

Tutorial - First steps in catman Easy AP

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Author: Thomas Markwitz, Product Manager Test & Measurement

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Abstract

The tutorial is dedicated to users doing their first steps in catman, but also for existing users it might be helpful. The tutorial includes basic catman functions and shows how to perform a whole measurement job from setup to analysis and reporting.

In detail:

1. Hardware setup
2. Measurement configuration and diagnostics
3. Online Analysis (Online computation and live review)
4. Data Acquisition jobs (trigger, recurrent measurements)
5. Review and compare several measurements in Analysis mode
6. Post Process Analysis (Computation)
7. Reporting

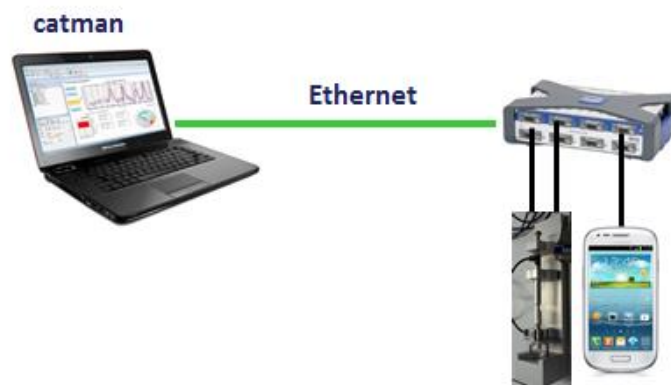
Used hardware and software for this tutorial

- QuantumX MX840 with firmware 4.0.34 or higher
- Force and displacement sensors
- Stereo jack/HD-Sub15 “adapter”
- Smartphone with Signal Generator App, e.g. “Sound Generator” from Jose Morais for Android OS
- catman Version 4.0 or higher
- Microsoft Word

Main part

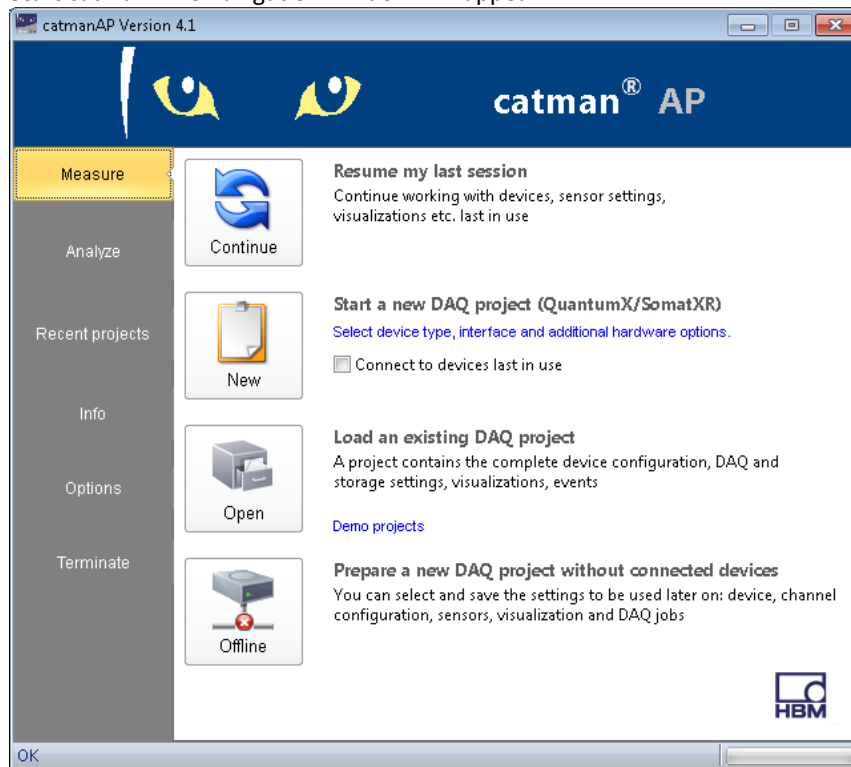
1) Hardware setup

QuantumX module and PC are directly connected to each other with an Ethernet cable. One sensor is already connected, the others are not yet connected. Power up QuantumX and the PC during your preparation as they need some time to find each other on the network.



2) Measurement configuration and diagnostics

Start catman. The navigation window will appear:

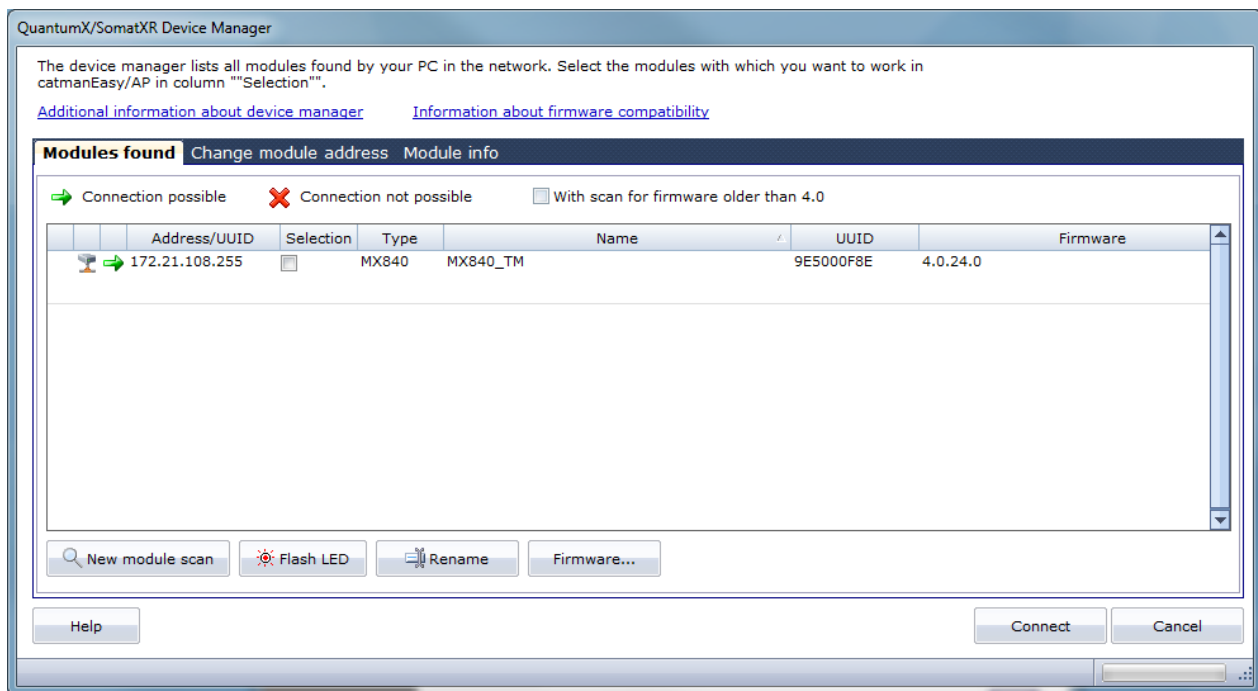


It is used to navigate to the desired function, e.g. new measurement project, resume last session or open analysis project. For a better usability the navigation window is separated into different parts:

- Measurement functions
- Analysis functions
- Last projects
- Info
- Options

In this example click on *Measurement->New* to create a new measurement project from the scratch. (Make sure that QuantumX is selected as device type with QuantumX/SomatXR device manager as search port).

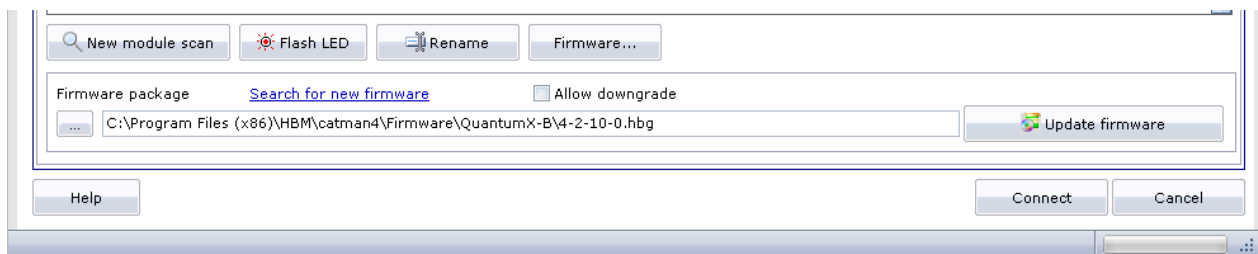
The QuantumX/SomatXR device manager is opened and the network is scanned for available QuantumX devices. The result is displayed in a list:



(Make sure that option “With scan for firmware older than 4.0” is disabled to speed up scan)

Easy setup: It doesn’t matter whether the QuantumX is used in a private measurement network or in a managed DHCP network. The user doesn’t need to take care about IP addresses or subnet masks. QuantumX and PC will configure themselves automatically (using DHCP and APIPA protocol). Of course it is possible to set QuantumX to a fixed IP address if necessary using the device manager.

If necessary a firmware update can be done using the device manager. In that case just click on the “Firmware” button and the window will be expanded with a field to specify the location of the new firmware and a button to start the update procedure.



Now select your module and click on “Connect” button.

Result: catman connects to the module, reads the configuration and automatically displays the current channel configuration, diagnostics and measurement values (if available). Like this you quickly get an overview which channels are connected and you receive first diagnostic information if the configuration of the channels is correct and already see live measurement readings. In this example one Voltage sensor is connected on channel 4:

catmanAP V4.1.0

File DAQ channels DAQ jobs Visualization DataViewer Sensor database

Start Measurement Channel Sample Live update Active Display filter Slow Default Configure Sample rates/filter Sensor TEDS Sensor Adaptation Edit mV/V Execute Zero balance Computation channels Create Delete Auxiliary channel Special

Configure DAQ channels

-	Channel name	Reading	Sample rate/Filter	Slot	Sensor/Function	Zero value
+	MX840A TM					
	MX840_TM_CH 1	No signal	300 Hz / BE 50 Hz (Auto)	1	DC Voltage	0,00000 V
	MX840_TM_CH 2	No signal	300 Hz / BE 50 Hz (Auto)	2	DC Voltage	0,00000 V
	MX840_TM_CH 3	No signal	300 Hz / BE 50 Hz (Auto)	3	DC Voltage	0,00000 V
	DC voltage 10 V	-0,04171 V	300 Hz / BE 50 Hz (Auto)	4	DC Voltage	0,00000 V
	MX840_TM_CH 5	No signal	300 Hz / BE 50 Hz (Auto)	5	DC Voltage	0,00000 V
	MX840_TM_CH 6	No signal	300 Hz / BE 50 Hz (Auto)	6	DC Voltage	0,00000 V
	MX840_TM_CH 7	No signal	300 Hz / BE 50 Hz (Auto)	7	DC Voltage	0,00000 V
	MX840_TM_CH 8	No signal	300 Hz / BE 50 Hz (Auto)	8	DC Voltage	0,00000 V

Computation channels

Now connect the other sensors.

Result: If the sensor is equipped with TEDS, the QuantumX module reads out the sensor configuration from the TEDS chip and activates the settings. Live measurement values are displayed in catman:

catmanAP V4.1.0

File DAQ channels DAQ jobs Visualization DataViewer Sensor database

Start Measurement Channel Sample Live update Active Display filter Slow Default Configure Sample rates/filter Sensor TEDS Sensor Adaptation Edit mV/V Execute Zero balance Computation channels Create Delete Auxiliary channel Special

Configure DAQ channels

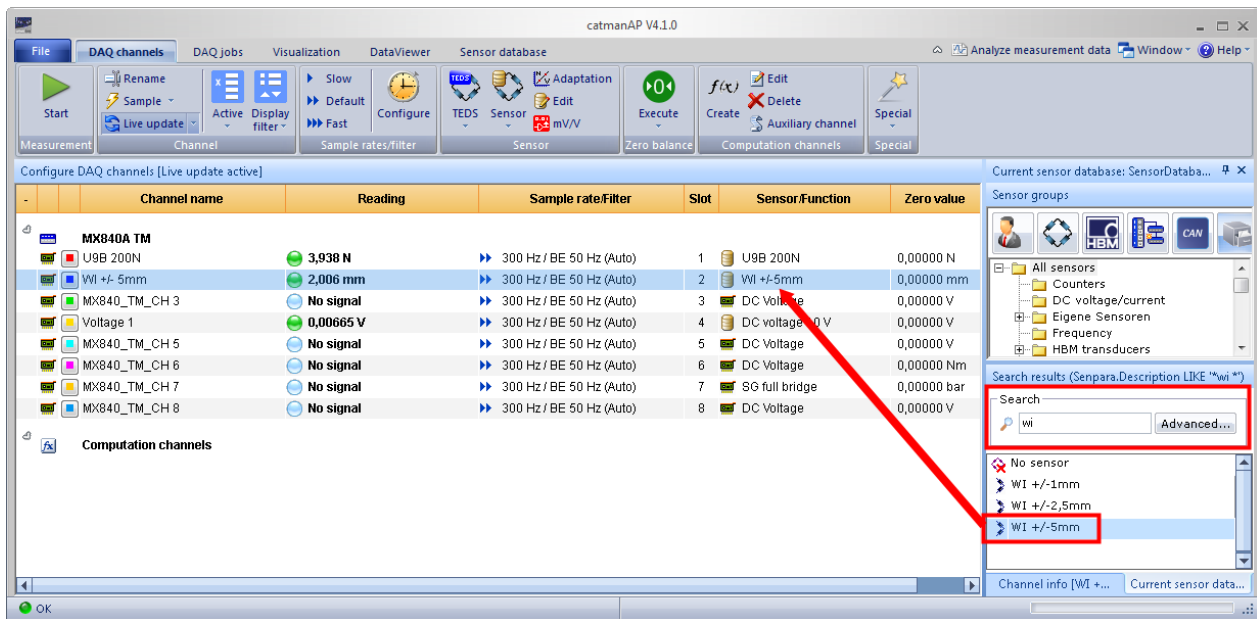
-	Channel name	Reading	Sample rate/Filter	Slot	Sensor/Function	Zero value
+	MX840A TM					
	U9B 200N	3,462 N	300 Hz / BE 50 Hz (Auto)	1	U9B (SG full bridge)	0,00000 N
	W1 +/-5mm	4,971 mm	300 Hz / BE 50 Hz (Auto)	2	W1 (Inductive half bridge)	0,00000 mm
	MX840_TM_CH 3	No signal	300 Hz / BE 50 Hz (Auto)	3	DC Voltage	0,00000 V
	DC voltage 10 V	0,02113 V	300 Hz / BE 50 Hz (Auto)	4	DC Voltage	0,00000 V
	MX840_TM_CH 5	No signal	300 Hz / BE 50 Hz (Auto)	5	DC Voltage	0,00000 V
	MX840_TM_CH 6	No signal	300 Hz / BE 50 Hz (Auto)	6	DC Voltage	0,00000 V
	MX840_TM_CH 7	No signal	300 Hz / BE 50 Hz (Auto)	7	DC Voltage	0,00000 V
	MX840_TM_CH 8	No signal	300 Hz / BE 50 Hz (Auto)	8	DC Voltage	0,00000 V

Computation channels

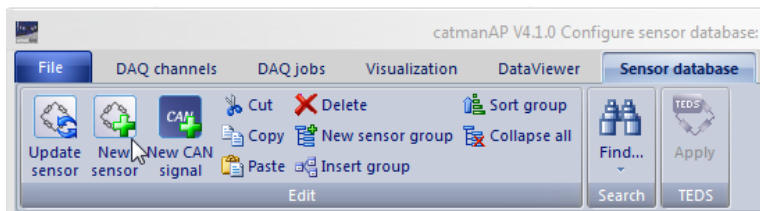
Channel configuration using Sensor Database

If you are not using TEDS the channel configuration can be done with the Sensor database. The database consists of several "sensors", which can be grouped by their functionality for example. One sensor is a set of data containing all relevant information which is necessary to configure the channel, e.g. transducer type, excitation voltage, calibration method, etc. In addition other useful information can be stored in a sensor dataset, e.g. Serial number and calibration date.

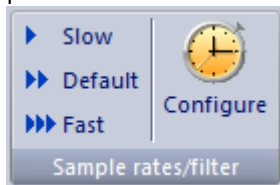
The Sensor database you can find on the right side of the window. Type in the first letters of the name of the sensor in the search field and all matching sensors will be displayed. Now drag & drop the sensor on to the desired channel and the channel will be configured according to the settings stored in the sensor.



If you want to add own sensors to the database, please switch to tab “Sensor database” and click on button “New sensor”:

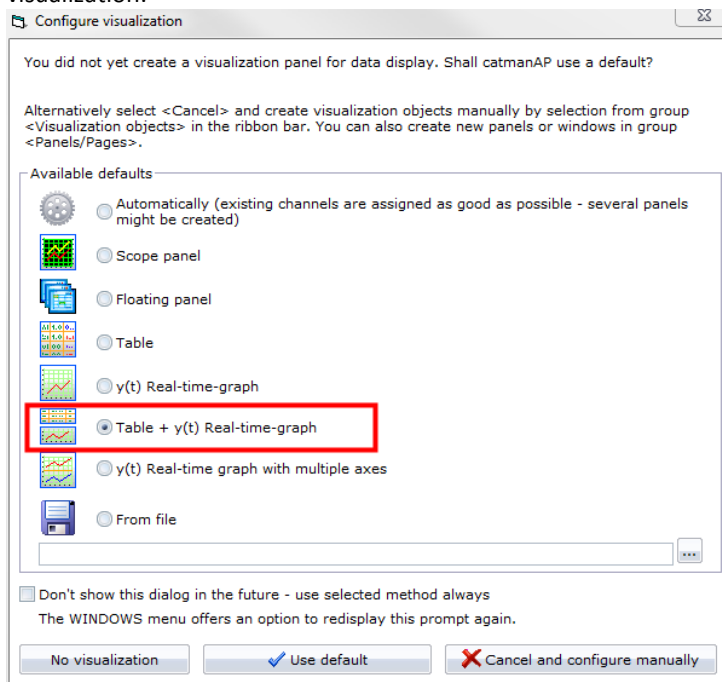


Check if the measurement rate and filter settings are appropriate for the measurement task. Catman allows using three different measurement rates in the project (slow, default, fast). With QuantumX measurement rates up to 200 kS/s are possible. The measurement rate can easily be adapted in the Sample rate and filters menu:

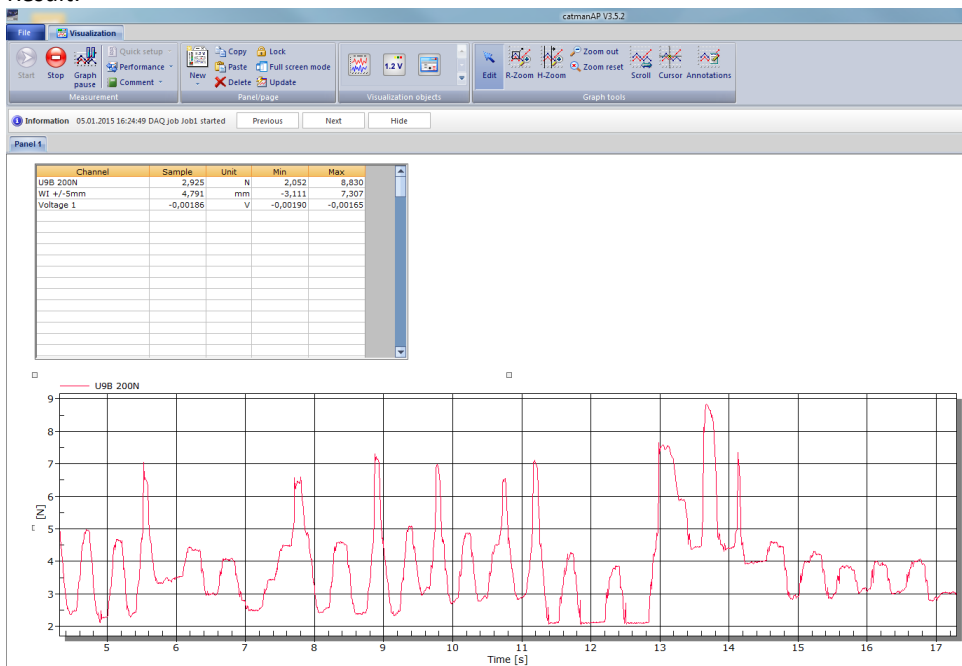


For this demo the default setting of 300S/s and Auto filter are ok.

To get fast to your results directly click on the Start button and choose “table + y(t) real time graph” as default visualization.



Result:

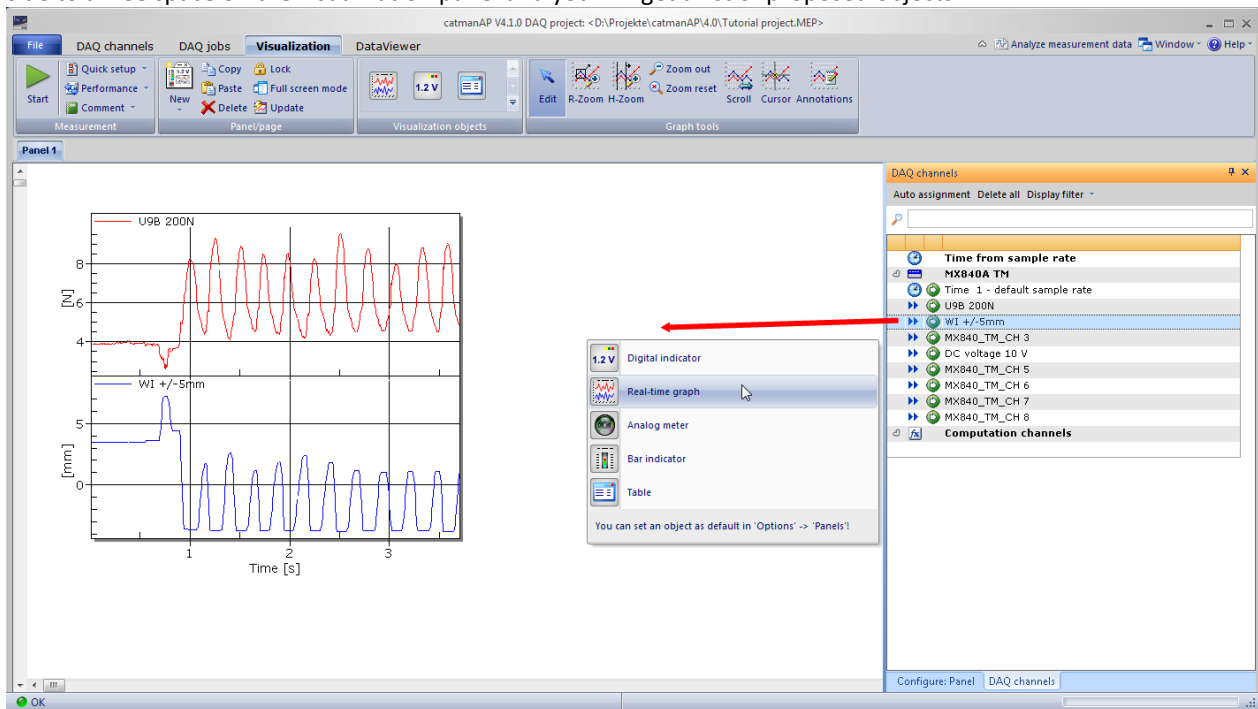


After only a few steps you have done your first measurement

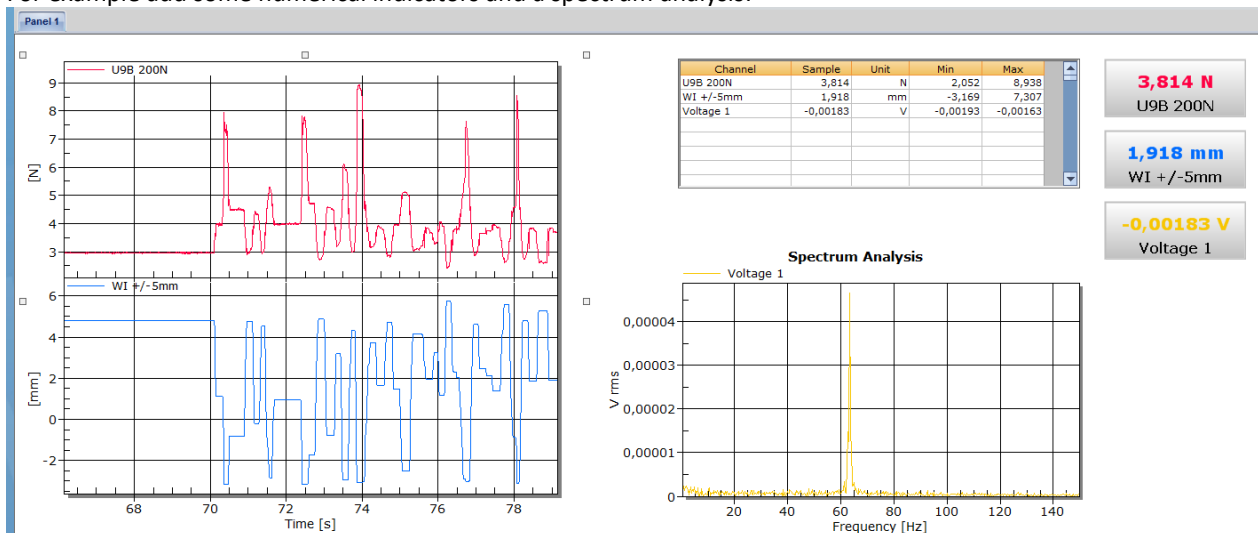
Without disrupting the measurement you can now online add further Visualization objects or modify existing objects. You can find the objects in the ribbon group “Visualization objects”



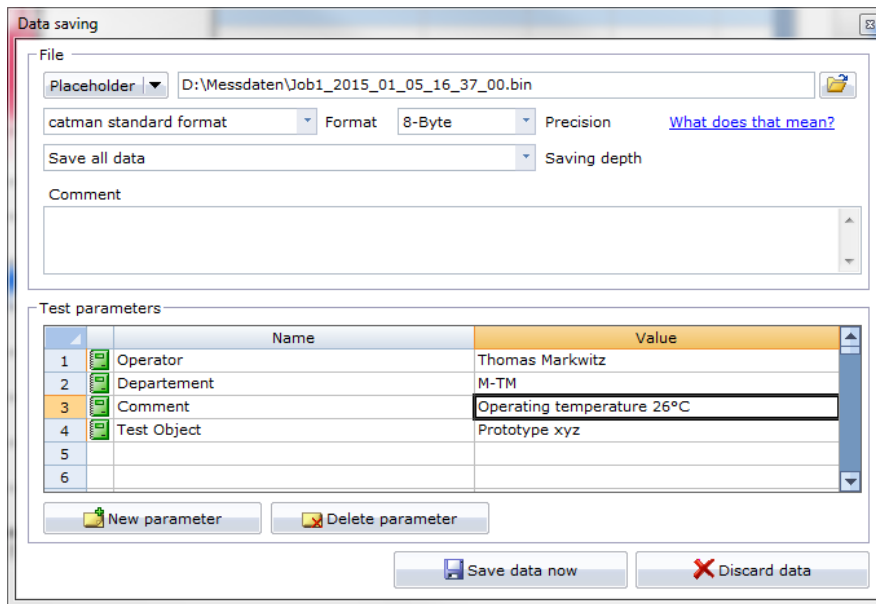
or even more simple just drag & drop the desired channel you want to visualize from the DAQ channels on the right side to a free space on the visualization panel and you will get a list of proposed objects:



For example add some numerical indicators and a spectrum analysis:



After some seconds stop the measurement. A window pops up where you define the file name and add important Meta Data. Fill out the fields. Of course you can also modify the proposed fields and add new parameters. For example a new field "Test Object":



The "Data saving" dialog box contains the following fields and controls:

- File:** A dropdown menu showing "Placeholder" and a text field containing "D:\Messdaten\Job1_2015_01_05_16_37_00.bin".
- Format:** A dropdown menu showing "catman standard format".
- Format:** A dropdown menu showing "8-Byte".
- Precision:** A text field with a link "[What does that mean?](#)".
- Save all data:** A dropdown menu.
- Saving depth:** A text field.
- Comment:** A large text area.
- Test parameters:** A table with 6 rows and 2 columns: "Name" and "Value".

	Name	Value
1	Operator	Thomas Markwitz
2	Departement	M-TM
3	Comment	Operating temperature 26°C
4	Test Object	Prototype xyz
5		
6		

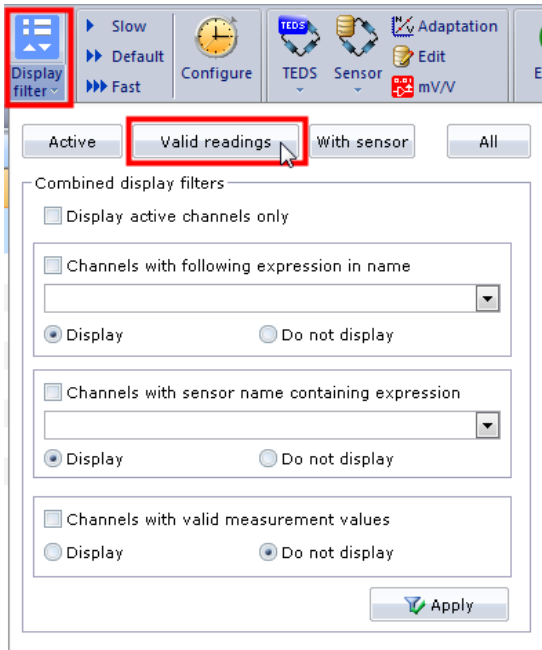
Below the table are two buttons: "New parameter" and "Delete parameter". At the bottom of the dialog are two buttons: "Save data now" and "Discard data".

The Meta Data is very important to differentiate, understand, analyze and interpret the measurement files during post process.

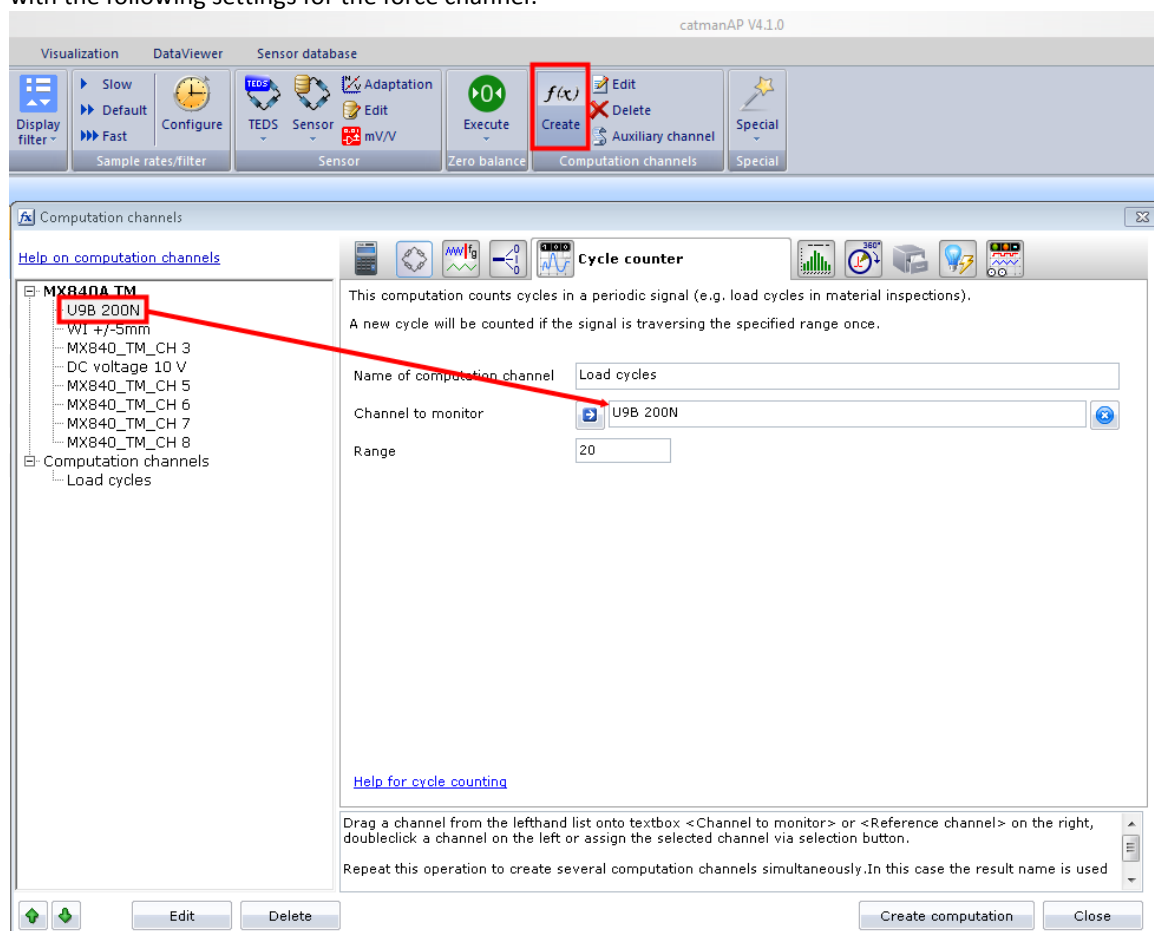
Save the data.

3. Online Analysis

Switch back to the DAQ channels and reduce the view to the channels with valid readings:

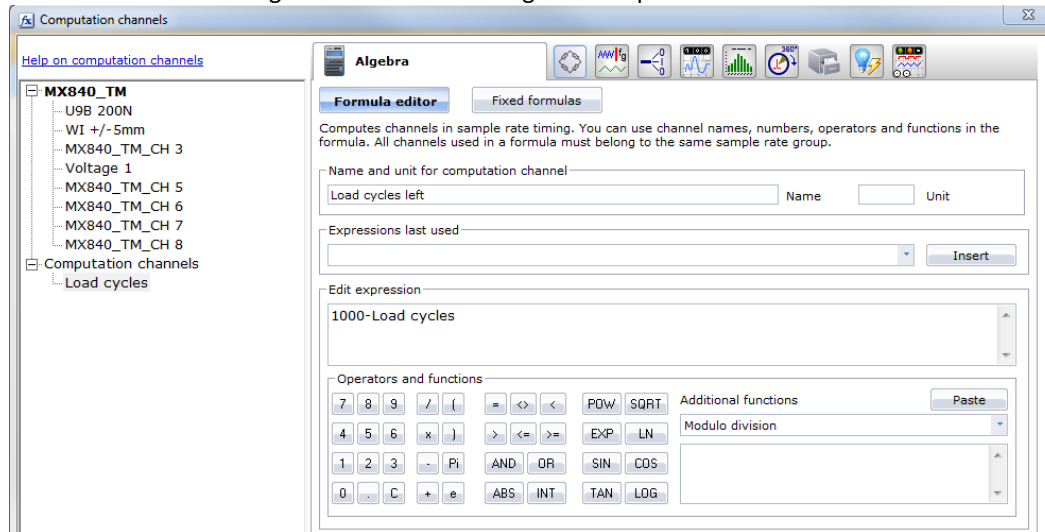


Add a computation channel with the name "Load cycles" to see the online analysis capabilities. Choose a cycle counter with the following settings for the force channel:



The counter value will be increased by one if a full period is detected with at least 20N peak-to- peak.

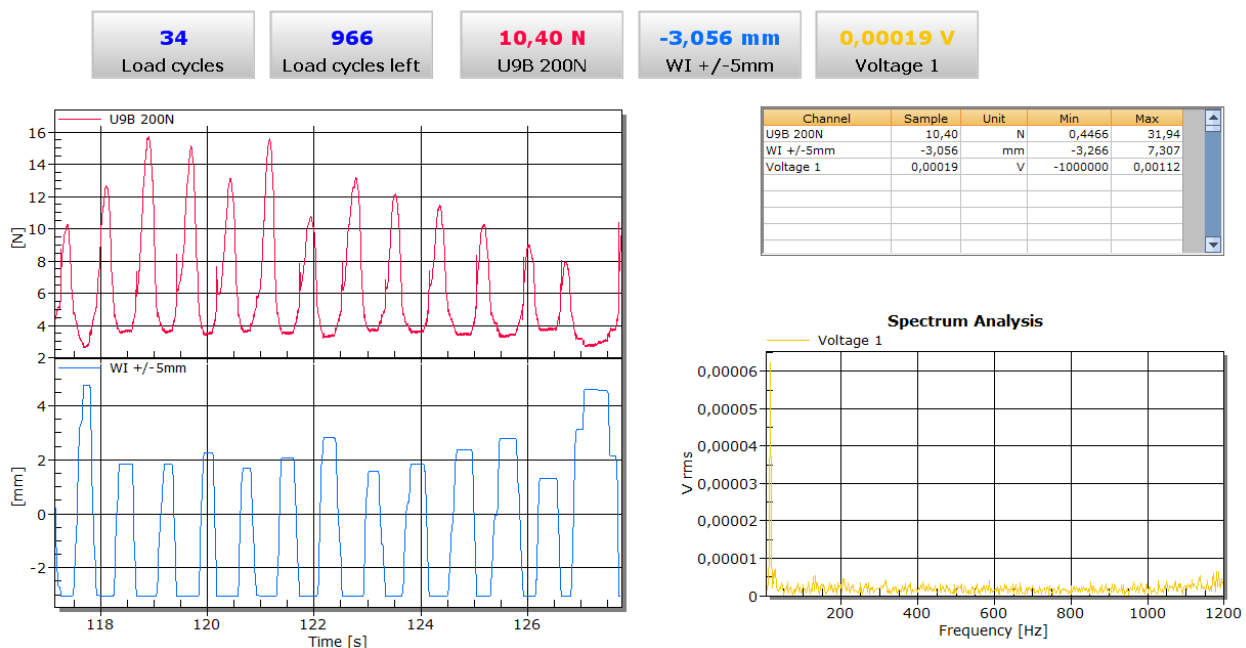
To have a down counting value add a further Algebra computation channel with the name "Load cycles left":



The new computation channels are now shown in the DAQ channels:

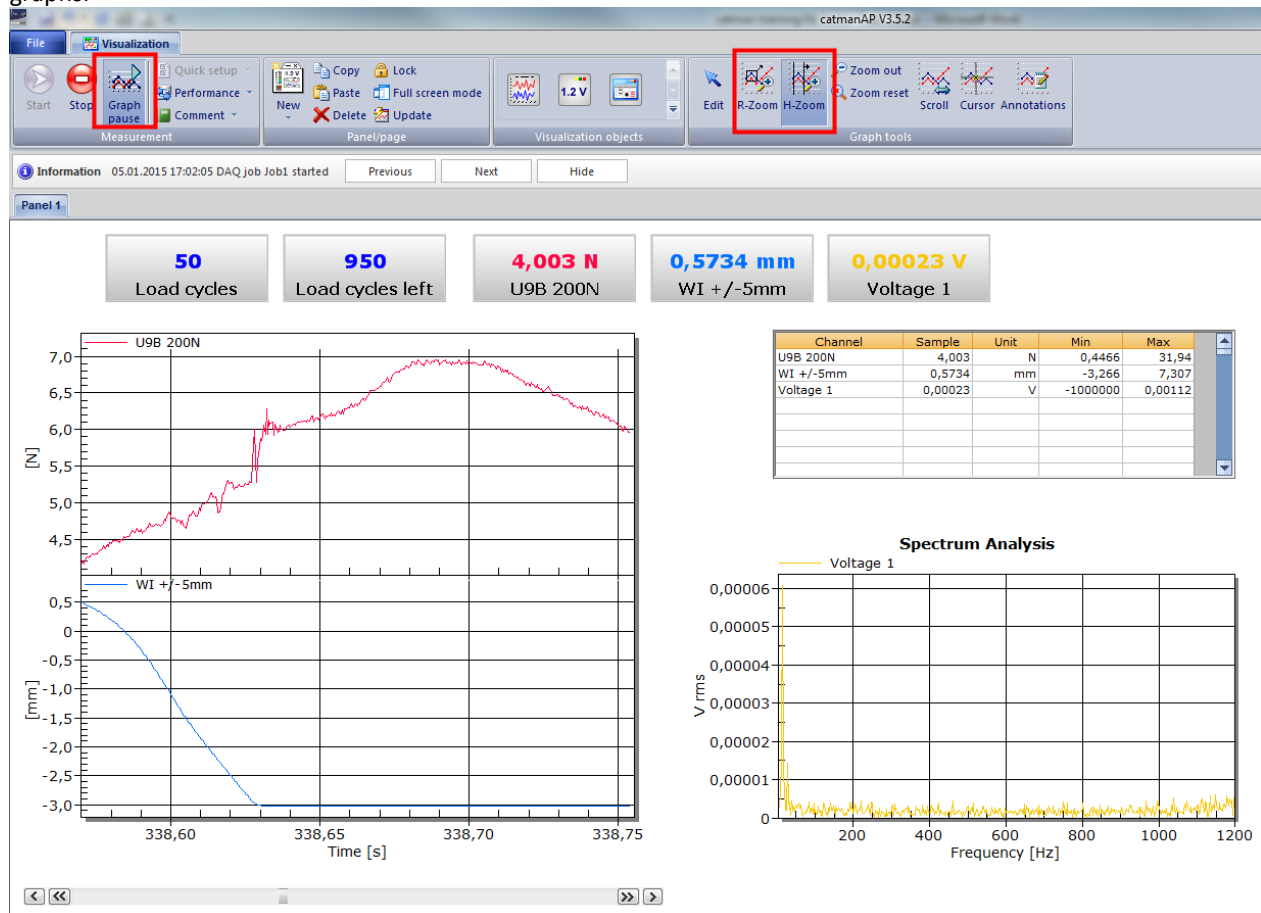
Configure DAQ channels						
	Channel name	Reading	Sample rate/Filter	Slot	Sensor/Function	Zero value
MX840_TM						
	U9B 200N	4,004 N	300 Hz / BE 50 Hz (Auto)	1	U9B (SG full bridge)	0,00000 N
	WI +/-5mm	0,9239 mm	300 Hz / BE 50 Hz (Auto)	2	WI (Inductive half bridge)	0,00000 mm
	MX840_TM_CH 3	No signal	300 Hz / BE 50 Hz (Auto)	3	Inductive full bridge	0,00000 mm
	Voltage 1	0,000 V	300 Hz / BE 50 Hz (Auto)	4	DC Voltage	0,00000 V
	MX840_TM_CH 5	No signal	300 Hz / BE 50 Hz (Auto)	5	DC Voltage	0,00000 V
	MX840_TM_CH 6	No signal	300 Hz / BE 50 Hz (Auto)	6	Inductive full bridge	0,00000 mm
	MX840_TM_CH 7	No signal	300 Hz / BE 50 Hz (Auto)	7	SG full bridge	0,00000 N
	MX840_TM_CH 8	No signal	300 Hz / BE 50 Hz (Auto)	8	DC Voltage	0,00000 V
Computation channels						
	Load cycles	0,00000			CYCLECOUNT~U9B 200N-2	0,00000
	Load cycles left	1000			1000-Load cycles	0,00000

Add the computation channels also to the visualization and start measurement. The force cycles should now be displayed correctly:



Please take always the time to create a nice visualization. With some training it will cost you only 1-2min per visualization panel.

During the measurement you can already do a visual analysis of your data by pausing and zoom into the real time graphs:



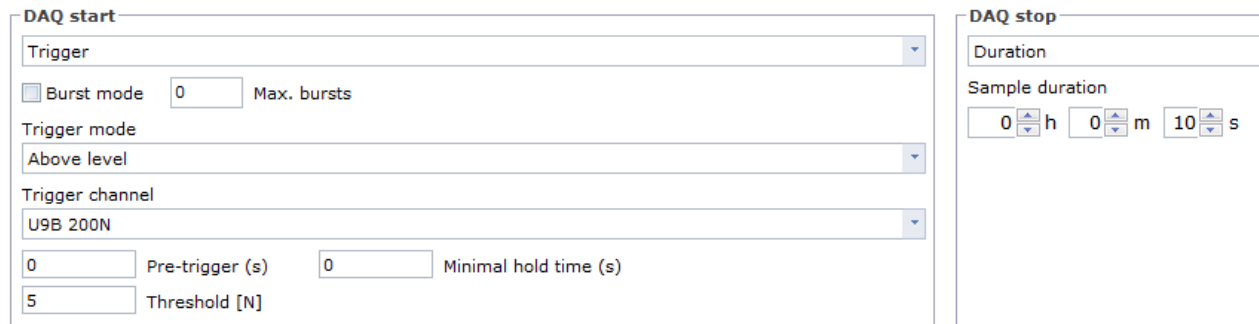
The measurement is not stopped and all numerical displays and tables are still updated.

4. Data Acquisition jobs (trigger, repeated measurements)

Task: In the next steps we want record a load cycle test using triggered and repeating measurements. Three load cycles with a length of 10 seconds should be recorded. Recording should start if the force channel exceeds 5N.

In the DAQ Job settings choose "Trigger" as DAQ start, "Above level" as Trigger mode, the Force signal as "trigger channel" and 5N as "Threshold".

For DAQ stop choose "Duration" and 10s as "Sample duration".



The screenshot shows the DAQ Job settings configuration window. The 'DAQ start' section is set to 'Trigger' mode. The 'Trigger mode' is set to 'Above level'. The 'Trigger channel' is set to 'U9B 200N'. The 'Pre-trigger (s)' is set to 0 and the 'Minimal hold time (s)' is set to 0. The 'Threshold [N]' is set to 5. The 'DAQ stop' section is set to 'Duration' mode. The 'Sample duration' is set to 0 h, 0 m, and 10 s.

In the channel parameters of the DAQ Job enter 2 repetitions in order to achieve three measurements and set a delay of 5s between the repetitions.

In order to store the relevant Meta data automatically also fill out the Test parameters

A DAQ job can be automatically repeated. Entering zero as number of repetitions will execute the job exactly once.




Repetitions
 ☐ Unlimited repetitions
 Delay between repetitions (s)

Upon DAQ job start a specific panel can be shown automatically.

Panel

Test parameters

☒ Add DAQ settings after job termination [What are test parameters?](#)

	Name	Value
	Operator	Thomas Markwitz
	Departement	M-TM
	Comment	Test

In the Data storage settings of the DAQ Job choose “Automatically on DAQ termination” for data saving and define an appropriate file name with “%DateTime%” as placeholder.

Data storage and saving

Storage mode

Data saving

☐ Editing of test parameters after job termination


File format


Precision

Saving depth

Saving file

Now start DAQ and produce some force cycles using the force sensor. Recording of the first test cycle will start only if the force exceeds 5N:







 DAQ job: Job1 (1 from 3)

 Waiting for start trigger(U9B 200N > 5 N)

After the first test cycle there will be a pause of 5s until the next test cycle is started. After the third cycle DAQ will be stopped automatically.

It is essential to understand that DAQ (transfer of data to the PC and visualization) starts directly after hitting the Start button, but recording only if the Trigger condition is fulfilled.

In your measurement folder you will now find six files. The “bin” files contain the measurement data and the “TST” files the meta data:

	Training_2015_01_06_15_26_46.bin	06.01.2015 15:26	BIN-Datei	286 KB
	Training_2015_01_06_15_26_46.TST	06.01.2015 15:26	catmanEasy Test f...	1 KB
	Training_2015_01_06_15_26_31.bin	06.01.2015 15:26	BIN-Datei	286 KB
	Training_2015_01_06_15_26_31.TST	06.01.2015 15:26	catmanEasy Test f...	1 KB
	Training_2015_01_06_15_26_15.bin	06.01.2015 15:26	BIN-Datei	286 KB
	Training_2015_01_06_15_26_15.TST	06.01.2015 15:26	catmanEasy Test f...	1 KB

If you open one *.TST file with a text editor you can see the general meta data of the measurement that is stored:

```

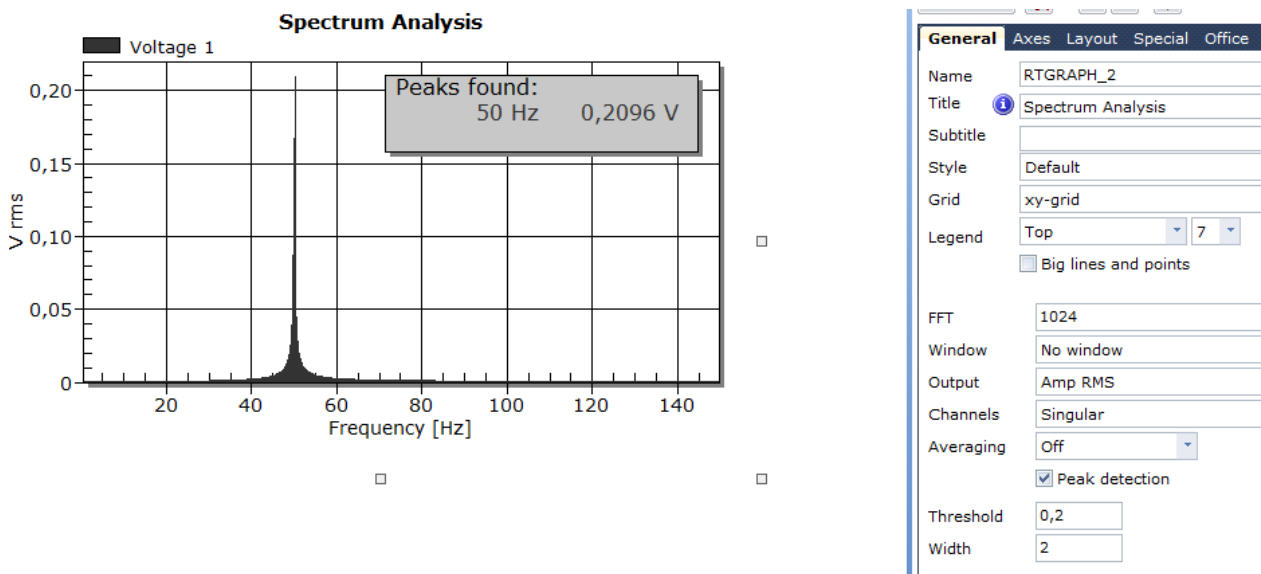
Training_2015_01_06_15_26_15.TST - Editor
Datei Bearbeiten Format Ansicht ?
CATMAN TEST FILE
PATH=D:\Messdaten
Job name=Job1
Data file with path=D:\Messdaten\Training_2015_01_06_15_26_15.bin
Data file=Training_2015_01_06_15_26_15.bin
File comment=
Operator=Thomas Markwitz
Departement=M-TM
Comment=Test
Default sample rate=300 Hz
Slow sample rate=10 Hz
Fast sample rate=4800 Hz
Number of samples default sample rate=3000
Number of samples slow sample rate=0
Number of samples fast sample rate=0
Start mode=Trigger
Start time=06.01.2015 15:26:03
Stop mode=Time
Stop time=06.01.2015 15:26:15
Trigger mode (START)=Above level
Trigger channel (START)=U9B 200N
Trigger level (START)=5 N
Trigger time abs. (START)=06.01.2015 15:26:05
Trigger time rel. (START)=1,806 s
Pre trigger (START)=0 s
catmanEasy/AP version=3.5.2.72
Numerical precision=8 Byte Float
DATAFILE=D:\Messdaten\Training_2015_01_06_15_26_15.bin

```

All channel specific meta data is stored in the *.bin file.

Frequency Analysis:

Use a signal generator App on your mobile phone to generate a 50Hz Sine signal as an input. Configure the Live FFT Visualization object in order that you can clearly see the peak. Then enable Peak detection in the parameters and find the appropriate values. You can now play a little bit with the frequency and the amplitude of the generated signal. Please take care to increase the DAQ sample rate for higher frequencies!!!



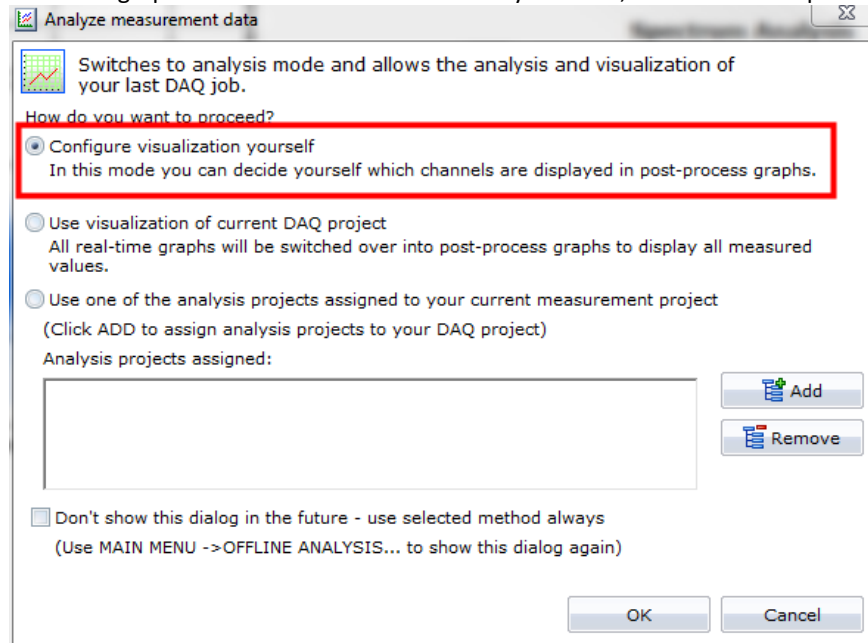
(Frequency Analysis in detail will be part of a different training)

5. Review and compare several measurements in Analysis mode

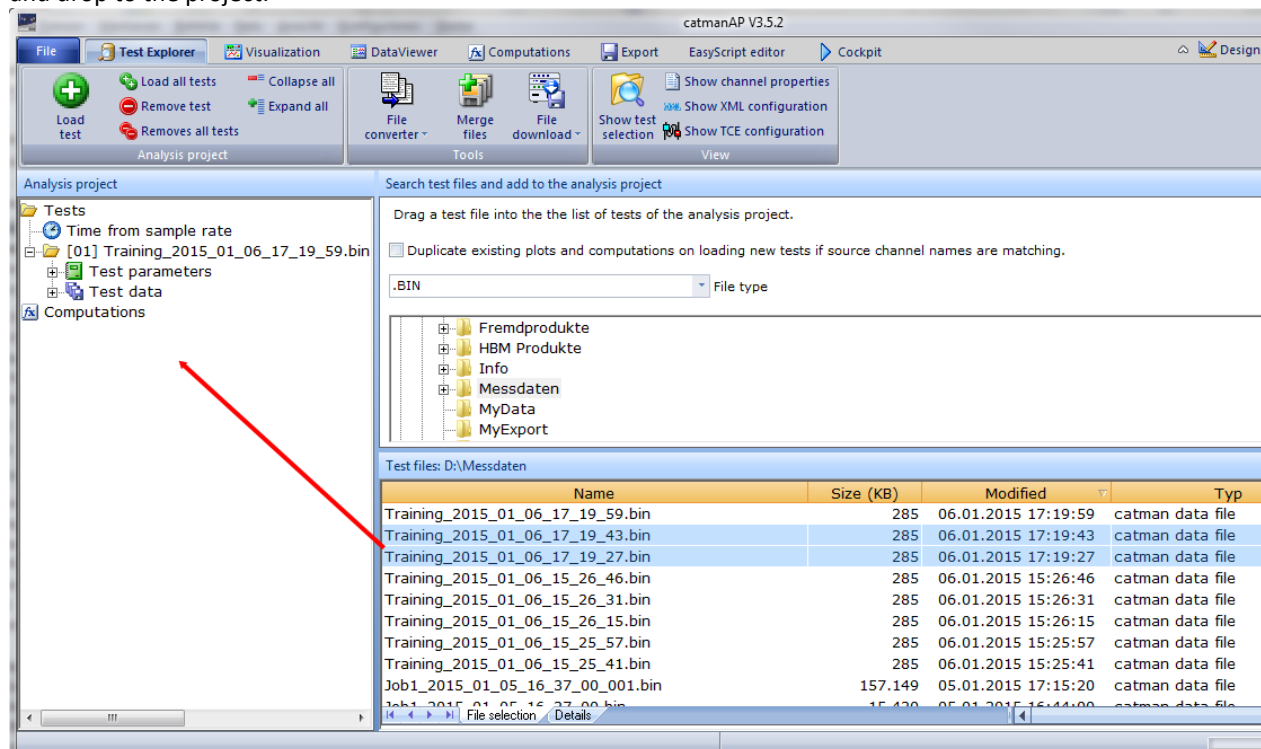
From the measurement mode now switch to the Analysis mode by clicking on the command in the upper right part:

Analyze measurement data

Real time graphs can be taken over to the analysis mode, but in this example we want to begin from the scratch:

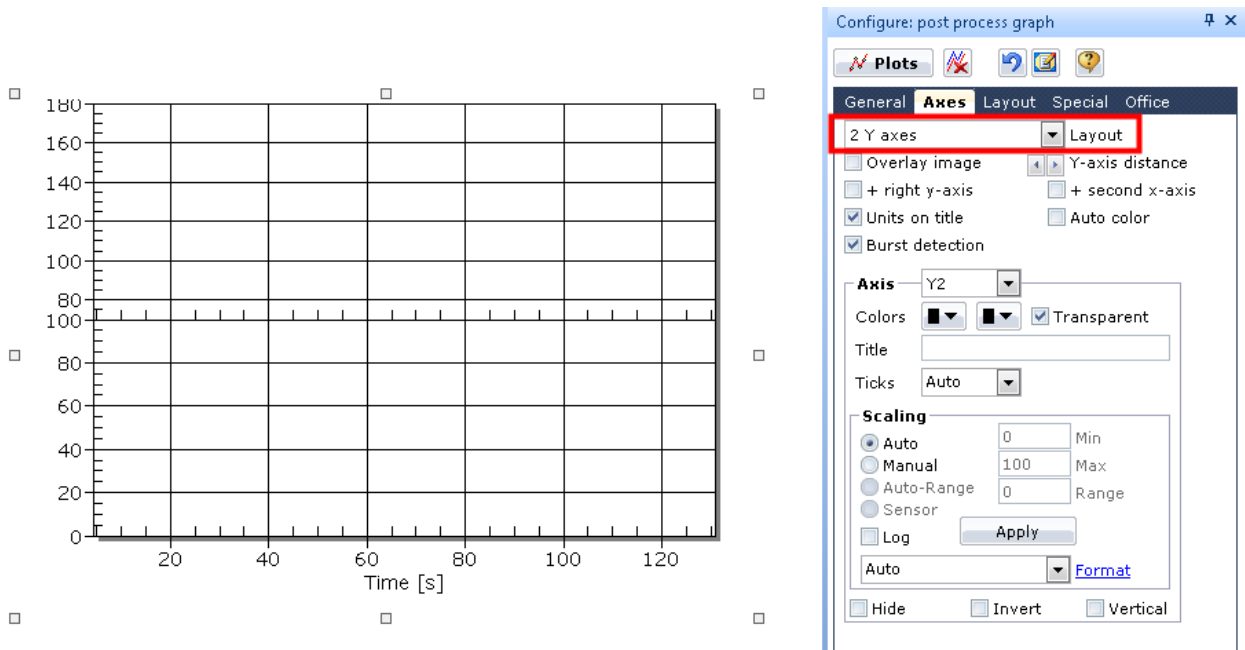


By default the data from the last test run is already added to the project. Now add the two missing test runs by drag and drop to the project:

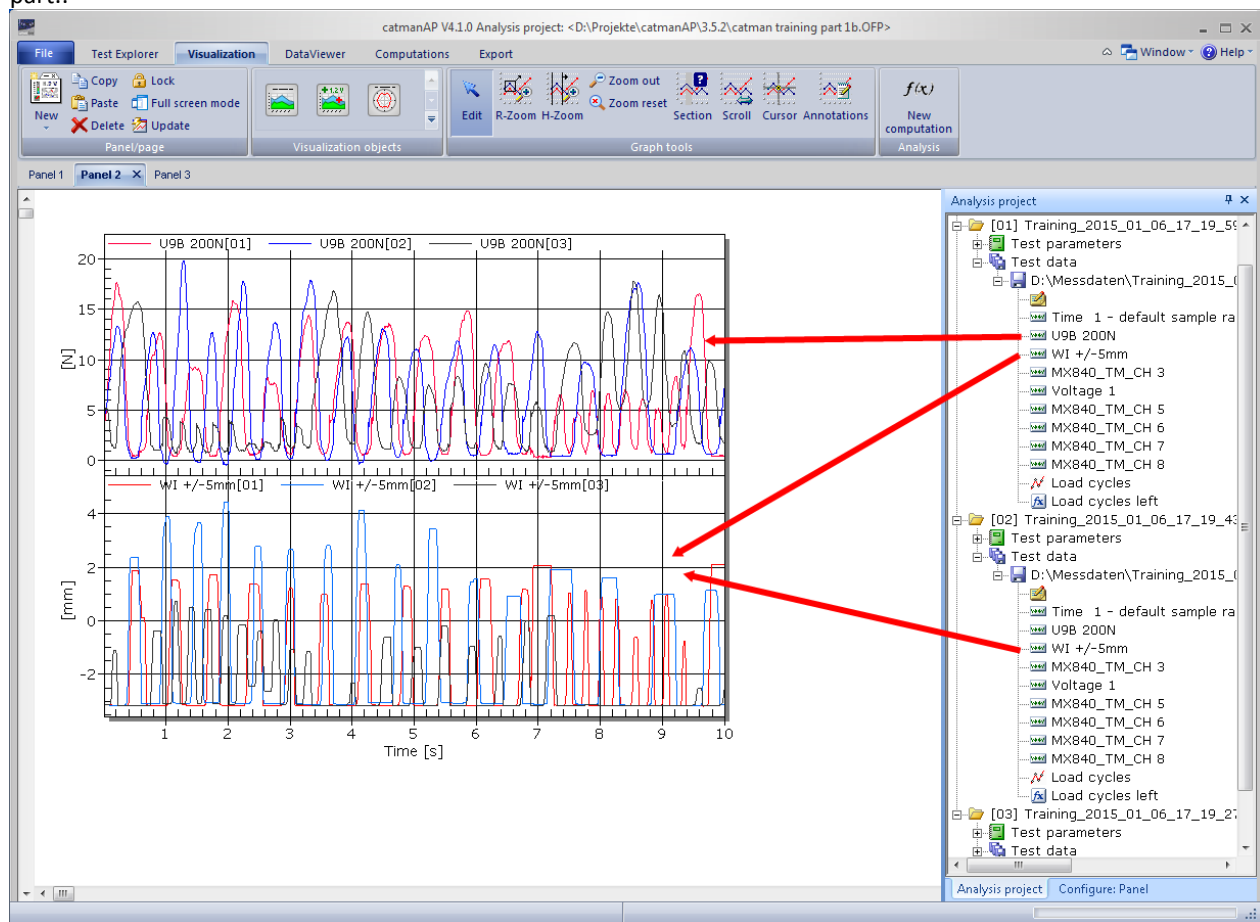


Switch to the visualization tab.

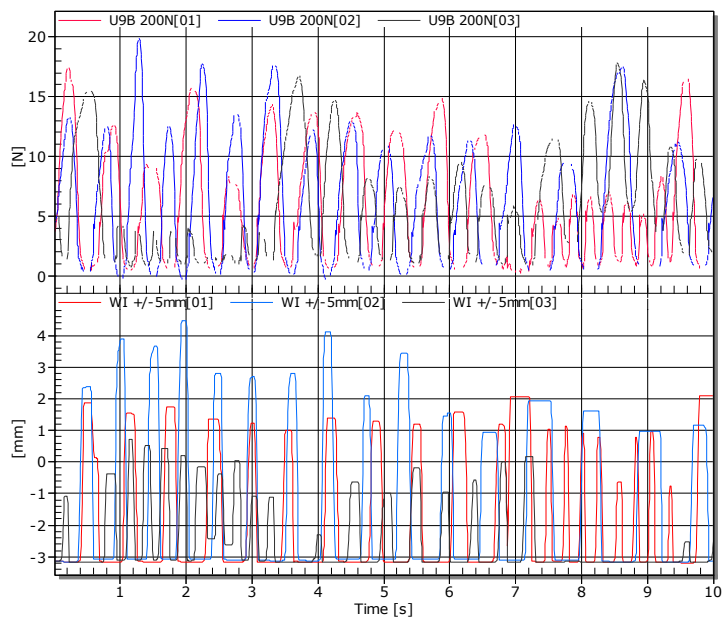
Add a post process graph from the visualization objects and increase number of y axes to two.



Drag and drop the three force signals to the upper part of the graph and the three displacement signals to the lower part.:



Modify the color of the three signals for a better visibility (e.g. 1st test run: red; 2nd test run: blue, 3rd test run: grey)
Add a table and display the corresponding maximum of the six signals:



	A	B	C	D	E
1	1	U9B 200N	Maximum	17,6 N	
2	2	U9B 200N	Maximum	19,8 N	
3	3	U9B 200N	Maximum	17,8 N	
4	1	Load cycles	Maximum	10	
5	2	Load cycles	Maximum	15	
6	3	Load cycles	Maximum	5	
7					
8					

6. Post Process Analysis (Computation)

Now look the signal with the highest force values and add a “time at level” computation for that signal. In this example it is the force signal from the second test run:

Computations

File Test Explorer Visualization DataViewer **Computations** Export

Create computation f(x) Modify computation Delete computation Refresh computation Delete all computations Refresh all Remove invalid computations Edit

Analysis project

Tests

- Time from sample rate
- [01] Training_2015_01_06_17_19_59.bin
 - Test parameters
 - Test data
- [02] Training_2015_01_06_17_19_43.bin
 - Test parameters
 - Test data
 - D:\Messdaten\Training_2015_01_C
 - Time 1 - default sample rate
 - U9B 200N**
 - WI +/- 5mm
 - MX840_TM_CH 3
 - Voltage 1
 - MX840_TM_CH 5
 - MX840_TM_CH 6
 - MX840_TM_CH 7
 - MX840_TM_CH 8
 - Load cycles
 - Load cycles left
- [03] Training_2015_01_06_17_19_27.bin
 - Test parameters
 - Test data
- Computations
 - Time At Level Force Testrun 2

Create new computations

[Help on creating and editing computation channels](#) [Help on this computation](#)

Class counting

Counting method

☐ Rainflow FromTo ☒ Time at level ☐ Span pairs

☐ Rainflow RangeMean ☐ Joint time at level (compound counting)

Name of computation channel TimeAtLevel Force Testrun 2

Channel to count U9B 200N

Configure class counting

16 Number of classes

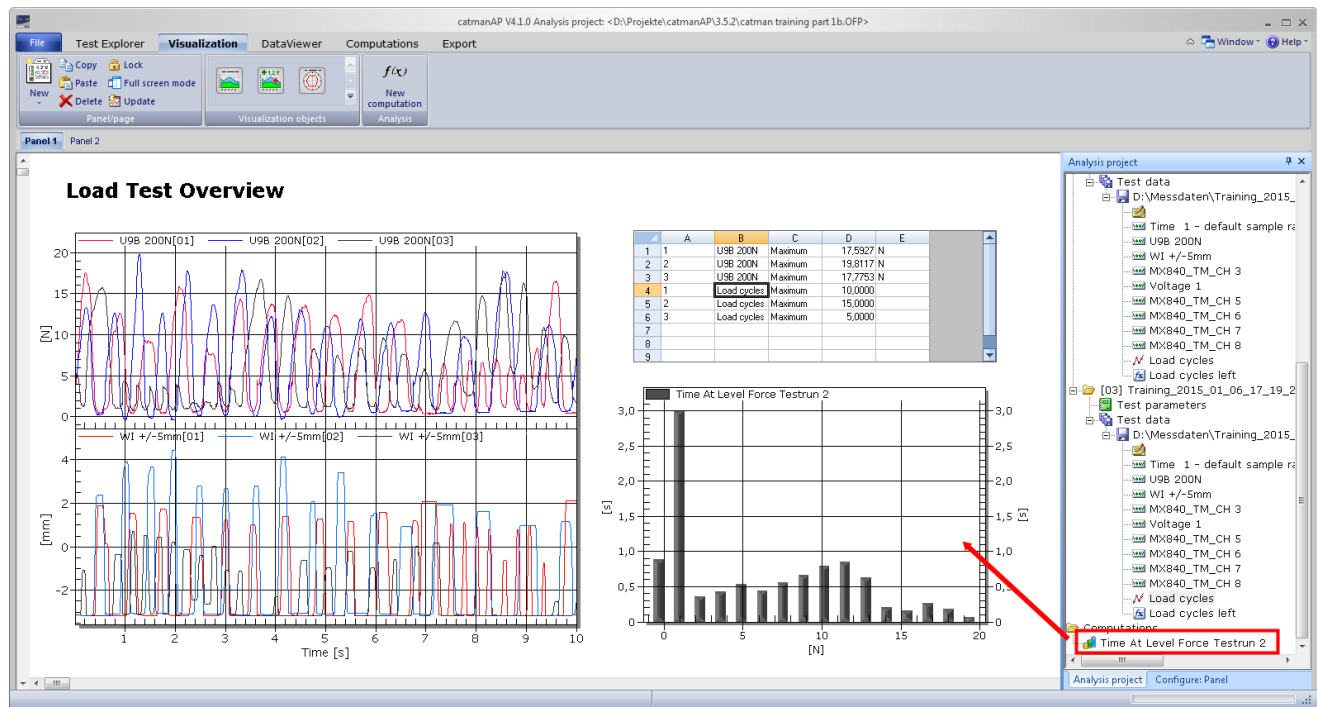
-1 Lower class limit

20 Upper class limit

0 Minimal amplitude (in % of total range)

☐ Determine limits from Min/Max of DAQ channel

The new computation channel can now be visualized by drag&drop into a free space in the visualization panel.
Then add a Text field as a headline and modify the text to "Load Test Overview".
Your Visualization now should look like this:



7. Reporting

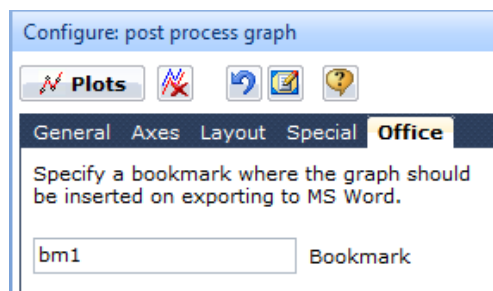
Direct Print of Visualization Pages

With File->Print->Print panel/page you can directly print out the panel or save it as a PDF file by using a PDF printer. Like this you can easily use your visualization as report.

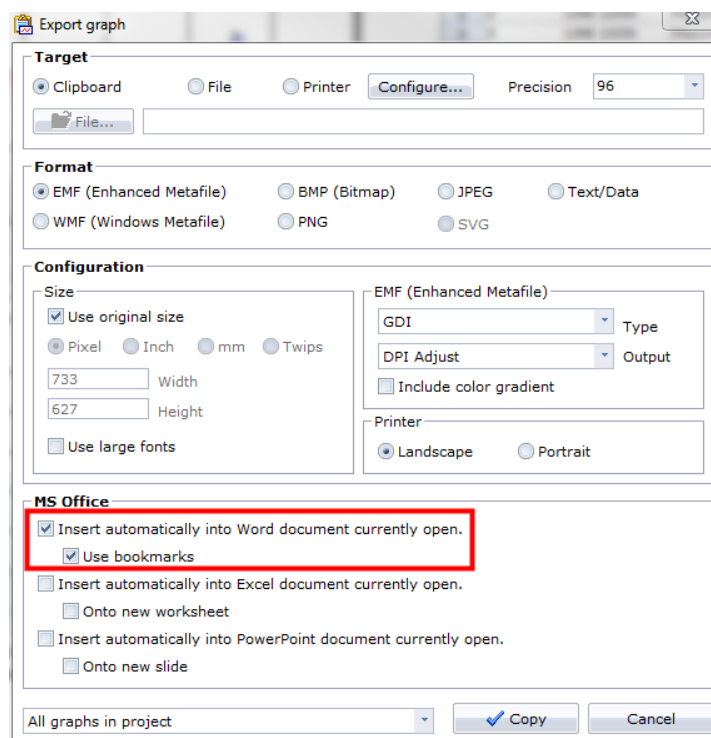
Export Visualization object to MS Word or Excel

Another comfortable way of reporting is to export the visualization objects to MSWord or Excel. Like this you can prepare nice report templates using the well-known capabilities of MS Word.

For all visualization objects that should be exported a bookmark in the object properties has to be defined:

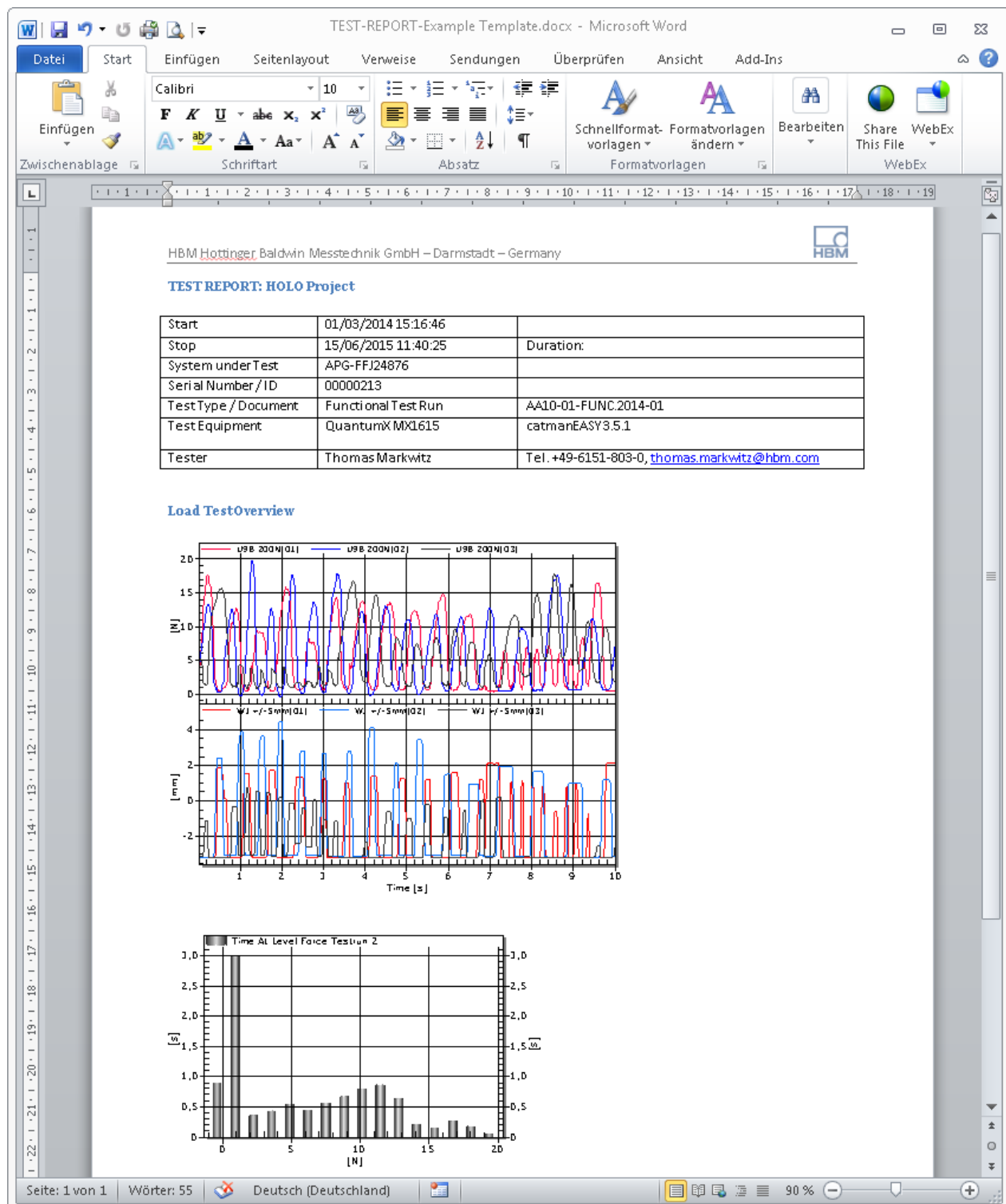


In the Word template you have to insert the corresponding bookmarks in the desired place. With right mouse click on a visualization object ->Export/Print the Export window pops up. Check "Insert automatically into Word document currently open" and "Use bookmarks":



Then click on "Copy"

Result: The visualization objects are copied in your Word template



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