5 - 19 Upgrade of Control System for SECRAL System

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To improve the control efficiency of Superconducting Electron Cyclotron Resonance Ion source (SECRAL) for Heavy Ion Research Facility in Lanzhou (HIRFL), a upgrade version of control system for SECRAL system was designed and set up in September 2014. The control software package is developed by Visual C++, which is able to control and monitor all of the equipment for the SECRAL system with about 130 parameters. The previous analog powers are discarded and four digital high powers are used newly at high voltage platform, which contain two stove powers, a bias voltage power, and a sputter power. Moreover, four servo motors are added newly, which contain work gas, support gas, bias voltage, and sputter voltage. Reflecting vacuum value picturesquely, we plot a graph of inject vacuum, elicit vacuum, and beam vacuum against time. In order to prevent the misoperation which may cause the quench of the superconducting magnet, alarm and interlock-protection functions are added to the software and hardware. Simultaneously, added stretch buttons are able to void accidental on-click that might bring about serious outcome.

The controllers of these devices operate under normal voltages; thus, it is highly likely that the signal from the high voltage terminal to the controllers can seriously damage the devices on both sides and perhaps even crash the entire system. The controller is located on the HV Platform. The communication between the controller and serial switch is implemented through an optical-to-electrical signal converter ECS6101B, which can be controlled through the RS485 protocol, as shown in Fig. 1. The device between the ECS6101B converters is a single-mode glass fiber.

Two types of special gases are required to produce plasma: supporting-gas and working-gas. Also there are added bias high voltage and sputter. The plasma is produced through the electric discharging of the mixed gas. The quantity and flow rate of these two types of gases that are injected into the ion source must be strictly controlled and accurately monitored. The flow rate of the mixed gas is controlled by four valves driven by four servo motors. The communication between the controller and serial switch is implemented through an optical-to-electrical signal converter ECS6101B, which can be controlled through the RS485 protocol, as shown in Fig. 1. The device between the ECS6101B converters is a single-mode glass fiber.

Fig. 1 The picture of HV platform.

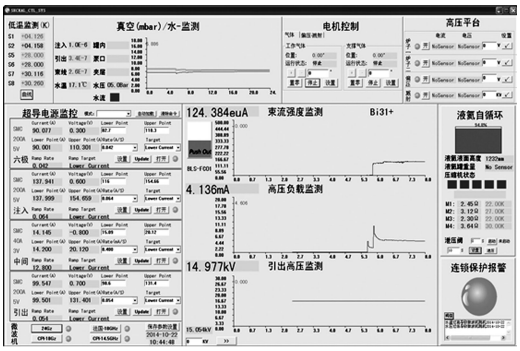

Fig. 2 Remote control software interface.

The control software is designed as independent classes. Thus, new devices can be easily added. If a new device is added, it is only necessary to instantiate the classes and call the functions of the classes. Most of the functions are called by these classes. For the hardware, the new controller to the Intranet must be accessed through a switch or a serial switch. Fig. 2 shows the remote control software interface. The system was completed and became operational in September 2014. The developed system has successfully provide various types of beams in many instances. This system can acquire data at a maximal rate of 3 times per second and complete the entire interlock protection and alarm process in one second.

The developed system enables remote control of the SECRAL and IPA. Thus far, the system has been running successfully for several months. Tests have shown that the system offers the advantages of precision, efficiency, stability and convenient operation.

References

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