

Welcome to the “Optimize Vehicle Testing” Webinar

The presentation will begin at 11am Eastern Standard Time

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Organizational Information

- All participants' **microphones** are **muted** during the webinar.
- Please do not forget to **activate** your PC **speakers** to enable **audio** or connect **headphones** to your PC. You may have to take the step of joining the audio conference to hear sound.
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- Today's presentation will be E-mailed to all attendees. The webinar will also be posted on our website: <http://www.hbm.com/en/3157/webinars/>
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Presenter

Ravi Shukla

- ▲ Business Development Manager at **HBK – Hottinger, Brüel & Kjaer**
- ▲ Degree in Electrical Engineering from University of Michigan
- ▲ Previously HBM BDM and Application Engineer for QuantumX & SomatXR Data Acquisition Systems
- ▲ Test & Measurement Experience for 10+ years



Agenda

- Challenges in Automotive Industry and Software Development
- Review typical workflow in linking Physical Sensor data during ECU calibration and diagnostics
- How to fine-tune Software in Lab or Mobile Testing
- QuantumX/SomatXR Data Acquisition xCP-on-Ethernet Integration
- Live Examples of xCP-on-Ethernet working on 3rd party software tools
- Summary and Benefits

Influencing Factors to the Automotive Market



Influencing Factors to the Automotive Market



Geo politics / economical
import taxes – protectionism!



Service / Sharing
Position-based digital journey



Urbanization / urban transport
Density, safety, traffic jams,
parking, public transport, ...



Old and New Players
Classic OEM / Tier 1 / Start-ups
Sharing services



Sustainability & Laws
Zero Emission, overall emission
reduction of fleet , energy mix,
noise, safety



Society & consumer trends
(voice, touch, gesture, always on,
streaming, crypto digital currency,
online ordering, monthly services,
...)

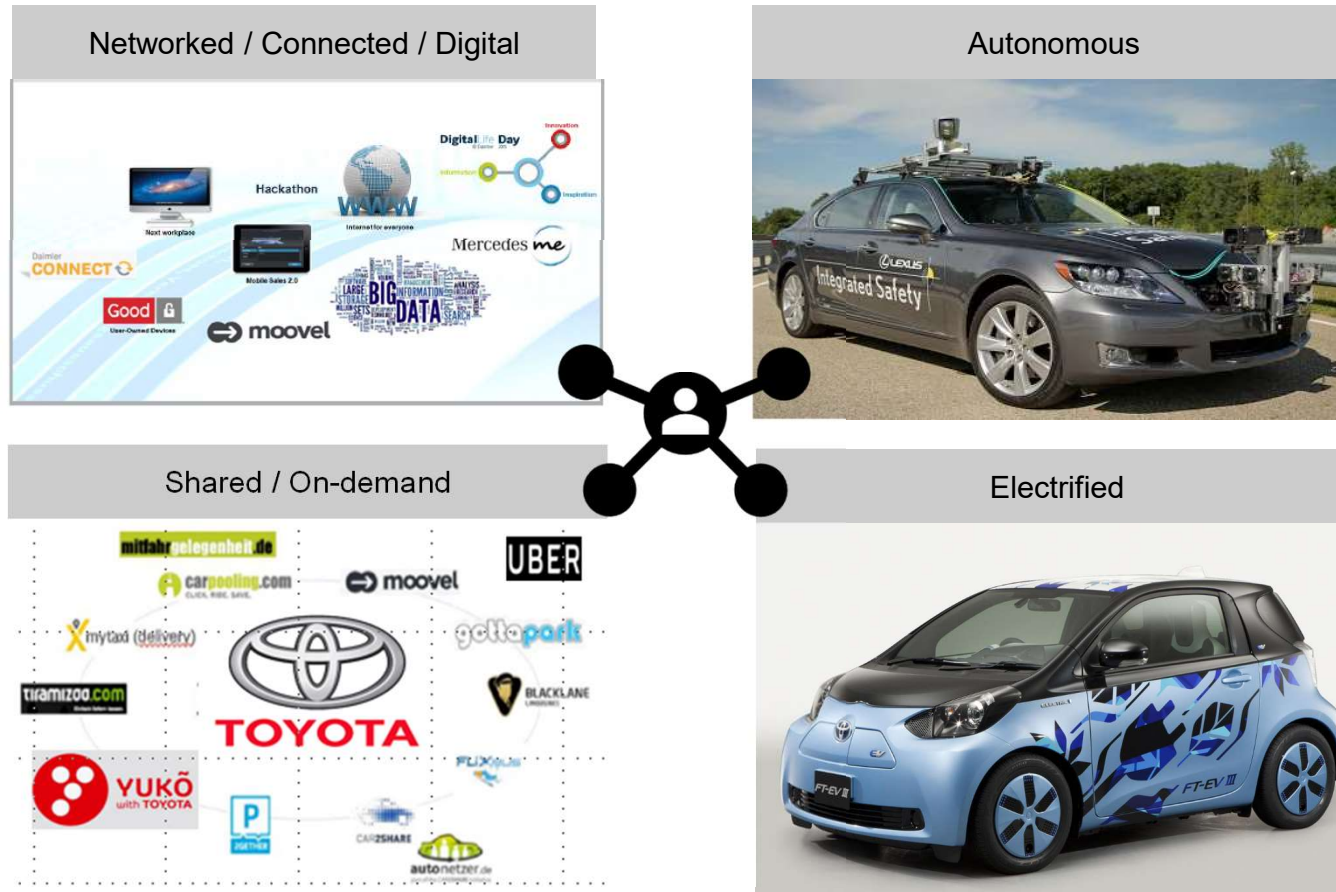


Innovative Technologies
Digital Transformation as Mega Trend –
software, smart / IoT, blockchain, 3D
printing, autonomous driving, SaaS,
simulation,



**Employees &
Work environment**
(work / life, digital, interactive)

The Automotive Mega Trends



The Challenge from a Product point of View

The Mega Trends – Sustainable – Electrified – Autonomous – Networked and Shared

The amount of software grows exponentially driven by multiple forces

- Innovation through an improved user experience in whatever geographical market
- Increasing **efficiency / performance**
- Increasing **comfort and safety** by further assistance (ADAS) or autonomous driving

The Challenge from a Product point of View

In vehicle electronics are established in all domains of a vehicle since decades. It started with radio and entertainment, electronic control or management units (ECU) attached to engine, gearbox, brakes, for safety – very local, dedicated sensors and actuators, typically CAN networked. The amount of ECUs was growing and growing and thus the overall networked complexity.

The Challenge - the amount of software in vehicles grows exponentially driven by multiple forces

- Innovation through an improved user experience in whatever geographical market
- Increasing **efficiency / performance** by electrification, hybrids or alternative fuels
 - Means electric drive, fuel cell, battery, charging, recuperating, overall thermal management, ...
- Increasing **comfort and safety** by further assistance (ADAS) or autonomous driving
 - Networked vehicles: V2V, V2I, to OEM including Over-the Air update (OTA) from the user

Challenges for Electronic development from testing point of view

- Need towards **less**, but more **powerful electronics** and an open **software framework**
(example: AUTOSAR – AUTomotive Open System Architecture)
- **Object-oriented programming languages** and **enhanced operating systems**
- **Scalable** and **reusable function blocks** cross domains and across different cars
- **Safe operation** is must, fulfilling safety standards (SOTIF, ISO 26262 / ASIL)
- **Quicker** from idea to roll-out into vehicles is a market advantage
- **Easy to maintain** when in use (OTA – Over-the-Air services)

Flexible tools are required for system and software development and testing

Reference:

SOTIF – Safety Of The Intended Functionality (ISO/PAS 21448)

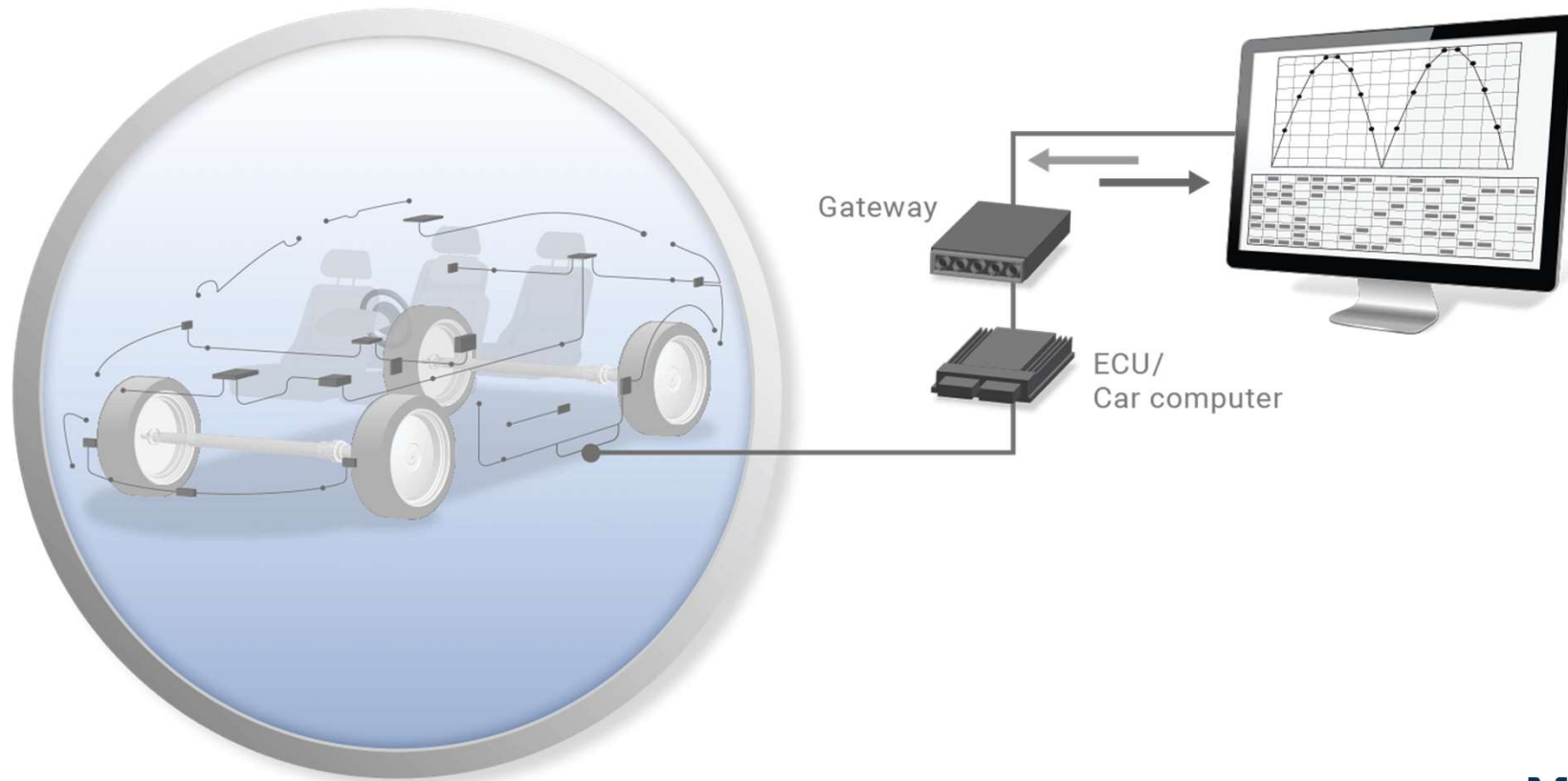
ASIL – Automotive Safety Integrity Level (ISO 26262)

The Challenge for EE development and testing point of view

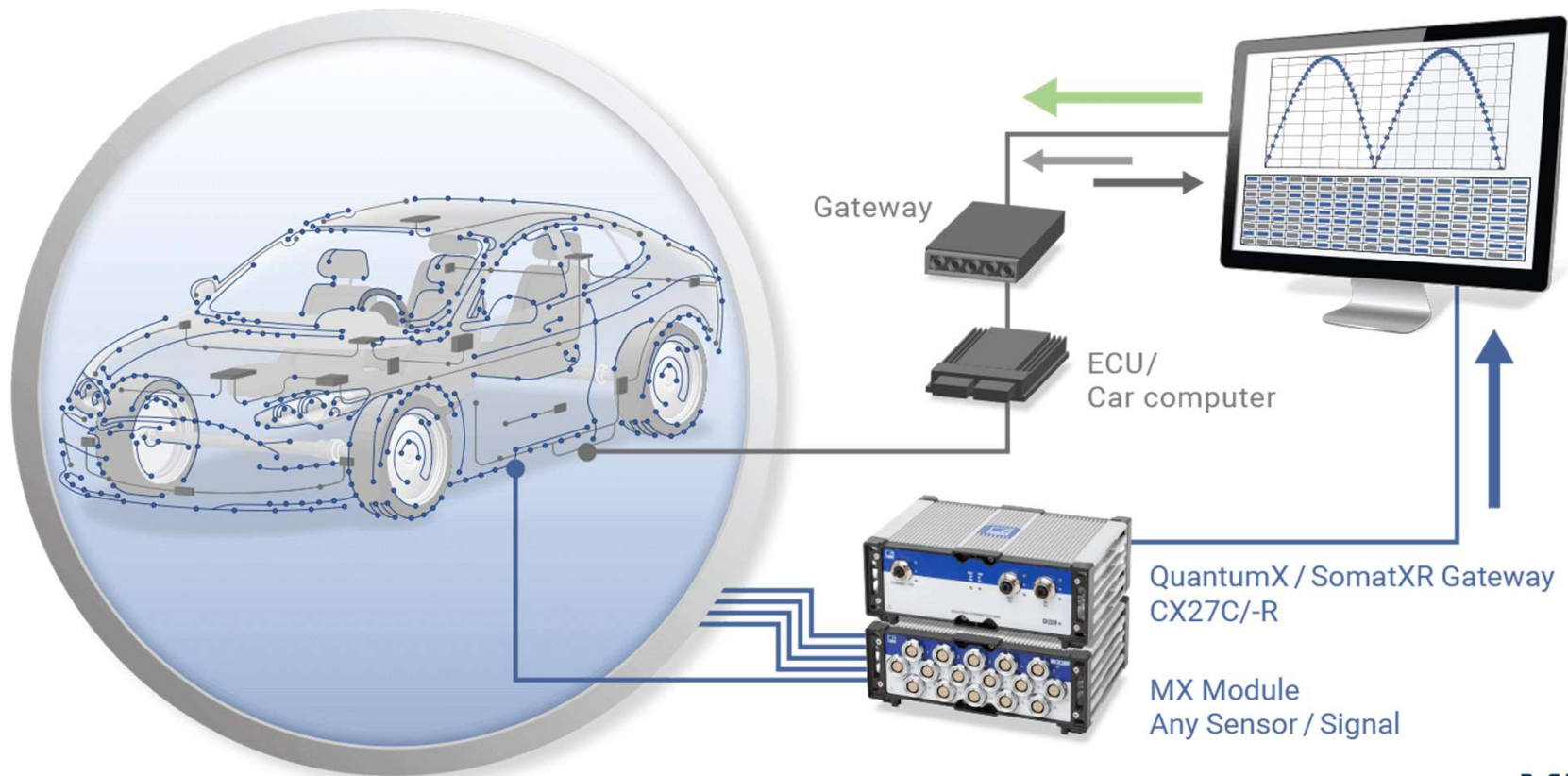
- Adding additional software into intelligent vehicles of the future is costly
- There is a need towards **less**, but more **powerful electronics** and an open **software framework**
- From code size optimization in C and assembler towards **object-oriented programming languages** and **enhanced operating systems** with the right links for maintenance and further improvements
- **Scalable** and **reusable function blocks** cross domains and across different cars (AUTOSAR) reduce cost
- **Safe operation** is must, fulfilling safety standards (SOTIF, ISO 26262 / ASIL), so high code quality
- **Quicker** from idea to roll-out into vehicles is a market advantage
- **Easy to maintain** when in use (OTA – Over-the-Air services)

Flexible tools are required for system and software development and testing

Fine-Tuning Software – Typical Setup



Fine-Tuning Software – Enhanced Setup



XCP – Calibration Protocol

Who offers this?

- XCP is an open calibration protocol, standardized by ASAM ensuring interoperability and can run on any “X” network transport layer (CAN, CAN FD, FlexRay or Automotive Ethernet)
- Successful because of its stability and backward-compatibility.



What does it offer?

- Time stamped **measurement** data, parameter **tuning** (calibration), **bypassing** functionality, **flashing** of ECUs and **debugging**
- **High data throughput** with XCP-on-Ethernet

What do you need?

- Parameter description files (A2L) and most likely a decrypting access key to electronics (SKB)

QuantumX or SomatXR CX27C-R Gateway



Functionality

EtherCAT[®] — EtherCAT[™] for test bench OR

PROFINET[®] — PROFINET IRT for test bench

- **Ethernet Gateway** (up to 2 MS/s) allowing to integrate all connected measurement modules to a PC
- **XCP-on-Ethernet** Gateway integrating any sensor to
 - INCA from ETAS
 - CANape from Vector
 - ControlDesk from dSPACE
 - Vision from ATI
 - DiagRA[®] X from RA Consulting
 - PUMA Open from AVL
 - Fleet recorders and many more



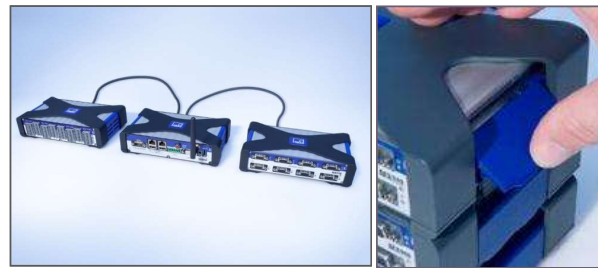
So this is all about openness and integration in **bench test automation** and **Cal tools in parallel**.

QuantumX – Versatile Distributable Data Acquisition System

Every module is a DAQ system...



... scale up and distribute modules...



... integrate in real-time ...



... stand alone recording!



QuantumX – Freely scale your System



Universal– “Swiss Army Knife of Measurement”
more than 16 transducers types
MX840B, MX440B

High Speed Mechanical
Force, Torque, Speed
MX410B, MX460B

High Accuracy Full Bridge
MX430B, MX238B

High Channel Count
Bridge, IEPE, +/-10V, 4..20 mA, thermocouple
MX1615B, MX1601B
MX1609KB, MX1609TB

Fully Isolated (CAT II / CAT III)
Voltage, current, universal thermocouple
MX403B, MX809B

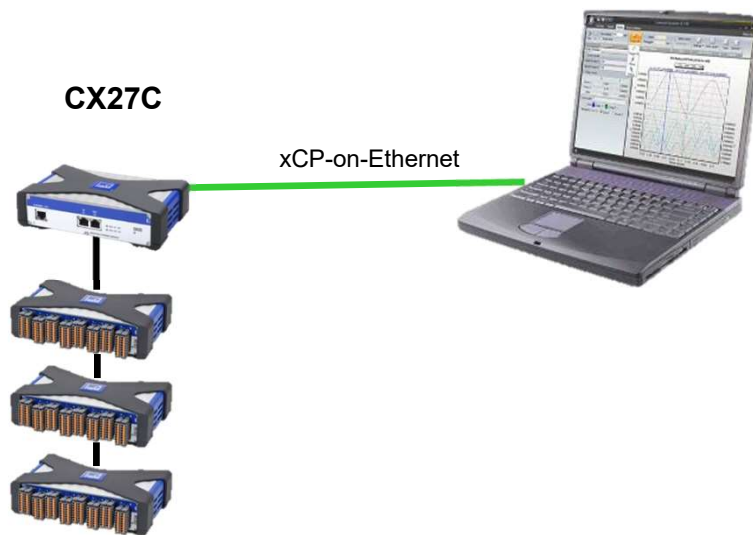
QuantumX – Freely scale your System



Optical Fiber Bragg Module
Strain, force, acceleration, temperature, inclination
MXFS8DI

Real-time Integration + Ethernet Gateway
EtherCAT, PROFINET, **xCP-on-Ethernet**
CX27C

Integrate QuantumX / SomatXR DAQ into any Automotive Measurement and Calibration Software in the market



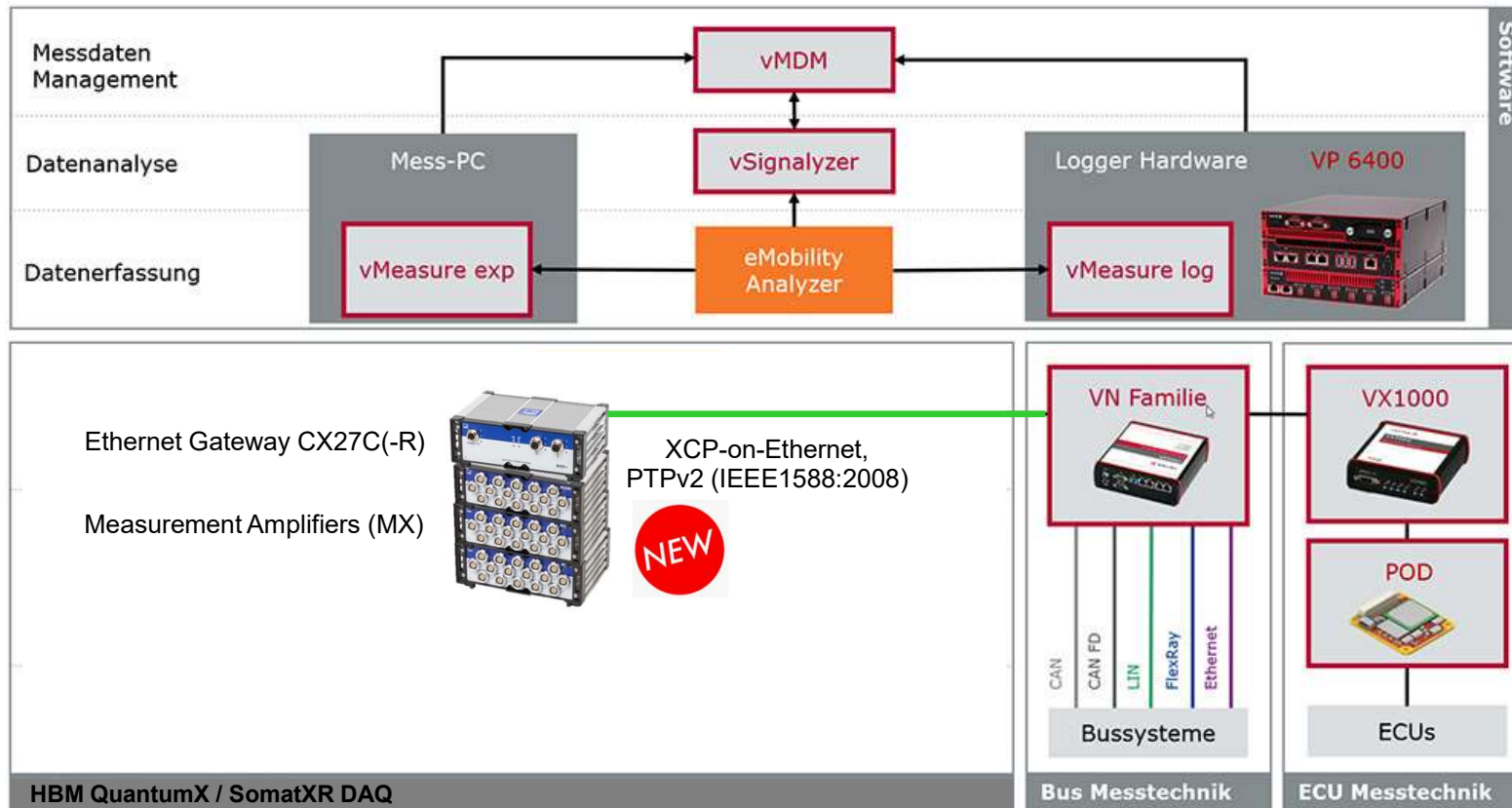
Established Software packages

- CANape from Vector (dynamics, gearbox)
- INCA from ETAS (engine, motor)
- ControlDesk from dSPACE
- Vision from ATI
- PUMA Open from AVL
- dSPACE prototyper / HiL
- DiagRA X
- Any automotive recorder
- ...

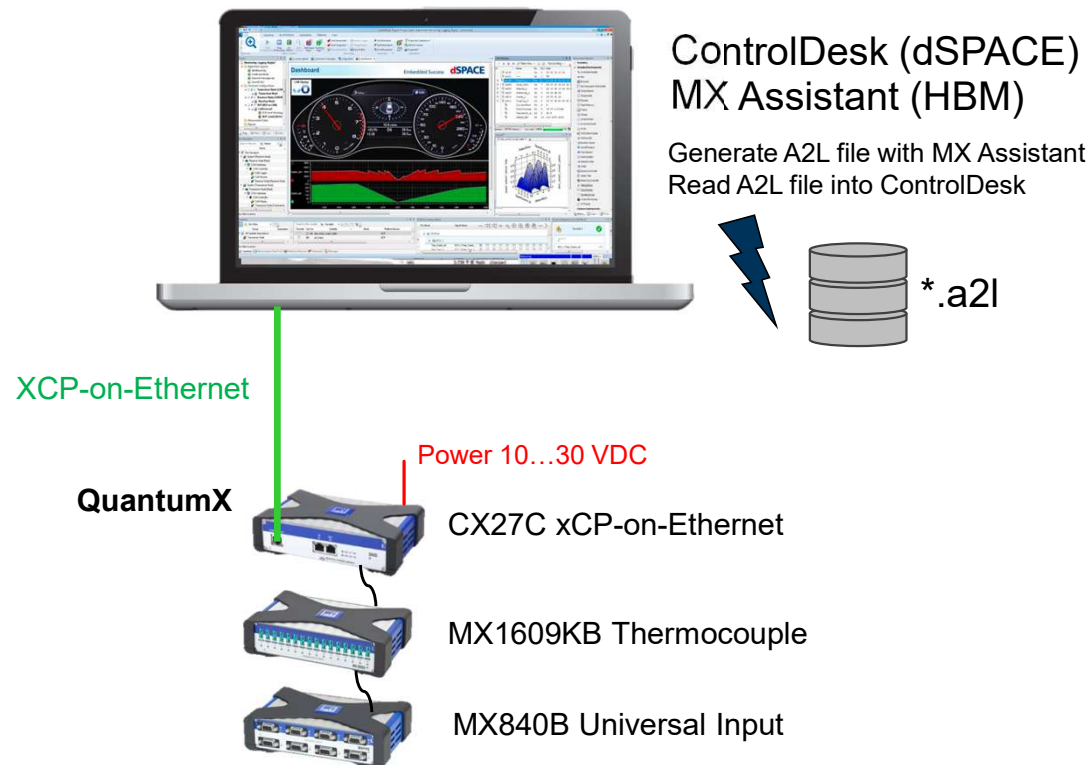
Task

- Optimization **function of ECU software**
- Optimizing overall mechatronics / system
- Mobile vehicle testing engineers
- Powertrain testing engineers

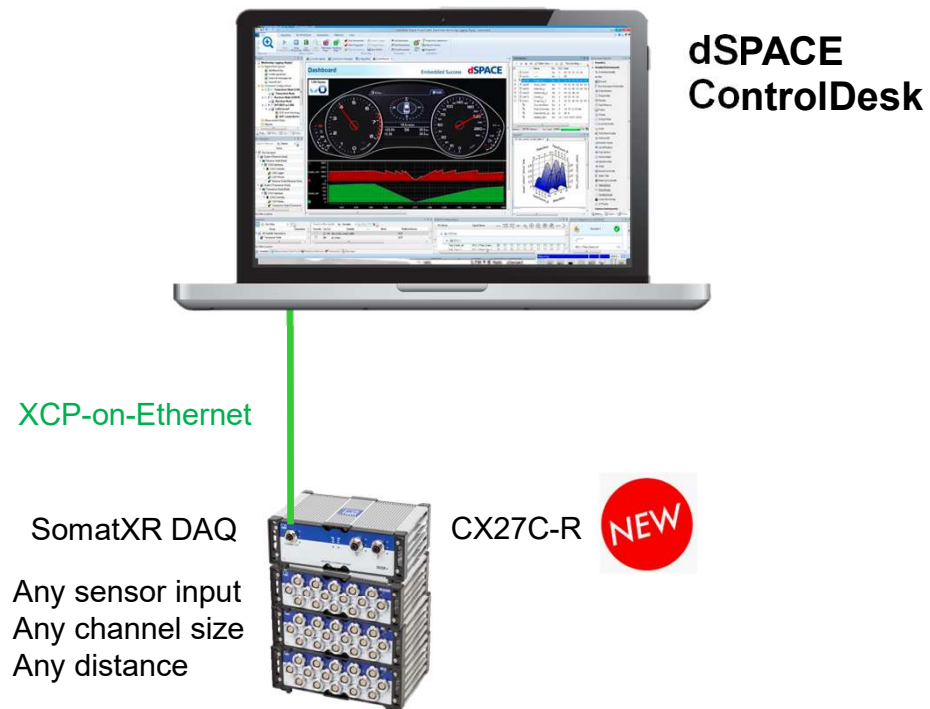
Vector Informatik Eco System Integration (HBM Integration)



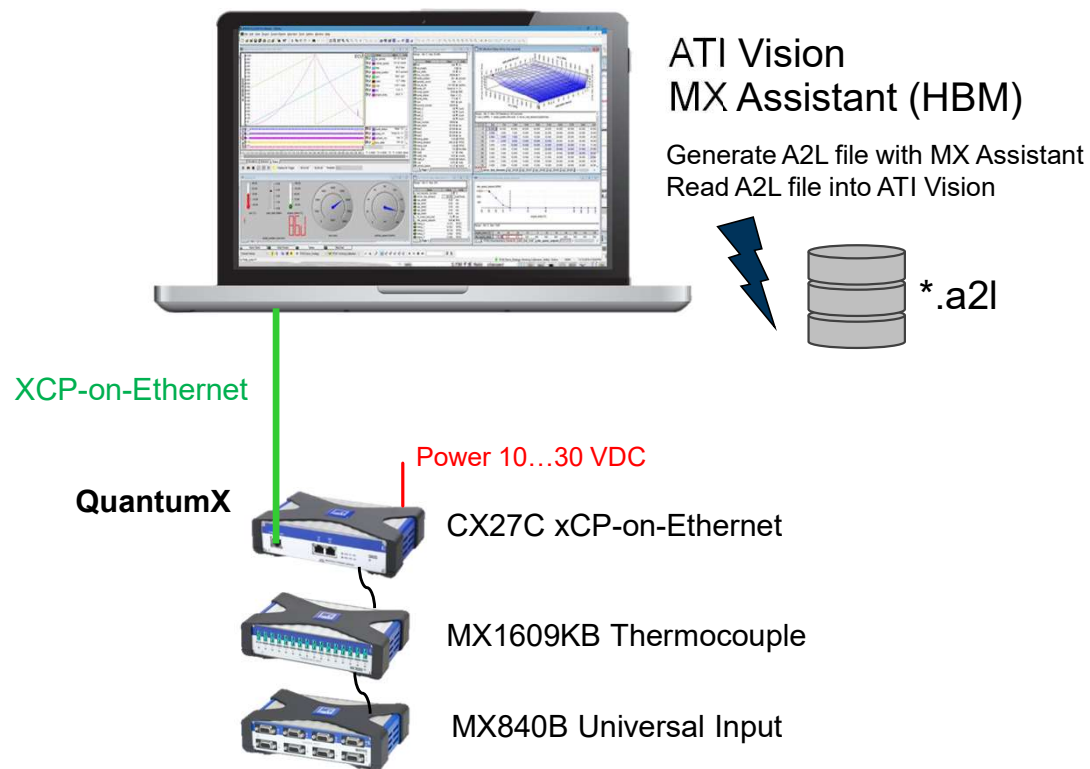
QuantumX Integration into ControlDesk



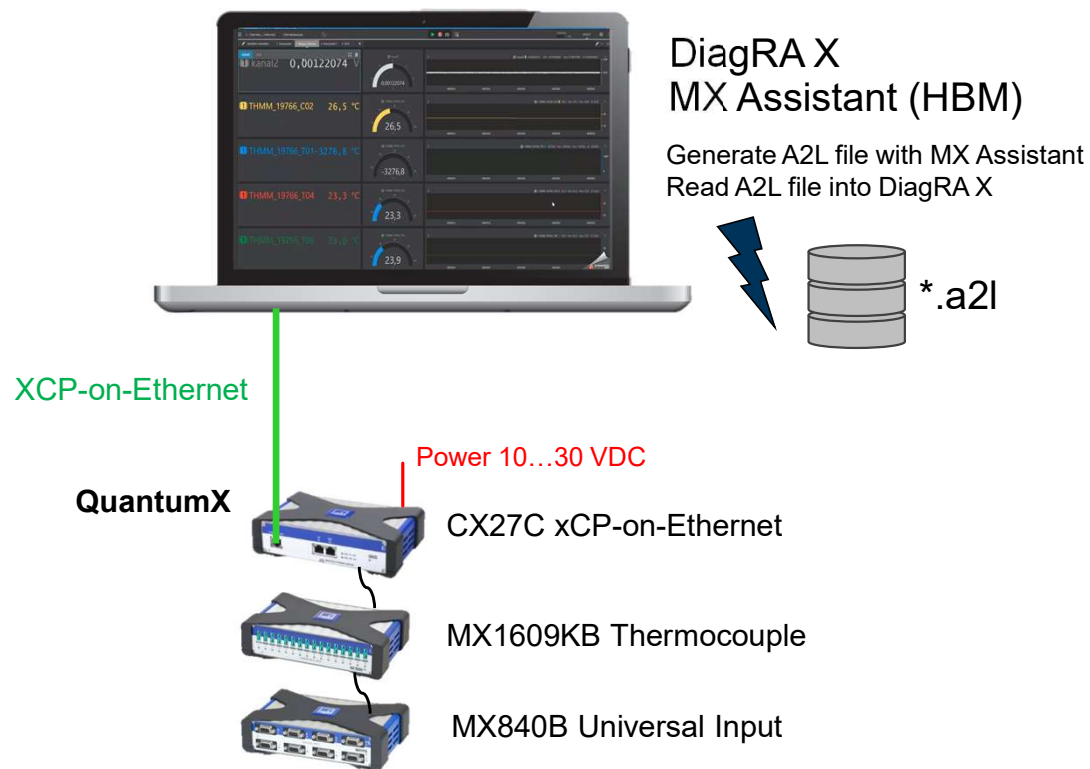
SomatXR Integration into ControlDesk



QuantumX Integration into ControlDesk



QuantumX Integration into DiagRA X



QuantumX analog signals working within ATI Vision Software

The image displays two software interfaces. The left window, 'MX Assistant V4.10 R1 (286)', shows a table of sensor data. The right window, 'VISION 5.3 - [Screen1]', shows a data list and system logs.

MX Assistant V4.10 R1 (286) Data Table:

Path	Type	Signal name	Sensor description	Amplifier setting	Output unit	Signal value
1.1: Strain Gage Amplifier (0083D9)	A-IN	Rosette Leg A Bottom	SG 3 wire 120 Ohm	Quarter ...	µm/m	9.3881 µm/m
2.1: Strain Gage Amplifier (0083D9)	A-IN	Rosette Leg B Bottom	SG 3 wire 120 Ohm	Quarter ...	µm/m	-1.9712 µm/m
3.1: Strain Gage Amplifier (0083D9)	A-IN	Rosette Leg C Bottom	SG 3 wire 120 Ohm	Quarter ...	µm/m	-0.2170 µm/m
4.1: Strain Gage Amplifier (0083D9)	A-IN	Strain Gage Amplifier_CH 4		Voltage:...	V	> No sensor connected <
5.1: Strain Gage Amplifier (0083D9)	A-IN	Strain Gage Amplifier_CH 5		Voltage:...	V	> No sensor connected <
6.1: Strain Gage Amplifier (0083D9)	A-IN	Strain Gage Amplifier_CH 6		Voltage:...	V	> No sensor connected <
7.1: Strain Gage Amplifier (0083D9)	A-IN	Strain Gage Amplifier_CH 7		Voltage:...	V	> No sensor connected <
8.1: Strain Gage Amplifier (0083D9)	A-IN	Strain Gage Amplifier_CH 8		Voltage:...	V	> No sensor connected <
9.1: Strain Gage Amplifier (0083D9)	A-IN	Strain Gage Amplifier_CH 9		Voltage:...	V	> No sensor connected <
10.1: Strain Gage Amplifier (0083D9)	A-IN	Strain Gage Amplifier_CH 1		Voltage:...	V	> No sensor connected <
11.1: Strain Gage Amplifier (0083D9)	A-IN	Strain Gage Amplifier_CH 1		Voltage:...	V	> No sensor connected <
12.1: Strain Gage Amplifier (0083D9)	A-IN	Strain Gage Amplifier_CH 1		Voltage:...	V	> No sensor connected <
13.1: Strain Gage Amplifier (0083D9)	A-IN	Strain Gage Amplifier_CH 1		Voltage:...	V	> No sensor connected <
14.1: Strain Gage Amplifier (0083D9)	A-IN	Strain Gage Amplifier_CH 1		Voltage:...	V	> No sensor connected <
15.1: Strain Gage Amplifier (0083D9)	A-IN	Strain Gage Amplifier_CH 1		Voltage:...	V	> No sensor connected <
16.1: Strain Gage Amplifier (0083D9)	A-IN	Strain Gage Amplifier_CH 1		Voltage:...	V	> No sensor connected <

VISION 5.3 - [Screen1] Data List:

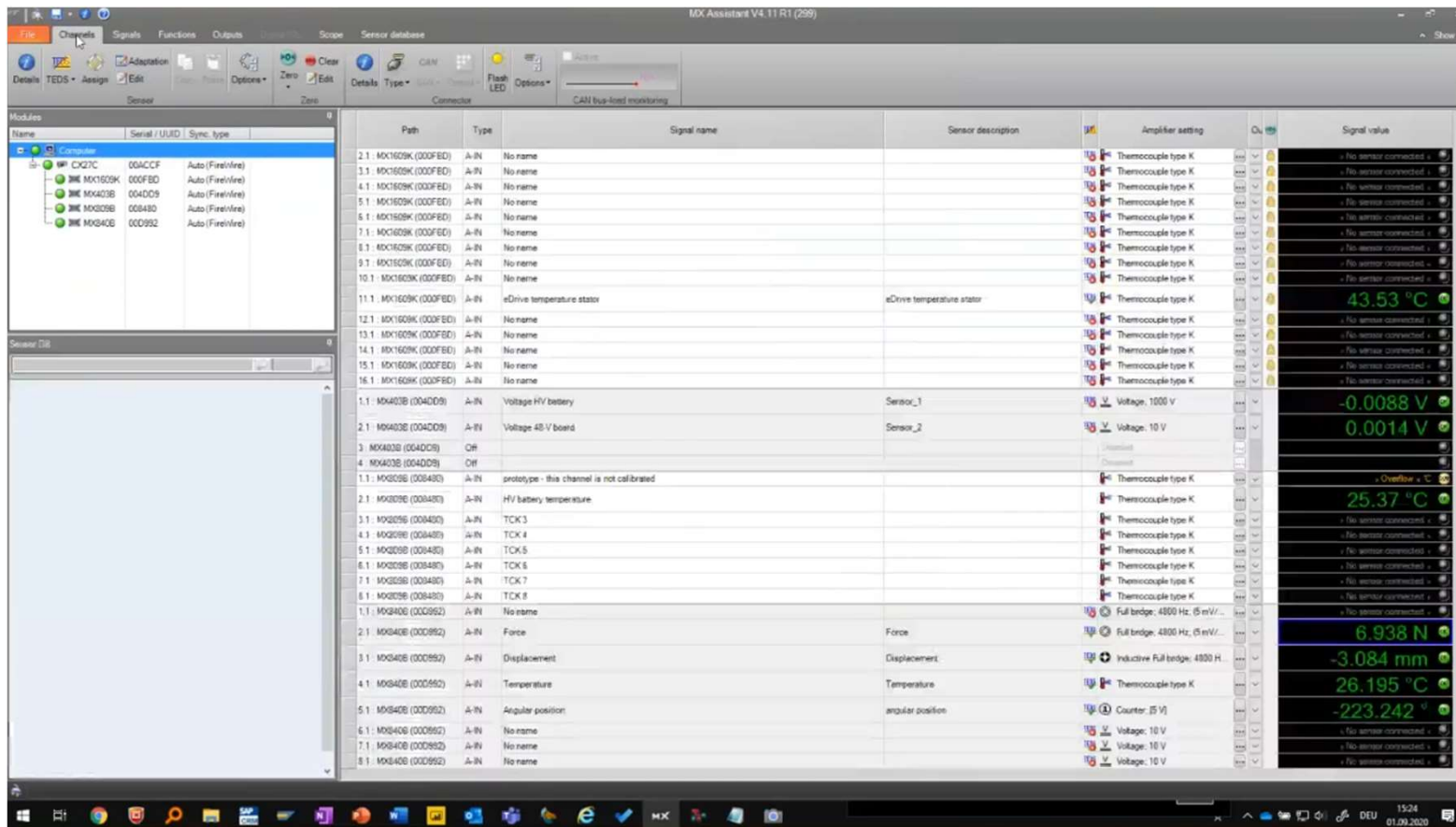
Name	Value
Rosette_Leg_A_Bottom	4.643193721771240
Rosette_Leg_B_Bottom	-1.478148578788757
Rosette_Leg_C_Bottom	-0.106246426701546

VISION 5.3 - [Screen1] System Logs:

```

08/05/2020 15:28:48:167 Saved D:\ATI Vision 5.3 Files\ATI Vision Demo with HBM SomatXR.vpj as [default version]
08/05/2020 15:29:16:963 VISION Online
08/05/2020 15:29:17:515 Opening trace file C:\Users\shukla\AppData\Local\Accurate Technologies\VISION\5.3\Logs\WCP-PCM.txt
08/05/2020 15:30:01:836 Closing trace file C:\Users\shukla\AppData\Local\Accurate Technologies\VISION\5.3\Logs\WCP-PCM.txt
08/05/2020 15:31:33:748 Backup D:\ATI Vision 5.3 Files\PCM\cx27c_xCP_ATIVisionTest_31_7_2020.vst to D:\ATI Vision 5.3 Files\PCM\cx27c_xCP_ATIVisionTest_31_7_2020.vst
08/05/2020 15:31:33:762 Saved D:\ATI Vision 5.3 Files\PCM\cx27c_xCP_ATIVisionTest_31_7_2020.vst as [default version]
08/05/2020 15:31:41:931 Selecting Strategy D:\ATI Vision 5.3 Files\PCM\cx27c_xCP_ATIVisionTest_31_7_2020.vst* for device PCM
08/05/2020 15:31:46:353 VISION Online
08/05/2020 15:31:46:901 Opening trace file C:\Users\shukla\AppData\Local\Accurate Technologies\VISION\5.3\Logs\WCP-PCM.txt
    
```

QuantumX analog signals working within Vector CANape



Further Information



SomatXR CX27C-R: Parallel Data Analysis and Automation via EtherCAT® and PROFINET IRT

The SomatXR CX27C-R Industrial Ethernet gateway enables the integration of up to 199 signals from up to 24 SomatXR modules into a measurement chain, which can also be simultaneously acquired in real time. It is, therefore, perfectly suitable for both simple and complex development test benches with high demands on ruggedness, such as engine or powertrain test stands.

Owing to its Industrial Ethernet interface, the said module allows real-time cycle times of few milliseconds, even with distributed measurements. In addition, the CX27C-R supports parallel data streaming via Ethernet TCP/IP. When combined with the catman data acquisition (DAQ) software, the data collected can be viewed, analysed, and recorded at sample rates of up to 100 kS/s per channel, without affecting the real-time automation tasks performed via EtherCAT® or PROFINET IRT.

Easy integration of all the SomatXR modules into a wide range of measurement environments is possible due to the variety of synchronization options available, such as EtherCAT™, PTPv2, IRIG-B, and NTP. Moreover, the automapping function ensures maximum convenience in the application. The module automatically configures individual channels.

Extreme durability	High flexibility	Fast configuration
<ul style="list-style-type: none"> IP65/IP67 degree of protection (dust and water) Reliable even in the event of continuous vibration loading up to 15 g Shielded up to 75 g Usable over a broad temperature range of -40 °C to +80 °C 	<ul style="list-style-type: none"> All typical signals and sensors can be acquired using one system Real-time cycle times of few milliseconds Output via EtherCAT® or PROFINET IRT with parallel Ethernet operation 	<ul style="list-style-type: none"> Automatic configuration due to automapping Multiple synchronization options TEDS support Free and easy-to-use configuration software

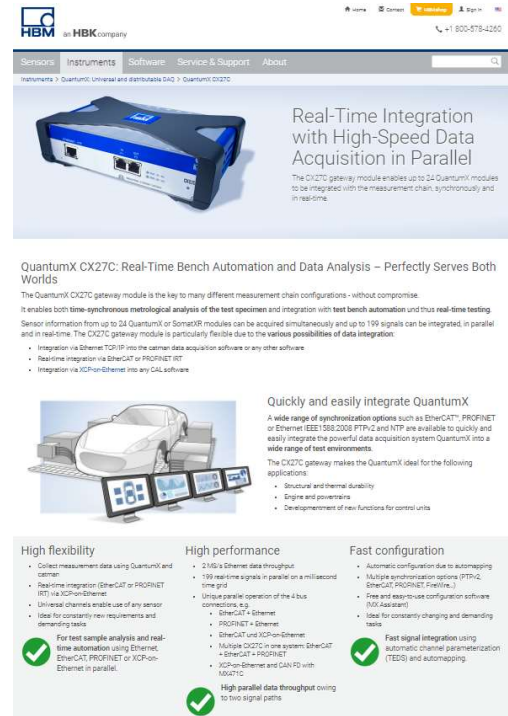
For real-time applications owing to easy integration into the test bench

Convenient system integration owing to automapping and TEDS

CX27C-R Industrial Ethernet gateway for test bench integration

- Output of up to 199 signals in EtherCAT or PROFINET IRT
- Parallel connection to the measurement software on the PC
- Real-time cycle times of few milliseconds, even with distributed measurements

[updates](#) [SomatXR overview page](#)



Real-Time Integration with High-Speed Data Acquisition in Parallel

The CX27C gateway module enables up to 24 QuantumX modules to be integrated with the measurement chain, synchronously and in real-time.

QuantumX CX27C: Real-Time Bench Automation and Data Analysis – Perfectly Serves Both Worlds

The QuantumX CX27C gateway module is the key to many different measurement chain configurations – without compromise. It enables both **time-synchronous metrological analysis of the test specimen** and integration with **test bench automation** and thus **real-time testing**. Sensor information from up to 24 QuantumX or SomatXR modules can be acquired simultaneously and up to 199 signals can be integrated, in parallel and in real-time. The CX27C gateway module is particularly flexible due to the various **possibilities of data integration**:

- Integration via Ethernet TCP/IP into the catman data acquisition software or any other software
- Real-time integration via EtherCAT or PROFINET IRT
- Integration via XCP-on-Ethernet into any CAL software

Quickly and easily integrate QuantumX

A wide range of synchronization options such as EtherCAT™, PROFINET or Ethernet IEEE 1588.2/PTPv2 and NTP are available to quickly and easily integrate the powerful data acquisition system QuantumX into a wide range of test environments.

The CX27C gateway makes the QuantumX ideal for the following applications:

- Structural and thermal durability
- Engine and powertrains
- Development of new functions for control units

High flexibility	High performance	Fast configuration
<ul style="list-style-type: none"> Collect measurement data using QuantumX and catman Real-time integration (EtherCAT or PROFINET IRT) via XCP-on-Ethernet Universal channels enable use of any sensor Idea for constantly new requirements and demanding tasks 	<ul style="list-style-type: none"> 2 MS/s Ethernet data throughput 199 real-time signals in parallel on a millisecond time grid Unique parallel operation of the 4 bus connections, e.g. <ul style="list-style-type: none"> EtherCAT + Ethernet PROFINET + Ethernet EtherCAT and XCP-on-Ethernet Multiple CX27C in one system: EtherCAT + EtherCAT + PROFINET XCP-on-Ethernet and CAN FD with MUX12C 	<ul style="list-style-type: none"> Automatic configuration due to automapping Multiple synchronization options (PTPv2, EtherCAT, PROFINET, Catman, ...) Free and easy-to-use configuration software (Catman) Idea for constantly changing and demanding tasks

For test sample analysis and real-time automation using Ethernet, EtherCAT, PROFINET or XCP-on-Ethernet in parallel.

High parallel data throughput owing to two signal paths



ECU Boosting: Software Optimization via XCP-on-Ethernet

Easy and flexible integration of QuantumX into your MCD Tool Chain

Easy Software Parameter Tuning by Additional Sensor Data via XCP-on-Ethernet

With the increase of size and complexity, functional software development plays a crucial role in any kind of vehicle. Algorithms running on modern Electronic Control Units (ECUs) need to be fine-tuned before the vehicles' release and maintained regularly. ECU fine-tuning and optimization start in simulated environment at the PC, but is still dominantly validated in real conditions in a test bench or mobile test on a track.

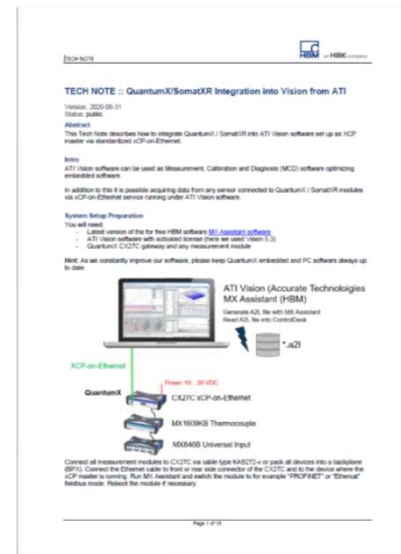
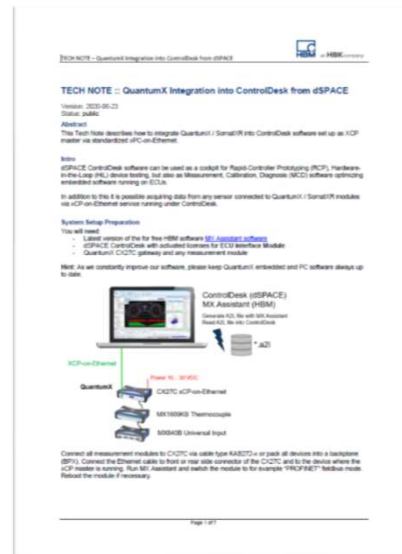
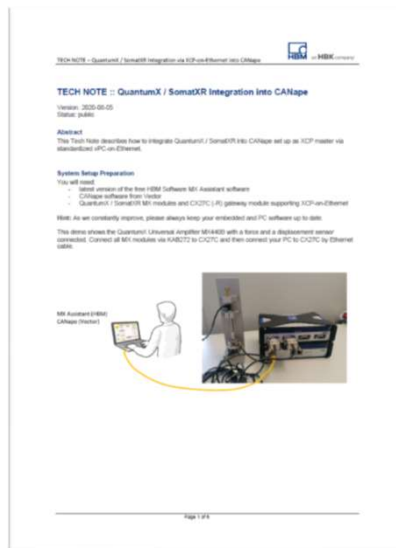
Additional sensor data improves physical insights and is fundamental for a quick optimization and software release. Adding QuantumX measurement modules and its highly universal inputs, gathering all sensor types in a scalable way, allows overlaying all data sources – in-vehicle sensors and bus signal data add-on sensors.

Pulling all data into the same workflow with the standardized XCP protocol is easy and very flexible. All this ensures a friendly integration into your existing software tool and testing setups for Measurement, Calibration and Diagnostics (MCD), optimizing embedded software.

Visit hbm.com for dedicated webpages on QuantumX CX27C & SomatXR CX27C-R

Webinar / Video

Further Information



Tech Notes available on hbm.com

- Vector: CANape
- dSPACE: CALdesk
- ATI: ATI Vision
- More to come

Contact our Sales & Support

Summary and Benefits

- Integrate any sensor input - mechanical, electrical, thermal, flow, ... for a better physical view
- High-quality signal inputs
- Work mobile, in lab or in bench testing integrating in real-time to your test automation software
- Choose between standard or ultra-ruggedized modules or combine both
- Use the modules in many other testing applications – mobile, lab or bench - one system

Questions?

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