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Multiplexer for temperature control in large detector systems

Temperature measurements play an essential role in controlling huge experiments. Using temperature sensors, one can monitor the operation of electronics within the system and detect possible faults, like overheating or, in worst case, fire. In order to work properly, sensors have to be scattered around the whole assembly, and data acquisition must be able to handle all of them.

Connecting each analog temperature sensor to its own analog-to-digital converter and reading all sensors at once is the simplest solution, although its cost increases with number of used devices. A different approach is to use only one ADC assigned to all sensors and use a switching device to measure temperature in many places one at a time.

This work presents the development of a multiplexer device for switching the sensors. The device consists of an 8-bit shift register driven by an AVR microcontroller. A prototype has been constructed and tested using a small test setup. The test uncovered several advantages and disadvantages of the multiplexing solution and contributed to the discussion comparing parallel, multi-ADC approach with single ADC, switching device option. The project was developed during International Student Practice 2017 in JINR, Dubna as one of possible solutions used in the Slow Control System for NICA Multi-Purpose Detector.

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