COMPUTER CONTROL OF 500 MEV BEAM TRANSPORT LINE AT KEK, PART II
(MAGNET CONTROL SYSTEM)

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Abstract

The 500 MeV beam transport system between the booster and the main ring has been controlled only manually using KEK standard modules. However, these standard modules are designed to be linked to the computer control system. Recently the test for the operation through the computer system has been finished, and the test has been done successfully.

Magnets[2]

The transport line is about 50 m long, and this system consists of ten quadrupole magnets (Q1 $\sim$ Q10), two bending magnets (BM1 $\sim$ 2) and nine steering magnets (ST1 $\sim$ 9). Generally each magnet is connected to its own power supply, but exceptionally a group of quadrupole magnets (Q6 $\sim$ Q10) is connected in series to single power supply (Fig.1).

The output current of each power supply is regulated to the constant value, which is given as the external reference voltage by a heli-pot module near the power supply. In this module the reference voltage is produced by a potentiometer driven by a pulse motor, which is excited remotely by pulse trains from an UP-DOWN module in the manual manner or from the computer.[1]

Computer control[3]

This computer control system is shown in Fig.2. Responding to the commands from the central computer, the satellite computer (S-2) transmits the pulse train to the heli-pot modules and collects analog data of the actual output current of the power supplies. Process input/output controller of S-2 generates 200 Hz pulse train and up/down signal. Analog data of the power supplies are taken by a 12-bit A/D converter, 100 mV full scale, through analog input multiplexers. Status of every magnet also is taken by digital input units.

Result of the operation

The power supply is enough responsible to the reference voltage produced by the heli-pot module, which is driven by the pulse train at 200 Hz. The time length, which is required during a command, is dependent on the length of the pulse train of the command. The 0.1 % settling time of analog multiplexer filter is 0.4 sec. Total responce time of feedback loop is limited by the settling time and pulse count.

Reference

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2) Y. Arakita, et al., "The KEK booster to main ring beam transport system", IEEE Transations on Nuclear Science (June 1977), Vol. NS-24, No.3, pp 1464-1466.
3) T. Katoh, et al., "Computer System for KEK Proton Synchrotron", IEEE Transactions on Nuclear Science (June 1977), Vol.NS-24, No.3, pp 1789-1791.
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KEK, Part I", of this meeting.
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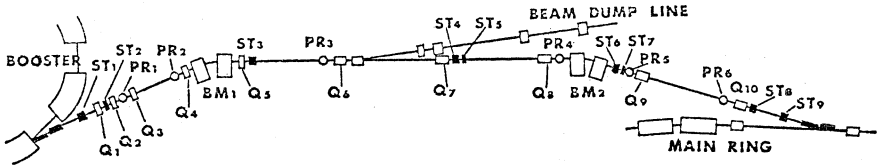
Fig.1 Beam transport line between the booster and the main ring. The elments indicated are Q=quadrupole magmet, BM= bending magnet, ST=steering magnet, and PR=profile monitor.
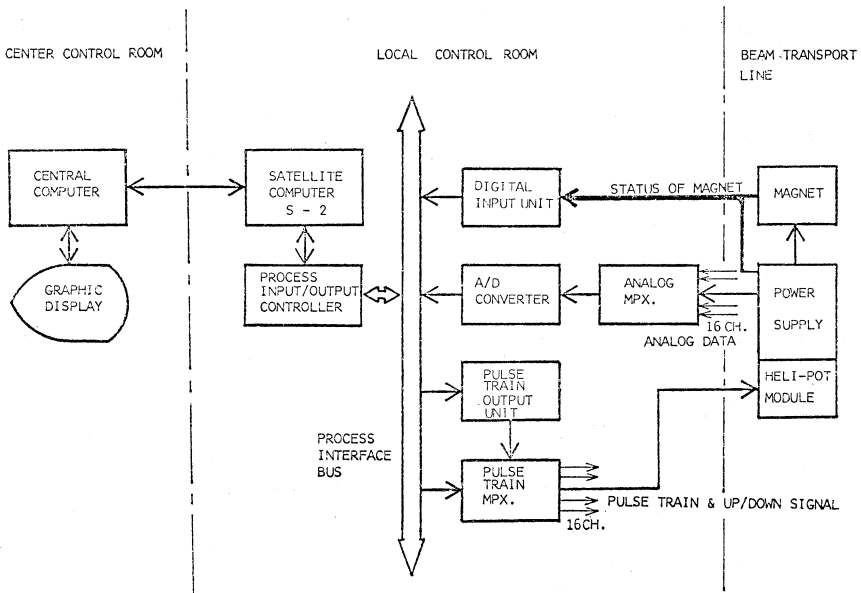

Fig.2 Block diagram of computer control system.