Bulletin of Electrochemistry Vol. 2(4) July-August 1986, pp.437-439

MICROCOMPUTER BASED MEASUREMENT SYSTEM

S BIRLASEKARAN, R KALIDOSS, A THIRUMALAI PARTHIBAN and S CHANDRASEKARAN
Central Electrochemical Research Institute, Karaikudi-623 006.

ABSTRACT

The details of interfacing a microcomputer witha microprocessor kit for data acquisition and data analysis are briefed. The experimental results on these cases are presented.

Key Words: Microcomputer, microprocessor kit

INTRODUCTION

The application of automated test system has been increasing rapidly in recent years [1-3]. Advances in computing technology have spawned this new generation of automated analytical instrumentation. Transfer of data from instruments to microcomputers which are capable of graphic and database manipulation is very much essential for analysis and prediction. Thus microcomputer becomes an integral part of either control, data acquisition or data reduction.

The automation of such a system can present serious interfacing problems, which are time consuming and costly to solve. In this laboratory, a preliminary attempt has been made to interface a 8-bit Z-80 microcomputer system (Data Wealth, India) with two output ports and a data acquiring Intel-8085 microprocessor kit. Very encouraging results have been obtained. In this communication, the salient points are highlighted.

FUNCTIONAL DESCRIPTION

The general layout of the measuring system is shown in Fig.1.

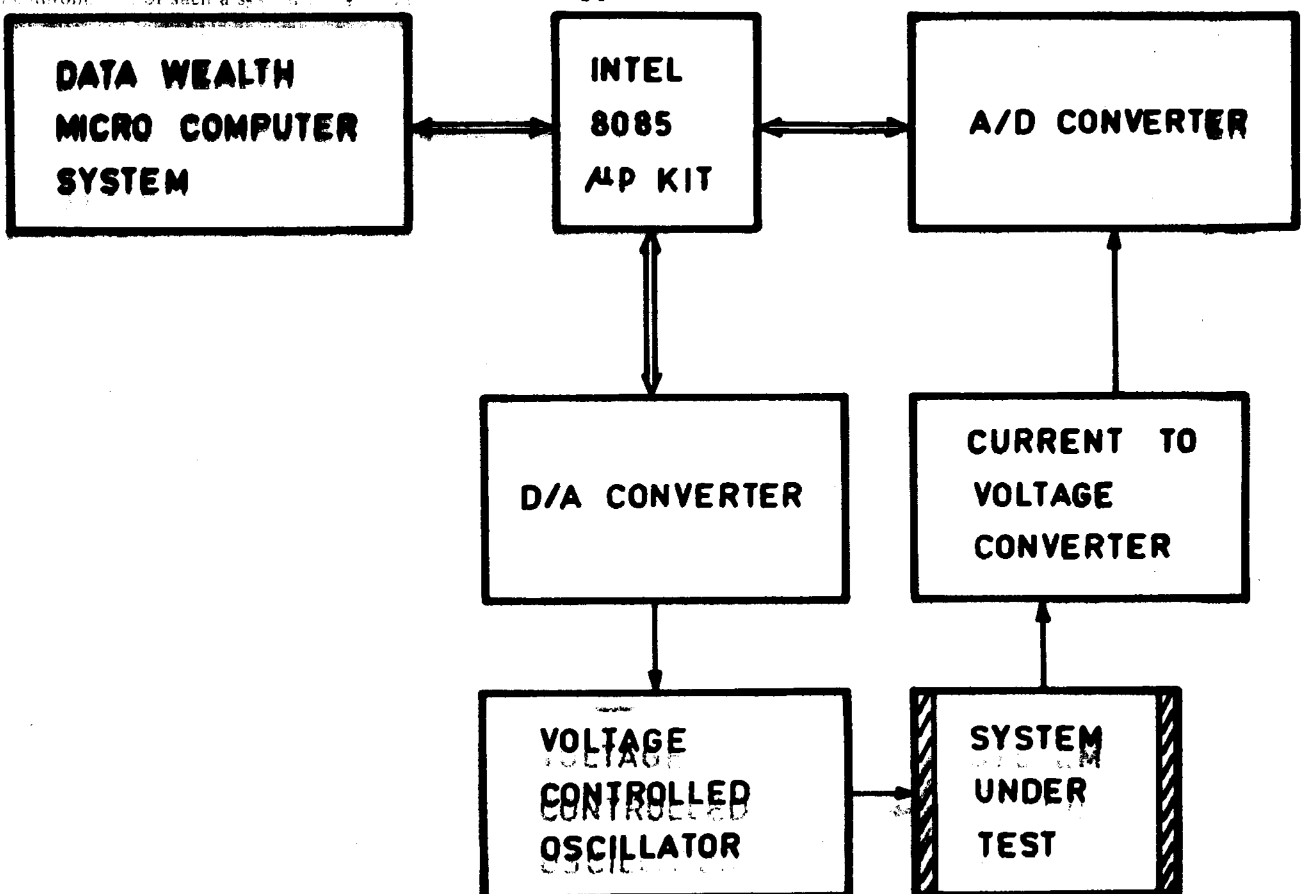

FIG.1 LAYOUT OF THE MICRO COMPUTER BASED MEASURING SYSTEM

The right hand side of Fig.1 forms the measuring end of the system. It consists of Intel 8085 kit to acquire and transfer data to peripheral devices, D/A converter to translate digital inputs to analog control output, VCO to generate ac signal of frequency controlled by the input voltage, measuring system, a current-to-voltage converter to read the response from the system and A/D converter to convert analog output to digital input. Intel 8085 mircroprocessor kit collects the current response for various programmed frequencies and stores them in its ram locations. The left hand side of Fig.1 forms the analysing and displaying part of the system. viz. microcomputer system.

The sequence of measurement is listed below:

i) Initialization and initiation sequences for the selected mode of measurement. This is mainly written in high level language in the microcomputer in an interactive mode for more flexibility, viz (a) fixing up the range of frequencies, (b) accuracy limit etc.

ii) Transfer the appropriate measuring software in machine language from microcomputer file to the ram locations of the microprocessor kit.

iii) Data acquisition by the microprocessor kit as per the loaded program (Step-2)

iv) Transfer of the acquired data from microprocessor to microcomputer.

v) Analysis and proper display of output from microcomputer.

The complete series of programming has to be done in both machine and high level languages and they are executed sequentially using CP/M commands in an automatic way. Programmes for data acquisition and analysis in three electrochemical measuring systems have been written and the results are presented in figures 1 to 3.

IMPEDANCE/CYCLIC VOLTAMMOGRAM/ CHRONOPOTENTIOMETRY

A.C. Impedance measuring system

Fig.1 briefs the measurement system. Initial parameters on range of frequency bit selection etc. are keyed in microcomputer. Microcomputer works out the dc voltage required for generation of such frequencies from VCO characteristics data which had been keyed in earlier. The computed data and machine language programme to do ac impedance measurement are transferred from computer to the microprocessor kit. Microprocessor collects the data on impedance and phase for each selected frequency and stores it in its RAM. At the end of it, hand shaking between computer and microprocessor is initiated to transfer data on impedance and phase from microprocessor RAM to microcomputer memory.

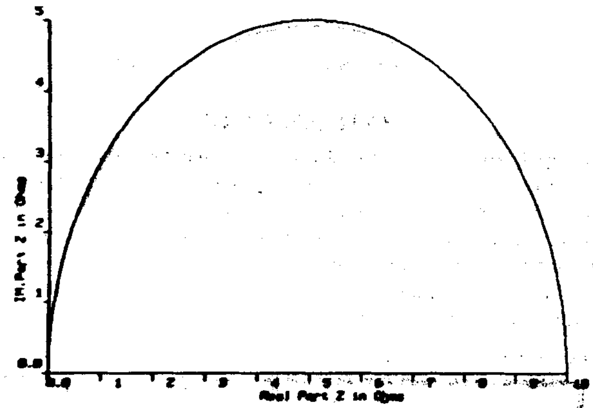

Fig 2: Graphical plot of impedance diagram

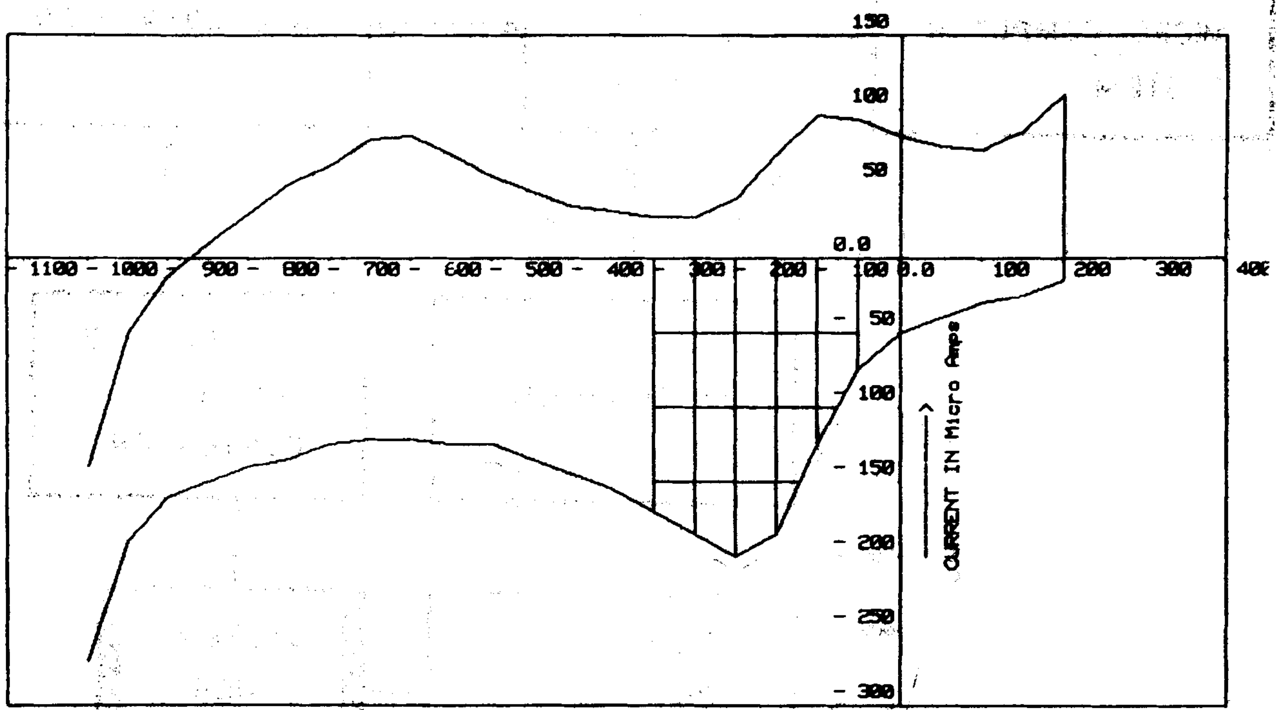

Fig.3: Graphical plot of cyclic voltammogram

COMPUTED AREA BY DIGITAL INTEGRATOR = 403 uC; BY MANUALLY MEASURED = 400 uC; BY COMPUTER = 408 uC

Microcomputer high-level basic programme fits a semicircle to the impedance results after evaluating the real and imaginary parts. It gives out the radius and centre of the fitted circle. Corrosion rate in terms of polarisation resistance or any other evaluation of kinetic parameters using the above results could be done by adding software. Graphical plot of the result obtained for a simple passive RC network is shown in Fig. 2.

Cyclic Voltammogram-set up

Initial conditions on sweep rate, peak magnitude of the traingular wave and dc bias could be programmed in a digital function generator [4,5]. otherwise a conventional analog function generator could be preset and actuation signal may be issued from microprocessor kit. In the latter case, computer acts as a transient recorder. Using two A/D converters, the analog signals on voltage and current from potentiostat are digitized and stored in RAM of microprocessor. At the end, microprocessor and computer handshake and transfer the data to a file memory in computer. Any processing of the waveform like programmable integration could be done more precisely now [6]. The acquired data is plotted using MAKEGRAPH utility programme as shown in Fig. 3.

Chronopotentiometric stripping analysis

The data [7] is loaded into the microprocessor. Transferring the data into the microcomputer, differentiation in high level language has been done to evaluate trace concentrations of cobalt and nickel in the water sample. The peaks could be seen clearly in Fig. 4.

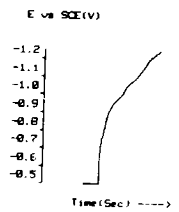

Fig.4(a) Experimental results [7]

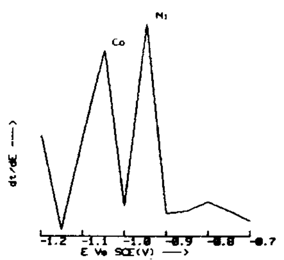

Fig.4(b) Graphical plot of (dt/dE) vs ***potential*** [*E*] ***output for*** *chronopotentiometric stripping analysis*

CONCLUSION

In this paper, the preliminary results obtained in an automated microcomputer based measuring system is reported on three typical cases. The main advantage viz the production of completely analysed electrochemical results is described. Further details on hardware and software will be published shortly.

Acknowledgement: The authors thank Sri Y Mahadeva Iyer, Head of Electrochemical Instrumentation Division for his interest in this work.

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