

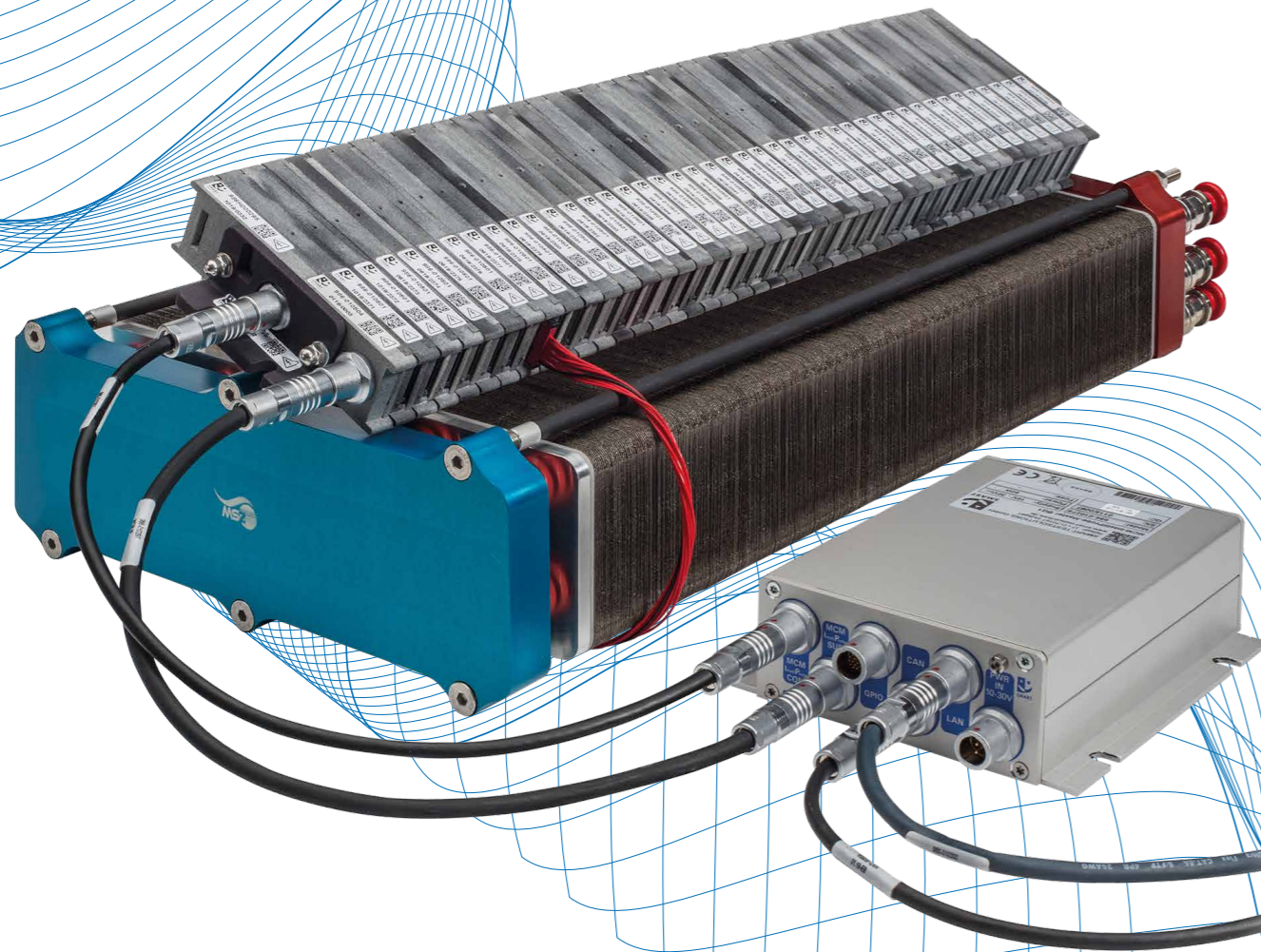


Cell Voltage Monitoring

Ultra-compact cell voltage monitoring
for stationary and mobile applications

SMART MCM-IntelliProbe

Systematic individualization



The MCM-IntelliProbe product family contains components for creating tailor-made cell voltage monitoring and processing systems. A decisive advantage of the modular concept is the great flexibility. It offers for adaptation to cell stacks.

SMART modules offer outstanding electrical properties. An extended temperature range at minimized self-heating, a higher IP safety class and an extremely compact design are important performance criteria for the latest CVM technology generation (CVM-G5) from SMART. This is the result of more than 20 years of CVM expertise.

Thanks to the modular design, the number of channels is highly scalable and permits specific adaptation to the target application. Depending on the requirements in terms of data volume and data processing rate, the modules can either be operated directly via CAN bus or in combination with a process module via LVDS, Ethernet, EtherCAT or GPIO.

The monitoring of bipolar electrochemical systems involves the measuring system having to satisfy a number of different requirements. The modules in the MCM-IntelliProbe product family not only meet all these requirements, they also offer a broad range of communication options:

- ▶ High sampling rates for optimum detection of changes in the system (batteries)
- ▶ Time-synchronous monitoring of measurement channels (fuel cells)
- ▶ Use of measuring system under harsh ambient conditions (electrolysis)
- ▶ Extended temperature range and moisture resistance for application in a variety of different climatic conditions
- ▶ Compact and modular design for application in stationary and mobile applications

Modules

MCM-IntelliProbe

Measurement module

MCM-IntelliProbe U10

Interface module

MCM-IntelliProbe-LINK

Termination measurement module

MCM-IntelliProbe-U10T

Stacking module

MCM-IntelliProbe-INTERLINK-SPC

Process module

MCM-IntelliProbe-MASTER

Voltage simulation module

MCM-IntelliProbe-Breakout

Fields of application

MCM-IntelliProbe



**Batteries, fuel cells,
electrolyzers**



**Measurement and
control technology**



**Stationary and mobile
applications**



**Test benches, plant engineering,
prototype vehicles**



Process module

Interface / data buffer / process computer

The MCM-IntelliProbe-MASTER process module expands considerably the cell voltage monitoring functionality. It provides synchronous data rates of up to 400 x 1 kHz per channel via LVDL bus, a high-speed data link to the PC via Ethernet and bus interfaces (EtherCAT, CAN, GPIO).

The Lua-scripting engine makes it easy to apply the integrated local data processing in the real time environment. The MasterModule also forms the central link with all the other I/O modules in the MCM family, thus permitting the implementation of complete process control systems.



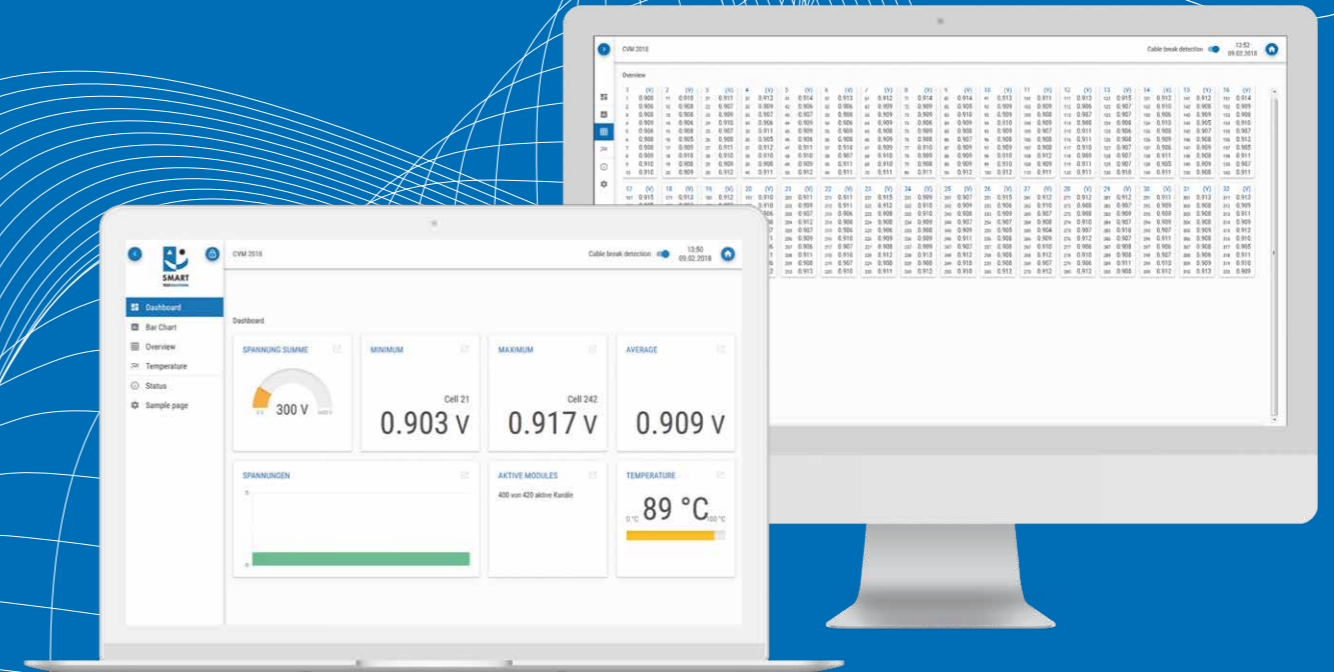
CVM-Modules

Ultra-compact design

The measurement modules of the MCM-IntelliProbe system feature an ultra-compact design and a high degree of modularity. Each measurement module has ten channels. Measurements can be taken in the ranges from -1 to 5 V or from -3 to +3 V. A measurement system is always made up of a communication module (MCM-IP-LINK), a termination measurement module (MCM-IP-U10T) and up to 59 measure-

ment modules (MCM-IP-U10). The available installation space is an important issue in many applications. The MCM-IntelliProbe-INTERLINK-SPC significantly increases flexibility by allowing a system to be arranged on two levels (biplane). A fan with directed air routing serves to dissipate the heat in between the module stacks.

CVM Web Interface



A highlight in SMART's CVM product family is the web-based user interface integrated in the MasterModul, which enables convenient, real-time monitoring of CVM data logging. The software is thus a valuable helper during the test drives of your fuel cell vehicles. Furthermore, by application of the web interface, having a monitoring system that is independent from PC can be considered as another advantage.

Precondition for the access is just an internet-enabled browser. The display can be wireless via WLAN. Of course, the web interface is also available for CVMs of the previous generation via software update.

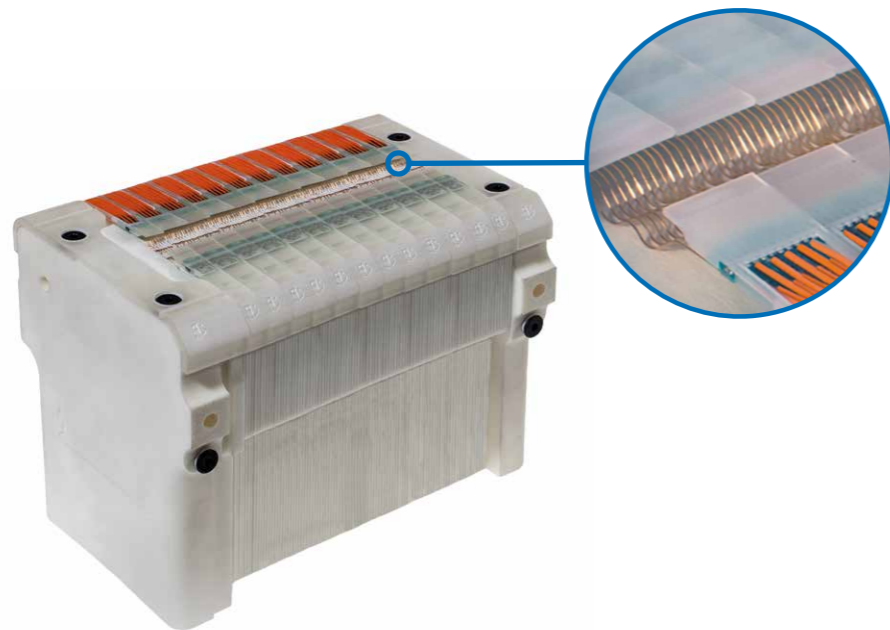


Voltage simulation module

Simple validation of process controls

Process control validation generally takes place separately from the end application. The MCM-IntelliProbe-BREAKOUT modules facilitate this process by simulating the single

cell voltages of an electrochemical stack. Alternatively they can be applied as a break-out adapter getting access to all individual voltage signals.



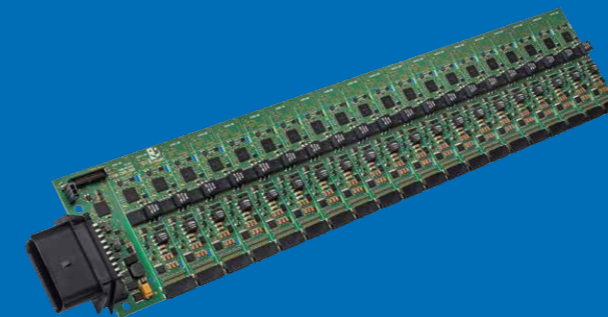
Cell Voltage Pickup

Multichannel voltage tap for fuel cell stacks

The cell voltage pickup unit CVP is a multichannel voltage tap for fuel cell stacks that can be individually adapted to the corresponding target application. In view of cell pitches of about 1 millimeter, the voltage pickup on the bipolar plates between the individual cells presents a

particular challenge. SMART pickup units are characterized by their low space requirement, easy-to-install design and reliable contacting properties, especially in mobile applications.

From prototype to series production: CVM systems by SMART



- ▶ High quality functionality
- ▶ Flexibility in usage
- ▶ Future-proof technology
- ▶ Low costs
- ▶ Scalability
- ▶ Robust processing

The background features a complex, abstract pattern of white lines on a solid blue background. The lines form a grid that is distorted and warped, creating a sense of depth and movement. The grid lines are thin and closely spaced, creating a mesh-like structure that flows across the page.

e_CELL ELECTRONICS

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