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## Overview of Fuel Cell Test Stations

GRandalytics develops and builds test stations for hydrogen fuel cell testing for more than 10 years. With experience in highly competitive automotive testing, we know that a test station needs to adapt to the test, rather than constraining your research innovation. In order to save valuable time and cost, alarms and filters can be configured during a running test; extra hardware channel can be added by the user without consulting support.

We are primarily focused on specialized stations such as fast Hardware-in-the-Loop (HiL) stations for cells and stacks, segmented cell stations, integrated electro-impedance stations for up to 240 cells or retrofitting your existing station with a new controller, adding hardware options and/or integrating high channel count Electro-Impedance Spectrometry.

Due to our modular software framework we can adapt the control quickly and economically to your requirements. You get exactly the station that you need with the option of future expansion.

Our software is split into a controller section and one or more Human-Machine-Interfaces (HMIs). The controller can be a standalone Real-Time (RT) PLC (compactRIO, PXI, etc.) or run on the same PC as the HMI.

By splitting the code, all operational and safety related tasks can reside in one section while the user input and convenient features can be easily customized without having to re-evaluate safety and functionality.

Some features and options of our control software are:

- channel configuration on-the-fly by user, with multiple access levels
- user upgradeable channels and functional core
- 2 upper/lower static alarms with hysteresis and delay
- 3rd upper/lower alarm on independent hardware layer for extra safety (RT only)
- 2 upper/lower dynamic alarms which can be linked to any other channel
- user configurable alarm response from warning lamp to ESD and automatic purge
- configurable filter on all analogue and digital (de-bounce) channels
- hardware watchdog, FPGA/RT core watchdog (RT only)
- sign-of-live and plausibility check of input channels
- software PID for heaters, blowers, pumps, etc.
- open data communication to multiple HMIs in parallel

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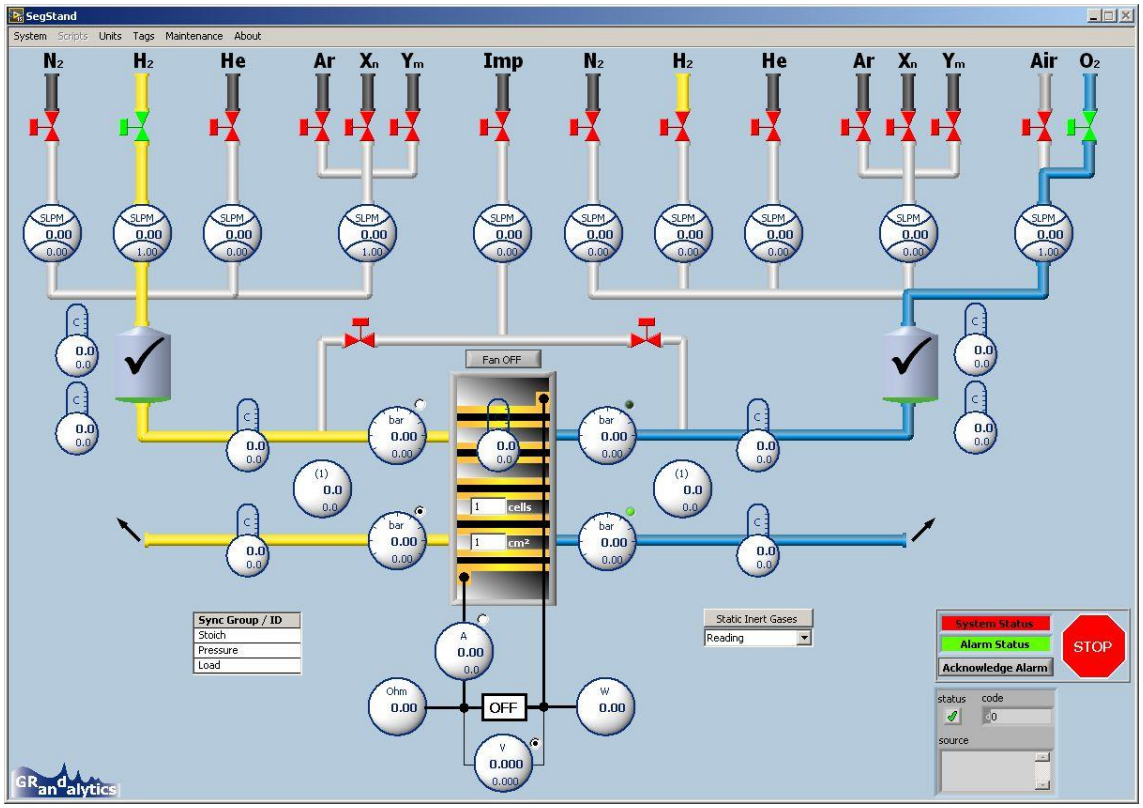
- multiple parallel script engines (LabVIEW VIs, Java, Simulink, etc.)
- stoichiometric control
- multi-range mass flow controllers
- switchable fore/back pressure control
- impurity injection
- operation with air, oxygen, synthetic air, liquid fuel, etc.
- post-mortem ring buffer with selectable channels and trigger events
- configurable logging and streaming
- ramping and synchronisation of set points
- intuitive, easy understandable HMI with configurable units and right-click info

## Examples of Executed Test Stations




Example of Segmented Cell station with multiple gases and multi-range MFC

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**Technical specifications subject to change without notice**

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National Instruments™ Alliance Partner
Certified LabVIEW™ Developer

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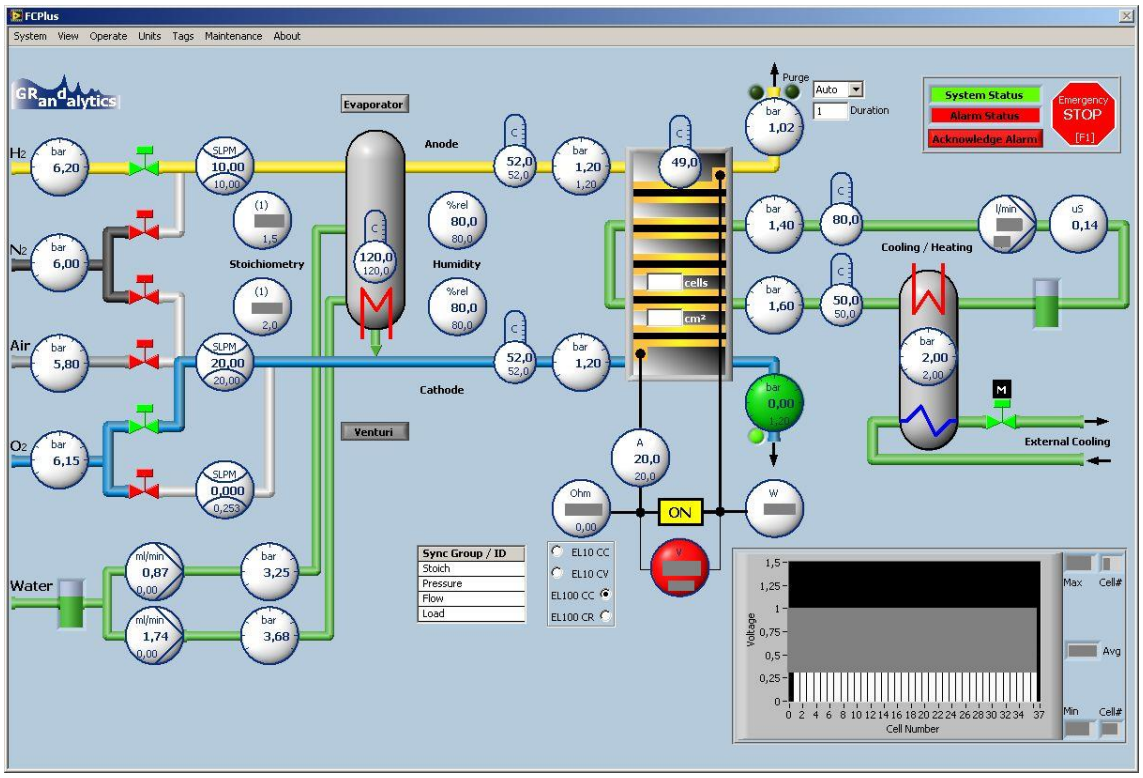
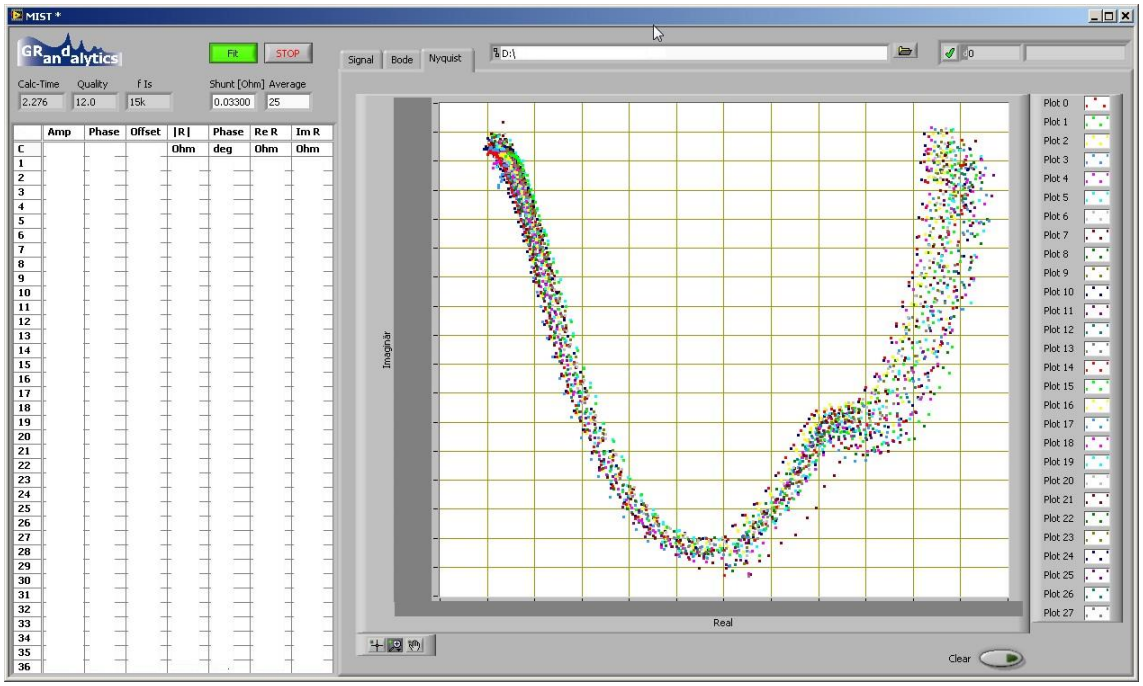



Example of HiL station with embedded Electro-Impedance Spectrometer




Example of Electro-Impedance Sweep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