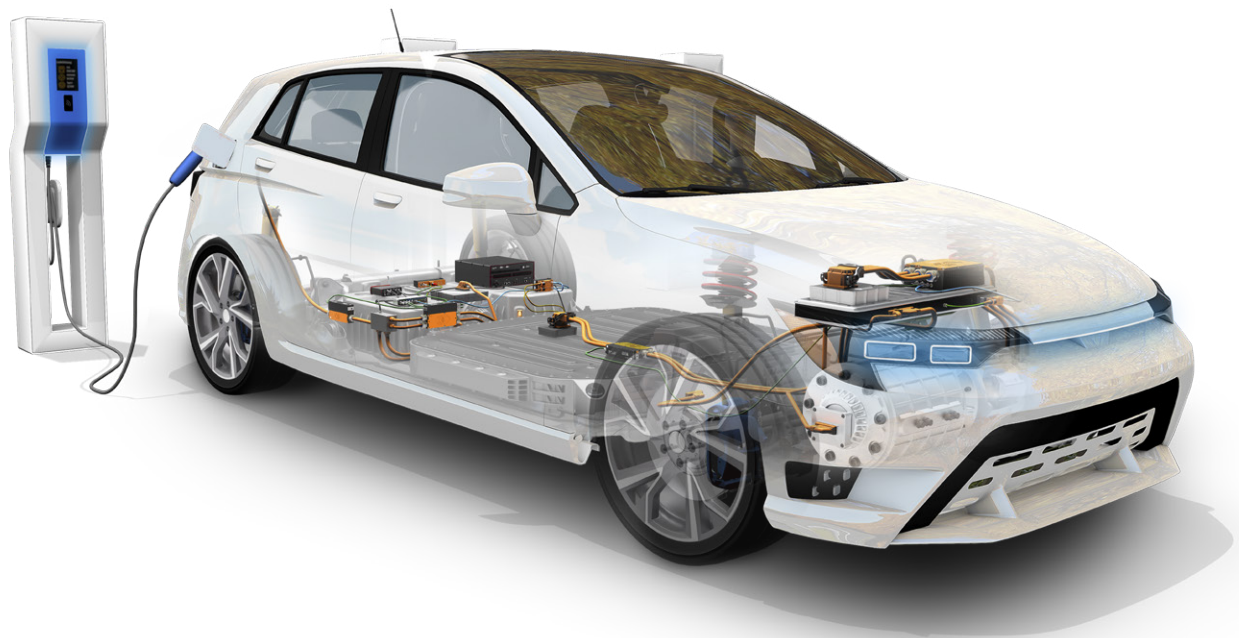


# High-Voltage Safe Measurements at Charging Stations



## HV Current and Voltage Measurement

The electric vehicle charging infrastructure will be greatly expanded in the coming years. Companies that provide charging solutions, and operators of charging station networks must thoroughly test and validate the different types of charging stations.



## Background

Currently, each vehicle manufacturer has its own charging strategy. With the aim of ultimately improving the efficiency of the various charging processes, they are all being compared. The tests and

measurements validate the charging station components as well as the charging modes, the energy flow, and different combinations of functions.



## Challenge

Charging stations are tested with test bench systems. In most cases, these test benches are specially developed for the test tasks, e.g. functional testing or testing charging components in a network. For

detailed examination of charge efficiency, the charging characteristics of different types of vehicles should be measured.

## The CSM Measurement Solution

The measurement setup shown in the diagram is an example of a DC charging station (three-phase 400V / 22kW DC charging system). In the high-voltage lines before and after the charging station, current, voltage and power are measured with **High-Voltage Breakout Modules (HV BM)**. If required, the measurement is also carried out after the charging socket (Combo 2) in the vehicle. The measurement data is recorded on the analysis PC. Validation of the charging process based on the measurement results is completed using Vector software vMeasure or CANape. All HV BM from CSM are connected to the analysis PC via EtherCAT and XCP-Gateways.

The various verification questions are, for example:

- ▶ Do loading functions behave correctly under all operating conditions?
- ▶ How does each individual energy flow behave over the charging time?
- ▶ What is the power loss of the charging device?
- ▶ Is the charging profile optimally controlled?
- ▶ How quickly can the maximum charging power be reached?
- ▶ How long does it take for the battery to be fully charged?

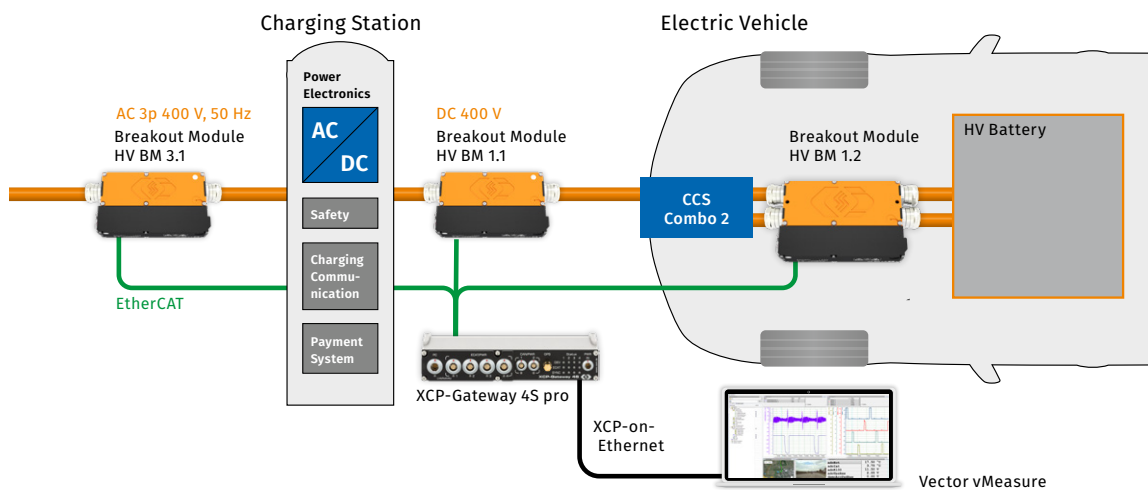


Fig. 1: A HV Breakout Module (HV BM) measures current and voltage between the charging station and the on-board charger in the vehicle.



Fig. 2: Single-phase current and voltage are measured between the on-board charger and the HV battery using an HV BM 1.2.

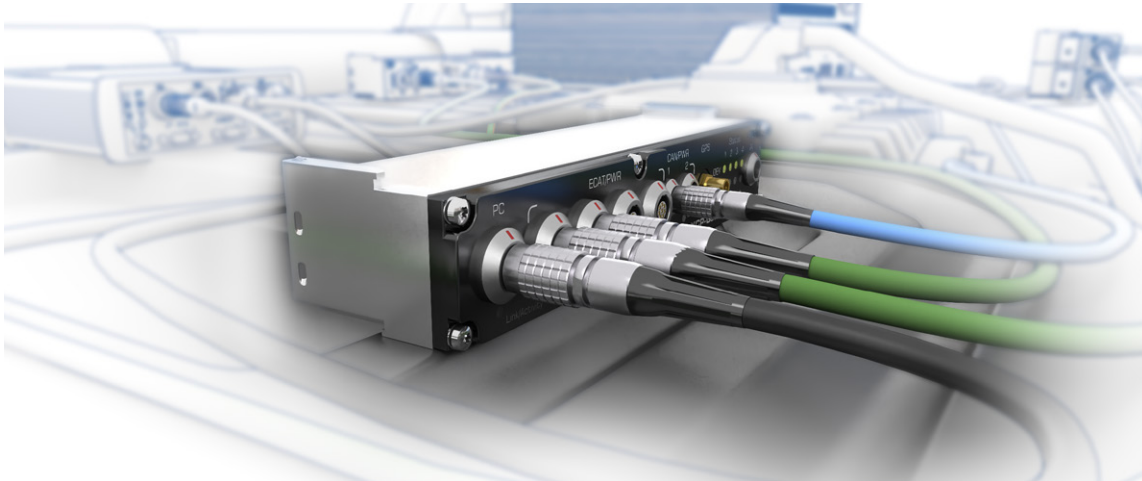


Fig. 3: With an XCP-Gateway, all HV BM and other measurement modules are connected via EtherCAT® and synchronized via PTP.

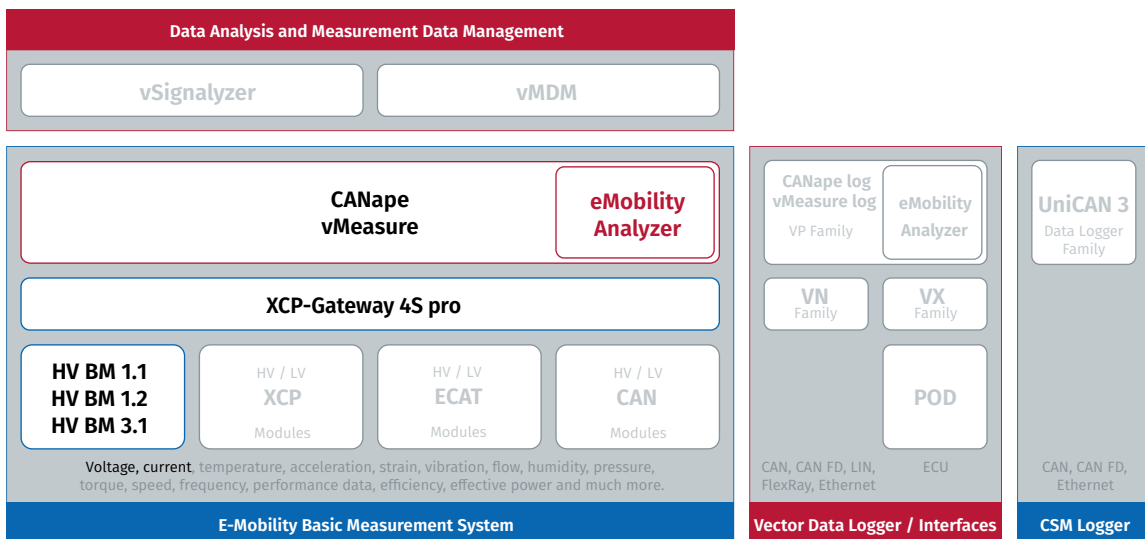


Fig. 4: The HV safe measurement at charging stations in the systematics of the Vector CSM E-Mobility Measurement System



## Benefits

The measurement configuration is particularly suitable for validation tests of new product solutions for wall boxes, charging stations and fast or ultrashort charging stations. For endurance and long-term tests, temperatures are also measured, e.g. from high-voltage connections, cables, system components and often also in the vehicle battery to

prevent overheating or fires. This measurement is easily carried out with temperature modules from CSM, which are also connected to the XCP-Gateway via CAN. In areas with high-voltage, measurement is performed with the HV test bench module (HV TH-TBM or HV PT-TBM).



## Featured Products

### HV Breakout Module – Type 1.1 | 1.2

CSM's HV Breakout Modules (BM) Type 1.1 and 1.2 have been specifically designed for safe measurement applications on high-voltage cables. Current and voltage are measured and the instantaneous power is calculated online in the module.

The HV Breakout Module 1.2 is available in two versions for connection via cable glands or PL500 plug-in system (HV BM 1.2C).



### HV Breakout Module – Type 3.1

CSM's HV Breakout Module (BM) Type 3.1 was developed for the three-phase determination of current, voltage and power on high-voltage carrying cables with currents up to  $\pm 32A$ . One module performs three-phase measurement, therefore offering enormous cost and space advantages.



### XCP-Gateway Series

CSM's XCP-Gateway Series protocol converters were specially developed for CSM EtherCAT® measurement modules and for measurement tasks with multiple measurement channels and high measurement data rates. The XCP-Gateway is available in "Basic" and "pro" versions. The "pro" version has two CAN interfaces via which CAN-based CSM measurement modules can be connected and integrated into the XCP-on-Ethernet measurement data protocol. In the "pro" version, temperature data from the HV Breakout Modules can also be transferred directly via EtherCAT®.



Complete solutions from a single source:

CSM provides you with comprehensive complete packages consisting of measurement modules, sensors, connecting cables and software - customized to your individual needs.

Further information on our products are available on our website at [www.csm.de](http://www.csm.de) or via e-mail [sales@csm.de](mailto:sales@csm.de).



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