CONTROL PROTOTYPE OF CORRECTOR POWER SUPPLY

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Abstract

BEPCII will construct double rings in the current BEPC tunnel. There will be approximately 400 magnet power supplies in the storage rings and transport lines. The control system of BEPCII will be developed with EPICS. The power supplies of corrector magnets in the Storage rings will be controlled by VME I/O modules. In order to preserve our investment, the existing CAMAC hardware used to control the power supplies in the transport line will remain. The CAMAC system will be connected to the VME system via a VME-CAMAC interface board. This paper describes the prototype system of the corrector power supply, including developing EPICS device supports of VME and CAMAC modules, establishing database and operator screens, testing the corrector power supply including current setting and readback, on/off control and monitoring.

OVERVIEW

After carefully investigated on the control systems of the domestic and foreign laboratories, BEPCII chose EPICS to develop the control system and VME-64x crates with Motorola PowerPC750 CPU boards as the front-end IOCs. Figure 1 shows the control architecture of BEPCII Magnet Power Supply system[1].

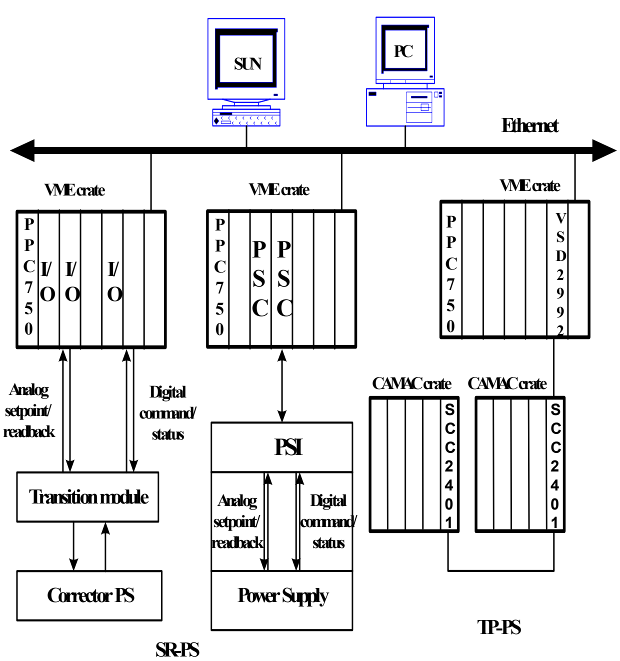

Figure 1: Control Architecture of BEPCII Magnet PS System.

The power supplies of corrector magnets in the storage rings will be controlled by VME I/O modules. We chose VIPC616 as the IP carrier board and Acromag IP modules as I/O boards. In order to preserve our investment, the existing CAMAC hardware used to control the power supplies in the transport line will remain. The CAMAC system will be connected to the VME system via a VME-CAMAC interface board. For testing the performance of these I/O modules, two prototype systems have been built.

VME I/O SYSTEM

Prototype System Architecture

There are about 140 corrector power supplies in the storage rings. The prototype system is shown in figure 2.

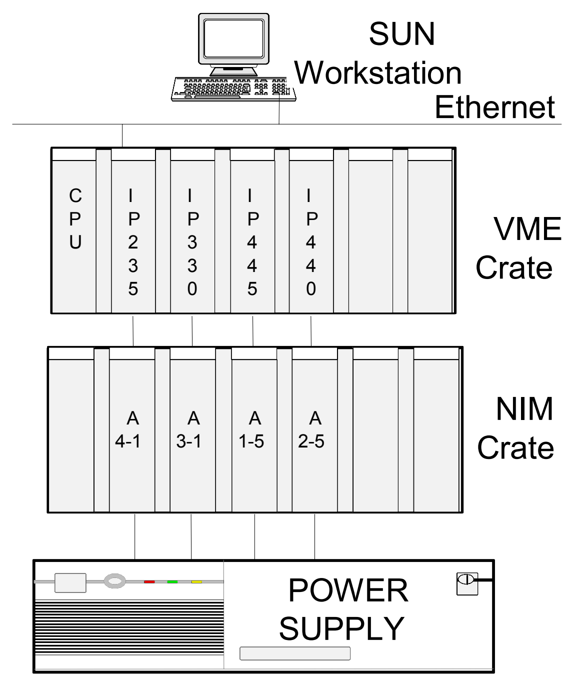

Figure 2: Prototype System of corrector PS control system using VME IO.

We used the following VME IP modules[2],

- Acromag IP235, 8 channels analog output board with eight 16-bit DAC
- Acromag IP330, 32 channels analog input board with a single 16-bit ADC
- Acromag IP445, 32 channels digital output board, optically isolated
- Acromag IP440, 32 channels digital input board, optically isolated

As shown in figure 2, there is a NIM crate with four modules on it, which are non-standard and are designed by ourselves. They realize that,

- Electric signal - Relay transition
- Different voltage transition
- Optical isolation

Device Interface

The NIM transition boards mentioned above are originally designed for BEPC. After the hardware interfaces of the corrector power supply and VME IP modules have been investigated, we decided to redesign the NIM boards to be compatible with them. Now the new NIM transition boards works well in our case.

Device Support

All device supports are based on drvIpac and drvVipc616.c[3]. drvIpac (Industry Pack Driver) is a software interface to a generic Industry Pack (IPAC) driver module for vxWorks. drvVipc616.c is IPAC carrier driver for VIPC616, which realizes VIPC616 special functions provides the interface between IPAC driver and the hardware. With drvIpac and drvVipc616.c, we developed the EPICS device supports for VME IP modules[4]. Each IP module includes three corresponding files, device support, driver support and the header file. Then for debugging all device supports, the corresponding db, dbd, Makefile and startup files are developed and the test applications are downloaded from the SUN workstation to the IOC, which is a MVME2431 board running VxWorks kernel.

Building the Prototype System

After all device supports have been tested and hardware connects have been built up, we then developed the needed db, dbd and startup files to build the prototype system. We also developed the graphical user interface by edm for control. As shown in figure 3, the GUI can realize current setting and readback, on/off control and status monitoring.

VME BASED CAMAC SYSTEM

Prototype System Architecture

Those power supplies and their CAMAC control system in the transport lines will remain. So, a VME based CAMAC system is built up. That is to say, we use one VME board as the CAMAC Serial Driver which can drive 62 CAMAC crates at most connected as one Serial Highway[5]. We chose HYTEC VSD2992 as the Serial Driver and HYTEC SCC2401 as the CAMAC Serial Crate Controller. The prototype system is shown in figure 4.

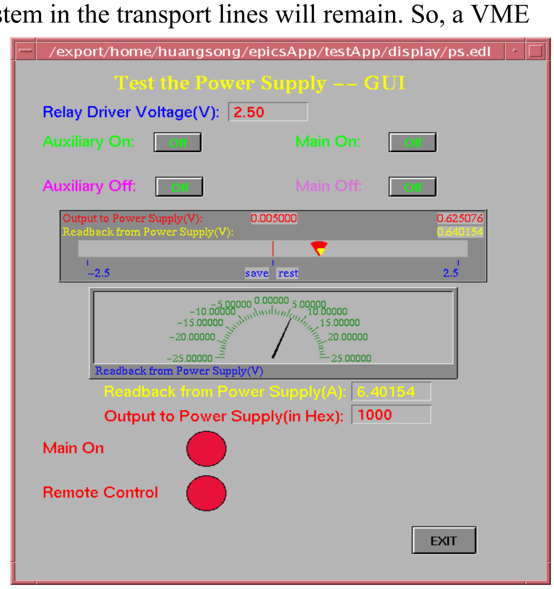

Figure 3: GUI for control corrector PS.

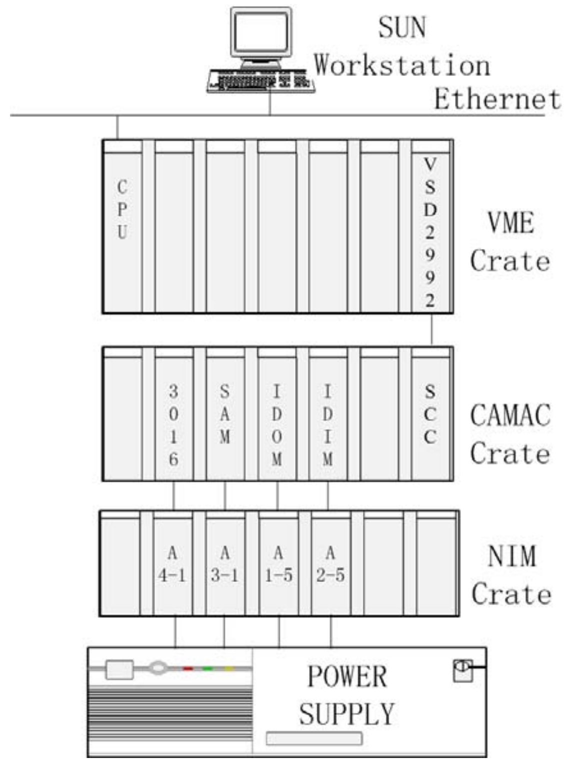

Figure 4: Prototype System of corrector PS control system using VME-CAMAC.

The following CAMAC IO modules have been used,

- 3016, 16 channels analog output module with a single 16-bit DAC
- SAM, 32 channels analog input board controlled by an internal microprocessor, precision 14-bit
- IDOM, 32 channels digital output board, optically isolated
- IDIM, 32 channels digital input board, optically isolated

These modules are all come from SLAC. We can find their manuals on the website of SLAC[6].

Also, we used the NIM transition modules described hereinbefore.

Device Support

The generic CAMAC driver are used, primarily the following

- camacLib.c, device-independent code for EPICS VxWorks ESONE-Compliant CAMAC Driver Library
- camacLib.h, header file for the EPICS CAMAC drivers, which will be included by device supports

- ht2992.h, hardware definition module for HYTEC VSD 2992

With the above files, we developed the device supports and drivers for each CAMAC I/O modules. Then for debugging all device supports, we developed the corresponding db, dbd and startup files and downloaded the test applications from the SUN workstation to the IOC.

Building the Prototype System

After all device supports have been tested and hardware connects have been tested, we then developed the needed db, dbd, startup files and GUI to build the prototype system. The GUI is the same as that of VME I/O system as shown in figure 3.

SUMMARY

We have evaluated the control accuracy and stability of these two prototype systems and are satisfied with their performance. In the next step we will develop the ramping and standardization programs for the power supplies based on these two control architectures[7]. And because all power supplies in the transport line will do online debugging in October, 2004, we should finish developing the whole control system for the Magnet PS system of the transport line before that.

REFERENCES

[1] C.H. Wang, J. Zhao, J. Liu, S. Huang, "A Prototype of the Power Supply Control System in BEPCII", ICALEPCS'03.

[2] User's Manual of VME IP modules.

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[4] EPICS Input/Output Controller Application Developer's Guide, by M.R.Kraimer, June 1998, EPICS Release 3.13.0 beta12.

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[7] Design Report of BEPCII.