§22. Construction of Remote Control and Data Acquisition System for Vacuum Pumping of the LHD

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1. Introduction

LHD vacuum pumping system consists of pumps, valves, pressure gauges and so on. The all of these devices must be controlled remotely from LHD control room. To control the devices and take data of total and partial pressure or information on the status of operation for each component, remote control and data taking system has been constructed. The main part of the system consists of six personal computers (PCs), four intelligent sequencers, and one Local Control Unit (LCU), which control the devices, monitor statuses of the devices, and take data of the pressure gauges. Fig.1 shows constitution of the remote control and the data acquisition system. Device controllers are put in LHD building, and they communicate with PCs in LHD control room using optical cables.

A sequencer of LHD device room also communicates with main control interface unit of the LHD for interlock system.

2. Control

To operate the device, operator sends a command to the sequencers through LCU using PCs, then the sequencers send a command to a controller of the device, and the device is operated. The controller of the device returns status information to the PC, and it displays the status information of the device.

Sequence and routine programs are contained in the sequencers, not in PCs. Roles of the PCs are just send commands to the sequencers and display the status. And the sequencers can executes complicated routines, for example regeneration of the cryo-pump, without PC. The sequencers have many interlock routine, and it forbids incorrect operations.

3. Data acquisition

Bit data, like open/close status of the valves, are sent into the sequencer. Analog data, like vacuum pressure, are sent into LCU, which is connected with the sequencer. The LCU has an Analog Digital Converter (ADC) and the data are transformed to word data. The bit data and the word data are send to the PC for a data acquisition, and written down on a hard disk of the PC with date and time stamps.

To Communicate with mass spectrometers, RS-232C (Recommended Standard) is used. Since neither the sequencers nor LCU has RS232C ports, a PC and mass spectrometers are connected directly by optical cable. Data of the mass spectrometers are written down on the hard disk of the PC with date and time stamps, too. Computer code of data acquisition system is written by LabView.

Both data are usually taken every 30 seconds. Data sizes are about 1.7Mbyte /day for pressure data and 230Kbyte/day for mass spectrometer data. To save disk space, all data are saved as integer. In order to read data and return them to real values, a computer code was developed. Using this code, table of the pressures can be easily made. This computer code is written by Visual Basic.
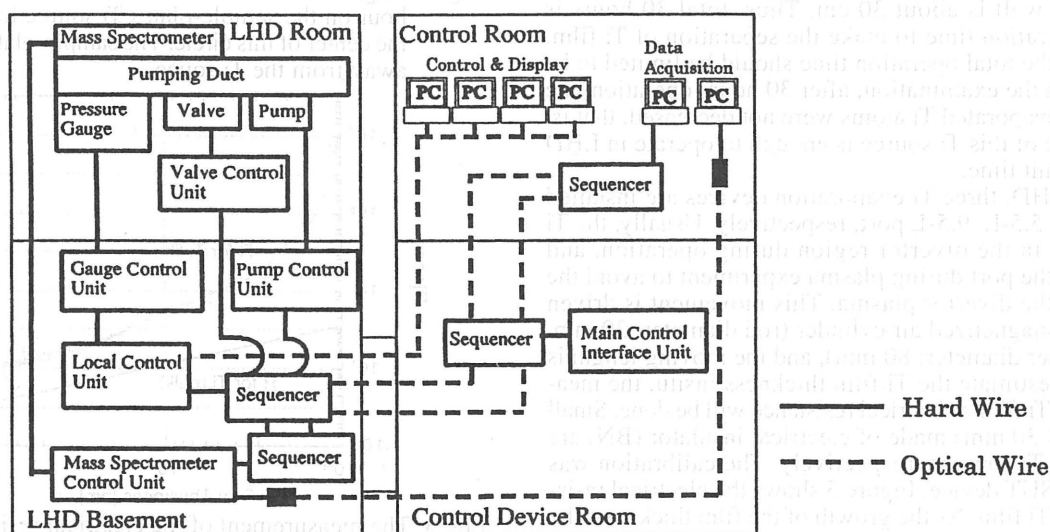

Fig.1 Control and Data Acquisition system for LHD vacuum pumping system