DEVELOPMENT OF A FAST CLOSING VALVE SYSTEM CONTROLLER FOR SYNCHROTRON RADIATION BRANCH BEAM LINE

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Introduction

A fast closing valve system (FCV) is required in order to protect the vacuum of the synchrotron radiation beam line and electron storage ring from a sudden vacuum failure at the downstream end of the beam line. The FCV system in main beam line section has been successfully operated for over six years [1], [2]. It is sometimes necessary for synchrotron radiation experiments to use an additional FCV system for a branch beam line, thus an FCV controller must operate in narrow experimental hall. A compact controller has been developed for these purpose.

System Configuration

The schematic diagram of the FCV system is shown in Fig. 1. A Synchrotron radiation is fed to a main beam line section and divided into two or three branch beam lines at the downstream beam line. The FCV system consists of a vacuum detector, blade, and controller.

The block diagram of controller is shown in Fig. 2. The controller consists of four blocks; a high voltage block, vacuum level comparater, control logic circuit and valve driver block. Fig. 3 shows a photograph of controller and Fig. 4 shows a photograph of the FCV.

Operating Sequence

A control logic has a micro-processor to reduce electric components and actuates following sequential operation. The vacuum signal is fed to comparator, then the signal is compared with presettable level $5x10^{-5}$ or $5x10^{-4}$ torr. The output of the comparator is fed to the control logic circuit. A micro-processor in the control logic operates as follows; to reset the blade to its open position, to turn on a high voltage power supply of the vacuum detector and to be initialized logic circuit as ready conditions.

Close action: on detection of vacuum deterioration, the controller closes the blade, simultaneously controller generates the interlocking signal to close the back up valve.

Open action: the FCV is resettable to its open position after the pressure of beam line has recovered to ultra high vacuum. The fail safe operation, the logic circuit monitors the operational conditions; open/close status, pressure of pneumatic source, and voltage across a capacitor bank. If the open/close status of the FCV is contradictory, that is, actual status is not equal to the desired status, then the back up valve would be closed.

Conclusion

A compact controller with fail safe function can operate at the synchrotron radiation branch beam line in narrow experimental environment and can reduce cable quantity, and increase cost performance.

References

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2. N. Kanaya, S. Sato, S. Asaoka, K. Nakajima, S. Hayashi, S. Kurita, IEEE Trans. on Nucl. Sci., Vol. NS-36, No. 4 pp. 1391 - 1395, 1989.

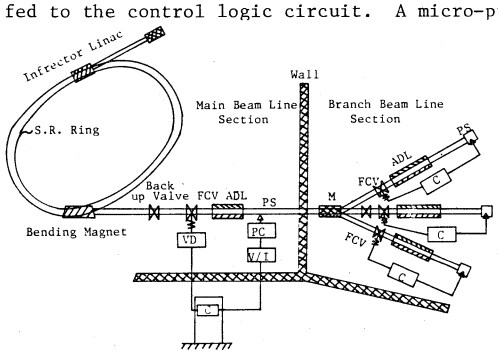

Fig. 1 Schematic Diagram of Fast Closing Valve System

Fig. 3 Controller

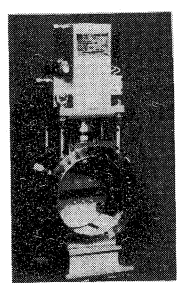

Fig. 4 FCV

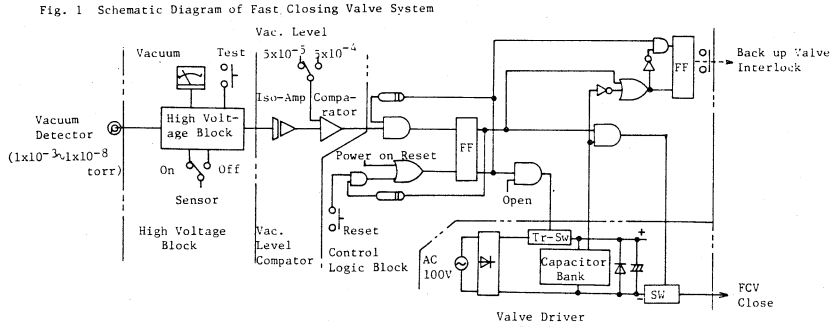

Fig. 2 Block Diagram of Controller