Network for Beam about System

Takashi Ohshima, Hiroyasu Ego, Masahiro Hara, Yoshitaka Kawashima, Yuji Ohashi, Isao Takeshita

SPring8, Kamigori, Ako-gun, Hyogo 678-12, Japan

When heavy accidents, such as irradiation of synchrotron radiation (SR) to a vacuum chamber wall, a large vacuum leakage, etc., occur in a storage ring, the electron beam should be aborted immediately. One method to abort the beam is to stop the RF power supply to the accelerating cavities. We examined some candidates for network system for this purpose.

The requirements for this network are as follows;

(1) fast response within 2 millisecond to avoid meltdown of vacuum chamber when photon beam of an insertion devices, (2) sending data to four RF stations distributed on a 1.5km circumference, (3) reliability, (4) electrical isolation, (5) fail safe, (6) latching signals to easily find where trouble occurs, (7) cheep, (8) easy to maintain, etc..

We are thinking two types of network loop. One is a series of switches on a current loop. A 20mA current loop with relay switches is used widely in industrial use. But the response time of relay switch is around 20 msec and this value is rather slow for our purpose. A photodiode may be used as a switch. We tested a system with a photodiode PC817 (SHARP Co.). The circuit used in this test is shown in Fig. 1.

The constant current of 20 mA is generated from voltage regulator, the photodiodes are connected in series through a single wire cable. The delay time was measured with changing the cable length L between the interlock modules. This was 29 μsec and 36 μsec for L=1 m and 400 m, respectively. This means that the delay time of the interlock module is 29 msec and that of the cable is 20nsec/m. The delay time with a 1.5 km cable becomes about 60 μsec.

The other type of network is a sequential loop. We tested a system using coaxial wire and high speed photodiode (6N137 HP) as shown in Fig. 2. The delay time of the photodiode is 600 nsec and that of a cable is 6 nsec/m. The delay time with a 1.5 km cable becomes 10 μsec. We also tested using optical fiber and optical transmitter / receiver (HFBR1422 / HFBR2422 HP). The delay time of the optical transmitter / receiver is 120 nsec and that of the cable is 5 nsec/m. The delay time with 1.5 km cable will be 7.5 μsec.

We think the second type with high speed photodiode will meet to our purpose because of its response time and cost, and also because here would be many switches along the storage ring.

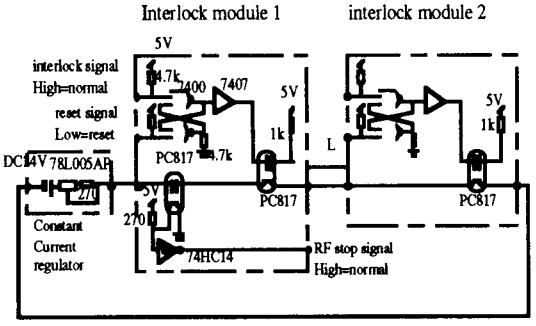

Fig. 1. Current loop with photodiodes

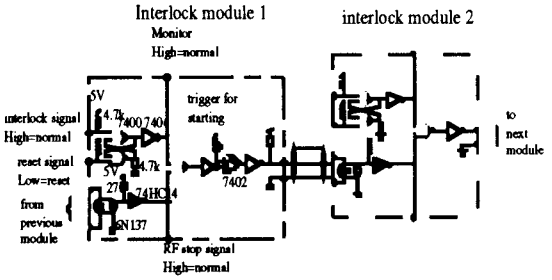

Fig. 2. Sequential loop with fast photodiodes