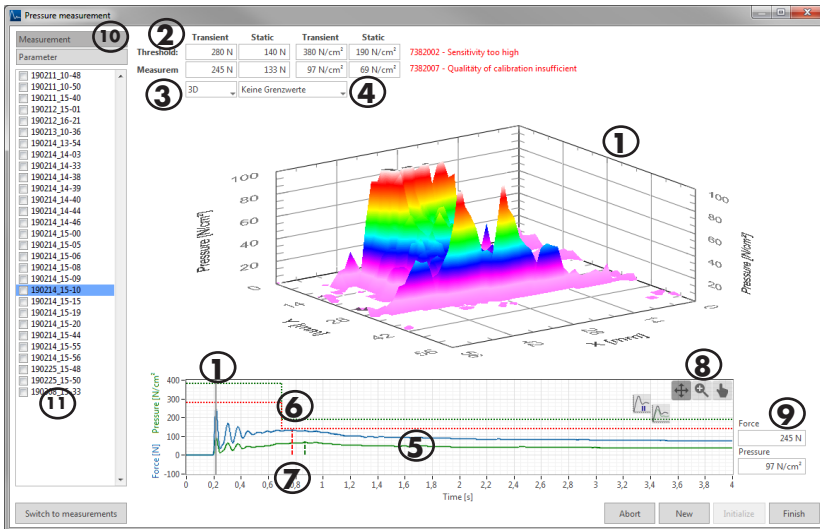


Fig. 33: Displays Pressure Measurement CoboSafe-Tek

- 1** Pressure image according to the cursor position.
- 2** Display of limit values and measured values.
- 3** Select the display in 2D, 3D or histogram.
- 4** Selection of the display with/without limit values.
- 5** Display of the force and pressure curve in the diagram.
- 6** Display of the limit values for force and pressure as lines.
- 7** Positions of the maximum values are marked with red dashes.
- 8** Toolbar (description see chapter 'Toolbar').
- 9** Display of the values at the cursor position.
- 10** Switch the view to measurement data or parameters. Check all details. Enter a descriptive name for the measurement.
- 11** Existing measurement files. Marked measurements are saved for further use by pressing 'Finish'.

#### **16.4.5 Warnings**

- Sensitivity too low/too high: Start a new measurement and change the sensitivity. Perform the measurement again and repeat the measurement until the warning signal disappears.
- Too few cells addressed: The selection of the Tekscan sensor type depends on the expected pressure area and the expected maximum pressure. As a rule of thumb, the pressure area should be at least one third of the sensor area.
- Film function test not complete: Complete the function test.

- Insufficient calibration quality: Initialize the measuring system again.



The selection of the Tekscan sensor type depends on the expected pressure area and the expected maximum pressure. As a rule of thumb, the pressure area should be at least one third of the sensor area.

#### 16.4.6 Sensitivity

The sensitivity of the Tekscan sensor is adjustable:

- The lower the set value, the less sensitive the Tekscan sensor becomes to pressures.
- The higher the value, the more sensitive the sensor becomes.

The sensitivity influences the measuring range of the sensor and must be adapted to the expected pressure in order to obtain correct measured values.

- If the measured pressures are very low, the sensitivity must be increased to produce a usable pressure image.
- If the pressures are very high, a lower sensitivity must be selected analogously.



#### **Attention Faulty measurement results possible!**

The sensitivity influences the measuring range of the sensor. An inappropriate setting of the sensitivity can lead to an incorrect measurement result!  
It must be measured with the appropriate sensitivity!

## 17 Subsequent Editing

If the measurement data are imported without further editing, they can also be edited later. Find the file in the 'Measurements' window. Double-click to open the corresponding window. Here you can change all boxes that are still allowed to be changed.



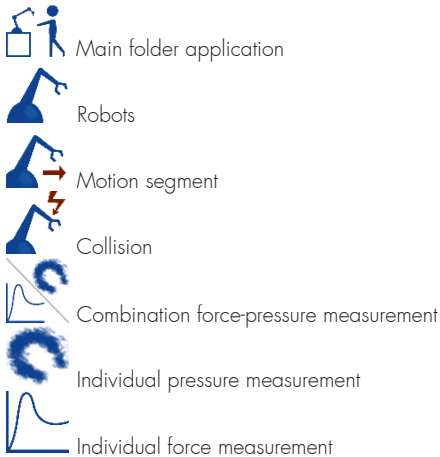
Assign a descriptive name that allows an unambiguous assignment to a collision.

## 18 Projects

The determination of the hazard potential of an application in the event of a collision between robot and human must be determined, evaluated and documented. The structure of a project



supports a professional documentation of the application.



## 18.1 New Project

Start a new project and follow the instructions. Complete the information in the respective windows. If the data is not available, a later processing is possible.

### ▷ Create project

- 1 ▶ Click on 'New Project' in the menu bar of the user interface to start the wizard.
- 2 ▶ Press the 'Next' button to open the next windows.
- 3 ▶ Enter the characteristics of the application.
- 4 ▶ Press the 'Next' button to open the next windows.
- 5 ▶ Select the test basis and the test equipment.
- 6 ▶ Enter all persons who are involved in the check and click "Next".
- 7 ▶ Enter the Customer data of the sold-to party.
  - ⇒ You have entered all the basic information of the project.
- ▷ Add the collision scenarios.
  - 1 ▶ Click "Add robot".

- 2 ▶** Enter the name.  
⇒ It opens a subtopic to define the movement.
- 3 ▶** Double click on Add movement to generate and name it.  
⇒ An sub-branch opens to define the collision.
- 4 ▶** Double click on "Add collision" to generate and name it.
- 5 ▶** Select the collision typ [4].
- 6 ▶** Select the collision point [5].
- 7 ▶** Add more movements and collisions [6].
- 7 ▶** Complete the wizard by clicking "finish".

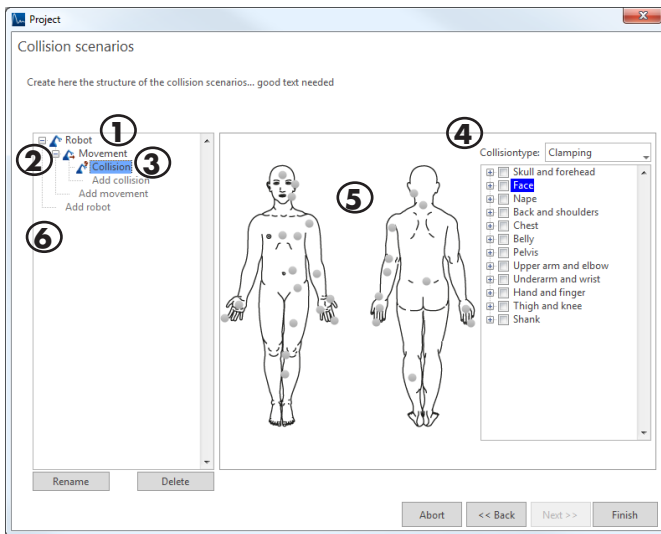


Fig. 34: Project

- ⇒ The project structure is created and can be further edited by double-clicking on the folders.

## 18.2 Archiving, Opening and Closing a Project

A project is already saved in the system and can be opened again. Further options are possible via the buttons in the window:



Fig. 35: Menu archiving, opening and closing a project

- 1** ▶ You can also save a complete project as a zip file.[3]
  - 2** ▶ You can delete marked objects such as individual measurements or a complete project. The button is deactivated for non-deletable objects.[4]
  - 3** ▶ The selected project is closed.[5]
- ⇒ The program calculates and generates a measurement plan in PDF format.

## 18.3 Edit Project

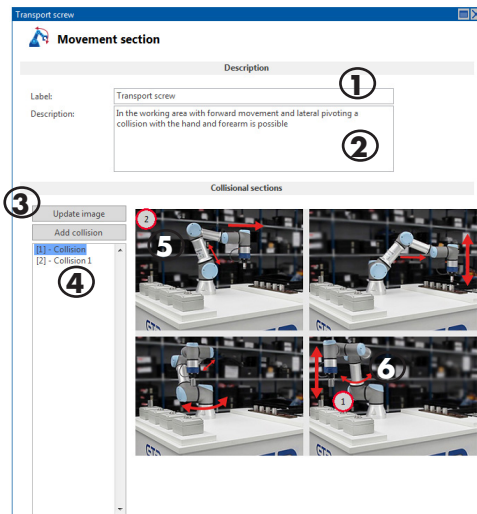


Fig. 36: Movement section

Double-click on the created folder to open the editing window. Here it is possible to change the name or parameter or to enter further information.

► **Edit a created movement section (example)**

- 1 ► Change the current name [1] of the folder.
  - 2 ► Describe the movement sequence and special features [2].
  - 3 ► Add an image to the application by clicking the 'Update image' button [3]. Select the image you want to import. (See our tip below).
  - 4 ► Mark the first collision [4]. The image shows a marker with the collision number [5].
  - 5 ► Drag the marker to the position in the image that represents the collision point [6].
  - 6 ► Proceed in the same way with the collisions.
- ⇒ You have edited the movement section.

► **Create an applied collision point (example)**

- 1 ► Change the current name [1] of the folder.
- 2 ► Select or change to the correct collision type [2].
- 3 ► Add a description or explanation [3].
- 4 ► Select the collision points on the body model [4] or via the list [5].

Fig. 37: Collision

- ⇒ The test equipment to be used with configuration and limit values are displayed as follows: The collision point has been edited

## 18.4 Create a Measurement Plan

After completion of the preliminary work and creation of the project with the collision scenarios, the practical part is required, i.e. carrying out the measurements.

In order to support measurements on the application, it is possible to create and print a measurement plan. The measurement plan is automatically generated by the program and summarizes the required measurements with the equipment.



Fig. 38: Button "measurement plan"

- 1 ►** Select the project or the main folder.
  - 2 ►** Click the [2] button in the function bar to create the measurement plan.
  - 3 ►** Select the directory in which the file is to be stored. The folder of the project is recommended. Assign a file name.
- ⇒ The program calculates and generates a measurement plan in pdf format.



The pages provide space to take handwritten notes, such as the measurement number, when performing the measurement.

## 18.5 Assign Measurement Files

After the project has been created and the measurements have been carried out, they are transferred or imported. In the window 'Measurements' the force and pressure measurements belonging to each other can be connected. See ↗ Chapter 16.3.7 'Combine Force and Pressure Measurement to one Measurement File'.

The measurements should have a descriptive name so that they can be assigned to the collision without any doubt. Only use measurements that can be assigned certainly. If this is not the case, you may have to repeat the measurement.

- 1 ►** Go to the project folder and open the sub-branch until the folder for the collision is displayed
- 2 ►** Now click on the corresponding measurement file in the 'Measurements' window and drag-and-drop the file onto the folder.

- ⇒ The measurement file is added.
- 3 ►** In case of wrong storage, the measurement file can be moved again in the same way.
- ⇒ The measurement file has been assigned.

## 18.6 Evaluate Measurement Data

Double-click to open the window for validating the measurements. All movement sections of the robot and the possible collisions are listed in tabular form.

The required measurements are displayed with limit values. Below you can find the assigned force-pressure measurement with its values. Thus, a direct comparison to the limit values and the classification of the measurement in 'Pass' or 'Fail' are possible.

Validation is not automated and must be performed manually. Click on the corresponding 'Pass' or 'Fail' button.

## 18.7 Project Record

After completion of the validation, a protocol about the application can be created. The protocol is created using Microsoft Word.

**1**



Fig. 39: Button "protocol"

- 1 ►** Select the project or the main folder.
- 2 ►** Click the [1] button in the function bar to create the protocol.
  - ⇒ The protocol is created and then opened.
- 3 ►** You can now edit and save the log as required. The recommended storage location is the project folder on the data carrier.
  - ⇒ The project was logged.



The log is created on the basis of a template. This template can also be adapted to your own needs (→ chapter 14 Overview of Menu Options).

## 19 Appendix

### 19.1 Warnings

Category	Message	Definition	Cause
CoboSafe-Scan	708001	Color areas were not recognized	Calibration sheet missing; calibration sheet dirty.
	708002	Sample page was not recognized	Scanner surface dirty; Sample dirty.
	708003	Incorrect sample page	Sample with the wrong side on. Turn sample over.
	708004	Measuring range exceeded	Film type LLW not suitable. Use type LW.
Force Measurement	757701	Measuring range exceeded	Incorrect parameterization of the robot. Adjust parameters to reduce values.
CoboSafe-Tek	7382001	Sensitivity too low	Film too insensitive. Increase sensitivity.
	7382002	Sensitivity too high	Foil too sensitive. Reduce sensitivity.
	7382003	function test of film not complete	Not all lines of the film tested. Carry out a complete function test.
	7382004	Defective film	Several faulty cells determined. Replace film
	7382006	Too few cells addressed	Pressure area too small in relation to measuring area. Use film with higher resolution.
	7382007	Quality of calibration insufficient	Too large dispersion of the equilibration factors. Replace or re-equilibrate the film.
Measurements	757702	Measuring setup incorrect	Default configuration was changed manually. Verify configuration.

## 19.2 Creating a Protocol Template

We recommend the protocol template provided by the software for editing.  
If you want to create your own document and work with the functions described in this document, integrate a user-defined XML entry as follows:

```
<?xml version="1.0" encoding="utf-8" ?>
<CoboSafeVision xmlns="CoboSafe-Vision Template">
  <Version>25</Version>
</CoboSafeVision>
```

### 19.2.1 Localized Texts

In the template, words beginning with a # will be replaced with localized text.

TAG	Localized Text
#DOCUMENTTITLE	Force and pressure measurement
#SUBTITLE	Application with Human-Robot Collaboration
#PROJECTNAME	Project:
#PROJECTSHORTCUT	Project abbreviation:
#PROJECTCODE	Ident. number:
#CUSTOMERCOMPANY	Customer:
#CUSTOMERAFFIX	Addendum:
#CONTACTNAME	Contact person:
#CONTACTTELEPHONE	Phone number:
#CONTACTEMAIL	E-mail:
#TESTERNAME	Inspector:
#PROTOCOLDATE	Test date:
#LOCATION	Place:
#DATE	Date:
#SIGN	Signature:
#TABLEOFCONTENS	Table of contents
#TITLEABBREVIATIONS	List of abbreviations
#TITLEINTRODUCTION	Introduction
#STANDARDS	Test basis



TAG	Localized Text
#CONTACTINFORMATION	Contact information
#CONTACTCUSTOMERINFORMATION	Customer
#CONTACTTESTERINFORMATION	Tester
#TITLEAPPLICATION	Application
#MEASUREMENTPOINTS	Measuring points
#DESCRIPTIONOFMEASUREMENTPOINTS	Description
#SUMMARYOFMEASUREMENTPOINTS	Measurement results
#MEASUREMENTSETUP	Test setup
#MEASURINGEQUIPMENT	Measurement equipment
#ITEMUNDERTEST	Test object
#APPENDIX	Annex
#BIOMECHANICALLIMITS	B – Biomechanical thresholds
#MEASUREMENTDETAILS	M – Details of measurements
#EQUIPMENT_FORCE	Force measurement
#EQUIPMENT_PRESSURE	Pressure measurement

### 19.2.2 Data and Measurements

Information from the project or from the CoboSafe-Vision software will be inserted at the following keywords:

TAG	Source	Field
%PROJECTNAME	Project	Project name
%PROJECTSHORTCUT	Project	Project abbreviation
%PROJECTCODE	Project	Ident. number
%CUSTOMERCOMPANY	Customer	Company name
%CUSTOMERAFFIX	Customer	Customer addendum
%CONTACTNAME	Customer	Contact person
%CONTACTTELEPHONE	Customer	Phone number
%CONTACTEMAIL	Customer	E-mail
%TESTERNAME	Inspector	Name of the first named inspector

TAG	Source	Field
%PROTOCOLDATE	—	Protocol generation date
%STANDARDS	Test basis	Normative bases
%CONTACTCUSTOMERINFORMATION	Customer	Detailed customer information
%CONTACTTESTERINFORMATION	Inspector	Detailed inspector information
%PROJECTDESCRIPTION	Project	Project description
%PROJECTPICTURES	Project	Pictures
%MOVEMENTSANDCOLLISIONPOINTS_WITHDETAILS	Movements & colisions	Movements with colisions, details included
%MOVEMENTSANDCOLLISIONPOINTS	Movements & colisions	Movements with colisions without details
%SUMMARYOFMEASUREMENTPOINTS	Evaluation	Summary of measurements
%FORCEMEASURINGDEVICES	—	List of all used force measurement devices, calibration date included
%PRESSUREMEASURINGDEVICES	—	List of all used pressure measurement devices, calibration date included
%COBOSAFEVISION	—	Software version
%LISTOFITEMSUNDERTEST	Robot	List of tested robots and setup
%BIOMECHANICALPICTURE	Test basis	Illustration of the body zones
%BIOMECHANICALLIMITS	Test basis	Biomechanical values of standards
%FORCEPRESSUREMEASUREMENTDETAILS	—	Details of all force and pressure measurements
%FORCEMEASUREMENTDETAILS	—	Details of all force measurements
%PRESSUREMEASUREMENTDETAILS	—	Details of all pressure measurements

### 19.2.3 Tables

Edit the format templates to customize the tables to your individual style.

Table templates	Usage
cobosafe_collision_details	Details of a collision
cobosafe_collision_short	Brief information of a collision
cobosafe_contactinformation	Contact information
cobosafe_evaluation	Summary and evaluation
cobosafe_infotable	General information
cobosafe_measurement_detailinformation	Details of a measurement
cobosafe_measurement_detailnote	Comments on measurements
cobosafe_measurement_results	Result of measurement
cobosafe_warnings	Warnings
cobosafe_itemundertest	Summary of a robot's information

**19.2.4 Localized Text at a Glance (English, French, Japanese, German)**

<b>TAG</b>	<b>English</b>	<b>Français</b>
#DOCUMENTTITLE	Force and pressure measurement	Mesure de la force et de la pression
#SUBTITLE	Application with Human-Robot Collaboration	Application avec collaboration homme-robot
#PROJECTNAME	Project:	Projet:
#PROJECTSHORTCUT	Project abbreviation:	Désignation abrégée:
#PROJECTCODE	Ident. number:	Ident. numéro d'identification:
#CUSTOMERCOMPANY	Customer:	Client:
#CUSTOMERAFFIX	Addendum:	Complément:
#CONTACTNAME	Contact person:	Personne de contact:
#CONTACTTELEPHONE	Phone number:	Numéro de téléphone:
#CONTACTEMAIL	E-mail:	Email:
#TESTERNAME	Inspector:	Examineur:
#PROTOCOLDATE	Test date:	Date de l'examen :
#LOCATION	Place:	Lieu:
#DATE	Date:	Date:
#SIGN	Signature:	Signature:
#TABLEOFCONTENS	Table of contents	Table des matières
#TITLEABBREVIATIONS	List of abbreviations	Liste des abréviations
#TITLEINTRODUCTION	Introduction	Introduction
#STANDARDS	Test basis	Bases de contrôle
#CONTACTINFORMATION	Contact information	Informations de contact
#CONTACTCUSTOMERINFORMATION	Customer	Client
#CONTACTTESTERINFORMATION	Tester	Examineur
#TITLEAPPLICATION	Application	Application
#MEASUREMENTPOINTS	Measuring points	Points de mesure
#DESCRIPTIONOFMEASUREMENTPOINTS	Description	Description
#SUMMARYOFMEASUREMENTPOINTS	Measurement results	Résultats de mesure
#MEASUREMENTSETUP	Test setup	Structure de contrôle
#MEASURINGEQUIPMENT	Measurement equipment	Moyen de mesure
#ITEMUNDERTEST	Test object	Objet du test
#APPENDIX	Annex	Annexe
#BIOMECHANICALLIMITS	B – Biomechanical thresholds	B – Valeurs limites biomécaniques
#MEASUREMENTDETAILS	M – Details of measurements	M – Détails des mesures
#EQUIPMENT_FORCE	Force measurement	Mesure de la force
#EQUIPMENT_PRESSURE	Pressure measurement	Mesure de pression

TAG	やまと	Deutsch
#DOCUMENTTITLE	力・圧力測定	Kraft- und Druckmessung
#SUBTITLE	人とロボットの協働によるアプリケーション	Applikation mit Mensch-Roboter Kollaboration
#PROJECTNAME	プロジェクト	Projekt:
#PROJECTSHORTCUT	略称。	Kurzbezeichnung:
#PROJECTCODE	アイデンティティ 番号です。	Projekt-ID:
#CUSTOMERCOMPANY	クライアント	Kunde:
#CUSTOMERAFFIX	追加です。	Zusatz:
#CONTACTNAME	担当者	Ansprechpartner:
#CONTACTTELEPHONE	電話番号	Telefon:
#CONTACTEMAIL	電子メール	E-Mail:
#TESTERNAME	インスペクター	Prüfer:
#PROTOCOLDATE	テスト日	Prüfdatum:
#LOCATION	場所	Ort:
#DATE	日付	Datum:
#SIGN	サインをする。	Unterschrift:
#TABLEOFCONTENS	目次	Inhaltsverzeichnis
#TITLEABBREVIATIONS	略語の一覧	Abkürzungsverzeichnis
#TITLEINTRODUCTION	はじめに	Einleitung
#STANDARDS	テスト原理	Prüfgrundlage
#CONTACTINFORMATION	お問い合わせ先	Kontaktinformationen
#CONTACTCUSTOMERINFORMATION	クライアント	Kunde
#CONTACTTESTERINFORMATION	インスペクター	Prüfer
#TITLEAPPLICATION	アプリケーション	Applikation
#MEASUREMENTPOINTS	測定ポイント	Messpunkte
#DESCRIPTIONOFMEASUREMENTPOINTS	商品説明	Beschreibung
#SUMMARYOFMEASUREMENTPOINTS	測定結果	Messergebnisse
#MEASUREMENTSETUP	テストセットアップ	Prüfaufbau
#MEASURINGEQUIPMENT	計測機器	Messmittel
#ITEMUNDERTEST	テスト項目	Prüfgegenstand
#APPENDIX	アネックス	Annex
#BIOMECHANICALLIMITS	B – バイオメカニクスの限界	B – Biomechanische Grenzwerte
#MEASUREMENTDETAILS	M – 測定値の詳細	M – Details der Messungen
#EQUIPMENT_FORCE	力測定	Kraftmessung
#EQUIPMENT_PRESSURE	圧力測定	Druckmessung





