UPGRADE OF THE MPS CONTROL SYSTEM FOR PLS LINAC

J. H. Kim, J. M. Kim, J. W. Oh, S. C. Kim, D. W. Kim, K. H. Kim, J. Choi,
S. H. Nam, J. Y. Huang, M. H. Cho, W. Namkung, and I. S. Ko
Pohang Accelerator Laboratory, POSTECH, Pohang 790-784, Korea

Abstract

The old control system of the PLS 2-GeV linac has a three-layered architecture. It was developed by in-house members in early 1993. The linac MPS control system is being upgraded based on EPICS as the protocol for the full upgrade of the PLS control system. We have replaced old VME 68K CPU boards with OS-9 to new Power CPU boards operated by VxWorks as IOC in the linac klystron gallery. The upgraded MPS control system consists of a MVME5100 EPICS IOC core in the lower level control. It is implemented with the MEDM tool of EPICS to provide friendly Graphical User Interfaces. This paper describes the EPICS-based IOC and OPI used for the MPS control in the PLS linac

1 INTRODUCTION

As of now, the PLS linac control system have been well performed the mission to operate 2 GeV linac as the beam injector for the PLS storage ring. However, in early 2001, we have decided to convert the current control system into the EPICS based one because of its lack of flexibility and control speed [1].

We have been studied the key technology for EPICS control system during the development of EPICS based test-bed control system completed at the early of this year. The development of EPICS application for the PLS is under progress for the linac and storage ring.

2 CONVERSION TO EPICS

Originally, the existing linac control system has three layers of hierarchy; the operator interface computer, the supervisory control computer(SCC) for data processing,

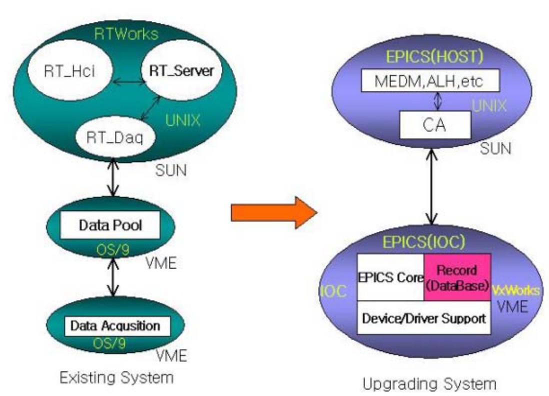

Fig 1: Structure of existing and upgrading control system

and the device interface computer(DIC) for distributed data acquisition as shown in Fig 1.

The operator interface is designed based on the commercial product, RTworks. The VME systems under OS-9 are used for data processing and data acquisition. In order to provide EPICS structure, our control system with three-layered architecture is being changed as shown in Fig. 1.

Table 1 shows the difference between the old and upgrading systems.

Table1: Comparison Table

	Old system	Upgrading system
S/W Toolkit	RTworks	EPICS
Architecture	3 Layer	2 Layer
Network	10base2	100base TX/FX
IOC Platform	M68K VME/OS-9	Power PC, VME/vxWorks
Core S/W	Homemade S/W	EPICSBase3.13.6
Device Intf.	Serial	Serial

3 UPGRADING MPS CONTROL SYSTEM

There are 100 power supplies for various magnets and solenoid in the linac and BTL [2-3]. These power supplies are placed in the three locations; 30 units in the pre-injector, 24 units for the rest of the linac, and 46 units in the BTL power supply room. Also VME systems are distributed in the three locations in the nearest power supply.

As shown in Fig. 2, this control system is based on the EPICS standard model. VME Systems as IOCs is used and connected via Ethernet for host and communicate with MPS interface controller using RS422 protocol.

This control system has currently following features.

- All Current Set, Power/On, Off
- Individual Current Set, Power/On, Off
- Status Monitoring (Remote/Local, Polarity, Over-temperature, Over-current, etc)
- Degaussing for Bending Magnet
- Saving of individual set current value

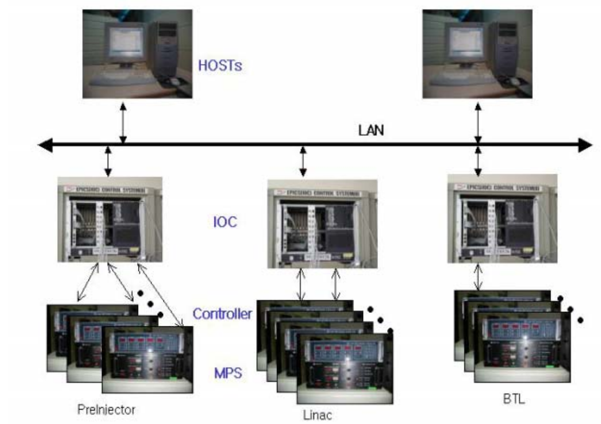

Fig. 2: Structure the upgrading MPS control system.

3.1 Operator Interface

Sun Workstation with 2 CPUs and 1GB memory are selected as the console computer. Many available EPICS tools has been installed and evaluated at the end of last year. The Motif Editor and Display Manager (MEDM) is chosen as the primary operator interface for MPS control system. New MPS operator windows are designed with schematic and user friend design concept as seen in Fig. 3&4.

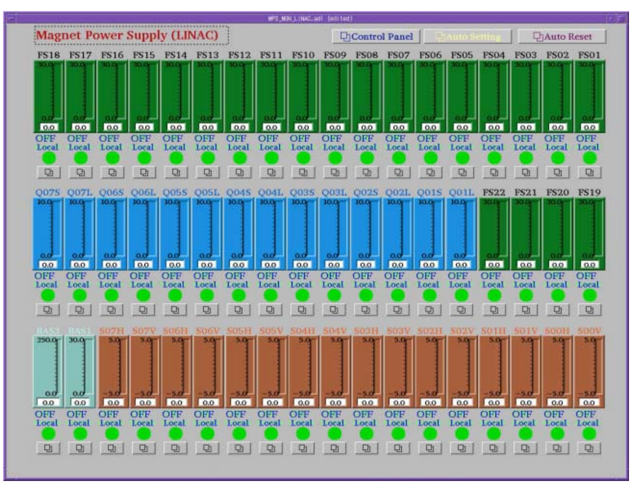

Fig. 3: Monitoring screen

Operator can access the MPS main control screen like sub-window by just clicking from PAL main menu windows. There are two panels for monitoring of power supply parameters and for controlling individual power supply. The operator screen is designed for monitoring all power supply data through bar graph object.

The monitoring panel gives a palette of color to identify the types of power supply; for example, green to indicate focusing solenoids, blue to indicate quadrupoles, and so on.

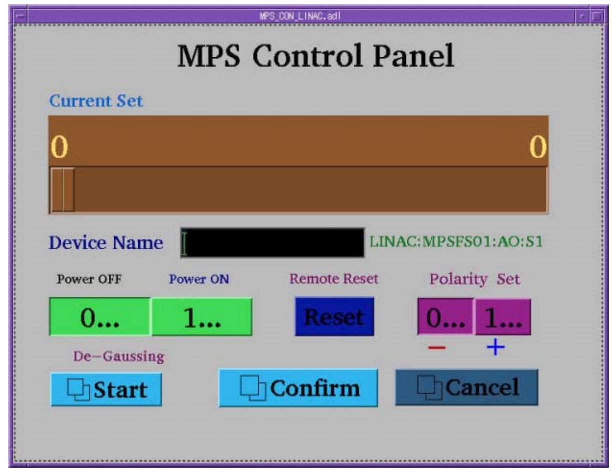

Fig. 4: Control panel

3.2 IOCs(Input/Output Controller)

EPICS IOCs are implemented in VME bus system with MVME5100 CPU running the vxWorks real-time operating system. We selected the VME system under vxWorks to preserve our investment in hardware and to make much use of the existing EPICS resources for VME I/O boards. To interface the MPS interface controller with serial interface, serial PMC module (TPMC866) with 8 channels on PowerPC CPU Board is used. Also we can monitor the status of the working VME crate parameter (voltage, temperature, etc) remotely. The application tasks running IOC is developed by a SUN Workstation and vxWorks development environment.

Base Release3.13.6, EPICS Core S/W is configured and successfully installed. The device/record support was obtained from the community of the EPICS collaboration and is slightly modified to satisfy the in-house protocol of the power supply controller. Before constructing database for IOC, PV (Process Variable) list was defined by the rule of PLS naming convention.

For PLS EPICS, the Capfast schematic editor was chosen as the IOC database configuration tool in the initial development stage. But MPS IOC uses generic editor (vi etc) to construct the simple IOC function database.

The following functions are implemented using various records like Analog Input/Output, Binary Input, String Input/Output, Scalout, Sequence record etc.

- All Set Current Out, Current Out
- All Set Power On/Off, Power On/Off
- Current Response Input
- Status Response Input

The configured IOC database is loaded into MPS IOC at startup. MPS IOCs is successfully tested in the test bed and pre-injector linac

3.3 MPS Interface Controller

MPS interface controller was designed by in house member. One MPS interface controller has the capacity of handling four power supplies.

It is the embedded single board computer with serial interface and Analog to Digital, Digital to Converter in the custom crate. Also, it has self-diagnostic functions and with keypad on the front panel can adjust control and monitor power supply current locally without IOC intervention.

It is programmed in EPROM the execution code to handle the communication between the IOC and this controller via RS422 with in-house protocol. Now, it is programming to perform the degaussing function that decreases the current in bending power supply as step by step for 2.5 GeV operation.

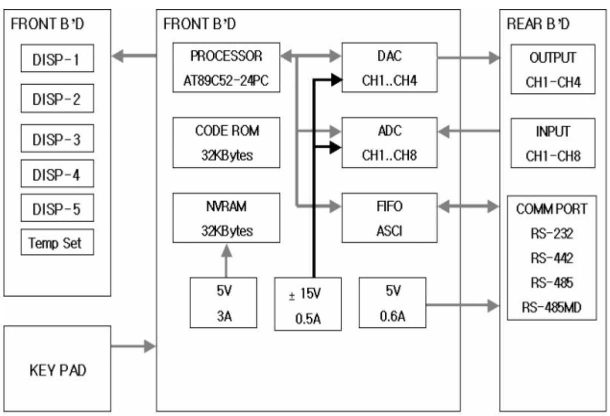

Fig. 5: Block diagram of MPS Controller

4 FUTURE PLANS

After building the EPICS development, the first EPICS system with the VME system has been developed in the PLS linac. During this development, we have learned more key technology of EPICS. First of all, we have the confidence of the development for the other PLS EPICS project in the future. After fully debugging in the klystron gallery, these control systems are expected to install in Winter 2002 maintenance period.

Based on the experience of the MPS development, we will continue the work for linac beam monitor, vacuum system that is not replaced to the EPICS.

5 ACKNOWLEDGMENTS

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