Vector Smart Logger

– The Intelligent Logging Solution for E-Mobility and ADAS Developments

CSM web seminars
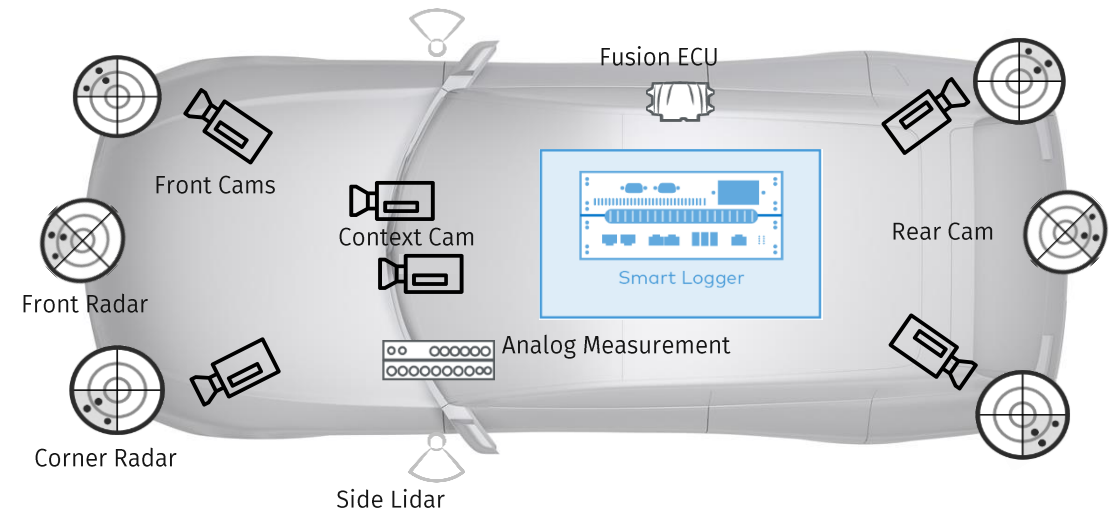
CSM Xplained
measurement technology

VECTOR

Motivation
Requirements for Logging Sytems - General

Challenges in ADAS, eMobility and conventional vehicle development require

▶ **Interoperability with many different signal source types**

(Cameras, Radar, LIDAR, vehicle network and protocols, external instrumentation)

▶ **Robust high-end analog measurement systems**

▶ **Precise correlation of all these different signal sources**

to determine cause and effect in the overall system

Economical as well as **safety** and **process reliability** related reasons lead to the need for **autonomous** automated **measurement logger systems**

Fusion ECU

Front Cams

Context Cam

Rear Cam

Front Radar

Smart Logger

Corner Radar

Analog Measurement

Side Lidar

Motivation
Requirements for Logging Sytems - Working processes moving closer together

▶ Technical innovation increases rapidly

  ▶ in the field of ADAS development and the electrification of vehicles

  ▶ at the same time development cycles become shorter

▶ A closer merging of the workflows between development and validation is required

▶ The measurement system should support the transition between interactive development and autonomous validation measurement with the maximum reuse of work artifacts

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Motivation
Requirements for Logging Sytems – Computation Performance

▶ Demanding acquisition performance increases performance attributes such as

  ▶ sampling rates

  ▶ total number of signals

▶ Results in ever expanding storage capacities and rising data rates

▶ Powerful online signal processing

  ▶ for high-speed online signal calculation like power, derivative, filter, …

  ▶ to handle complex trigger conditions

 ▶ Enables online data reduction by only capture the essence

Vector Smart Logger
Breaking Down the Boundaries Between Two Worlds

CANape / vMeasure

User controlled measurement software

- ▶ Configuration and visualization
- ▶ Measure many sources:
  Vehicle Networks (ECU and Bus), Cameras, Analog …
- ▶ Time-synchronous data collection from different sources
- ▶ High data rate up to 2 GByte/s
- ▶ Calculation of complex algorithms and trigger conditions
- ▶ Visualize measured and calculated signals
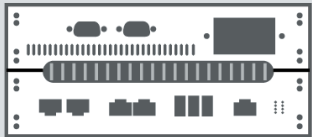
Logger

Autonomously acting loggers

- ▶ Robust hardware for long-term test drives
- ▶ Capable for special environmental conditions:
  - ▶ Temperature range
  - ▶ Electrical system voltage drops
  - ▶ Size, robustness
- ▶ Unattended measurement control
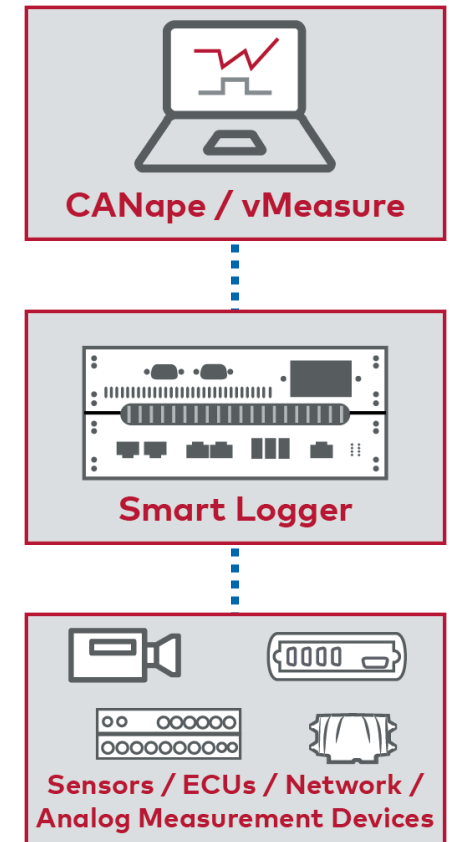- ▶ Remote Logger configuration

Smart Logger

Merging the best of both worlds
in **one solution**

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Vector Smart Logger
Smart Logger Configuration and Interactive Use

- **vMeasure/CANape** on the computer as visualization interface for

  - Configuration of sensors, ECUs, interfaces …

  - Measurement configuration

  - Trigger definition

  - Visualization

- **Smart Logger**

  - Executing the measurement project in "interactive" mode

  - Synchronization of sources

  - Sensors, ECUs, interfaces …

    are connected direct to the logging hardware

  - Logging and storing the measurement

The complete tool UI is available on the computer,

**but the core application is running on the Smart Logger**

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Vector Smart Logger
Switching from "Interactive" mode to "Standalone" logging

Disconnecting the
configuration computer

CANape / vMeasure

▶ **Smart Logger**

   ▶ The measurement project is running "Standalone" on the logger

   ▶ Synchronization of sources

   ▶ Sensors, ECUs, interfaces …

      are connected direct to the logging hardware

   ▶ Logging and storing the measurement

Smart Logger

Sensors / ECUs / Network /
Analog Measurement Devices

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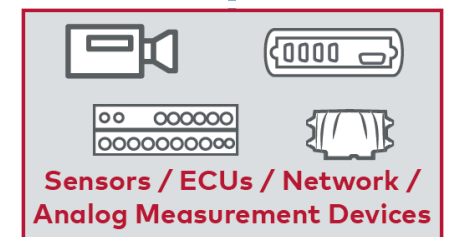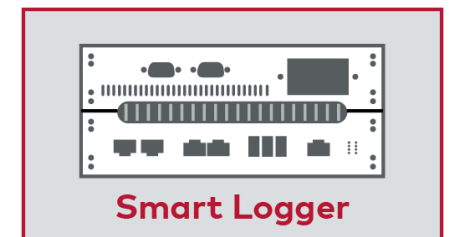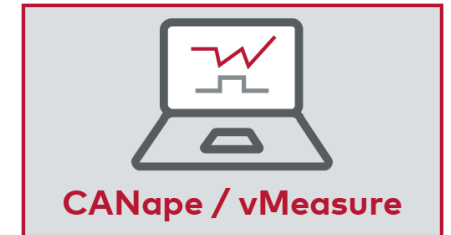
Vector Smart Logger
Visualization of logger status without configuration computer

- ▶ **Smart Logger**
  - ▶ "Standalone" logging
  - ▶ Synchronization of sources
  - ▶ Sensors, ECUs, interfaces …
    are connected direct to the logging hardware
  - ▶ Logging and storing the measurement

- ▶ **Mobile UI**
  - ▶ Visualization of logger status and measurement values

Mobile UI

Smart Logger

Sensors / ECUs / Network /
Analog Measurement Devices

Vector Smart Logger
Simple switching between the Use-Cases

- **vMeasure or CANape** on the computer in "Interactive" Mode
  - Visualization of measurement in the full tool environment
  - Calibration is possible (with CANape)
  - The tool kernel is running on the logging HW
    - Data visualization runs in tool on laptop

- **Smart Logger**
  - "Standalone" logging
  - Synchronization of sources
  - Sensors, ECUs, interfaces …
    are connected direct to the logging hardware
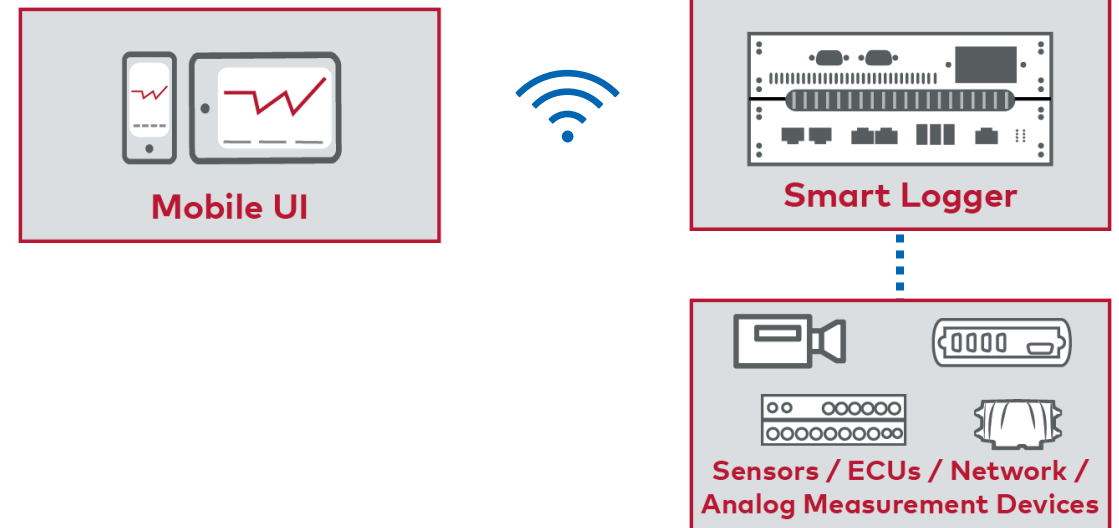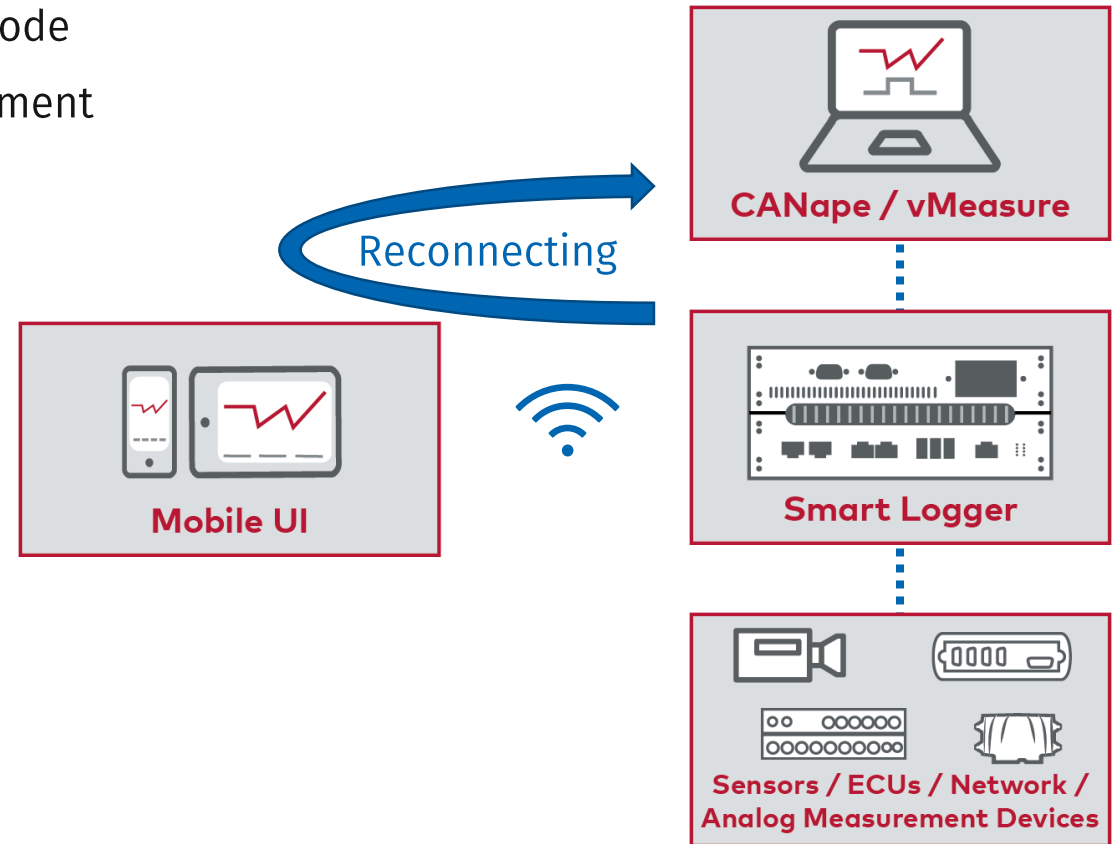 - Logging and storing the measurement

- **Mobile UI**

Fast switching between the use-cases without interrupting the logger or reconnecting the sources

Reconnecting

CANape / vMeasure

Mobile UI

Smart Logger

Sensors / ECUs / Network /
Analog Measurement Devices

Overview of the different Smart Logger Variants
Overview of the different Smart Logger Tool Variants

▶ The software running on our Smart Loggers are based on our tools vMeasure and CANape

 ▶ Depended on the use case vMeasure log or CANape log is used

	vMeasure log	CANape log
Configuration Tool	vMeasure	CANape
Support of ADAS Sensors	No	Radar, LIDAR, Camera
Context Cameras	Yes, AXIS and Direct Show cameras	
Customer Specific Protocols and Sensors	No	Yes
Automotive Networks	CAN, CAN FD, LIN, FlexRay, Automotive Ethernet	
Protocols and Network Interfaces	CCP, XCP, SOME/IP, VX1000, GNSS, Analog Measurement Technology	
Supported Description Files	A2L, AUTOSAR ARXML, DBC, Fibex, LDF, XML	
Signal based Recording	Yes	
Message based Recording	No	Yes
Record Raw/Debug Data	No	Yes
Time Synchronization	Yes	
Online Calculations	Yes	
eMobilityAnalyzer Included	Yes	
Measurement Data Format	MDF 3.2, 4.0 and 4.1	
Mobile UI	Yes	

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Overview of the different Smart Logger Variants
## vMeasure log – Autonomous Execution of your Measurement Task

Fits ideally for eMobility and conventional vehicle measurement of different signal sources like :

- ECUs and vehicle busses

- Acquisition of analog signals with high sampling frequencies
  - Analog Signals up to 2 MHz per signal
  - High data rates up to 2 GByte/s on a storage medium

- The build in **eMobilityAnalyzer** function library
  - allows real-time calculation of:
    - DC/AC voltages and currents analysis
    - Real/Apparent/Reactive power
    - Power factor and efficiency
    - Shaft/Axle Power
    - Harmonics
    - …
  - Use the results as trigger conditions to start recording, set measurement markers, …

eMobilityAnalyzer

Raw Data — Calculation — Processed Results

E-Motor Power Analysis
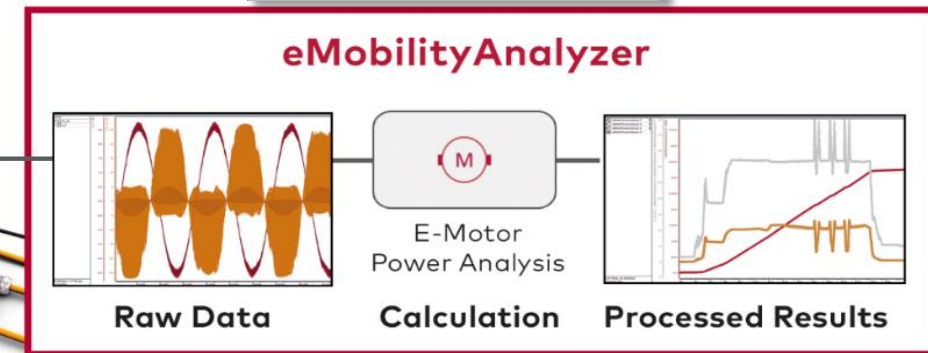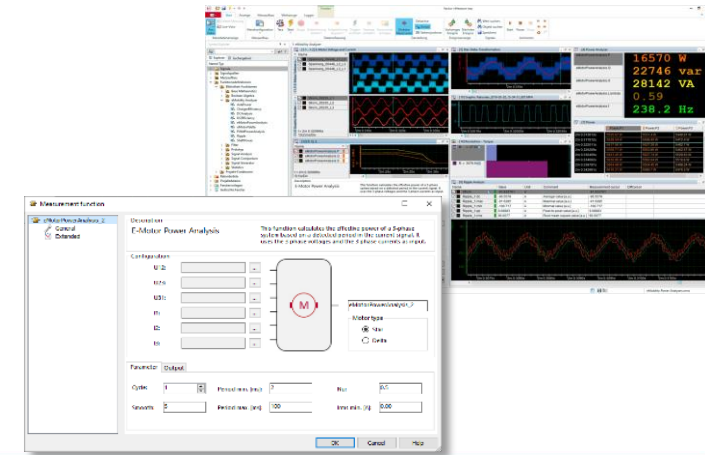
Overview of the different Smart Logger Variants
Example: Smart Logger acquiring complex CSM - HV Analog Measurement Setup
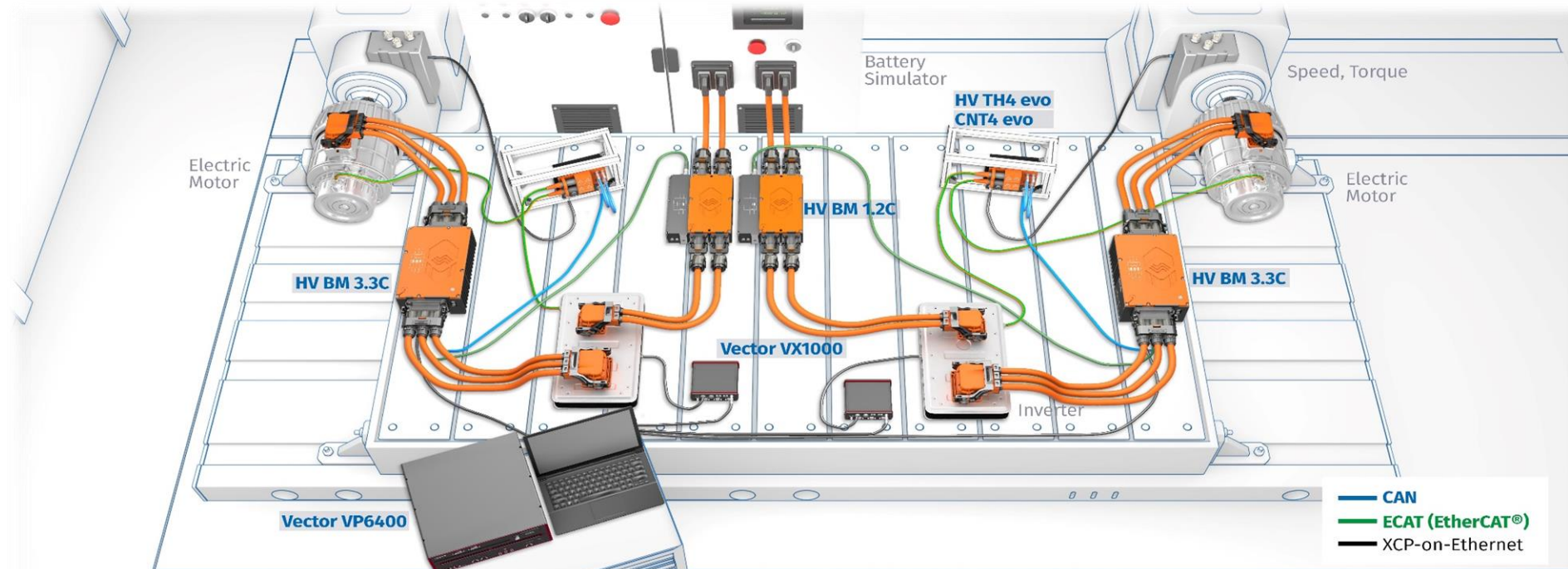
| CSM's Measurement Technology	▶ Fast & Precise Raw Data Acquisition ▶ High Voltage Safe Work Environment
Vector Smart Logger	▶ Acquisition and Calculation on High Data Rates ▶ Accurately Synchronized Signals ▶ Many build in interfaces ▶ Build in Time Master

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Overview of the different Smart Logger Variants
CANape log – Brings your ADAS development from the desk to the road

CANape log extends the functionality of vMeasure log with ADAS and Ethernet logging capability

▶ Allows the recording of data from cameras, radar and LIDAR sensors

  ▶ Multiple GB/s to handle for logging the complete environment

▶ In addition to the signals, the raw data of the sensors has to be recorded too

▶ Vector can quickly integrate specific sensors and protocols via an open interface

▶ Recording of Ethernet communication in the vehicle

  ▶ Secured or encoded communication

  ▶ Support of complex custom specific Ethernet protocols

▶ Calibration tasks can be solved elegantly without changing the wiring

▶ Connect a computer running CANape via Ethernet

  or Wireless Local Area Network to Smart Logger

  ▶ Full access to the ECUs via the CANape interface

    for calibration or flashing

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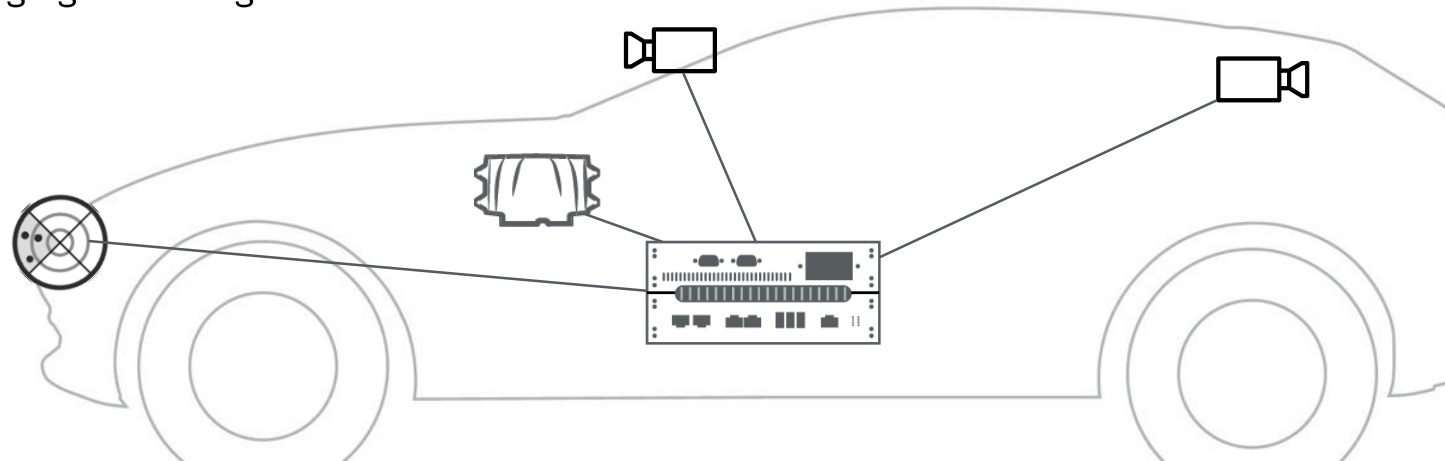
Overview of the different Smart Logger Variants
vMeasure log or CANape log can run on different dedicated Hardware platforms

▶ combination of hardware and software

▶ Three hardware platforms are available

VP6400   VP7400   VP7500

Available Hardware Platforms
Logger Classification for Smart Logger

VP7400

VP7500

High Performance Logger

- ▶ Focus on monitoring of vehicle functions
- ▶ Raw data and complex protocols on vehicle networks
- ▶ ECU internal data
- ▶ ADAS sensor data
- ▶ Complex computations (Matlab/Simulink) and triggering
- ▶ eMobilityAnalyzer

Mid Range Logger

- ▶ Focus on analog data signal acquisition
- ▶ Fast computations and triggering on analog signals
- ▶ eMobilityAnalyzer

VP6400

Data Rate / Number of Sensors

Performance

+++

+++

Available Hardware Platforms
Technical Data comparison

	VP6400	VP7400	VP7500
Processor	Intel® Core i3 8100H (4x 2,60 GHz)	Intel® Core i7 6820EQ (4x 2,8 GHz)	Intel® Core i7-9850Q (6x 2.7 GHz)
Memory	16 Gigabyte	32 Gigabyte	64 Gigabyte
Removable Storage	Storage Cartridges with up to 4 Terabyte	Storage Cartridges with up to 16 Terabyte	Storage Cartridges with up to 32 Terabyte
Logging Data Rate	**Up to 500 Megabyte/s**	**Up to 1 Gigabyte/s**	**Up to 2 Gigabyte/s**
Interfaces	2x 10 Gbit/s Ethernet 2x 1 Gbit/s Ethernet 1x 1 Gbit/s Eth (MGMT) 3x USB 3.1	2x 10 Gbit/s Ethernet 5x 1 Gbit/s Ethernet 1x 1 Gbit/s Eth (MGMT) 4x USB 3.0 GPIO	6x 10 Gbit/s Ethernet 4x 1 Gbit/s Ethernet 1x 1 Gbit/s Eth (MGMT) 4x USB 3.0, 4x USB 2.0, GPIO
Integrable Network Interfaces (optional)	Up to 6 CAN / CAN FD, 2 LIN	Up to 16 CAN / CAN FD, 8 LIN, 4 FlexRay	Up to 16 CAN / CAN FD, 8 LIN, 4 FlexRay
Time Synchronization	IEEE 1588 (PTP), with GNSS-based UTC clock Vector Hardware Sync Line	IEEE 1588 (PTP), with GNSS-based UTC clock	IEEE 1588 (PTP), with GNSS-based UTC clock
Dimensions (WxHxD) in mm	216 x 84 x 250 (19" / 2)	VP7440: 320 x 66 x 250 VP7470: 320 x 110 x 250	VP7570: 320 x 110 x 250
Power Supply	12 VDC to 24 VDC tolerates voltage drops down to 6.5 VDC 50 W to 155 W	12 VDC to 24 VDC tolerates voltagedrops down to 6.5 VDC 110 W to 200 W	12 VDC to 24 VDC tolerates voltagedrops down to 6.5 VDC 110 W to 200 W
Temperature Range	-20 °C to +70 °C (Storage Cartridge: 0 °C to +70 °C)	-20 °C to +70 °C Storage Cartridge VP7250-xr : 0 °C to +50 °C VP7250-xe : -20 °C to +70 °C	-20 °C bis +60 °C Storage Cartridge VP7250-xr : 0 °C to +50 °C VP7250-xe : -20 °C to +70 °C
Measurement Data Transfer	Via Ethernet or separate readout station for Storage Cartridges	Via Ethernet or separate readout station for Storage Cartridges	Via Ethernet or separate readout station for Storage Cartridges
Control of the Logger in the Vehicle	Web-based Mobile UI (free of charge)		

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Summary

▶ **Comfortable and fast handling**
  ▶ One configuration and easy switching between standalone logging and interactive working

▶ **Use case-related interface**
  ▶ Full CANape interface for professionals and a simple web-based interface for monitoring

▶ **Easier solving of complex tasks**
  ▶ Real-time evaluations, statistical real-time analyzes and the calculation of virtual signals at runtime
  ▶ Complex trigger conditions to get a significant data reduction

▶ **Measuring everything**
  ▶ Complex protocols such as SOME/IP or customer-specific proprietary protocols

▶ **Tailored solution through modularity**
  ▶ Usage of the complete range of Vector network interfaces
  ▶ The increased use of Automotive Ethernet in the vehicle is already taken into account

▶ **Adaptability**
  ▶ Customized protocols and sensors can be quickly integrated through open interfaces

▶ **Scalability**
  ▶ The logging solution can be distributed across multiple hardware platforms and storage media

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About CSM

CSM has been setting technological standards for decentralized measurement technology in vehicle development for over 35 years. Our CAN bus and EtherCAT® measurement devices support worldwide renowned vehicle manufacturers, suppliers and service providers in their developments.

Continuous innovation and long-term satisfied customers are our guarantee for success. Together with our partner Vector Informatik, we have developed an easily scalable and powerful E-Mobility Measurement System for hybrid and electric vehicles and are constantly expanding the areas of application. With our high-voltage safe measurement systems designed for fast and synchronous measurements and power analyses, we actively accompany the change to **E-Mobility.**

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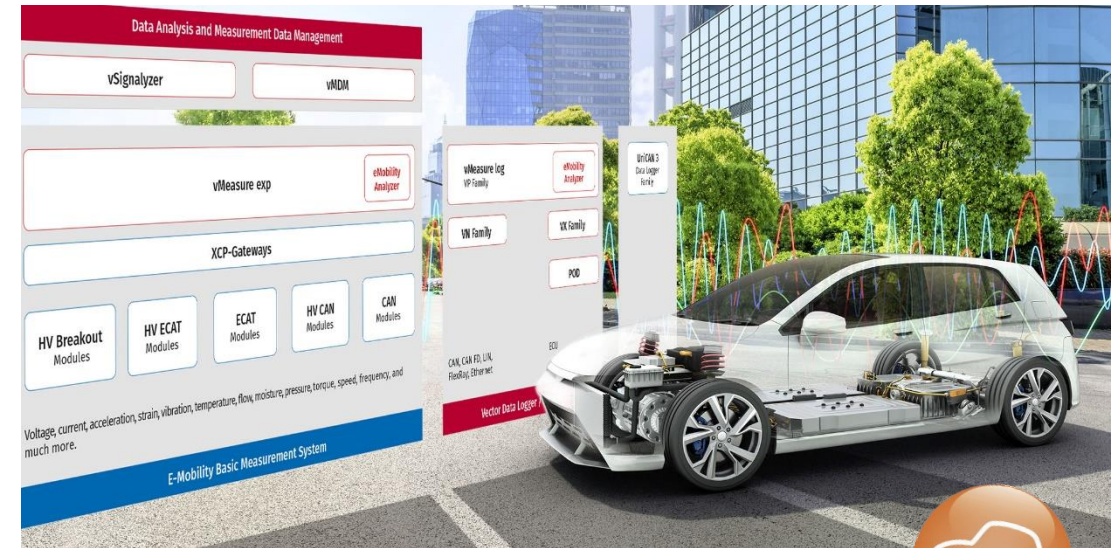Phone: +49 711 – 77 96 40
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