HIRFL CONTROL SYSTEM UPGRADE

Xinmin Huang, Jianhua Li, Yun chen, Jianjun Hu, Hui Li, Wei Zhang, Na Sun

Institute of Modern Physics, Chinese Academy of Sciences
P.O.Box 31, Lanzhou 730000, China

Abstract

A centralized control system has been used in HIRFL for several years. It was only used to control SSC (Separated Sector Cyclotron) power supplies and used a VAX/8350 computer as central control machine.

The new HIRFL control system is a distributed one based on the high end PCs, workstations and servers (Fig.3). The system consists of a SFC control and beam diagnosis station, an SSC power control station, an SSC beam diagnosis station, an SSC vacuum station and a RF control station. Each control station is an independent subsystem and a high-speed network is used to communicate between control stations. The control system upgrade, including hardware upgrading and applications rewriting, is described in this paper.

1 INTRODUCTION

The rebuilding of the HIRFL control system is necessary since there have been some problems in the VAX/8350. The upgrading for the control system was started in 1997. The main task consists of building a fast network, SFC (injector) upgrading, SSC RF control system upgrading and designing the SSC Power supply controller and motor controller. A new PC-based distributed control system was finished in the middle of 1999.

2 COMPUTER NETWORK

The HIRFL computer network is a 100M Fast Ethernet. Inter express 100M 12 port stackable HUBs are used in the network. 3COM's 3C905 100M PCI network adapter is used in each PC workstation and an AMP type 5 cable is used to interconnect between PC workstation and HUB. In order to insure correct transport, the maximum distance of the cable is limited to 90M.

3 SFC CONTROL SYSTEM UPGRADING

The computers that were used to control SFC were IBM PC/XT, 286 and IBM PC/AT in 1997. Since the old computers are very difficult to run in a high-speed network, we changed them to HP Pentium 586/200, P2/3 workstation and PC server. The are two CAMAC series in the SFC control system, one for control and another for beam diagnosis.

4 SSC RF CONTROL SYSTEM

The radio frequency (RF) computer control system is a very important part of HIRFL control system. The control object of Radio frequency control (RFC) system is composed of 2 cavities and 3 stability systems which are a frequency-modulated device, an amplitude stabilizer and a phase stability system.

We use CAMAC-Computer serial loop, which has a standard interface and the good expansion ability. The outline of our CAMAC-Computer serial loop is a KS2926 module (PC interface) in an ISA slot is connected with a KS3922 module (Crate controller) by a 50-conductor ribbon cable. KS3922 is connected with a KS3992 module (serial highway driver) in the main crate. Crates is connected with KS3992 constitute a serial loop. There are 4 crates in this loop. The first crate controls the 2 RF cavities, No.2 controls frequency-modulated device, No.3 controls the phase stability system, and No.4 controls amplitude stabilizer (Fig. 1).

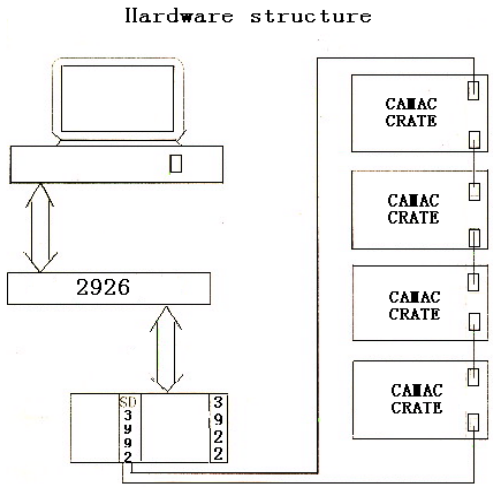

Fig. 1 SSC RF CAMAC Serial Loop

Our software works on the Windows98 operating system. It is composed of 3 parts. First, a friendly, easy to use interface is important, therefore, we use MS Visual Basic and Visual C++ to program the interface. The interface that we have designed has a standard Windows style. The next part is the I/O interface program. We put the I/O control program into several DLLs (Dynamic-link Library) that can be used by other application programs. Our database is set up in Access. The Database is used to store the running parameters of the RF control system. The program controls the running status at different frequencies by rewriting these parameters.

These three parts make up the entire application program. The RF computer control system is finished, and the main part is running at HIRFL and works well.

5 CAMAC PS. CONTROLLER

There are more than 300 power supplies in HIRFL. There were a few modes to control the power supplies before 1998. In order to unify the control system, a new, general CAMAC controller for power supply has been designed. The block diagram is shown in Fig.4. All the control functions, such as turning on/off the PS., presetting the input current, monitoring the status of the PS. and measuring the current, have been included in one single-width CAMAC module. A 16 Bit DAC converter is used to provide a very high precision voltage. A DC/DC converter ensures the isolation between CAMAC and the PS. It needs only one module to control one set of the PS. This controls network is very easy to maintain.

6 CAMAC MOTOR CONTROLLER

About 20 sets of stepping-motors are located in the injection and extraction regions of SFC and SSC. A single-width CAMAC motor controller module has been designed and used in the control system in 1999. Many functions, such as turning on/off the motor driver, generating a pulse series, changing the moving direction of the motor and limiting the moving distance of the motor, can be found in the controller. In order to get a higher velocity, an oscillator with two speeds, 200HZ and 2KHZ is adopted. If the distance difference greater than 50% of maximum distance, the 2KHZ oscillator is enabled. A 13-bit angle encoder, with 1/8192 resolution, is used to measure the position.

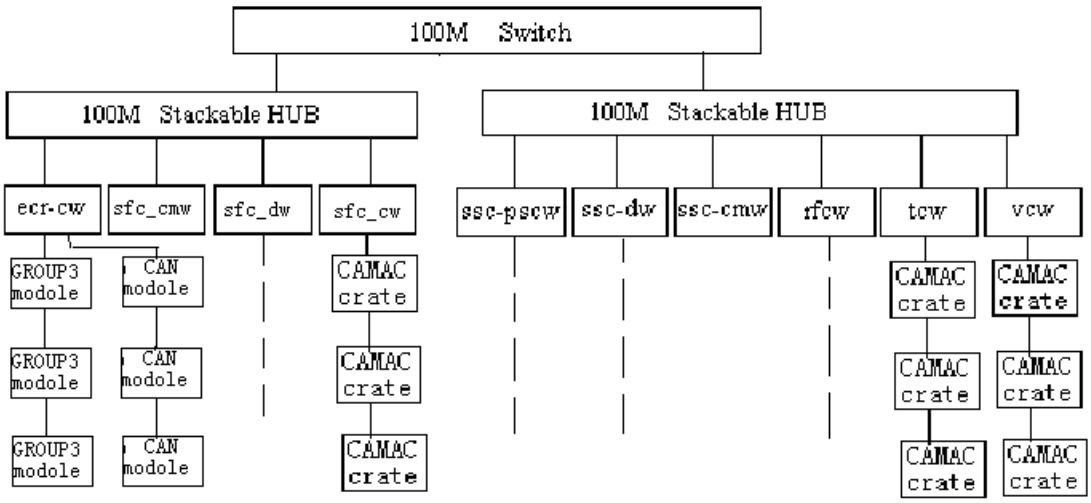

Fig. 2 Layout of HIRFL Control System Network

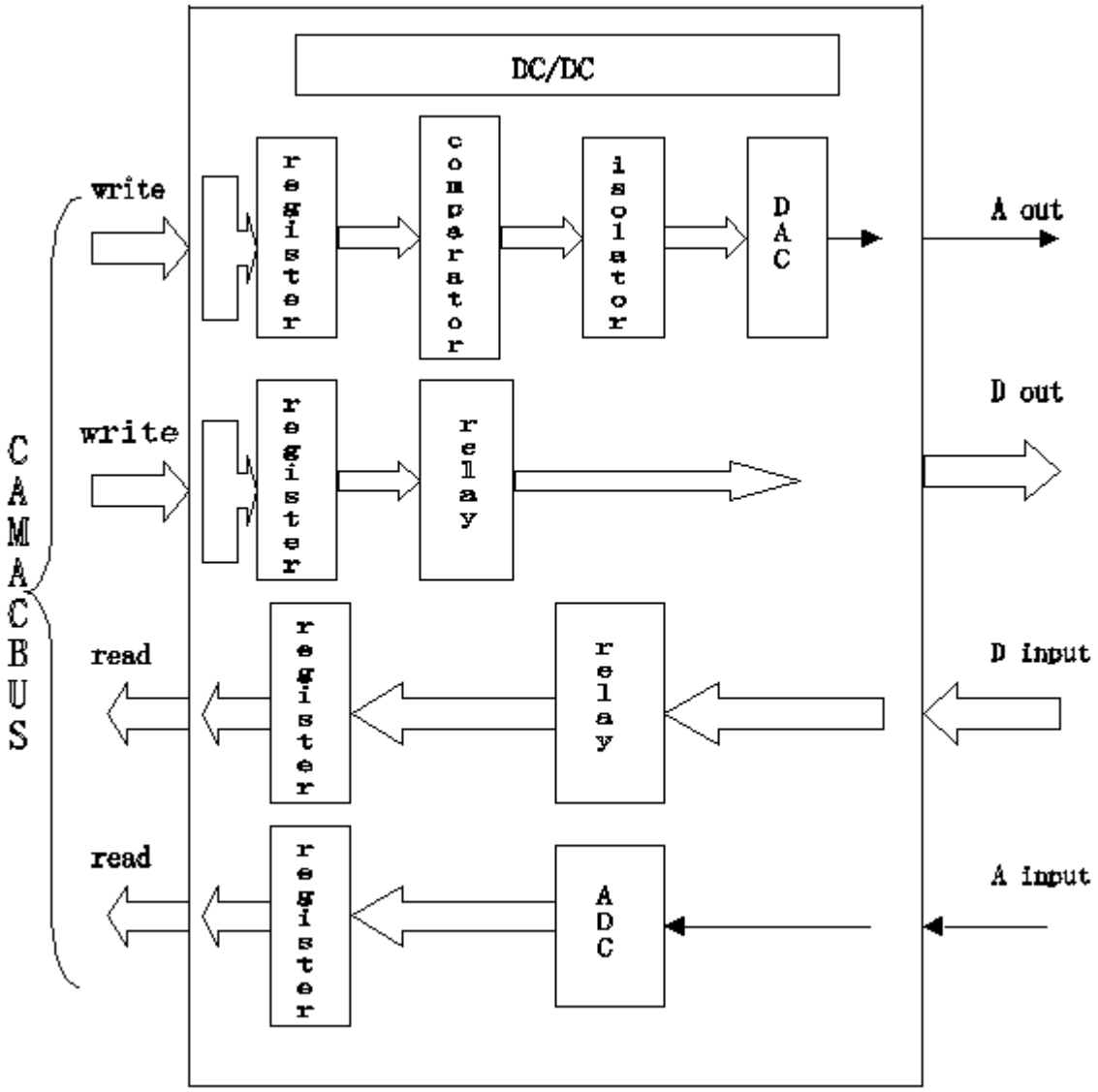

Fig. 3 Block diagram of CAMAC power controller