

MULTICHANNEL MEASUREMENT MODULE UNDER MS-EXCEL CONTROL

Marin B. Marinov, Todor S. Djamiikov, Svetla P. Matova
Technical University – Sofia, FEET, Electronic Engineering Department
e-mail: {mbm|tsd|smatova}@vmei.acad.bg

ABSTRACT

The usage of personal computer has entirely changed the architecture of measurement and automation systems. It puts aside the vendor-defined instruments and enforces the PC based instruments with flexible software defined measurement functions. As a result, user can combine general-purpose measurement hardware with PC and create a measurement system tailored in software to meet the specific problem depended tasks.

At the present days, the work with PC is concentrated more and more in bounded circle of MS-Windows based programs. But to solve specific problems, in the area of measurement it is much and more widely used specialized software, provided basically from the hardware manufacturers and depending on different standards. Frequently users are required to solve problems connected with compatibility of different programs and to translate the stored data between distinct formats. As it is well known the last one costs much more time, nerve and sinew.

In the present work it is proposed a solution of this problem, which is based on the simple idea, that specialized measurement hardware could be managed directly of standard Windows software. The measurement results can be formatted in simple manner in text and tables.

1. INTRODUCTION

At the present days, the work with PC concerns in more and more bounded circle of MS-Windows based programs. But the solution of specific problems, in the area of measurement, widely spread utilizes specialized software, provided of hardware manufacturers in dependence of different standards. Frequently the desire of users to solve problems connected with compatibility of different programs causes translation of stored data between different formats. Out of doubt, the latter costs much more time, nerve and sinew.

The present work represents a variant of solution for such kind of problems, based on the simple idea, justifying the possibility to manage specialized measurement hardware directly, via standard Windows software. As a result measurement results can be manipulated in simple manner as text and/or tables.

The key term, in solution of explained problem, is to use the macro commands, which improve some properties of conventional programs. This opportunity is rarely used yet and, which is more, is not well known from the wide circle of users.

Office-programs MS Excel and MS Word are widely used and have become a standard. They provide big opportunities to be supplemented and fashioned to individual users needs, in addition of basic functions. The main role is set to enlargements realized in own written macros. The macro commands are developed in Visual Basic shell, and actually form Standard Visual Basic upgrade. This standard requires minimal amount of MS Visual Basic knowledge and utilizes macro programming.

This approach can be used in the environment of compatible/similar office programs, such as Star – Office, Lotus Notes, etc.

2. MULTICHANNEL MEASUREMENT MODULE “MMM-1”

2.1. HARDWARE IMPLEMENTATION

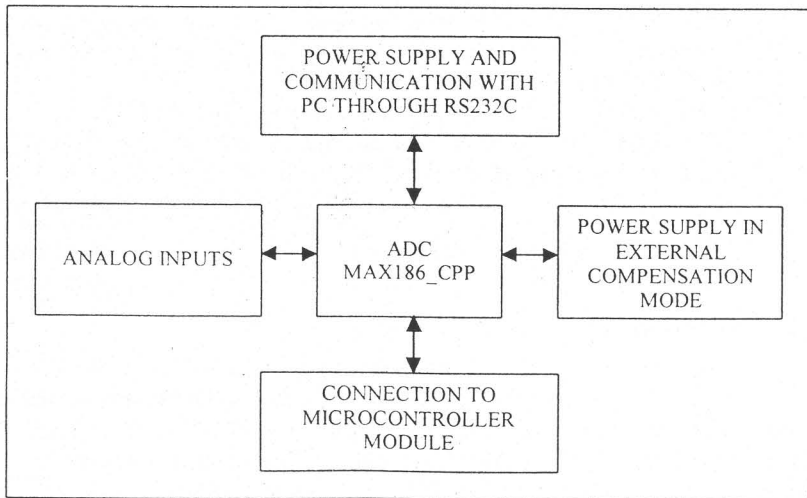


Fig .1. Block-scheme of MMM-1.

In the implemented scheme an ADC is MAX186_CPP, which is 12-bit data-acquisition system combining an 8-channel multiplexer, high-band-width track/hold,

and serial interface together with high conversion speed and ultra-low power consumption. MAX186 operates in single +5V supply or dual $\pm 5V$ supplies. Its analog inputs are configurable for unipolar/bipolar and single-ended/differential operation.

The implemented scheme is divided into two functional parts - for direct connection with personal computer, and one for connection with microcontroller module. Jumpers (JU1-JU11) accomplish the division.

The direct connection with PC realizes through serial interface RS232C, via standard coupling DB9. The voltage on outputs of the interface is $|12V|$ but on inputs - $|5V|$. Circuit's power supply gets from the interface line TxD, being fixed in BREAK mode. A level converter L7805 is connected to the line. On its output a necessary positive supply voltage (+5V) is received.

A clock signal for circuit comes from DTR interface line and with its assistance along RTS line data is clocked into MAX186. Serial data are read along CTS line. The output of A/D converter is monitored through DSR line, to identify conversions end.

The ADC has ability to work in different modes, which are assigned by giving a serial control byte. A conversion can be fulfilled with internal or external clock signal. When external clock signal is chosen, the successive-approximation conversion is synchronous for data receiving. Because of the assumption that, symmetrical clock signal must be guaranteed, not being lower than 100kHz. Other wise accuracy grows worse because of droop on internal sample-and-hold capacitors in the MAX186. Using a program control in different environment does not allow reaching the necessary frequency. The reason puts, for direct interface line control was chosen the internal clock mode. The clock signal, pulsed from PC, controls only data exchange, and can vary into broad limits (up to 10MHz).

2.2. SOFTWARE PROVIDENT

A developed program provident has two levels - high and low. The high level is realized in an environment of MS Excel 7.0. MS Excel is a program for electronic tables that is able to accomplish arithmetic operations, sorting, chart drawing, analyses, and represent text and numbers through them. It also includes a variant of Visual Basic.

The low level of the program provident is supported from Dynamic Link Libraries. There are developed two different releases of the same library - one 16 - bits under Windows 3.x and one 32-bits (Windows 95/98/NT - compatible). Excel performs macros slowly, and also there are no procedures and functions for direct PC ports control. DLL provides appropriate functions for necessities of peripheral module; the key term is Windows looks at RS232C as fail.

The next functions from DLL are used:

OPENCOM- opens serial interface;

- CLOSECOM- closes serial interface;
 - DELAY- defines delay in work, a period of insensitiveness;
 - TIMEINIT- sets an internal clock;
 - TIMEREAD- the time, elapsed from setting TIMEINIT;
 - work with serial interface lines-
- DTR, RTS, TXD- switches over output lines of the serial interface;
 CTS, DSR, DCD- reads state on input lines of the serial interface.

3. EXPERIMENTAL RESULTS

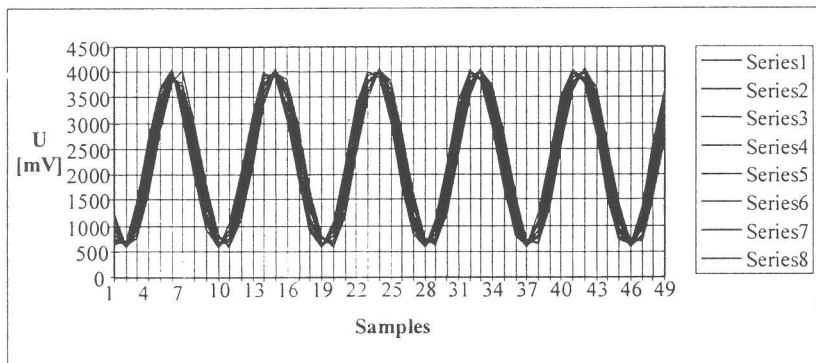


Fig.2. Converted from MMM-1 signals on the eight channels, with an input signal frequency 10Hz.

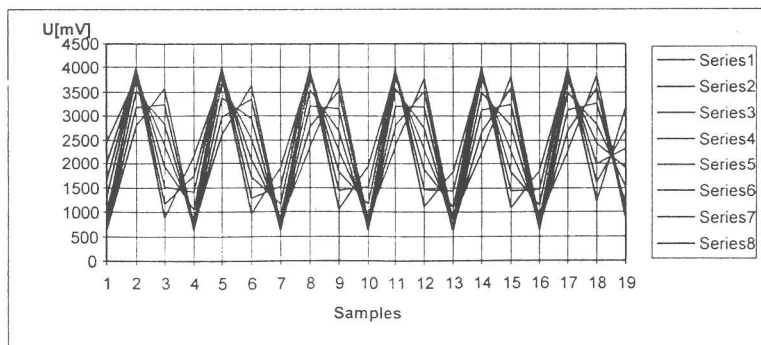


Fig.3. Converted from MMM-1 signals on the eight channels, with an input signal frequency 30Hz.

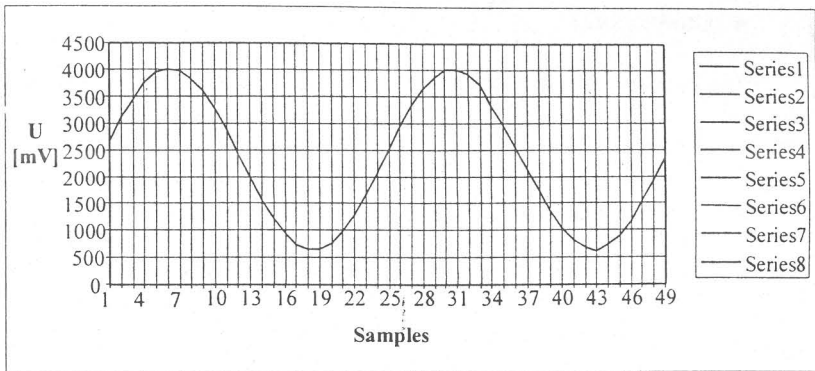


Fig.4. Converted from MMM-1 signal on a one channel, with an input signal frequency 30Hz.

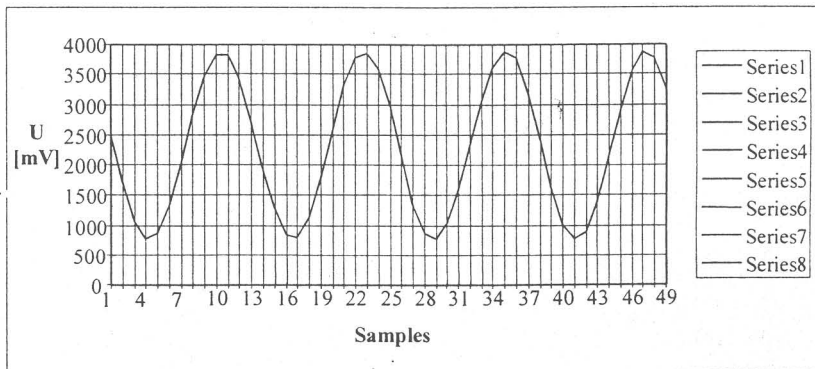


Fig.5. Converted from MMM-1 signal on a one channel, with an input signal frequency 60Hz.

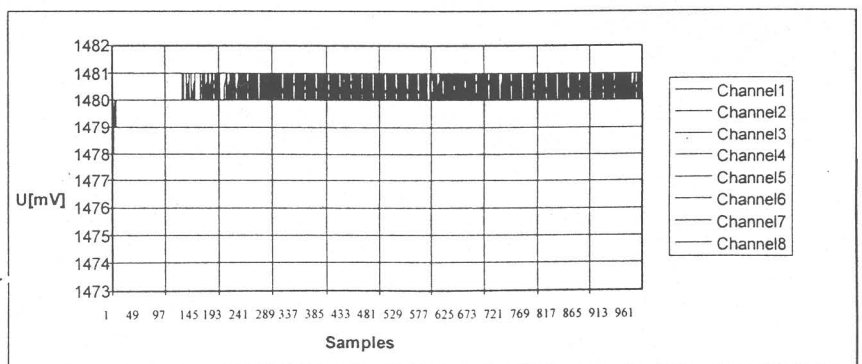


Fig.6. Battery measuring (1.48V).

4. CONCLUSION

The measurement module, described above, owns simple construction and is very easy to use. It is suitable for use in industrial and field conditions, and the only presence of a personal computer or a laptop with free serial port is enough.

The developed Multichannel Measurement Module suits for constant or slowly varying signals measuring – approximately up to 10Hz, when the eight analog inputs are converted together, and signals with frequency up to 60Hz, when only one input is processed. Such signals can be received from sensors reflect behavior of comparatively slow processes – temperature variation, pH etc.

The Multichannel Measurement Module “MMM-1” is already in use for tuition students on disciplines “Measurement in Electronics”, “Sensor Schemes” and “Electronic Systems for Ecological Control”.

5. LITERATURE

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