GAS SENSORS RESEARCH AND CONTROL SYSTEM

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The complexity of gas sensors electrical parameters researches, high demands towards measurement systems require the creation of a highly intelligent systems.

The system has been built as a structure of modules, each having its own functions but at the same time interacting with each other. The system allows introducing new modules, deactivating those existent and their excluding from the system.

Physical components of the system form the following system structure:

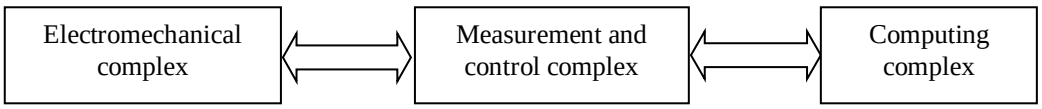

Fig.1 Research and control system structure

- Electromechanical complex consists of mechanical components and electronic measurement system adjustment components, as well as the electromechanical components governed by the control system.

- Control and measurement system works in the real time and is composed of modules forming control signals for the electromechanical system and the modules of signal correction.

- Computing complex takes the information from the measurement and control complex, processes information, makes conclusions, takes decisions, monitors the data, collects useful information, and configures modules, in other words governs the whole system.

Such grouping of modules comes out of their intelligence level, having the following peculiarities: electromechanical modules interact immediately, while the others need some processing time to make a decision. Measurement and control complex intelligence is limited to correction of data from the electromechanical system, signals conversion into a suitable processing form for the computing complex and the measurement process control. Complex intelligence is reflected in the complex algorithms and in the modules it consists of.

To create the system electronically mostly generalized structure has been chosen to provide the minimum of modifications in future system evolution.

As a nucleus the AT90S8535 microcontroller has been chosen, containing an analog digital converter that allows analogical signal collecting from 8 different sources.

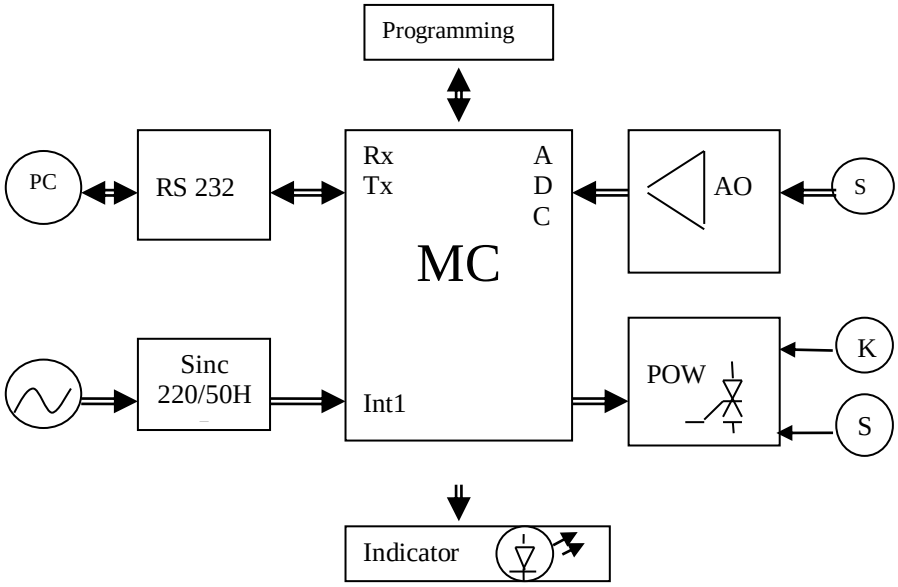

Fig.2 Gas sensors measurement and control system scheme

The system consists of the following peripheral components:

RS232 – communication block for the connection with the computing system incorporated in the microcontroller.

Sinc – Network synchronization block ~220/50hz to control the free power, for the trial support heating, to maintain the thermal regime.

AO – analogical signals amplification block built on the bases of some operational amplifiers, meant to adjust the analog signal in 0-5 V taking into consideration Analog Digital converter from Microcontroller input characteristics.

POW – Power block that assures big powers commutation to control gas , air pump, support heater.

Indicator – indication (index) block based on several LEDs for the preliminary monitoring of the system functioning.

Programming – Programming Interface, to be able to load the renewed program in case of the system's evolution.

Mechanical part consists of support containing two covering levels to maintain the room temperature and to evacuate the experimental gases.

Valve block allows to choose in the experimental room gas pumped with the help of a pump and checked with a flux meter.

Software constitutes the most important part of the system, one less complicated, the microcontrollers' interior part, and the other one complex enough, from the computing station that is responsible of the whole system configuration, conclusions and decisions.

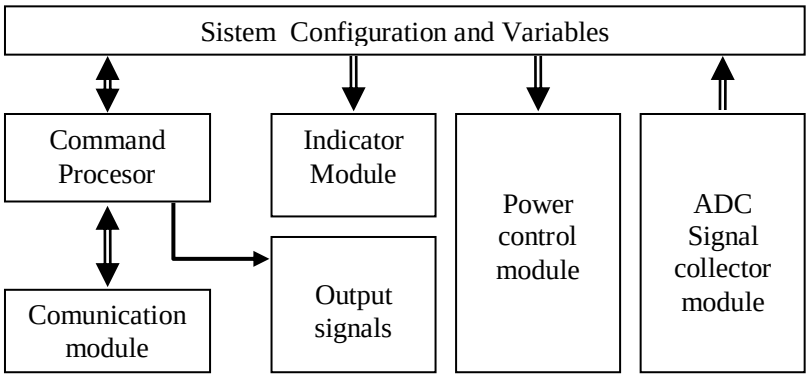

Fig. 3 Block scheme of the program included into microcontroller

Microcontroller program consists of the following modules:

- communication module with a specialized protocol of communication, whose packages contain command name, data for the given command and the control sum.

-temperature control module – maintains the temperature in the experimental room at the established level.

- Analogical signals collector module – scans the analogical ports

- Indicator module – indicates the system state via light signals on the LEDs

- Power control module – controls the heaters and electromechanical flapper

All data are collected into the system variables permanently being renewed by the current data and depending on the system configuration are sent to the computing system. One of the analogical channels and namely the one that collects the signal from the thermocouple is meant to the temperature control. The reason being the fact that at higher temperatures, it is necessary to apply a bigger power to the heater to maintain the temperature; the power is calculated depending on the established temperature and difference between the real temperature and the established one.

To control the valves special commands are supposed to be ordered by the computing system.

System indicator block depends on the system's current state.

The most sophisticated calculations made by this part of the system present calculation of the power according to a special formula and communication assurance. The other blocks don't need fast reaction and are accomplished in the computing system. Computing station software is the

most important part of the system. It is responsible of the whole system configuration, of the experiment progress, conclusions and decisions.

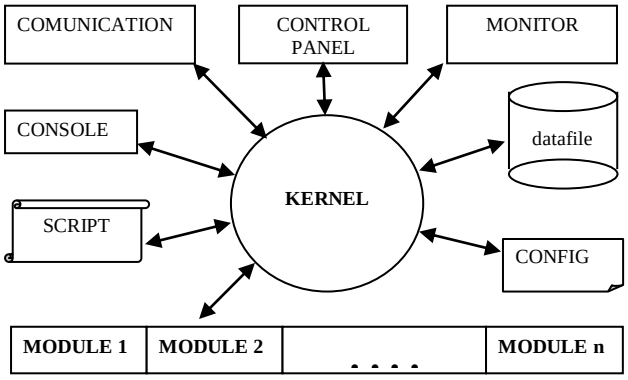

Fig.4 Computing system software block scheme

Kernel – computing system nucleus built on the bases of a command processor.

Datafile – files, where the system's current data are stored.

Console – system consol meant to control the experimental process.

Monitor – experimental process monitoring windows in form of indicators and graphs.

Communication – communication module with the microcontroller.

Script – file, that allows system control by behavior description in a small sub-program.

Config – the file that maintains system configurations.

Module 1-n – Computing system component modules that can be appealed to via nucleus.

CONCLUSIONS

An installation for the gas sensors research has been made. The installation is connected to the computer by AT90S8535 microprocesor. The device allows obtaining the following dependences simultaneously: sensibility dependence time function; resistance dependence time function; temperature dependence time function; resistance derivative dependence time function; resistance dependence temperature function. The installation is endowed with a simple software in use, a mass for measurements, a pump to pump the gases, a flux meter, and a central command bar. The installation work parameters are the following:

- Work temperature 50-450^{o}C
- Measurement domain to 100 MΩ
- Data renew time 1 sec.
- Measurement relative error 0,01- 0,5%
- Gas debit < 100 l/h.

This measurement system proved to be very efficient, considerably decreasing the time of measuring gas sensors parameters.