USE OF A MICROPROCESSOR IN A REMOTE WORKING LEVEL MONITOR*†

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Various investigations in an experimental uranium mine demand an instrument which measures short-lived radon-daughter concentrations and the working level (WL) in sealed chambers with potentially high radiation levels (up to 2000 WL). Using the "Instant Working Level Meter"[1] concept, we have designed a remote working level monitor (RWLM) to perform these functions.

The RWLM shown in Fig. 1 consists of two remote sensors, located in sealed "hot chambers" in the mine, a processing and control system located near the mine entrance, and the required interconnecting cables. The remote sensors contain a detection system, an air sampler, a filter paper transport mechanism, and control electronics.

The detection system uses a surface barrier detector for alpha-spectroscopy and a plastic-scintillator-photomultiplier-tube assembly for beta counting. Using standard spectroscopy, including level discrimination and single channel analysis, the RaA and RaC' pulses are separated and digitized.

The filter paper transport moves a sample from the collection port to the detectors. This motor-driven mechanism is activated by a command from the microprocessor. One sensor has enough filter paper to allow up to 200 samples or, if desired, one sample per hour for eight days. The minimum timo between samples is six minutes. The flow rate is controlled by the microprocessor through pump speed control. The normal flow rate of 10 liters per minute is automatically reduced when extremely high working levels are encountered. A signal cable and a multiconductor power cable (both 500 ft long) connect each remote sensor with the microprocessor.

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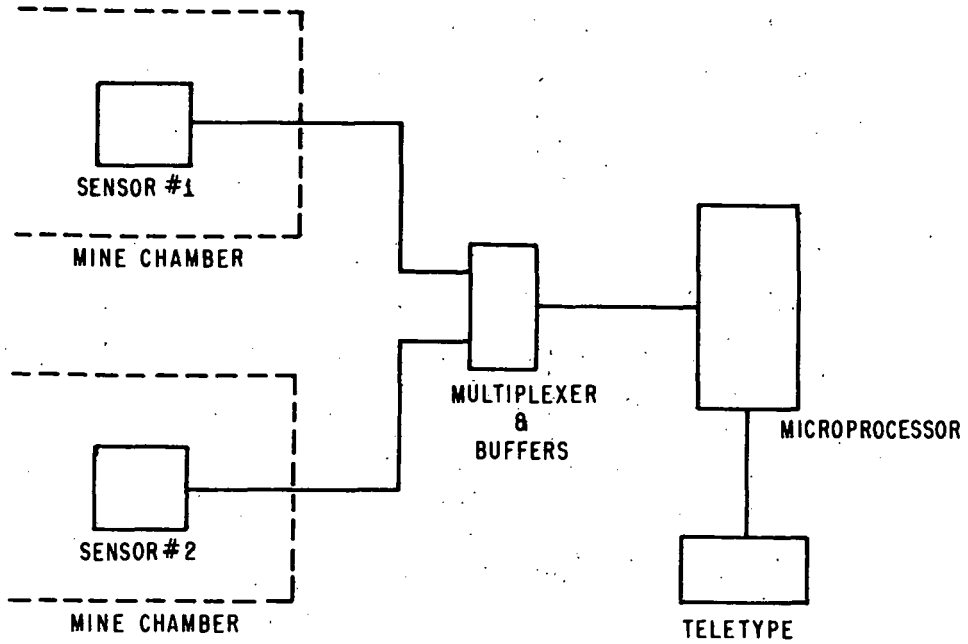

FIG. 1.--Schematic diagram of the Remote Working Level Monitor.

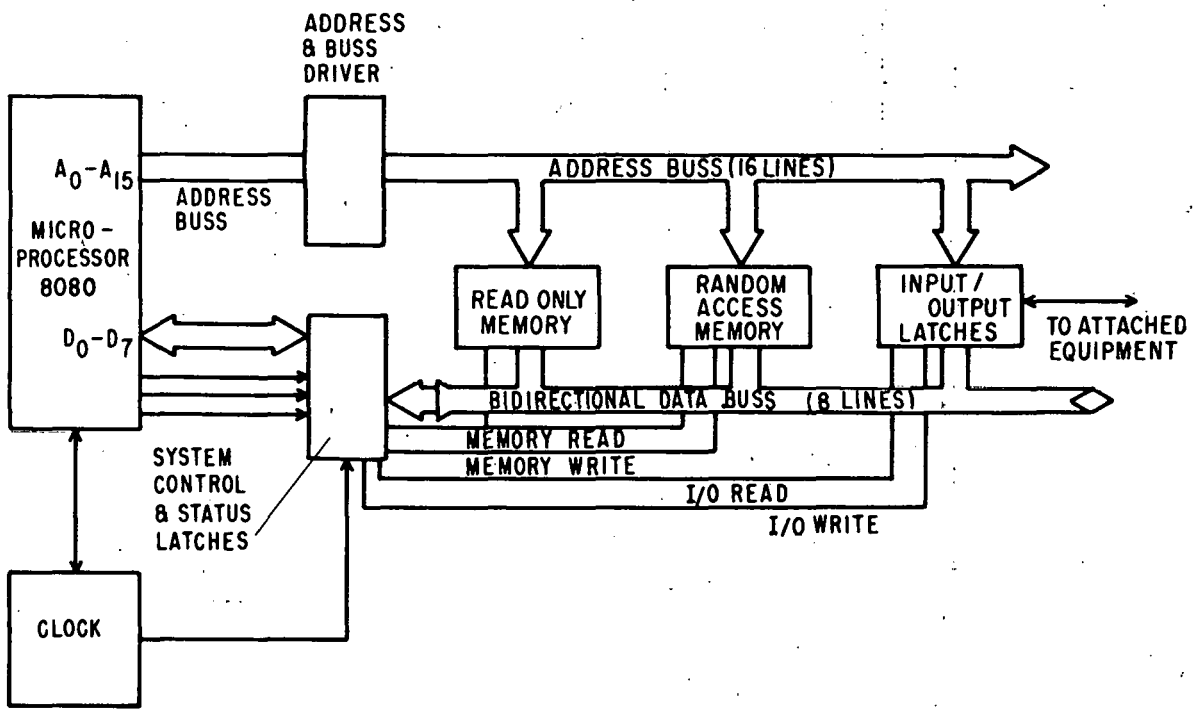

FIG. 2.--Block diagram of the microprocessor.

The control and data processing unit (CPU) consists of an eight-bit N-MOS microprocessor (Intel 8080) with its required ancillary devices mounted in a National Instrument Module (NIM). The organization of the processor is shown in Fig. 2. It consists of the CPU section with its associated clocks and latches, a read-only memory (ROM) section which stores the fixed program, a random-access memory (RAM) section where computations are performed and operator changes to the main program are stored, the input where the multiplexed count data and the operator commands are read, and an output section which drives the system printer, and status indicator lights.

Details of the counting system, the programming of the microprocessor and solutions to problems of adapting the microprocessor to standard NIM modules will be covered.

Reference

1. Groer, Peter G., Donald J. Keefe, William P. MaDowell, and R. F. Selman. An instant working level meter with automatic and individual Rn-daughter read out for uranium mines. Proc. 3rd Int. Congr. Int. Radiation Protection Assoc., Washington, D. C., Part II, Sept. 1973. USERDA Report CONF-730907-P2, pp. 950–956.