

INTERFACING WITH A DMM by Jim Beatty*

Interfacing an instrument to a microcomputer could be a major chore if one chooses to build an analog to digital converter and the necessary power supply. Building and testing of the A/D converter can be a useful educational experience. But, for a busy teacher at a liberal arts college or a research scientist, purchasing a digital multimeter (DMM) with an IEEE-488 option is often more sensible.

The DMM approach can be economical and is versatile. A DMM is well protected from overloads and other potential abuse. There are no long delays encountered when waiting for parts. Connecting the DMM to a microcomputer is as easy as plugging in a disk drive. Test data can be collected within the first hour. A physical chemistry experiment introduced last year at Ripon College illustrates how useful and simple an interface can be. Explanations are given below for some of the decisions which were made.

The hydrolysis of tertiary butyl iodide in aqueous ethanol was selected because the reaction is too fast to be followed conveniently by classical methods (half-life of the order of 5 minutes) and it is slow compared to the sampling time of the DMM (2.5 readings per second) and associated equipment. The hydrolysis was followed by measuring the conductance of the solution using a dipping type conductance cell and a Yellow Springs Model 32 conductance meter. The YSI meter was selected because it had a 0 to 2 volt recorder signal directly proportional

to the conductance reading. The solution was stirred using an air driven magnetic stirrer in a constant temperature bath. The reaction vessel was a graduated cylinder. A Keithley 179A 4 1/2 digit multimeter with an IEEE-488 option was connected to the recorder outputs of the *conductance* meter. A Commodore 8032 *was* connected to the IEEE output of the multimeter using a cable purchased with the meter. A BASIC program about one half page in length was used to collect and store the data in a disk file, and print out a back-up copy of the data.

The BASIC statements given below collect N data from the DMM at time intervals DT seconds apart.

```
100  REM DT = TIMN INTERVAL IN SECONDS, N = NUMBER OF POINTS
110  DT = 30
120  N = 60
130  T(0) = 0
140  OPEN 1,24
150  FOR I = 0 TO N
160  REM TI IS COMPUTER TIME IN 1/60 SEC
170  IF TI/60 < T(I) THEN 160
180  INPUT ,tP 1, V(I)
190  IF ST = 2 THEN 180
200  PRINT T(I), V(I), TI/60
210  T(I+1) = T(I) DT
220  NEXT I
230  CLOSE 1,24
```

ST is the status bit in the above program. The program remains in a loop until data is received.

Students were advised to make a sample run and then to modify the program to take an optimum number of data points. The students were asked to modify a least squares program so that it would load the disk file and determine the order and rate constant.

There is a definite advantage in using an IEEE parallel bus over an EIA-RS-232C serial bus. The EIA *serial* bus requires the matching of Baud rates and everyone seems to use a different level of EIA. Keithley recently made available a 5 1/2 digit multimeter at roughly the same price as for the 4 1/2 multimeter I purchased.

A copy of the laboratory experiment may be obtained from the author on request.

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