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Fast Spin State Interchange Control System

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We have developed the Fast Spin State Interchange Control System (FASSICS) to make the polarization experiments with polarized deuteron beam more effective and more accurate incorporated with polarimeters. The versatile system has been constructed at low cost by using a personal computer NEC PC-8801 and associated S-100 bus system.

With our polarized ion source (PIS) of the Lamb-shift type equipped with a spin filter, the spin state of deuteron beam can be changed by applying the modulating magnetic field $\pm$ 10G to the main magnetic field 575G at the spin filter. For the control of the spin state of the deuteron beam we supply the current to the modulation coil from a power supply, of which is controlled by external signals. The control signals of TTL level are converted to optical signals just outside PIS for the isolation.

The block diagram of FASSICS is shown in fig.1. Main part of the system consists of a 8-bit personal computer NEC PC-8801 and the associated S-100 bus system. The CPU of this microcomputer is Z80A-compatible running at 4MHz. The operating system CP/M (Microsoft) runs on this machine. The slot bus of PC-8801 is converted to S-100 bus by the S-100 bus interface. The system is constructed as modules of the " S-100 BUS " board of 138mm x 254mm in size, interconnected with 100 pin card connectors according to IEEE Task.696. The card rack and the power supply has been installed in a case for the standard rack. Several D-sub-connectors are put on the back panel of this case for the connection to the other I/O. The control module which installed the programmable devices:Z80A-PIO (parallel input/output interface controller) and Z80A-CTC (counter timer circuit) and the parallel input (6-byte) module are connected to the front panel. Each interval for the interchanging among the spin states and the period of a run can be arbitrary set by digital switches on the panel. The control of a run is also done by the push switches on the panel. The operating mode (timer or counter) of Z80A-CTC is selected by a switch. When CTC is in the counter mode, the digitized output from a digital current integrator ORTEC 439 which indicates beam currents is connected. The timing chart of FASSICS is shown in fig.2. The gate signals (TTL) corresponding to each spin state and the permit gate signal are generated to control the counting system.

The program has been developed by using the assembler MACRO-80 and the linker LINK-80 (Microsoft). The interrupt mode 2 of the Z80A-CPU is used for the interrupt of Z80A-CTC. Then the dead time is corresponding to the interrupt routine.

Usually the spin states are interchanged every few seconds corresponding to the preset counts of the digitized beam current integration. The dead time of about 100 msec is sufficient to complete exchange of the spin state. This system is also applicable for the experiments using the polarized proton beam with a rapid spin-reversal system in PIS.[1)]

References

1) H. Tanaka et al.: UTTAC-47 (1983) 9

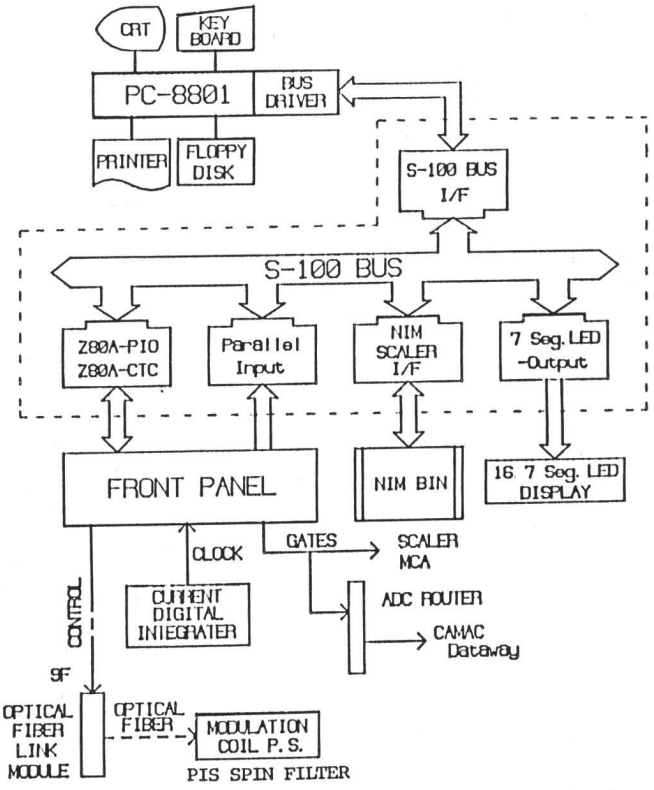

Fig. 1. Block diagram of the FASSICS.

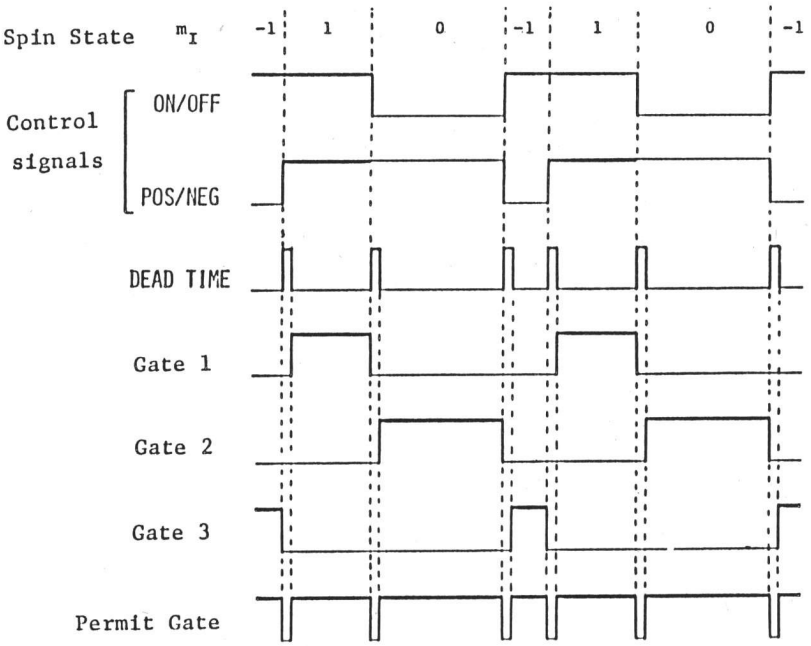

Fig. 2. Timing chart of the FASSICS.