Beam Abort System for The SPring-8 Storage Ring

Takeo TAKASHIMA, Yoshitaka KAWASHIMA, Togo KUDO,
Takashi OHSHIMA, Tetsuya TAKAGI

SPring-8, Kamigori, Ako-gun, Hyogo 678-12, Japan

1. Introduction

In The Storage Ring, about 60 synchrotron radiation beam lines will be made. If troubles occur in the beam lines, electron beam in the storage ring must be aborted for protection the beam lines from the synchrotron radiation. And the electron beam must be aborted because of trouble of vacuum system and beam monitor in the storage ring, too. A method to abort the electron beam is to stop RF power in the accelerating cavities [1][2][3].

In order to abort the electron beam,we constructed Beam Abort System (BAS). This system consists of Beam Interlock Modules (BIM) that are mounted in 8 safety interlock racks around the storage ring.

2. The Beam Abort System.

Block diagram of the beam abort system is shown in Fig. 1.

The BIM has 9 beam abort inputs which are connected to devices with twisted pair cable and are isolated by a photocoupler or a relay.

To transmit abort signal to other BIMs, the BIMs are linked with optical cables. To simplify the circuit to reset, the BAS has 2 semiloops;one is CCW (counter-clockwise) link and another is CW (clockwise) link.
A BIM has a beam abort output which is connected RF station with twisted pair cable and is isolated by a photocoupler.

The safety interlock Programmable Logic Controllers (PLC) connected to the BIM can watch every status and can reset the held statuses .

When the storage ring is in no operation, the safety interlock PLC can disable a beam abort output of the BIM.

3. The Beam Interlock Module

Front panel of the BIM is shown in Fig. 2.

3-1. The beam abort input

As shown in Fig. 3, inputs from No.1 to No.9 are driven by the RS422 driver and isolated by a photocoupler (HP 6N137). And inputs No.8 and 9 can be driven by a point contact (relay), too.

Each input has a switch to disable the beam abort signal and 2 LEDs to indicate the status as shown in Fig. 2 : one LED named “interlock” indicates statuses of the beam abort signal and the other LED named "early arrival" means to finish sending an abort signal that the BIM sends out beam abort signal to other BIMs or the RF stations. The “interlock” and the “early arrival” are held the status by the BIM. These statuses and the switch statuses are sent to the safety PLC.

3-2. The link between the BIMs

Optical receiver is HP HFBR-2422 and optical transmitter is HP HFBR-1424.

Others are same as the beam abort input.

3-3. The beam abort Output to the RF station

The output is sent through RS 422 driver (TI 75158).

3-4. Reset the statuses

The held statuses are reset by the safety PLC or the reset switch on the front panel of BIM.

3-5. Status indicators on the front panel

"Interlock"	Time chart is shown Fig. 4.
Green :	normal.
Red blink :	change to abnormal.
Red :	reset but input is abnormal.
Green blink :	the switch is disable position.
"Early arrival"	
Green :	normal.
	Red : finish sending an abort signal that the BIM sends out beam abort signal to other BIMs or the RF stations.
"RF" output	
Green :	normal.
Green blink:	disable the output.
"CCW", "CW" output	
Green :	normal.
Off :	abnormal.

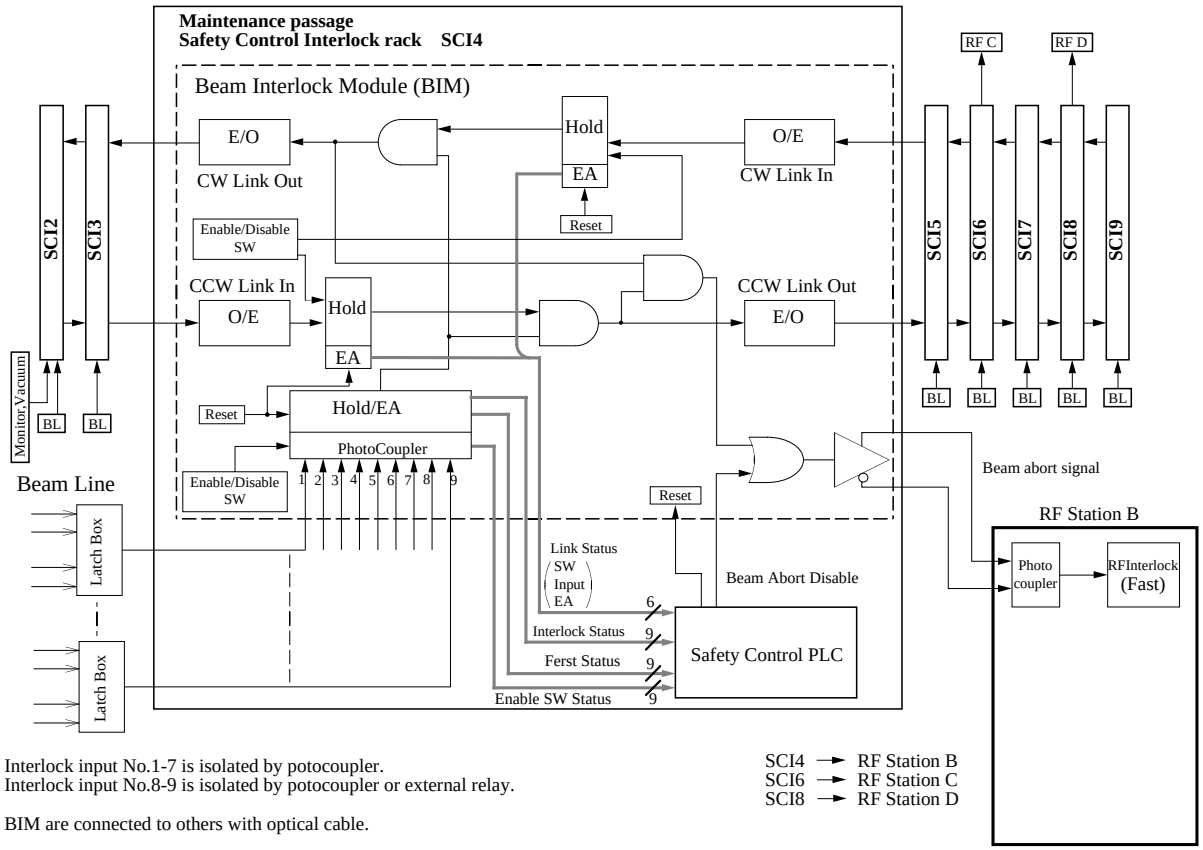

Fig. 1. Block diagram of the beam abort system.

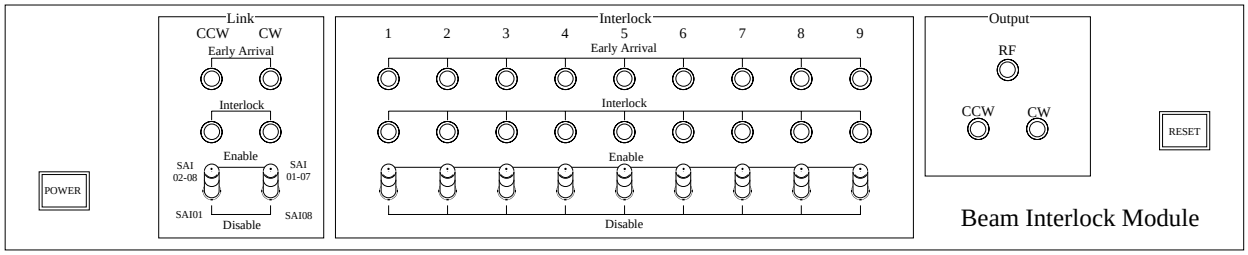

Fig. 2. Front panel.

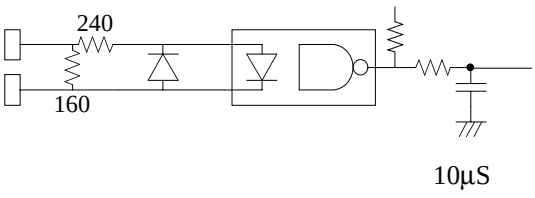

Fig. 3. Circuit of the beam abort input.

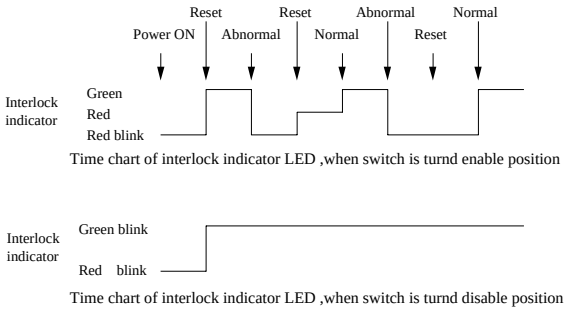

Fig. 4. Time chart of “Interlock” LED.

References

[1] Interlock System for the SPring-8 storage ring,SPring-8/94-1.

[2] T.Ohshima et al.,Network for Beam abort System, SPring-8 annual report 1994,p140.

[3] T.KUDO et al.,High Speed Interlock System for the SPring-8 Beam Line,SPring-8 annual report 1996.