OPERATION TECHNIQUES FOR HWR1 CRYOMODULE*

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Abstract

Control systems such as PLC and EPICS are developed for a half-wave resonator (HWR) cryomodule. PLC rack is fabricated for the HWR1 cryomodule. The PLC controls pumps, heaters and valves. The PLC communicates with temperature monitors through Ethernet. HMI of PLC and EPICS controls and monitors pumps, heaters, valves and temperature sensors through switching hub. The PLC HMI is developed and EPICS is also developed. The CSS of EPICS consists of control, monitor, parameter set-up, alarm and data browser screen.

INTRODUCTION

Properties of superfluid helium fog were studied [1-3]. Thermal radiation from n-dimension was investigated [4]. The size effect of thermal radiation [5, 6] and the effective temperature for non-uniform temperature distribution were investigated [7, 8]. Superconducting Radio Frequency (SRF) test facility in RAON was designed [9] and was almost constructed. The SRF test facility consists of cryogenic system, clean room, cavity test and cryomodule test. The clean room is used for cavity process and assembles.

In this research, we develop the Programmable Logic Controller (PLC) and Experimental Physics and Industrial Control System (EPICS) for HWR1 cryomodule. The PLC rack is fabricated and PLC program is developed. EPICS is developed from the PLC program.

ARCHITECTURE

CompactLogix PLC and Studio 5000 software of RockwellAutomation is used to develop the PLC program for HWR1 cryomodule. AllenBradley PLC controls pumps, heaters and valves. The valves include gate valves, cryogenic valves and solenoid valves. Pumps consist of dry pump and TMP for vessel and cavity, respectively. Figure 1 shows the architecture for HWR1 cryomdoule. The PLC communicates with temperature monitors through Ethernet. PLC and EPICS control and monitor pumps, heaters, valves and temperature sensors through switching hub.

HWR1 CRYOMODULE

Figure 2 shows the picture of HWR1 cryomdoule. Figure 3 shows the PLC rack and temperature monitors.

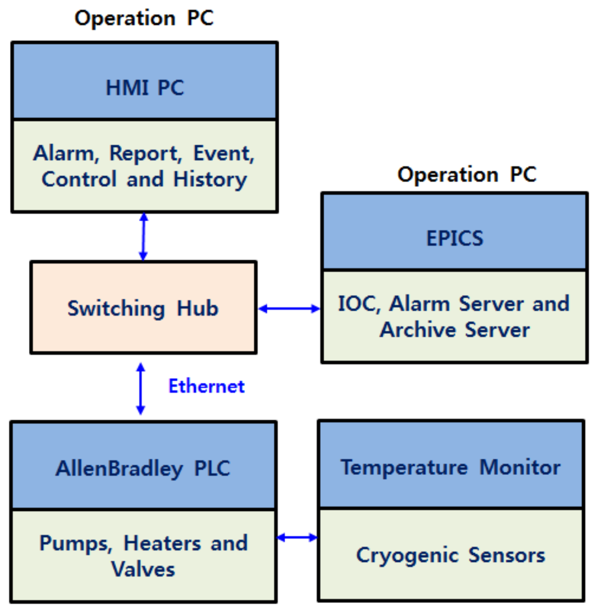

Figure 1: Architecture for HWR1 cryomdoule.

Figure 2: Picture of HWR1 cryomodule.

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Programmable logic controller (PLC) rack consists of 19 inch monitor and three heater controllers. Liquid helium level monitor and a switching hub are located below the temperature monitors.

Figure 3: PLC rack and temperature monitors.

PLC AND EPICS

PLC Human machine interface (HMI) for HWR1 cryomodule is shown in Fig. 4. It consists of 4 K He reservoir, 2 K He reservoir, two cavities, etc. The total number of Tag name is about 300 for the cryomodules. Figure 5 shows the temperatures are shown as a function of time. The drive frequency for the HWR1 cryomodule is 162.5 MHz and the cavities are operated at 2 K. Temperature, pressure and liquid helium level can be monitored. Cryogenic valves, pumps and heater powers can be controlled.

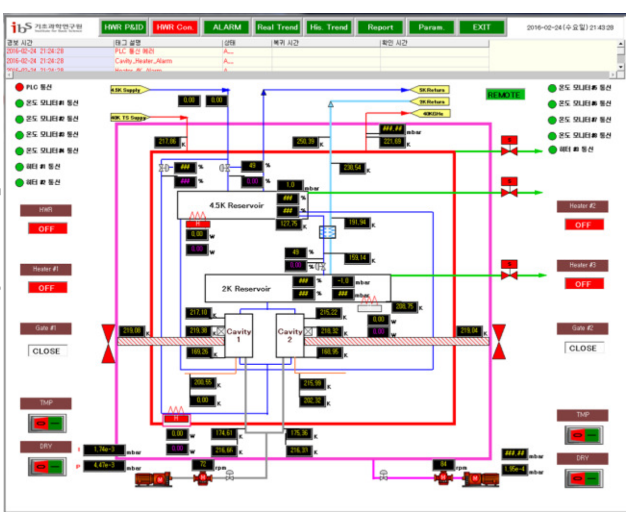

Figure 4: PLC control screen.

EPICS are developed by mapping PLC Tag name to process variable (PV) name. The control screen of EPICS is almost same as that of PLC. Figure 6 shows the CSS control screen in EPICS. EPICS for the cryomodule consists of control, monitor, parameter set-up, alarm and data browser screen.

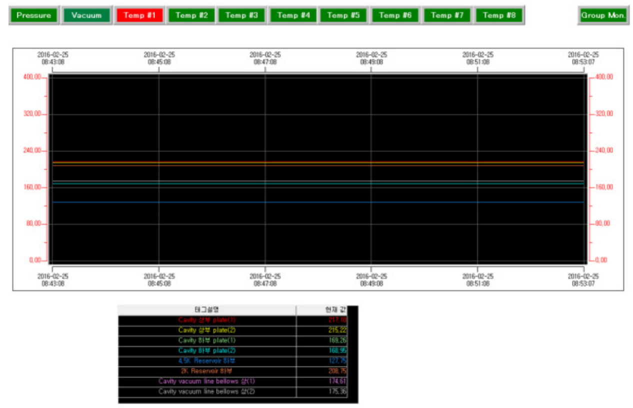

Figure 5: Temperature Monitoring.

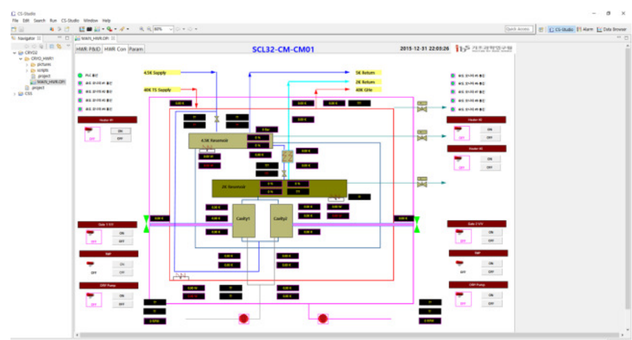

Figure 6: CSS control screen in EPICS.

SUMMARY

We have developed the PLC and EPICS for HWR1 cryodmoule. The PLC Rack for the HWR1 cryomdoule was fabricated. The PLC controls the pumps, heaters and valves and monitors the vacuum pressure and temperatures of the HWR1 cryodmoule. The CSS of EPICS consists of control, monitor, parameter set-up, alarm and data browser screen. HWR1 cryomdoule will be tested with the developed PLC and EPICS soon at RAON SRF test facility.

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