CONTROL BOARD FOR CATHODE ETCHING

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ABSTRACT

This paper covers control board for cathode etching. This device is designed in order to analyze and control optimal cathode etching cycle. Main function of this control board is control position system, measure etching current and control cathode etching cycle.

1 INTRODUCTION

Cathode etching cycle is complicated physical process. For measuring and control this process is designed control board. Control board allows us to set all parameters of etching cycle, measure main variables and storage trace of etching cycle for latest evaluation. This storages data is necessary for improving etching cycle and as a result better and more accurately cathode.

Programmable setting of parameters of the cathode etching system is realized by communication with a personal computer. The personal computer is applied for more accurate analyzes of measured values of current, temperature and plunge position in etching bath. Analyzed data are most valuable for finding optimal etching process improving cathodes etching accuracy.

2 DESCRIPTION

The control board hardware consists of several functional blocks. Its essential block diagram is shown in Fig. 1. Control part is realized by an ATMEL T89C51CC01 microcontroller and its supporting peripheries (eg. reset circuit with a HC132D fast Schmitt flip-flop circuit). Another function block contains the power supply part. The first power unit block supplies the microcontroller and the digital part of the on-board computer. The second power unit block is symmetric power supply for analog and measuring part of the control board. The third power unit block supplies position system drive and the last power supply block is used for creating etching current.

For setting cathode position distance in etching bath is used electric motor and slow motion screw. The motor is drive by two optical sensors, which produced two analog phase shifted signals. This signal is conversed by flip-flop circuits to digital signal, which is processed in a four 4-bit up/down counters. In the counters is stored actual position of etching cathode. Accuracy of this position system is 100um.

Electric drive is controlled by two relays for slow movement up and down. This relays is operated by microcontroller in dependence on actual position and executing task.

Communication between the control board and a personal computer is realized by serial bus RS232. The user can manage etching process through control program in PC.

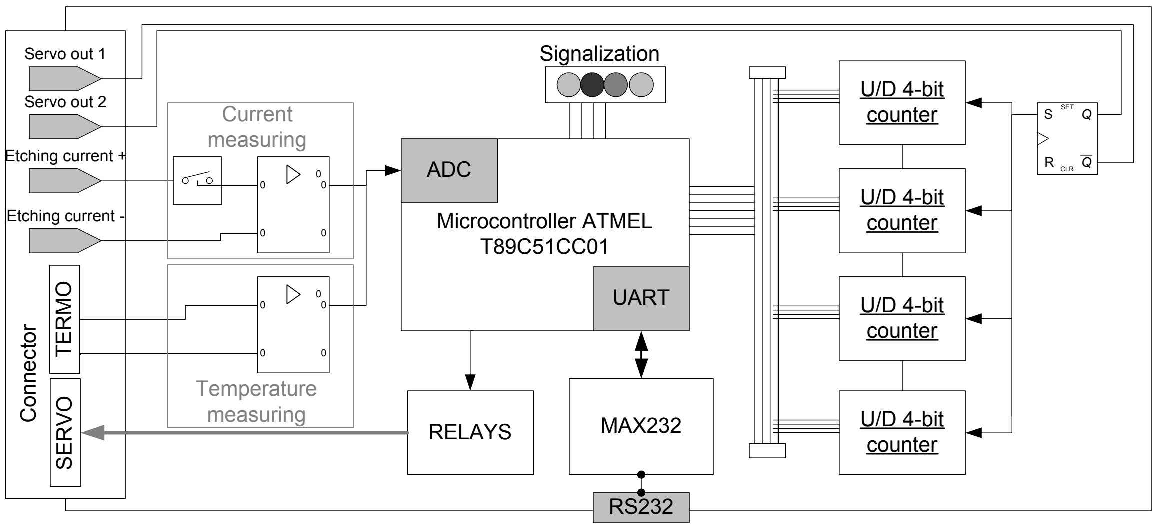

Fig. 1: *Block diagram of the control board*

3 REALIZATION

The control board was designed with emphasis to simple engagement and maximum usage of microcontroller performance. It was designed and produced in several prototypes. An ATMEL T89C51 microcontroller completed with some discrete components an external A/D converter realized the first prototype. Insufficient conversation accuracy and long reaction time caused the following changes moving the microcontroller type to an ATMEL T89C51CC01 microcontroller, completed with rebuilding the whole engagement.

The second type of the on-board computer was realized exploiting surface-mounted devices, the ATMEL microcontroller and additional position controller system. The circuit diagram was simplified and resulting realized board is more smaller then the previous one.

Final type of this board is in production now, but photography of this board will be presented later.

4 SOFTWARE

The first version of software accessories was written in assembly programming language. Complexity of following software versions requested better evaluation tool for larger projects. That’s reason why the second version of software for the on-board computer was created in KEIL C51 C++ development environment.

Main software measures etching current, temperature of etching bath and controls etching time and actual position. Measured data are stored in memory for continuous analyzing.

The communication with PC via serial port is serviced by a subroutine for interrupt handling. This interrupt is invoked when initializing bit is received. This subroutine sends all measured data to the computer for final evaluation.

The software for PC was written in Borland Delphi evaluation tool. This service program can set all necessary parameters. Another possibility is to collect data from the control board. Main window of this program is shown in fig. 3.

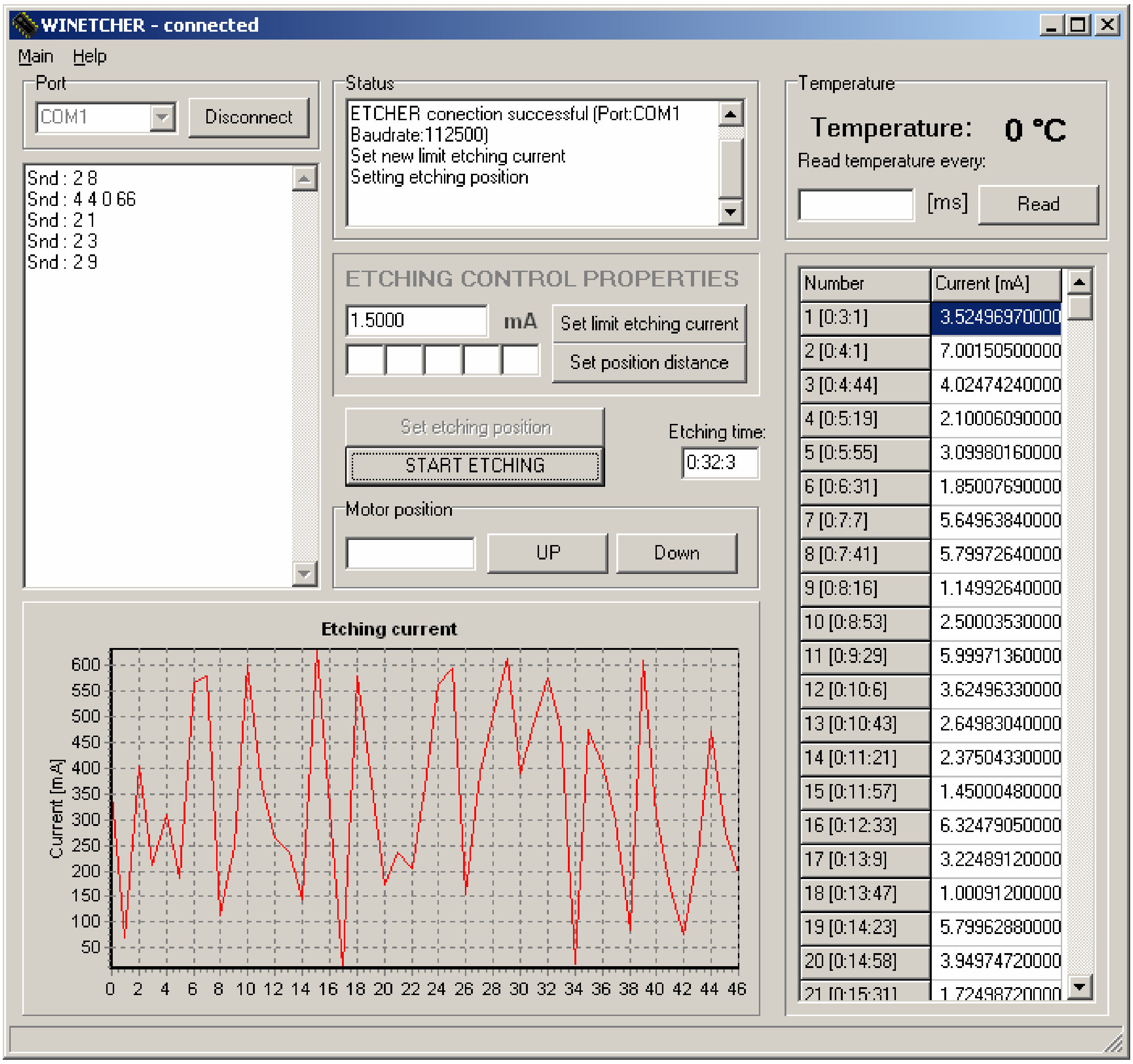

Fig. 2: *Initial window of the service program for PC*

5 CONCLUSION

The control board for cathode etching is designed with regard to maximum field of the microcontroller performance and minimum complexity of the circuit diagram. We can exactly determine all fundamental parameters of etching cycles and sequentially compute the optimal etching cycles on the basis of measured values of current, temperature, plunge in etching bath and etching time.

The control board is designed for immediate visual check of etching cycle track and all important parameters. On the basis of those parameters the user can decide about the optimal etching parameters. Those main requirements are necessary for application of the control board in the cathode production.

REFERENCES

[1] T89C51CC01 8-bit MCU with CAN controller and Flash. User´s Guide, Atmel, www.atmel-wm.com, USA 2002

[2] ADuC812 Micro Converter TM, Multi-Channel 12-bit ADC with Embedded MCU. User´s Guide, Analog Devices, www.analog.com, USA 2002