Hall D Cryotarget Controls

(General Overview)

Robert Werth Teachey
Detector Support Group
Topics

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## Requirements – Signals

### Analog Signals

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Sensory Name</th>
<th>Signal Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>H2 Supply Pressure</td>
<td>4-20 mA</td>
</tr>
<tr>
<td>1</td>
<td>H2 Return Pressure</td>
<td>4-20 mA</td>
</tr>
<tr>
<td>1</td>
<td>Coarse Vacuum Gauge</td>
<td>0-10 V</td>
</tr>
<tr>
<td>1</td>
<td>Gate Valve (Open / Close)*</td>
<td>24 V</td>
</tr>
<tr>
<td>1</td>
<td>PTR Compressor LCW Flow</td>
<td>0-10 V</td>
</tr>
<tr>
<td>1</td>
<td>PTR Compressor LCW Inlet Temp.</td>
<td>0-10 V</td>
</tr>
<tr>
<td>1</td>
<td>PTR Compressor LCW Outlet Temp.</td>
<td>0-10 V</td>
</tr>
</tbody>
</table>

### Instrument Signals

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Sensory Name</th>
<th>Signal Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Temperature Readback (T1, T2, T3, T4, T5)</td>
<td>RS-232</td>
</tr>
<tr>
<td>4</td>
<td>Temperature Readback (T1, T2, T3, T4)</td>
<td>GPIB</td>
</tr>
<tr>
<td>2</td>
<td>Heater ON/ OFF Control (H1, H2)</td>
<td>GPIB</td>
</tr>
<tr>
<td>2</td>
<td>Heater Setpoint Control (H1S, H2S)</td>
<td>GPIB</td>
</tr>
<tr>
<td>6</td>
<td>PTR Compressor (ON, OFF, H_Press, L_Press., He.Temp, Oil.Temp)</td>
<td>RS-232</td>
</tr>
</tbody>
</table>
Requirements – User Controls / Display

User Controls

• Allow the user to select one of three control actions. (Fill Target, Empty Target, Target Off)
• Open / close gate valve.

User Display

• Display all 26 monitored signals.
• Display current status of the target based on the control action selected.
• Display strip charts of all monitored signals.
• Display alarm indicators based on the current control action.
Requirements – Expert Controls / Display

Expert Controls

• Allow expert to modify Lakeshore 336 setpoints.
• Allow expert to modify alarm indicator thresholds.
• Allow expert to manually modify the Lakeshore 336’s PID settings.
• Allow expert to turn on / off the PTR compressor.

Expert Display

• Fields and confirmation buttons to modify the aforementioned expert controls.
Overall System Map

- Ethernet
- RS232
- LakeShore 218
- PTR Compressor
- GPIB
- Lakeshore 336
- PLC
- L35
- IF8
- OW 16
- IQ16
- LCW Flow Meter
- Omega RTD Meter
- Omega RTD Meter
- Target Cart

Analog signals from target and compressor LCW panel (0-10 V, 4-20 mA, 24 V)
Hardware Description

PLC Controller to 435 NBX Module to Lakeshore 218

• Real time automation 435NBX module is an ASCII <-> RS232 Converter.
• Sends and receives data from the Lakeshore 218 using IEEE 488.2 standard commands.

PLC Controller to 435 NBX Module to PTR Compressor

• Real time automation 435NBX module is an ASCII <-> RS232 Converter.
• Sends and receives data from the PTR Compressor using SMDP.
Hardware Description

PLC Controller to 435 NBX Module to GPIB converter to LS336

- Real time automation 435NBX module is an ASCII <-> RS232 Converter.
- ICS Electronics 4896 Serial to GPIB converter is used to convert the RS232 signal from the NBX module to GPIB.
- Sends and receives data from the Lakeshore 336 using ICS’s proprietary and IEEE 488.2 standard commands.
Hardware Description

**Flow Meter** (GEM 250207)
- 0-10 VDC output
- 0 – 150 psi range

**Flow Meter Display** (Omega DP25 - VRMS)
- 0-10 VDC output
- Scalable display

**LCW RTD Display Meters** (Omega DP25 - RTD)
- 0-10 VDC output
- 2 NO / NC relays activated via setpoints
Hardware Description

**Analog I/O Module** (Allen Bradley Compact Logix 1769-IF8)
- Accepts 8, 4-20 mA / 0-10 VDC inputs
- Used for: H2 supply / return pressures, vacuum, PTR LCW flow, PTR LCW inlet / outlet temperatures

**Digital Input Module** (Allen Bradley Compact Logix 1769-IQ16)
- Accepts 24 VDC inputs
- Used for: various signals from the target hardware interlock box. (Undecided what is needed or to implement)

**Relay Module** (Allen Bradley Compact Logix 1769-OW16)
- Relays 16, 5-125 VDC signals
- Used for: remote gate valve control
Software Description

Structured Text

• Used to command and acquire data from the Lakeshore 218 / 336 and PTR Compressor.

Function Block Diagram

• Used to convert voltage and current from the analog input module to sensor readback values.

Ladder Logic

• Used to “schedule” command and readback sequences.
Software Description

HMI
- Developed with Rockwell Factory Talk Studio.
- Displays controls and readbacks from the PLC Controller.

Strip Charts
- All readbacks are data logged.
- Strip charts are displayed in a separate window by clicking on the value on the HMI.
Current Status - Hardware

Completed Tasks

• PLC chassis installed and powered.
• PLC chassis cabled with all signals.
• PTR LCW meters installed, cabled, and powered.
• Target cart heater / temperature controllers installed, cabled and powered.

Tasks to be Implemented

• Labeling of cables.
• Scale readback of the flow meter panel display.
Current Status - Software

List of completed tasks

• Code developed and tested to control / readback all analog signals and Lakeshores.
• HMI to display and plot data from target readback devices.

Tasks being implemented

• Troubleshooting intermittent communication issue with the Lakeshore 336.
• Addition of manual PID controls for the Lakeshore 336.
• Addition of PTR compressor status displays.
• Tag list to export to the EPICS database.
Current Status - Testing

**First Fill / Empty** (EEL – manual control)

- Tested Lakeshore 218 readback code successfully.
- Tested Lakeshore 336 temperature readback code successfully. (Intermittent communication issue existed but did not pose an issue during EEL testing)
- Tested PTR Compressor ON / OFF commands successfully.
- Tested gate valve control successfully.

**Second Fill / Empty** (Hall D – manual control)

- Tested HMI readbacks successfully.
- Tested strip chart displays successfully. (No data logged due to database issue.)
- Gate valve control issue discovered.
Current Status - Testing

**Third Fill / Empty** (Hall D – remote control)

- Tested Fill control process button successfully.
- Tested Empty control process button. (Discovered intermittent communication issue with the Lakeshore 336)
Summary

• Generally the hardware and software works well.

• The intermittent issue with the Lakeshore 336 communication should be sorted out by early next.

• One more Fill and Empty process is planned to collect data and test bug fixes.

• Detailed documentation of the system has been started.