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SIMPLE MCA SUPPORTS A VARIETY OF APPLICATIONS

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Abstract

A greatly enhanced version of the Violinist I, Simple Multichannel Analyzer has been developed at Los Alamos. The new instrument includes a more powerful microprocessor, more memory, and a sophisticated set of I/O devices. The combination of these features allow the same basic electronics package to function in a variety of "smart" sophisticated monitoring instruments. Only the packaging, detector, and software need be changed to change the instrument from a field survey instrument for Pu contamination to a continuous air monitor to a neutron dosimeter. This instrument should spawn a new generation of user-friendly, highly effective instrumentation.

General Description

An enhanced version of earlier instruments developed at Los Alamos [1,2] combines a 256-channel pulse height analyzer with an advanced microprocessor. This combination allows for a much more powerful I/O and computational capability, thus allowing the use of this instrument in a variety of data acquisition applications as well as the portable field survey applications of the earlier instruments.

Hardware Description

The electronics are assembled on a single printed circuit board (Fig. 1) which is 4.5x6.5 inches (11.5x16 cm). This board contains everything necessary for operation except the display module and keyboard, which are usually mounted on the case. The electronics and software have been designed so that I/O devices not needed for a dedicated application may be omitted from the board to save power and manufacturing costs.

Since the device is primarily designed for dedicated applications and a variety of configurations, it is difficult to describe a "standard" configuration. Therefore, the following description is for a maximum system with the "Violinist" software package.

The block diagram is shown in Fig. 2. The input circuitry accepts a 10ns tail pulse. The input amplifier gain adjust allows pulse amplitudes of 50mV-500mV full scale. The input amp is followed by a 2 s shaping amplifier with dc restoration. This feeds a 256-channel Wilkinson ADC. The ADC is coupled to a microcomputer consisting of a NSC-8000 microprocessor with 2-8K of RAM and 2 12K of EPROM. I/O devices include a RS-232 serial port, an 84x32 dot matrix LCD, a 20-key keyboard, a real time clock, an audio cassette interface, an 8-bit DAC, and several single bit I/O ports.

Figure 1

Figure 2

The microcomputer accumulates data from the ADC in classic MCA fashion or in a multi-scale mode. The data are then processed by summing the integrals of the ROIs. The integrals are computed into rates and these values are used in a computation which results in a value which is displayed on the LCD. The formula used in this computation varies with the application. Currently, this formula must be programmed into the firmware. However, software currently under development will allow the device to be programmed similar to a calculator by the end user.

The power consumption is approximately 50mA at 6 Volts. The combination of low power consumption and small size makes this instrument useful in portable applications such as the Violinist [1] and as a replacement for the electronics in the portable beta spectrometer [2] instrument. The I/O capabilities make it useful in fixed data acquisition systems such as continuous air monitors (CAMs), criticality monitors, and fencepost monitors around nuclear power plants.

Software

It is expected that the software will be tailored for the specific application. There are several versions that have been written so far. The most elaborate is for the Violinist application. It uses menus to guide the operator through the setup of the instrument. When it has been set up, it can run in an automatic or manual mode with readout of the data via a prerecorded parameters tape from the cassette.

A simpler software package was developed for a medical application which had a very narrow operational requirement. It needed only the data acquisition and output routines. Setup and control were handled entirely through the RS-232 port. This version did not require a display or keyboard. The instrument then became a peripheral device for an IBM personal computer.

A software package currently under development will allow the device to be programmed similar to a programmable calculator to allow the maximum in versatility.

Application

The instrument has currently been incorporated into a plutonium contamination survey instrument. Application software and hardware is being developed for an alpha-in-air monitoring system (CAM), a portable neutron dosimeter, and a beta dosimeter. The instrument will be interfaced in the near future to a microwave ranging and tracking system [3] for doing rapid, accurate surveys of contaminated areas.

Summary

The applications mentioned above show the inherent versatility of this new instrument. It combines the portability of simpler SCA based instruments, a microcomputer to analyze data, and a complete MCA/MCS analyzer. This allows much more sophisticated processing of data in situ than previously available. This is then combined with sophisticated I/O for interfacing to computerized systems for data acquisition and processing and control of other devices (i.e. HV supplies). Instruments like this should serve as the basis of a new generation of radiation monitoring instrumentation.

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