



**PRAGMA
INDUSTRIES**

professional test stations

For advanced fuel cell testing,
diagnostic, teaching and research

Reliability

Quality insurance

**Flexible and
open design**

**Intuitive user
interface**



Over a wide range of fuel cell power, our professional test stations are the most reliable and adaptable solutions for your lab. Relying on our knowledge of electrochemistry, fuel cell design, thermodynamics and gas instrumentation, **we design and deliver tailor-made test rigs.**

A **Pragma Industries** test station is characterized by a **fully open architecture** and accessible components that facilitate station hands-on operation as well as making **teaching intuitive.** It also drastically reduces maintenance costs.

Pragma rigs advantages:

- Built-in top-level precision and reliable instrumentation only
- Open architecture, evolution-oriented design.
- Intuitive software and hardware user interface
- State-of-the-art National Instruments Programmable Logic Controller
- Fully automated for unattended operation
- Fast calibration services

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Contact us with your testing need, we will tailor a test station for you.



As Pragma Industries designs taylor-made test stations, all specifications above are given as illustration of rigs capabilities but may vary depending on your needs and technical constraints.

All equipment with provided drivers (HFR, impedance spectrometer, cooling devices,...) can be integrated in our software.



Adaptable power range

| | |
|------------|--|
| 1W to 10kW | Load bank selected upon your need of power range |
|------------|--|

Applications

| |
|--------------------|
| Single cells |
| Large single cells |
| Stacks |

Gas flows on anode and cathode (nlpm)

| | |
|---------------------------|--|
| From 0.1 to 500 and above | Flow range of [50 x minimum value] as standard. Larger range is possible with additional MFC |
|---------------------------|--|

Gas mixing

| | |
|---|-------------------------------|
| Unrestrictive number of inlet gas lines | H2, air, O2, N2, CO2, CO, H2S |
|---|-------------------------------|

Gas humidification and temperature control

| | |
|---|--------------------|
| Bubble humidifier | Up to 2 nlpm (gas) |
| Mass flow evaporator | From 2 nlpm (gas) |
| Gas temperature control from ambient to 180°C | |
| Dew point control calibrated upon desired operational temperature | |

Fuel cell temperature regulation

| | |
|-------------------------------|----------------------------------|
| Electrical heating | Ambient to 180°C |
| Air cooled | Ambient to 180°C |
| Water cooled | Ambient to 180°C |
| 2 K type thermocouples inputs | Additional T° inputs is possible |

Pressure control

| | |
|-------------------------------|-----------------------------|
| Cathode back-pressure control | 0.1 to 4 Bars |
| H2 control mode | Dead-end or continuous flow |

Sensors

| | |
|-------------------|---|
| DeltaP | Anode and cathode inlet/outlet Anode/cathode |
| Temperature | Gas inlets/outlets Water Cells |
| Relative humidity | Gas inlets/outlets optional |
| Gas sensors | H2, H2S, CO |

Fuel cell interface

| | |
|---|------------------|
| Single and multi-cells voltage monitoring | 2 to 64 channels |
| Power cable to load bank | |

PLC, PC and display

| | |
|--|--|
| National Instruments robust PLC | 4 or 8 I/O card slots. Unlimited number of I/O with master/slave PLCs combination |
| PC | Included and installed |
| Dual 19" LCD screens display | |
| Intuitive step-by-step programmable software | Fully manual to full authority digital control |

Working space and environment

| | |
|--|---|
| Enclosed with internal gas sensors or open with external sensors (wall-mounted for instance) | |
| Water de-ionizer | Can be integrated or externally mounted |