Upgrades to the cyclotron computer control system

T. Cowden, F. P. Abegglen, R. Burch, and T. O'Berski

The Rabbit based microcontroller and base card have been designed to control Alpha power supplies configured with two sixteen bit ports, one to drive a DAC and the other to read an ADC. Since the introduction of the Rabbit embedded controller into the cyclotron computer control system, several benchmarks and improvements have occurred. Beam has been extracted from the K150 under computer control with only minor glitches. The Rabbit controller has been incorporated into parts of the K500 control system with prospects for replacing aging components and obsolete systems. The base board the embedded controller plugs into has been improved with buffered outputs and more inputs. A variation of the base board has been built to handle serial I/O, handling up to six serial ports. The infrastructure to support the embedded controllers has begun to be put into place.

Serial Rabbits have been put into use as remote vacuum readouts throughout the beam-line system. They have improved reliability and eased expansion over the old system. Some of the ion-gauge controllers have direct serial outputs and only require a serial line to the vacuum microcontroller. Older ion gauge controllers require a small parallel to serial card designed to imitate the serial ion gauge controller protocol. The system has been in operation for a year. The adapter card is useful in other applications as a bit status indicator. New power supplies with serial ports can be controlled with the serial embedded microcontroller with the addition of a relay card and a parallel to serial adapter card.

The standard model Rabbit controller base board used in the K150 trimcoil supplies has been improved with the addition of buffers to the parallel DAC outputs and a multiplexed status input to increase the number of status inputs from five to eight. This was necessary with the retrofit of a Rabbit controller in a large dipole power supply that is switched between several magnets. The microcontroller can now read what load it has been switched to. The DAC outputs are buffered for improved drive capability in future applications. A separate external multiplexer attached to the standard embedded controller allows one Rabbit to read and write to the Alpha quadrupole power supplies that consist of one supply and two separate outputs.

Other variations on the standard base board include some test models with the parallel DAC output replaced by an on board digital to analog converter, an isolated sixteen bit serial DAC that can swing from 0 to 10 volts. As the ADC input can be adapted to read a meter, this configuration can replace the STD Bus crate system that controls a majority of the power supplies currently in use. The use of an opto-isolated meter readback completes the electrical isolation of the controller.

Ethernet switches and the electrical boxes to hold them are being installed as needed to provide the network connections for the embedded controllers. The electrical boxes also contain a regulated power supply for the controllers. The central control nexus in the K500 control room has been upgraded with a 24 port ethernet switch to handle the extra ethernet connections. The improved connectivity allows some troubleshooting to include a laptop version of the control console to be plugged in where needed.

Upgrades to the rest of the system are in progress. A new wide screen flat panel display added to the control panel improves the look and feel of the control screens, but highlights the age of the workstation computers. A system to test the workstation upgrade is on order, with the need to bridge several computer generations of hardware and software of greatest concern. It is hoped that the hardware upgrade will pave the way for a general software upgrade at a later date.