UPGRADE OF THE BEPC STORAGE RING MAGNET TEMPERATURE PROTECTION SYSTEM

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Abstract

The old BEPC storage ring magnet temperature protection system was finished and put into use in 1988 .The protection system controlled 32 sets of power supplies and protected 162 magnets of the storage ring. Some defects were exposed during last 12 years especially the way of relay control. The upgrade is implemented via programmable controller which takes a key role in the protection control system .The hardware configuration, the software design and test of the new system are discussed in the paper.

1 INTRODUCTION

The Magnet Temperature Protection System (MTPS) of Beijing Electron Positron Collider (BEPC), both for the storage ring and the transport line, was designed and carried into use in 1988. We have upgraded the MTPS for transport line in Sep. 1999. At present, the MTPS for the storage ring controls 32 magnet power supplies and is dedicated to protect 162 water-cooling magnets of the whole ring.

During the last 12 years, the MRPS undertook an important responsibilities and detected a few overtemperature-alarming signals which were sent our to cut off the main circuit of magnet power supplies. But in the course of these years, many defects were exposed to us as well. To begin with, the identification of many cables is obscure which will cause the difficulty for examining and repairing. Secondly, many components used 12 years ago are non-standard, so we can't purchase them from the market now. Especially, the old system used relays as switching part to satisfy the controlling demands. As we all know, this part will largely enhance the fault ratio of the system itself. To equal to the new requirements of BEPC and avoid such defects, we upgrade the MTPS for storage ring which uses programmable logic controller (PLC) as the key part for the whole system.

2 DESIGN FOR UPGRADING

At first, we consider which type of sensor we'd better choose. In the past, we selected the normally open type. Despite the controlling circuit has no current at normal status, it is unavoidable that the damage of sensors or the breaking of wires will be identified as normal too. This condition is not permitted. In the new system, we choose the normally close sort. If it is over temperature, the consistent input will transform from open to close which will be collected by PLC and then an alarming signal (output) will be sent to the corresponding magnet power supply. The second, we ever used temperature-collecting boxes (in the tunnel) not only for collecting but also for transition, controlling and displaying. It is obvious that such important functions was put together into the boxes especially in the tunnel as was very inconvenient for the person on duty. So in upgrading design, we use temperature collecting box only for collecting and transition. The other functions will be undertaken by PLC. And we place PLC and its other auxiliary parts in the Power Supply Hall. Furthermore, we enhance the function of MTPS. We achieve the interlock between this system and the power supply system. Only if the MTPS turns on, each power supply can turn on or else can not. We also set switches for transforming. If the switch is close, the corresponding power supply can run independently of the protection system, which means we can repair the two systems respectively. In order to resolve the problem of too many wires, we use 12p cables that reduce the number of wires greatly. At last but the most important, we use PLC as the substitution for old relay-controlling system. The following is the block diagram of arrangements:

Explanation:
J3, J2, J4: connectors
K: push button switches (for the independent repairing of the MTPS and the Power Supply system)
JA: intermediate relay (satisfy the different logic of power supplies)

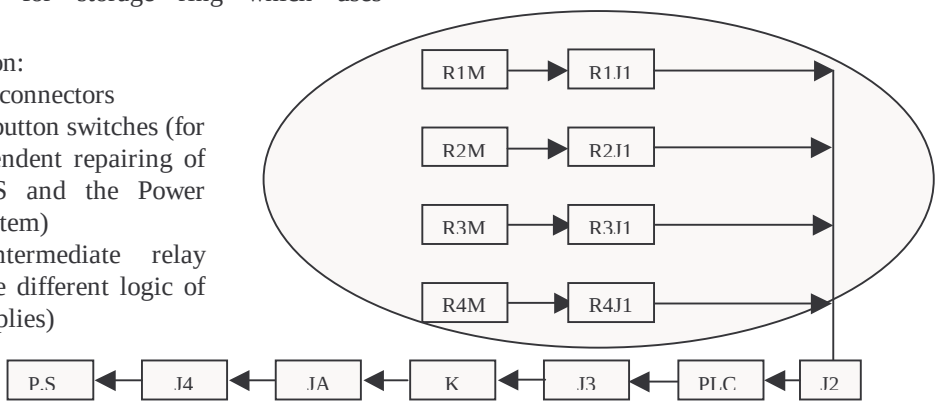

Figure 1: block diagram of arrangements

3 REALIAZATION

According to the requirements all outputs signals should be close under normal condition, but they will turn to open when abnormal (generally over temperature). Additionally, when the MTPS doesn't work or the whole system doesn't been used, we consider it as an abnormal status, and the power supplies can't be turned on. The program meets the demands perfectly. And we have set 10s which is dedicated to identify the over-temperature input signal is real or false. If there is an alarming signal, the person on the shift must dispose of the fault that means to examine the magnet temperature in the tunnel. After all the person must press the reset button at the end of disposal to release the self-locking signal. The flow chart is as follows: (Figure2)

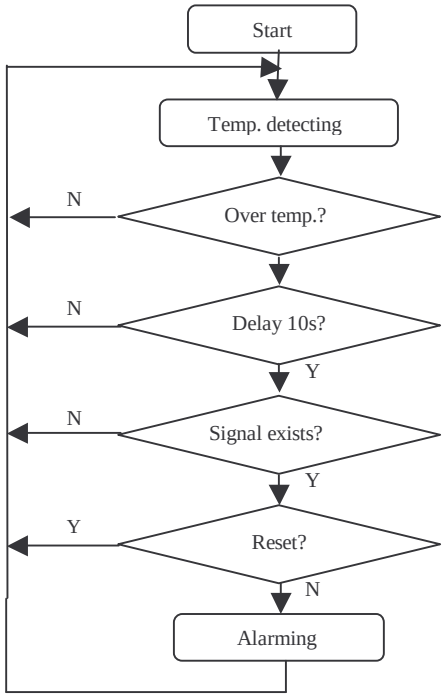

Figure 2: Flow Chart Diagram

4 CONCLUSION

The MTPS has been upgraded and tested by simulating inputs. The system was put into use in Oct. 2000. During a few months of running, the new system runs well and justifies satisfying the requirements.

REFERENCES

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[2] OMRON Corp. C200HX/C200HG/C200HE Programming Manual, July 1997.