

# SAFE OPERATION OF ELECTROLYTIC CELLS

## White Paper

It is only through the precise measurement and analysis of the voltage-current-time relationship of every individual cell that the earliest possible detection of all probable electrolyser malfunctions can be achieved. Hazardous situations can therefore be avoided by enabling an emergency shutdown of the individual power supply preventing irreversible damage to equipment and/or personal injuries.

## TRADITIONAL BALANCE VOLTAGE MONITORING SYSTEM (BVMS)

Balance Voltage Monitoring Systems have traditionally been used to monitor and shut-down electrolyzers. Not only do they lack the capability of individual cell performance analysis and security, but due to their large voltage measuring range they are prone to excessive noise, preventing them from implementing adequate detection limits. Furthermore, the intrinsic nature of BVMS systems makes them inadequate for any protection during load changes.

## EMOS®: A UNIQUE APPROACH TO SAFETY

EMOS® has been designed to provide the most precise individual element voltage measurement available for electrolytic cells ( $\pm 1.5\text{mV}$ ). Hardwired interlock functions have been integrated into EMOS® in order to shut down an electrolyzer, independent of the plant network and with a response time of less than 1 second, in case of the spontaneous malfunction of any individual cell (short circuit, membrane tear, blockage, etc.) The specialized alarm algorithms programmed into the EMOS® hardware have been developed based on an extensive HAZOP study using data from more than 30,000 cells monitored by EMOS® worldwide. The proprietary design of EMOS® also protects against consequential damages in case of slowly evolving malfunctions (insufficient electrolyte feed, failing temperature control, etc.)

EMOS® not only stores the data related to the voltage-current-time relationship for all individual cells, but also independently stores and synchronizes all other relevant operating parameters taken from the plant DCS. EMOS® has a comprehensive database that gives a producer very valuable information and insight for further performance analyses, leading to improved preventive maintenance strategies and numerous options for additional process optimization.

## EXPERIENCE IN SAFETY

Since 1989 R2 has specialized in the design, development, and deployment of systems to monitor electrolytic cells. R2's most recent EMOS® product offering has been developed according to IEC 61511 "Functional Safety – safety-relevant systems for the process industry". The patented modular design of EMOS® provides a Safety Integrity Level 2 (SIL2) as a stand-alone system. EMOS® instrumentation installed in the cell room has also been developed for cells which are producing explosive gases and is compliant with ATEX standards for zone 2.

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