TECH NOTE #025:: Signal Analysis using QuantumX and catmanAP

Version: 2020-06-24 Status: public

Abstract

This hands-on workshop gets you familiar with some basics in signal analysis working with QuantumX data acquisition module and catman software. Main aspects are active data analysis and modification, report generation and offline demonstration. This shall help you in getting more familiar with the tool set, its functionality and performance.

Preparation

We will work only with one single PC tethered module. The only input is a signal generator running on a smart phone, connected via 3.5 mm head phone jacks to voltage input pins of the SubHD15 connector on the QuantumX unit. In best case you use a MX410B supporting date rates of 100 kS/sec per channel or a MX840B with 40 kS/sec per channel.



Workshop Tasks

- 1. Online Analysis
- Set a 500 Hz sine signal on your signal generator app
- Visualize the signal in time and frequency domain (standard FFT, 2D spectrum)
- Acquire data for 10 sec and store it in binary format
- Then set a 500 Hz rectangular signal
- Visualize the signal in time and analyse the harmonics in frequency domain (standard FFT, 2D spectrum)
- Acquire data for 10 sec and store it in binary format
- 2. Post-process Analysis and Report Generation
- Switch to "Analysis Mode" and load / merge the two BIN files
- Do a frequency analysis of the overall file
- Cut out in total 4 harmonic periods (2 sine and 2 rectangular) and store this section as wave file (CATWFM)
- Do a statistical analysis with min, max, mean, ...



- Generate an overall test report in Microsoft Word and describe the overall result of the test
- 3. Offline demo
- Restart catman without a DAQ module and start a "offline demo project"
- Open the signal generator, replay your wave file in an endless loop, visualize, analyse, ...

Solution Guide

As in live it's always best to think about the tasks and the way to solve it by yourself and without any tool.

Nevertheless, in the following pages you will find one possible solution solving the different tasks.

1. Preparing the ground

Now start catmanEasy, create a new DAQ project, select the instrument you want to work with and connect to it.

For signal analysis, please take the maximum data rate for all channels and work with the highest filter you get.

You will find this information in the datasheet of your QuantumX module.

Configure sample rate	e groups and filters						
-Sample rate groups-]			
Useful sample rates							
Slow sample rate	10 Hz	•	•				
Default sample rate	300 Hz	-	•				
Fast sample rate	19200 Hz	•	•••				
Filter							
Help regarding filter s	ettings						
Channel: PC line-out							
Use current device Filter is set via TED	settings S or Setup Assistant.						
Use automatic Anti-Alias filters The frequency will be determined before DAQ start based upon the sample rate. Usually a Bessel characteristic will be selected.							
If the frequency se possible frequency	 Chose characteristics and frequency If the frequency selected is not supported by the device the best possible frequency will be selected. 						
Butterworth 100 Hz Butterworth 200 Hz Butterworth 500 Hz Butterworth 1000 Hz Butterworth 2000 Hz Butterworth 4000 Hz							
Working without filter Internal low-pass filters of device are deactivated. This setting applies to QuantumX/SomatXR, espressoDAQ and eDAQ systems only.							
OK Cancel							

Deactivate other channels and use the display filter to hide them:

1					_	catm	anAP V4.2.0 [Presenta	tion version]	
File	DAQ channels DAQ jobs	Visualization Sense	or database	Channel d	heck Aut	oSequer	nce editor Eas	Script editor Co	ockpit
Start	Image: Sample → Image: Sample → Image: Sample → Active Display → Image: Sample → Image: Sample →	 Slow Default Fast 	TEDS Senso	Adaptation Control Con	Execute	f(x) Create	 ☑ Edit ✗ Delete ☑ Auxiliary channel 	LV 1 OFF Configure LV 2 OFF LV 3 OFF	* *
Measureme	ent Channel	Sample rates/filter	S	ensor	Zero balance	Comp	putation channels	Limit val	ues and events
Configure	DAQ channels [Display filter active] [Live	update active]							
-	Channel name	Reading	9	Sample ra	te/Filter		Sensor/	Function	Zero value
e 💼	් 🚍 MX840A Universal Module								
3 🗉	Time 1 - default sample rate	9	3			3	Time from samp	le rate	0,00000 s
3	Time 1 - fast sample rate		3			3	Time from samp	le rate	0,00000 s
.	PC line-out	😔 -0,09354 \	V 🁐 1	9200 Hz / BU	2000 Hz	TEDS	special transduc	cer (DC Voltage)	0,00000 V



Store your measurement job for later demonstrations.

Save DAQ project					x
🕞 🕞 🗸 🖌 Eig	jene Dokumente 🕨 MyDAQjobs	-	6 7	MyDAQjobs durchsuchen	٩
Dateiname:	QuantumX-catmanAP-Workshop-Sig	nal-Analysis			-
Dateityp:	Measurement projects				•
Ordner durchsuch	hen	Hilfe		Speichern	ien

2. Online Analysis

Create a 500 Hz sine signal on your signal generator app



Use the standard panel visualizing the signal in time and frequency domain (y-over-t / FFT)



Use the <u>Scope Panel</u> and analyse frequency. Do a peak analysis by using threshold and width as parameters.



Use a new <u>standard panel</u> and the object frequency spectrogram. Do a peak analysis by using threshold and width. Tune the following parameters: FFT window, averaging, etc.

Set up your <u>DAQ job</u> according to the task: 10 sec max recording time. Store in BIN format.

			Carmanace v4.0.2 [Pro	sentation version) DAQ proj	een wer(oseis(saicher(bocai		P-workshop-signal	-Analysis with the	
File 😅	DAQ channels	📾 Video camer	ras 🛛 🚳 DAQ jobs 🛛 🐹 Vis	ualization					🛆 🛝 Analyze measurement data 📑 Window * 🔞 Help *
Start DAQ Measurement	New DAQ job X Delete DAQ job Copy DAQ job	Insert DAQ Up Down DAQ jo	job 🤹 Use as default 🙀 Reset default settings À Check bs	General Data storage	Channel Video parameters Settings	Job parameters	Advanced		
Job list			General settings						
C DAQ jobs			Sample rate groups 10 Hz 10 Hz 10 OHz 000 Hz DAQ start Immediately at job start	Slow Default Y Fast	Uzeful sample rates		DAQ stop Duration Sample duration 0 2 h 0 2	m 10 ks	•

Start the DAQ job. Before saving the data enter some meta data describing your DAQ job.

Data savir	ng						
File -	- File						
Place	c:\Temp\2015_04_24_Sine-Signal_10	sec.bin 🖉					
НВМ	HBM catman standard format Format 8-Byte Precision What does that mean?						
Save	all data	 Saving depth 					
Com	ment						
10 s	10 s sine signal						
Test p	arameters						
	Name	Value					
1	Operator	The Duke					
2		Marketing Team					
3							
4							
6	6						
New parameter							

Create a 500 Hz rectangular signal on your signal generator app

Use the created standard panel visualizing the signal in time and frequency domain (y-over-t / FFT)

Analyse the harmonics (peaks) of the rectangular signal.

Again, acquire data for 10 sec and store it in BIN format

Dat	Data saving 💽					
ſ	File					
	Place	ehol	der 🔽 C:\Temp\2015_04_24_Rectangular-Sig	nal_10sec_001.bin		
	HBM	cat	man standard format 💌 Format 8-Byte	Precision What does that mean?		
	Save	e all	data	 Saving depth 		
	Com	mer	nt			
				*		
				-		
	Fest p	ara	meters			
			Name	Value		
	1		Operator	The Duke		
	2		Department	Marketing Team		
	3		Comment	2nd acquisition of workshop		
	4					
	5					
	6					
	New parameter					
	Save data now XDiscard data					

3. Post-process or Offline Data Analysis Now analyse your measurement data.

.P-Workshop-Signal-Analysis.MEP>	
An 🖓 An	alyze measurement data 📇 Window 👻 🛞 Help 🔪
Cursor Annotations	Switches to analysis mode for the data measured last.
Analyze measurement data	
Switches to analysis mode and allows th your last DAO job.	e analysis and visualization of
How do you want to proceed?	
Configure visualization yourself In this mode you can decide yourself which char	nels are displayed in post-process graphs.
 Use visualization of current DAQ project All real-time graphs will be switched over into provalues. 	st-process graphs to display all measured
Use one of the analysis projects assigned to you	r current measurement project
(Click ADD to assign analysis projects to your DA	AQ project)
Analysis projects assigned:	
	같 Add 필 Remove
Don't show this dialog in the future - use selecte	ed method alwavs
(Use MAIN MENU ->OFFLINE ANALYSIS to sho	w this dialog again)
	OK Cancel

Go to the Test Explorer, mark the two BIN files and MERGE them:

_ 	catmanAP V4.0.2 [Presentation Version]	
File 📑 Test Explorer 🐹 Visualization	🔚 DataViewer – 👧 Computations 🛛 💭 Export	🛆 🧧 Back to DAQ mode 📑 Window 👻 🔞 Help 🕤
👝 🗞 Load all tests 💻 Collapse all	Show channel properties	
Remove test 📲 Expand all	Show XML configuration	
Load	File Merge Show test the Show TCE configuration	
Analysis project	View	
A de la constanti de		
Analysis project	Seal Merges selected test files in the s project	
Tests	Dr file. This is only possible for files tests of the analysis project.	
Computations	in catman standard format	
	.BIN File type	
	Temp	^
	e Upload	
	🗄 🗓 Windows	
	DVD-RW-Laufwerk (D:)	*
	Test files: C:\Temp	
	Name Size (KB) Modified	Typ
	2015_04_24_Rectangular-Signal_10sec_001.bin 6.254 24.04.2015 14:17:20 catmar	n data file
	2015_04_24_Sine-Signal_10sec.bin 6.254 24.04.2015 14:13:39 catmar	n data file
	Job1_2015_01_20_15_10_52.bin 157 26.01.2015 10:10:54 calmar Job1_2015_01_26_15_27_16_bin 74 _26.01.2015 16:27:10 _cstmar	r data hie
	Job1 2015 01 26 15 45 48.bin 289 26.01.2015 16:45:50 catmar	n data file
	Job1_2015_01_26_16_54_59.bin 51 26.01.2015 17:55:03 catmar	n data file
	Job1_2015_01_27_14_15_27.bin 41 27.01.2015 15:15:29 catmar	n data file
	Job1_2015_01_27_14_23_36.bin 68 27.01.2015 15:23:38 catmar	1 data file
	lob1_2015_01_2/_15_10_39.0m 3 27.01.2015 10:10:41 catmar lob1_2015_03_23_12_03_34.bin 30 23.03.2015_13:08:09 catmar	n data file
	It ()) File selection (Details (
P		

TECH NOTE – Signal Analysis using QuantumX and catmanAP

Load the merged file to your "Test Setup" on the left side by drag and drop.

	5	0 1	
2015_04_24_Sine-Signal_10sec.bin	6.254	24.04.2015 14:13:39	catman data file
2015_04_24_Rectangular-Signal_10sec_001.bin	6.254	24.04.2015 14:17:20	catman data file
2015 04 24 Sine-Rectangular-Signal 20sec Merge.B	IN 12.504	24.04.2015 14:27:06	catman data file

Analyse frequency of this artificial overall file by setting up a new computation channel. \rightarrow "Visualization tab" \rightarrow create "new computation" \rightarrow "Frequency analysis" and parameterize accodingly.

New computation	# ×
Help on creating and editing computation channels	Help on this computation
Frequency analysis	🛇 🌋 📾 🌺 🖍 🖽 🏬
With this function you can analyze a time signal in signal dataset and averaged depending on the ch	n the frequeny domain.Partial FFTs are built over the entire time osen frequency resolution.
Computation type	
Amplitude spectrum	
Name of computation	
FFT merged PC line out	
Source channel	
PC line out	
From FFT number of points	Frequency resolution (Hz)
2048 points FFT 67	Overlap in % Always perform zero padding
Linear 💌	Averaging
None 💌	Window function
Linear 💌	Scaling
Amplitude Peak	Output unit
In a Joint-Time-Frequency spectrum one spectrur a waterfall, 3D or contour graph to display this m	n is computed per time window. This results in a matrix. You need atrix.
Create Joint-Time-Frequency spectrum 0	Time window in seconds (0=automatic determination)
Specify a reference channel if you want to display different quantity than time.	the Joint-Time-Frequency spectrum over a
	Create computation

Drag and drop the created FFT to the panel:

쳙 Tests
Time from sample rate
🖻 🗁 [01] 2015_04_24_Sine-Rectangular-Signal
🗉 📳 Test parameters
🗄 🔖 Test data
🗄 🖳 C:\Temp\2015_04_24_Sine-Rectang
- 🛃 10 s sine signal
- 🔤 Time 1 - fast sample rate
PC line out
Computations
FFT merged PC line out

Parameterize the graph in color, layout and axis.

graph in color, layout and axis.

Visualize in time and frequency domain.

Cut out a certain section:

• Target 2 sine and 2 rectangular waves

and store this section as wave file (CATWFM)

How?

Use the <u>Section</u> tool. Zoom into the graph, <u>Remove</u> the overlapping sections, <u>Copy</u> the result as an own file. The original data is not touched.

Result is a temporary file you can individually name.

Now drag and drop this file section to a graph again.

Work again with the section tool if necessary. Hint: firstly, adapt the middle section and remove the non-harmonic part!

Result: exactly two sine and two rectangular signals.

	catmanAP V4	.0.2 [Presentation version] Analysis project: <c:\users\salcher\do< th=""></c:\users\salcher\do<>		
File 🧊 Test Explorer 🛛 🐹 Visualization	🔝 DataViewer 🛛 🏂 Computation	ons Export		
🞜 Add channel 🗠 Up 📕 Save export list	Select export format	انت ا		
E Remove channel ⊠ Down 🛱 Load evport list	HBM catman standard format	Export		
	HBM catman standard format HBM nCode s3t			
Configure list	HBM playback			
Analysis project	ASCII ASCII + channel info	computations in different formats.		
🔁 Tests	MS Excel 97-2003	anutations or files from the lefthand side into this list		
Time from sample rate	MS Excel Office 2007 XML	iputations of mes from the lettinund side into this list.		
	NI Diadem	Name		
[Matlab (5.0)	REGION_COPY_85-404		
🕀 🔛 Test parameters	Vector MDF 3			
🗄 🙀 Test data	ASAM MDF 4	T		
Computations				
EFT merged PC line out				
TompEdit 001 RECION CORV 20072	7-400270			
TempEdit 001 REGION COPY 05 40	1 400279			
TempEdit_002_REGION_COPY_85-40	4			

Set up a statistical analysis with min, max, mean, ...

This can be done by using the "Statistics table":

	Data analysis 🔺	🔍 📈 🦯 Zoom out
ode		Edit R-Zoom H-Zoom
		Graph to
pectr	<u> </u>	
REGI	🙀 🖉 📻 📗	
Λ		
\uparrow		
1	Statistics table	
	Displays statisti	cal data of a
	Layout	
	Abc 🗾 🗖	
	Developer tools (AutoSeq	

Visualize the result in a new panel:

Side Topic: Post-process Computation

Post-process computation

Beside the "manual analysis and editing" of data there is a bunch of pre-defined computations available in the catman package EasyMath making post-processing easier than ever:

- Formula editor you can cross calculate signals with each other
 - Including fixed formulas: Statistical analysis (min, max, mean), linearization table, removing offset
- <u>Frequency analysis</u> (see screenshot below)
- Filter box
 - Sliding mean
 - o Savitzky-Golay smoothing
 - Mean over time window
 - o RMS value over time window
 - Low-, high-, band- and band-rejection filters in Butterworth, Chebyshev and elliptic characteristics
 - o Low-pass filter with Bessel characteristic
 - Sound pressure filter in dBA
 - Strain gage rosette calculation
- Curve Operations
 - Form plot function cuts out the specified section of a channel. Alternatively, you can also use the Section functions or the cursor functions.
 - Shift plot function moves all values of a channel in the positive or negative direction, for example to compensate a time delay (propagation time) of various filter characteristics.
 - Outlier elimination in case the signal level exceeds a certain value (threshold)
- Interpolation
 - converting to other sample rates (higher or lower) or x-y recalculation allowing an easier comparison of several data sets of the same test
 - Accurate PEAK detection using interpolation algorithm
- <u>Class Counting</u>
 - Rainflow (FromTo, RangeMean) counts the frequency of occurrence of certain amplitude values subdivided into sections, the so-called classes used for material fatigue tests.
 - Time-At-Level (TAL) counts how long a signal is located in a certain amplitude range, the socalled classes and shown in a so-called histogram.
 - Span Pairs counts the frequency of occurrence of certain amplitudes.
 - Joint-Time-at-Level (2-dim) counts how long a signal is located in a certain amplitude range considering also the amplitude range of a second reference channel, for example for monitoring torque towards rotational speed.

4. Test report generation

Test engineers often need to report their analysis results in a convenient way. In most of the cases Microsoft Word or EXCEL is used as this simply installed on many computers.

At the end of this chapter you will find more details about reporting itself.

What do we offer speeding up that process?

Bookmarks.

Highlight the graph you want to automatically transfer into your <u>Test Report Template</u> in Microsoft Word format.

Go to "Office" tab of each graph and set a bookmark name. *Example: BM_RAW or BM_FFT or BM_SECTION-PEAK...*

Now open your <u>Test Report</u> template in Microsoft Word and integrate the bookmarks in a place you want to automatically copy the graphs to.

Go to the specific place \rightarrow Insert tab \rightarrow insert Bookmark \rightarrow enter name. Done. We recommend to also entering the bookmarks name into the text itself. Modifications are quicker in the future.

Test Test Revolution Very Very Very Very Very Very Very Very		S (5)	_	TEST-REPORT-catmanEASV-Qua	ntumX.docx - Microsoft Word		_ D <u>_ x</u>
 	Datai	Ctart	Finfügen Seitenlaweut		Angicht Add Inc	abat	
Image: State of the	Datel	Start	Einfugen Seitenlayout	verweise Sendungen Oberprüfen	Ansient Add-Ins Acro	obat	
Image Image <th< th=""><th></th><th>Å (</th><th>Calibri • 10 • A A</th><th></th><th>AaBbCcDdE AaBbCcDdl Aa</th><th>aBbCcDdf A</th><th>i i i i i i i i i i i i i i i i i i i</th></th<>		Å (Calibri • 10 • A A		AaBbCcDdE AaBbCcDdl Aa	aBbCcDdf A	i i i i i i i i i i i i i i i i i i i
Autoreado Subtrait Participant Permathoningen Autoreado Net He do Image: State of the	Einfüg	en 🦼	F K U - abe x, x ² A		Fett Hervorhe 1	Standard Formatvorlagen Bearbeit	ten Share WebEx
Test & Measurement Image: Start 10/03/2014 15:15:456 Start 10/03/2014 15:15:456 Image: Start Image: Start Start 10/03/2014 15:15:456 Image: Start	Zwischer	nab 🗔	Schriftart	Z↓ 1	Formatvor	lagen G	This File * WebEx
HBM Test & Measurement Image: Control of the set of t		1.1.1.1	1 . 2 . 1 . 1 . 1 . 2 . 1 . 3 . 1	· 4 · I · 5 · I · 6 · I · 7 · I · 8 · I	· 9 · I · 10 · I · 11 · I · 12 · I ·	13 · · · 14 · · · 15 · · · 16 · · · 17	· 18 · I · 19
PM Torst & Measurement Different of the Construction of the				1 1 1 1	1 1 1 1		
<page-header> EMINTENTING EMINTENTING EMINTENTING EMINTENTING</page-header>							
PMM Test & Measurement PMM TCSC REPORT: Workshop 	-						
TEST REPORT: Workshop <u>Statt</u> <u>01/03/2014 15:16:46</u> <u>Stop</u> <u>14/04/2015 14:58:09</u> <u>Duration:</u> <u>Stopemunder Test</u> <u>RXD-67125697</u> <u>Serial Number / ID</u> <u>0000213</u> <u>Test RXD-67125697</u> <u>Serial Number / ID</u> <u>0000213</u> <u>Test Type / Document</u> <u>Functional Test Run</u> <u>AA10-01-FUNC.2014-01</u> <u>Test Equipment</u> <u>A232-1</u> . QuantumX MX8408 catmaneASY 4.0.2 <u>Test Equipment</u> <u>A232-1</u> . Quantum MX MX8408 catmaneASY 4.0.2 <u>Test Equipment</u> <u>A322-1</u> . Quantum MX MX840	-		HBM Test & Measureme	nt		нвм	
TEST REPORT: Workshop <u>Start</u> 01/03/2014 15:16:46 System under Test RXD-GGT245637 System Under Test RXD-GGT245637 System Under Test RXD-GGT245637 Test Type / Document Functional Test Run AA10-01-FUNC.2014-01 Test Type / Document functional Test Run AA10-01-FUNC.2014-01 Test Equipment A232-1. QuantumX MX840B catmanEASY 4.0.2 Test Pype / Document functional Test Run Tel. +49-6151-803-666666, TheDuke @hbm.com Signal Analysis BM_EAW Frequency Analysis BM_FFT Time at Level Analysis BM_FT Time at Level Analysis System or components. Stration is OK and does not harm the overall system or components. Stration is OK and does not harm the overall system or components.	ŀ						
Start 01/03/2014 Stop 24/04/2015 Stop 24/04/2015 System under Test RXD-GGT245637 Serial Number / ID 00000213 Test Type / Document Functional Test Run AA10-01-FUNC.2014-01 Test Equipment A232-1. QuantumX MX8408 catmanEASY 4.0.2 Test Equipment Test Equipment A232-1. QuantumX MX8408 catmanEASY 4.0.2 Test Equipment A232-1. QuantumX MX8408 catmanEASY 4.0.2 Test Result BM_RAW Frequency Analysis BM_FFT Time at Level Analysis Punctional Test has been passed according to the testing parameters. Vibration is OK and does not harm the overall system or components.	-		TEST REPORT	: Workshop			
Start 01/03/2014 15:16:46 Stop 24/04/2015 14:58:09 Duration: System under Test RXD-GGT245637 Serial Number / ID 0000213 Test Type / Document Functional Test Run A10-01-FUNC.2014-01 Test Equipment A232-1. QuantumX MX8408 catmanEASY 4.0.2 Tester The Duke Test Raw Signal Analysis BM_RAW Prequency Analysis BM_FFT Time at Level Analysis Sum FFT Stet: 1 wort 74 Stet: 1 wort 74 Englisch (Großbortannier) Englisch (Großbortannier) Englisch (Großbortannier) Englisch (Großbortannier) Englisch (Großbortannier) Englisch (Großbortannier)	-						
Stop 24/04/2015 14:58:09 Duration: System under Test RXD-G01245637 Serial Number / ID 00000213 Test Type / Document Functional Test Run AA10-01-FUNC.2014-01 Test Equipment A232-1. QuantumX MX840B catmanEASY 4.0.2 Test Type / Document Percence Test Type / Document A232-1. QuantumX MX840B catmanEASY 4.0.2 Test Test The Duke Test Amalysis BM_RAW Frequency Analysis BM_FFT Time at Level Analysis Functional Test has been passed according to the testing parameters. Vibration is OK and does not harm the overall system or components.			Start	01/03/2014 15:16:46			
System Unumber / ID 00000213 Serial Number / ID 00000213 Test Type / Document Functional Test Run AA10-01-FUNC.2014-01 Test Equipment A232-1. QuantumX MX840B catmanEASY 4.0.2 Tester The Duke Test Participation Signal Analysis BM_RAW Frequency Analysis BM_FFT Time at Level Analysis BM_FFT Vibration is OK and does not harm the overall system or components. Vibration is OK and does not harm the overall system or components.	-		Stop	24/04/2015 14:58:09	Duration:		
Settial Multip 7/10 00000213 AA10-01-FUNC.2014-01 Test Type / Document Functional Test Run AA10-01-FUNC.2014-01 Test Equipment A232-1. QuantumX MX840B catmanEASY 4.0.2 Tester The Duke Tel. +49-6151-803-666666, TheDuke@hbm.com Signal Analysis BM_RAW Frequency Analysis BM_FT BM_FT Time at Level Analysis BM_FT Vibration is OK and does not harm the overall system or components. Sette: I von 1 Worter 74 Yest External Time at Level (Großbritannien)	m		System under Test	RXD-GG1245637			
Interview of the content of the con	-		Test Type / Document	Eurotional Test Run	AA10-01-EUNC 2014-01		
Tester The Duke Tel. +49-6151-803-66666, TheDuke@hbm.com Signal Analysis BM_RAW Prequency Analysis BM_FFT Time at Level Analysis BM_FFT Time at Level Analysis Frequency Analysis BM_FFT Time at Level Analysis Sette: 1 von 1 Worter 74 Verter 74 Yenglisch (Großbrittannien) The Setter 100 (Großbrittannien) The Setter 100 (Großbrittannien)	4		Test Equipment	A232-1, QuantumX MX840B	catmanEASY 4.0.2		
Tester The Duke Tel. +49-6151-803-66666, TheDuke@hbm.com Signal Analysis BM_RAW Frequency Analysis BM_FFT Time at Level Analysis Time at Level Analysis Functional Test has been passed according to the testing parameters. Vibration is OK and does not harm the overall system or components. Sette: 1 von 1 Worter: 74 Englisch (Großbritannien)	-						
Signal Analysis BM_RAW Frequency Analysis BM_FFT Time at Level Analysis Test Result Functional Test has been passed according to the testing parameters. Vibration is OK and does not harm the overall system or components.	ю •		Tester	The Duke	Tel. +49-6151-803-666666,	TheDuke@hbm.com	
Signal Analysis BM_RAW Frequency Analysis BM_FFT Time at Level Analysis Test Result Functional Test has been passed according to the testing parameters. Vibration is OK and does not harm the overall system or components. Sette: 1 von 1 Worte: 74 ✓ Englisch (Großbritannien)	-						
Signal Analysis BM_RAW Frequency Analysis BM_FFT Time at Level Analysis Time at Level Analysis Functional Test has been passed according to the testing parameters. Vibration is OK and does not harm the overall system or components.							
BM_RAW Frequency Analysis BM_FFT Time at Level Analysis Time at Level Analysis Test Result Functional Test has been passed according to the testing parameters. Vibration is OK and does not harm the overall system or components.			Signal Analysis				
Frequency Analysis BM_FFT Time at Level Analysis Test Result Functional Test has been passed according to the testing parameters. Vibration is OK and does not harm the overall system or components.	2		BM_RAW				
Frequency Analysis BM_FFT Time at Level Analysis Test Result Functional Test has been passed according to the testing parameters. Vibration is OK and does not harm the overall system or components.							
Frequency Analysis BM_FFT Time at Level Analysis Time at Level Analysis Test Result Functional Test has been passed according to the testing parameters. Vibration is OK and does not harm the overall system or components. Sette: 1 von 1 Worter: 74 Set Englisch (Großbritannien)	-						
BM_FFT BM_FFT Time at Level Analysis Test Result Functional Test has been passed according to the testing parameters. Vibration is OK and does not harm the overall system or components. Sette: 1 von 1 Worter: 74 Senglisch (Großbritannien)	6		Frequency Analysis				
Time at Level Analysis Test Result Functional Test has been passed according to the testing parameters. Vibration is OK and does not harm the overall system or components. Sette: 1 von 1 Worter: 74 Sette: 1 von 1 Worter: 74 Sette: 1 von 1 Worter: 74	-	BM_FFT					
Time at Level Analysis Test Result Functional Test has been passed according to the testing parameters. Vibration is OK and does not harm the overall system or components. Sette: 1 von 1 Worter: 74 Sette: 1 von 1 Worter: 74 Sette: 1 von 1 Worter: 74	9						
Test Result Functional Test has been passed according to the testing parameters. Vibration is OK and does not harm the overall system or components. Seite: 1 von 1 Wörter: 74 Seite: 1 von 1 Wörter: 74		Time at Level Analysis					
Test Result P Functional Test has been passed according to the testing parameters. Vibration is OK and does not harm the overall system or components. Seite: 1 von 1 Wörter: 74 Seite: 1 von 1 Wörter: 74	Ē		Time at Dever Timary 515	·			
Test Result Functional Test has been passed according to the testing parameters. Vibration is OK and does not harm the overall system or components. Seite: 1 von 1 Wörter: 74 Seite: 1 von 1 Wörter: 74 Seite: 1 von 1 Wörter: 74							
Functional Test has been passed according to the testing parameters. Vibration is OK and does not harm the overall system or components. Seite: 1 von 1 Wörter: 74 Seite: 1 von 1 Wörter: 74 Seite: 1 von 1 Wörter: 74	-		Test Result				
Vibration is OK and does not harm the overall system or components. Seite: 1 von 1 Wörter: 74 Seite: 1 von 1 Wörter: 74	EI	Functional Test has been passed according to the testing parameters.					
Seite: 1 von 1 Wörter: 74 🕉 Englisch (Großbritannien)	-	Vibration is OK and does not harm the overall system or components.					
Seite: 1 von 1 Wörter: 74 🥩 Englisch (Großbritannien)	14						
Seite: 1 von 1 Wörter: 74 🧭 Englisch (Großbritannien)	-						Ŧ
	Seite: 1	von 1 Wo	örter: 74 🛛 🍑 Englisch (Großbrit:	annien)		🔲 🛱 🗟 🚡 📄 116 % 🖵	• • "i

Textmarke	Y X
Textmarkenname:	
BM_FFT	Hinzufügen
BM_FFT	Löschen
DM_KAW	Logenen
	<u>G</u> ehe zu
_	
Sortieren nach: Namen	
Ort	
Ausgeblendete Textmarken	
	Abbrechen

Now go back to catman and export all graphs from your analysis project:							
File 🗊 Test Explorer 🐹 Visualization 📰 DataViewer	catmanAP V4.0.2 [F	resentation Versionj					
Copy 🔒 Lock	- 🔨 🕰 🎝 🖓 Zoom out	fix)					
New Celete 2 Undate	Edit R-Zoom H-Zoom Section Scroll C	ursor Annotations New					
Panel/page Visualization object	s Graph tools	Analysis					
Time and Frequency Spectrogram							
	0,30 FFT me	rged PC line out					
5,3							
	0,25						
5,2		Properties Update					
		Copy visualization object					
5,1	0,20	Delete visualization object Configure/delete plot					
		X Delete all plots					
2.5 0		Export/print					
	≥ -	To back					
		Load					
4,9	0.10	Horizontal zoom					
		Rectangle zoom					
4,8		Reset zoom					
	0,05	Create curve sections					
4,7		x-Datasources					
Time [s]	5,000 0 IX	Frequency [Hz]					
C Export graph							
Clipboard File Printer	Configure Precision 96						
File							
Format							
EMF (Enhanced Metafile) OBMP (Bit	tmap) 🔘 JPEG 🔘 Text/Data						
WMF (Windows Metafile) OPNG	SVG SVG						
Configuration							
Size	EMF (Enhanced Metafile)						
	GDI Type						
Pixel Inch mm Twips	DPI Adjust 💌 Output						
533 Width	Include color gradient						
653 Height	Printer						
Use large fonts	Iandscape OPortrait						
_ MS Office							
✓ Insert automatically into Word document							
✓ Use bookmarks							
Insert automatically into Excel document currently open.							
Onto new worksheet							
Insert automatically into PowerPoint docu	ment currently open.						
Onto new slide							
All graphs on panel	Copy Cancel						

Now go back to catman and export all graphs from your analysis project:

Result is that all objects are copied into your test report. For recurring tests with a pre-defined analysis project and a pre-defined test report this is a quick solution.

TECH NOTE – Signal Analysis using QuantumX and catmanAP

Datei	Start Einfügen Seitenlavou t * te Tabelle Tabellen Illu * 1 * 1 * 2 * 1 * 3 * 1	ut Verweise Sendungen SmartArt Somen Screenshot v Istrationen 14 1 1 5 1 1 6 1 1 7 1 1 8 1 1	Überprüfen Ansicht Add-Ins Acrobat Kopfzeile * Schnellbausteine Fußzeile * WordArt * Seitenzahl * Textfeld Kopf- und Fußzeile Text	 C ? C Formel * Ω Symbol * Symbole 17/₂ + 18 + 19 						
Deckblatt Leere Seit Seitenum Seiten L L L L L L L L L L L L L L L L L L L	te bruch Tabellen Tabellen HBM Test & Measuremen	Image: Streen shot Image: Streen shot <td>■ Kopfzeile * ■ Fußzeile * ■ Seitenzahl * Kopf- und Fußzeile ■ • • •</td> <td></td>	■ Kopfzeile * ■ Fußzeile * ■ Seitenzahl * Kopf- und Fußzeile ■ • • •							
	HBM Test & Measuremen	· 4 · I · 5 · I · 6 · I · 7 · I · 8 · I	· 9 · I · 10 · I · 11 · I · 12 · I · 13 · I · 14 · I · 15 · I · 16 ·	17, 1.18 19						
	HBM Test & Measuremer									
-	TEST REPORT	: Workshop	HBM Test & Measurement TEST REPORT: Workshop							
-	Start	01/03/2014 15:16:46								
- 2	Stop	24/04/2015 14:58:09	Duration:							
	System under Test	RXD-GGT245637								
-	Test Type / Document	Functional Test Run	AA10-01-FUNC.2014-01	_						
4	Test Equipment	A232-1. QuantumX MX840B	catmanEASY 4.0.2							
	Tester	The Duke	Tel. +49-6151-803-66666, <u>The Duke@hbm.com</u>	_						
18+1+17+1+16+1+15+1+14+1+13+1+12+1+11+1+10+1+9+1+8+1+7+1+6+	Signal Analysis — Templ 5,3 5,2 5,1 5,1 2,5,0 4,9	Edit_002_REGION_COPY_85-4								

Now save your analysis project for upcoming projects.

Side Topic – Why Test Reports?

Now we all don't like writing long test reports but it is helpful in case you need to do a similar tests in the future and some documentation might help making life easier and reproducible for others. The prime objective of such a document is to explain various details and activities about the testing performed in your project and therefore of great value for the respective stakeholders like the mechanical engineering department, senior management, client or others. Assume that if the client who sits in a remote location need to understand the results and status about a testing project which has been performed for some months, A Test Report will solve this purpose. Most of the companies are ISO9001 certified and thus documentation is essential anyhow.

A typical Test Report template should therefore contain:

- Purpose of the document
 - Example: This document explains the various activities performed as part of Testing of system part XYZ.
- Testing Scope (in and out, Items not tested)
 - Pictures (test object itself, measurement spots, equipment, environment, ...)
 - Example: The following functions have been in Scope.... Performance Testing was out of scope...
- Metrics if you have any, i.e. amount of items to improve... or numbers of tests you do (passed / failed)
- Types of testing
 - In-field Load Data Acquisition and Analysis
 - Functional Test
 - System Integration Test
 - o System Test
 - Regression Testing
- Test Environment & Tools
 - Describe the equipment you work with, i.e. QuantumX module, serial number, type and firmware, but also PC operating system and software
 - The acquired data will host all META data you entered before in catman, like name of tester, identification of the system under test (i.e. serial number), weather conditions, date, type of test, etc.
 - Sensor META data (from sensor data base or TEDS) will be stored in the acquired data as well
- Lessons Learned and way to improve
- Recommendations / Best Practices / Conclusion/Sign Off

Please think about it, a repetitive task done manually every time is time consuming. Tasks can be automated by using the same analysis project and test report templates. You can further on automate testing by creating and using scripts running over your data, which saves time and resources.

5. Offline presentation

_ - × 🖳 catmanAP Version 4.0 catman[®] AP 19 0 **Resume my last session** Measure Continue working with devices, sensor settings, visualizations etc. last in use Continue Start a new DAQ project (QuantumX/SomatXR) Select device type, interface and additional hardware options. Connect to devices last in use New Load an existing DAQ project A project contains the complete device configuration, DAQ and storage settings, visualizations, events Open Demo projects Prepare a new DAQ project without connected devices You can select and save the settings to be used later on: device, channel configuration, sensors, visualization and DAQ jobs Ο. Offline OK

Open the "Signal Generator" tab and parameterize it by loading the file you exported before (CATWFM) and which shall be replayed now. Create the new computation signal which can be replayed in an endless loop (Redo).

<u>fx</u> Computation channels						
Help on computation channels	🛢 🚫 🗯 式 🎬 📠 🐼 🕞	Signalgenerator				
□- Computation channels └── Playback signal	Create simulated measurement values to prepare a DAQ project (trigger, events etc.) if you do not have access to real hardware signals. With a playback file you can replay already measured data.					
	Playback signal	Name of computation channel V Unit				
	Playback file	Function				
	Playback file (319 values / 39999,9994039536 Hz s	ample				
	C:\Temp\TempEdit_002_REGION_COPY_85-404.catwf	im				
	✓ Redo	What are playback files?				
	① The time base of your signal will be more precise if y	ou acquire a hardware channel in the same sample rate				
	Drag a channel onto the formula or doubleclick the chann	el to use it as an argument.				
		T				
😯 🌢 Edit Delete		Create computation Close				

Restart catman without a DAQ module and start one of the Demo projects

Now drag and drop the new Computation channel to a graph and start data acquisition. You are now able to demonstrate your data without a device using it in replay mode.

Done. Thanks for your patience. I hope you feel more comfortable with your tool now. Please let us know your comments/questions/thoughts...

Preparation

Please download and install a "<u>signal or function generator app</u>" for your smartphone. Examples: Signal Generator, ArbGen, Audio Function Generator, FuncGen

₩ 1500.0	2 46 m 25 2	ArbGen	_	_		🗳 12:40 AM
	4147.15 Hz	Sine	Triangle	Square	White Noise	Pink Noise
SINUS @ F#6 VOLUME:50%		AM		PM	Sweep	ARB
				Frequency	440	
7 8 9	0.62			Amplitude	100	
		Start		Duty Cycle	50	
0 C		Frequency				

Now you have your own demo tool for signal analysis.

Typical features are:

Wave form: Sine, cosine, square, triangle / sawtooth, white noise Parameterization: Direct frequency input or dial wheel (sweep) Frequency range: 20 ... 20000 Hz

In case you don't have a smart phone or tablet available you can use the PC software <u>SweepGen</u> and generate any signal with the sound card of your notebook. SweepGen is a freeware-tool you can download from the internet.

Tipp: plug in the 3.5 mm jack and tune the sound volume of your smart phone, tablet or PC to the max. **Attention**: turn down volume before unplugging!

-- end

Legal Disclaimer: TECH NOTEs from HBK are designed to provide a quick overview to a specific topic beside the usual documentation. TECH NOTEs are continuously improved and so change frequently. HBM assumes no liability for the completeness of the descriptions. We reserve the right to make changes to the features and/or the descriptions at any time without prior notice.