

EPICS implementation for the KSTAR vacuum control system

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Abstract

KSTAR is fully superconducting tokamak under construction, capable of quasi-steady state, and long pulse operation. KSTAR has two parts of vacuum system. One is the cryostat vacuum system to maintain low temperature (4/80 K) for thermal shielding of superconducting magnets. Other is the vacuum vessel to contain the plasma in double-walled evacuated space. For integration of KSTAR machine control, we chose experimental physics and industrial control system (EPICS) as a middleware at the engineering phase. Because EPICS is a good solution to implement the distributed control and the real time control for the tokamak, aiming at long pulse operation. The vacuum control system is the first local control system implemented using EPICS, and becomes an important pilot system to demonstrate the capability of EPICS on the machine control system. In this paper, we describe a procedure from designing hardware drivers to realizing operation panel.

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1. Introduction

The vacuum space for KSTAR is composed of two parts, cryostat for the superconducting magnet system to maintain cryogenic temperature, vacuum vessel for the space of plasma, and it should be managed and operated independently. The vacuum system is to evacuate cryostat and vacuum vessel, its machines are as follows: turbo-molecular pump and cryo-pump system for high vacuum, dry system for low vacuum, vacuum valves for connection and disconnection of vacuum, and vacuum gauges for measuring vac-

uum. For the successful operation of vacuum system, the control system requires the functional cooperation of the KSTAR machine control system (MCS) as well as fully local operation at the system level, real-time control, monitoring, archiving, machine interlocks. Fig. 1 shows the overview of vacuum control system.

EPICS [1] is widely used in control systems of large-scale experiments, like accelerators, telescopes, etc. A few years ago, KSTAR already announced that EPICS is chosen as the development middle-ware software for the KSTAR MCS [2]. Initially, EPICS was only available in the hardware based on VME. But today, EPICS supports various kinds of hardware and OS. However, there is still limited supported hardware available. This situation can be a major obstacle for the users to adopt

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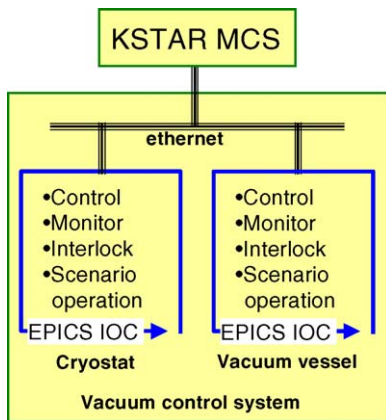


Fig. 1. Control system overview.

EPICS as a high performance, low cost, distributed control system.

The vacuum system is the first sub-system implemented using EPICS in KSTAR, it has a role of test bed to develop and test EPICS. The system implementation on the cryostat vacuum system is complete, and it is now operational. The hardware for the vacuum ves-

sel vacuum system is also complete. It is now waiting for utilities, electricity and chilled water.

2. System description

According to the previously mentioned functions and requirements of vacuum system, KSTAR control team has proposed and implemented the EPICS based vacuum control system as shown in Fig. 2, it is now under test. We have tried to construct a high performance, low cost system using three particular features.

- Linux based soft-IOC: server for EPICS, which is installed in a rack mount server.
- Async server: server for the RS232 communication, which guarantees simple and reliable communication with legacy hardware.
- Compact field-point (cFP): server for the digital input output operation. It is the most important part in the vacuum control system, which replaces the PLC or the DIO card based on VME. The control logic in cFP is embedded using LabVIEW-RT

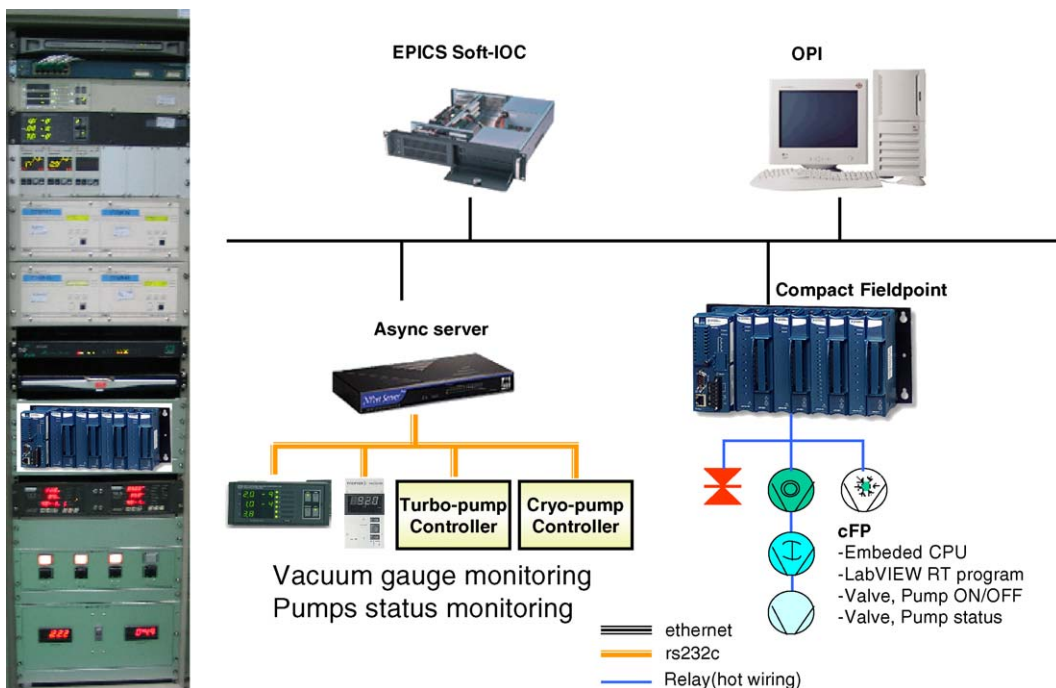


Fig. 2. Control rack and control system configuration.

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