



MICE Hydrogen Control System

MICE Collaboration Meeting CM33

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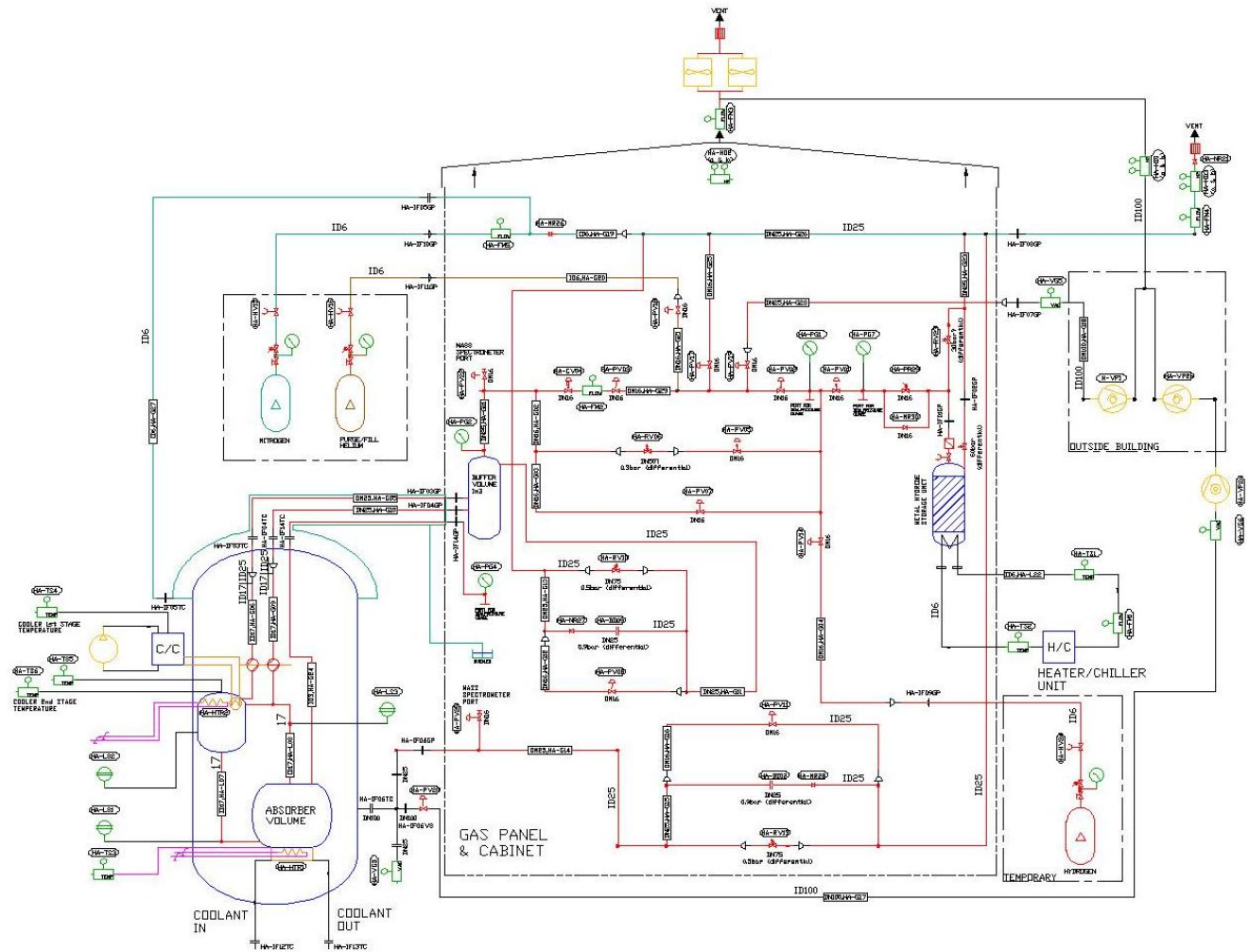


Control System Functions

- Operate Valves
- Monitor - Temp Pressure, Flow & Vacuum
- Control - Vac Pumps, Heater Chiller & Cryo-Cooler
- Run Control Sequences
- Gas Detection System
- Extract System
- UPS



Control System P&ID





Control PLC

- Omron CJ1M Modular PLC with Ethernet
- Existing Software for Link to EPICS
- NS8 Programmable Terminal (HMI), 8.4 inch Touch Screen with Ethernet
- Key Switches on Selected Functions





Intrinsic Safety (Ex i)

- Limit energy in electrical circuits to less than the value required to ignite Hydrogen (20 micro J @ 25%)
- All Circuits in the Gas Panel
- Temp & Level sensors in Cryostat
- Cryostat Heaters are protected by pressure interlock (SIL Rated)





Control System

- Valve air solenoids mounted on the outside of the Gas Panel Enclosure
- Valve limit switches are intrinsically safe and can detect short circuits and broken wires,
- Pressure transducers are 4-20mA giving broken wire detection.
- The PLC provides start / stop signals to pumps; manual control is also available.

Note:- PLC status does not affect pump operation i.e. the pumps do not go off if the PLC does.



Gas Detection System

- Oliver Tocsin 920
- All Detectors and Beacons paired on separate bus loops
- Warning at 25% LEL
- Alarm at 50% LEL
- Linked to Extraction System to increase speed on detection of leak
- Annual Testing / Maintenance by contractor



Extraction System

- Two Inverter controlled 7.5kW Fans mounted on the roof
- One fan on its own can providing the flow rate required to deal with a leak.
(DSEAR rec = 450 air changes per hour).
- Differential Pressure Sw & Inverter Current feedback to prove operation
- Normal running at 100 ACH with increased speed on detection of leak



UPS

- 20kVA UPS - 2 Hour back up of Fans & Control System PLC, Heaters, Vac Gauges etc
- 50 min to boil off LH2 In Cryostat
- Annual Testing / Maintenance by contractor





Safety Functions & Interlocks

- Operation of the Ventilation System on Detection of a Hydrogen Leak – Hardwired
- Shut PV20 if there is a Pressure Rise in the Cryostat during operation
- Cryostat Insulation Vacuum Poisoning to boil off gas if heaters fail / can not be used
- A Shut-off Facility for the Hydride Bed Heater/Chiller on Detection of Bed Overpressure
- Cryocooler Shut-off if Temperature drops below Hydrogen Freezing Point (14k) or Heaters Faulty



Control Sequences

- Helium Purge
- Helium Supply Line Purge
- Helium Fill
- Helium Empty
- He Purge H2 Side
- Hydride Bed Charge
- Hydrogen Fill
- Hydrogen Empty
- Cryostat Vacuum
- Diagnostic / Test



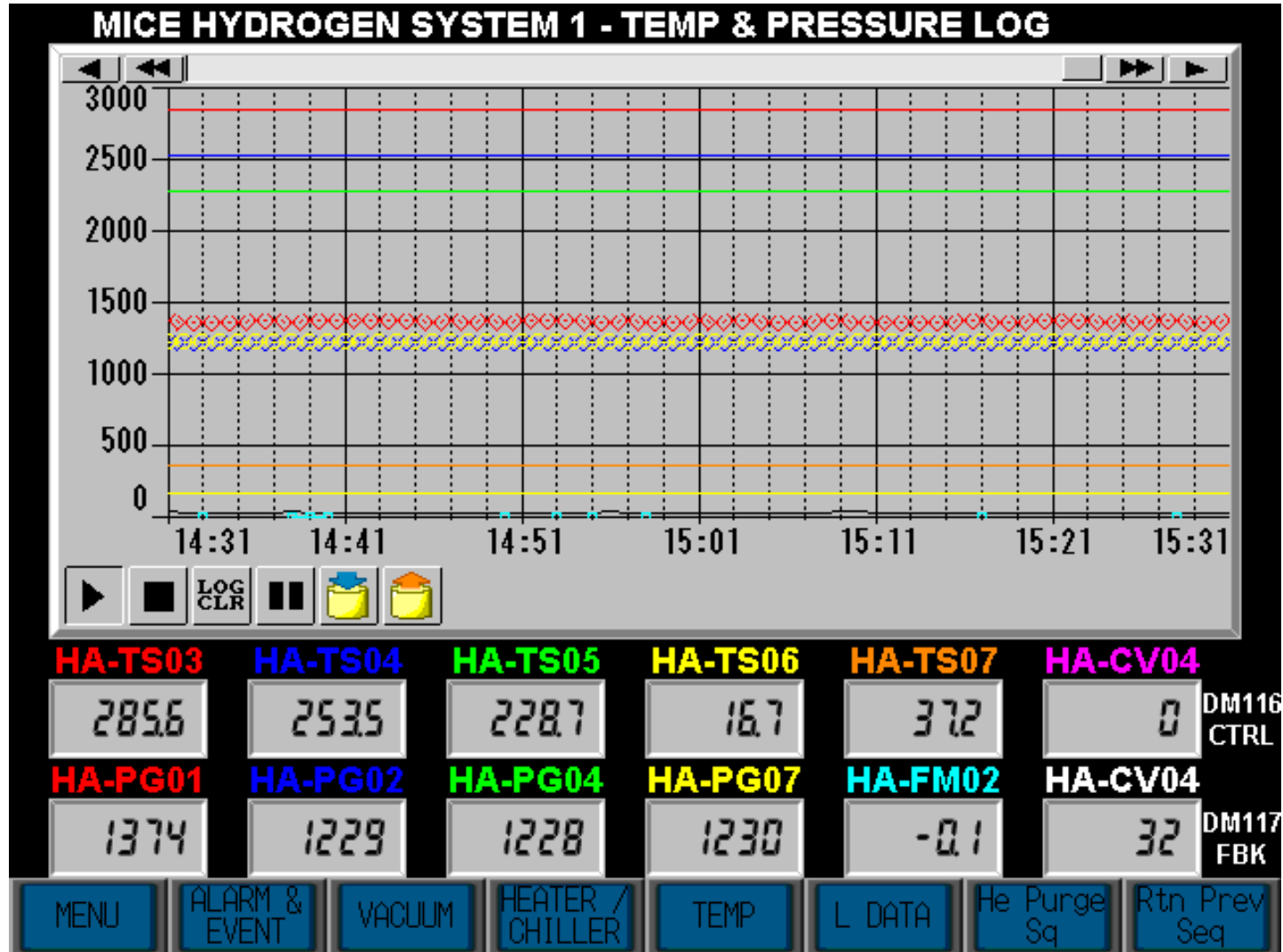
Typical Data Log Screen

Data Logging of
Key Data

Scroll Back 24H

Files saved to
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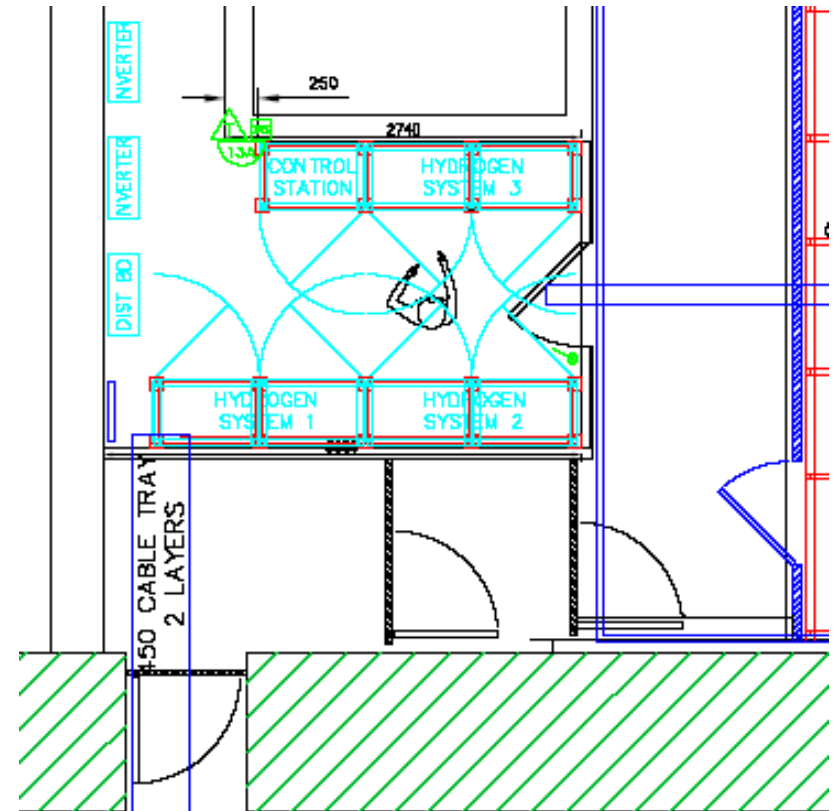
Numeric Readout





Hydrogen Control Room Layout

- New Door (1 Hour Fire Rated)
- UPS Installed
- Gas Detection Installed
- Ready for H2 Testing





Questions