FAILURE-SAFE STRUCTURES OF INFORMATION COMPLEX RAKURS OF NUCLEAR REACTOR PIK

A. A. Beltchenko

At present designing the information complex (IC) of reactor PIK is developed in PNPI (code of work RAKURS). A software of subsystem of the top level IC is developed in Moscow Institute of control sciences (Russian academy of sciences). The structure of a subsystem is jointly developed.

Certainly, a software of top level, which is based on results of long-term work in the Institute of control sciences on expert systems, influences the structure, but as a whole IC is based on failuresafe structures of early PNPI works. Structure circuit IC RAKURS is shown in Fig 1.

IC represents a distributed structure consisting of two subsystems. The subsystem of the low level consists of control and measuring stations (CMS), accepting signals from gauges. All CMS are connected to the technological duplicated network, which is bus with direct access, designed in Kiev Institute of cybernetics. The subsystem of the top level consists of a duplicated gate station, two diagnostic stations and four monitor stations. Computers of the top level are connected to the network Ethernet. The gate station tratsferes signals from one network into the other, just here is a border of the two subsystems, giving opportunity to modernize in a future both parts of the complex independently from each other.

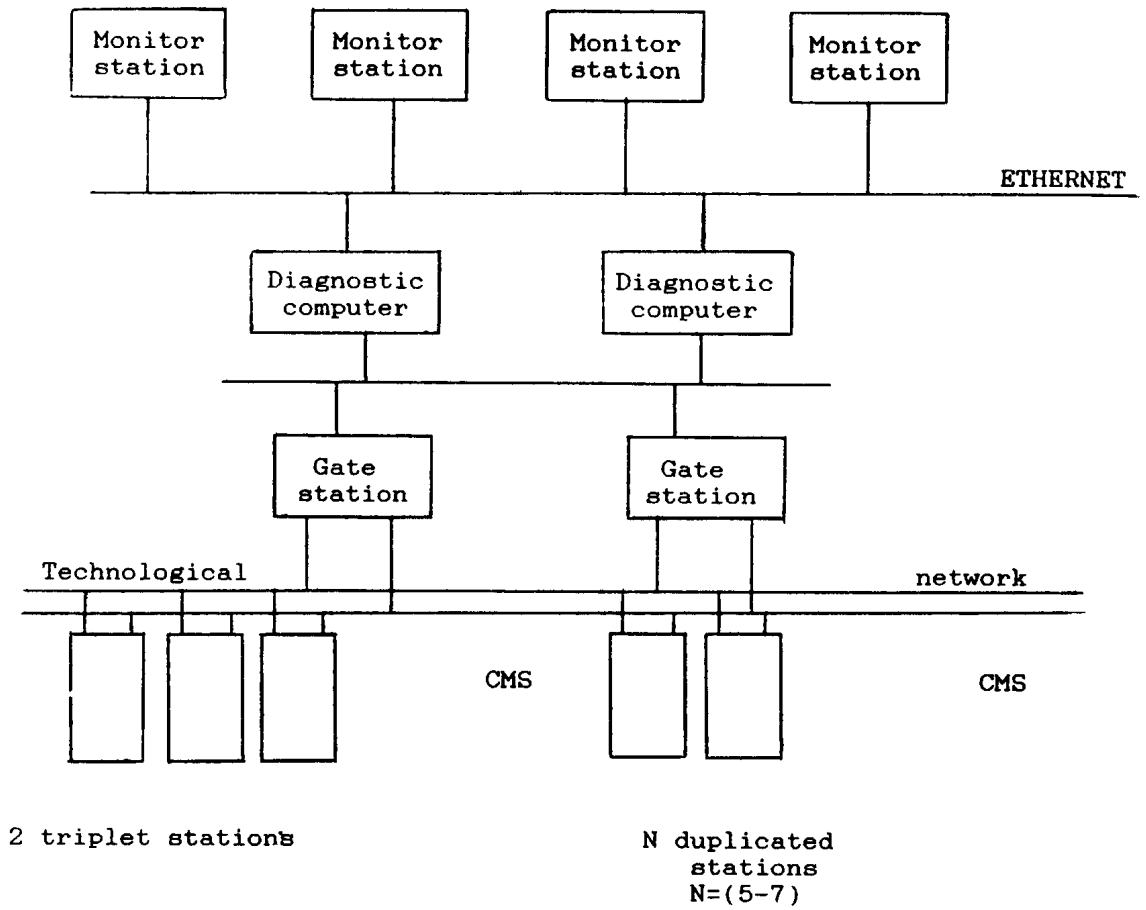

Fig.1. Structure circuit of IC RAKURS

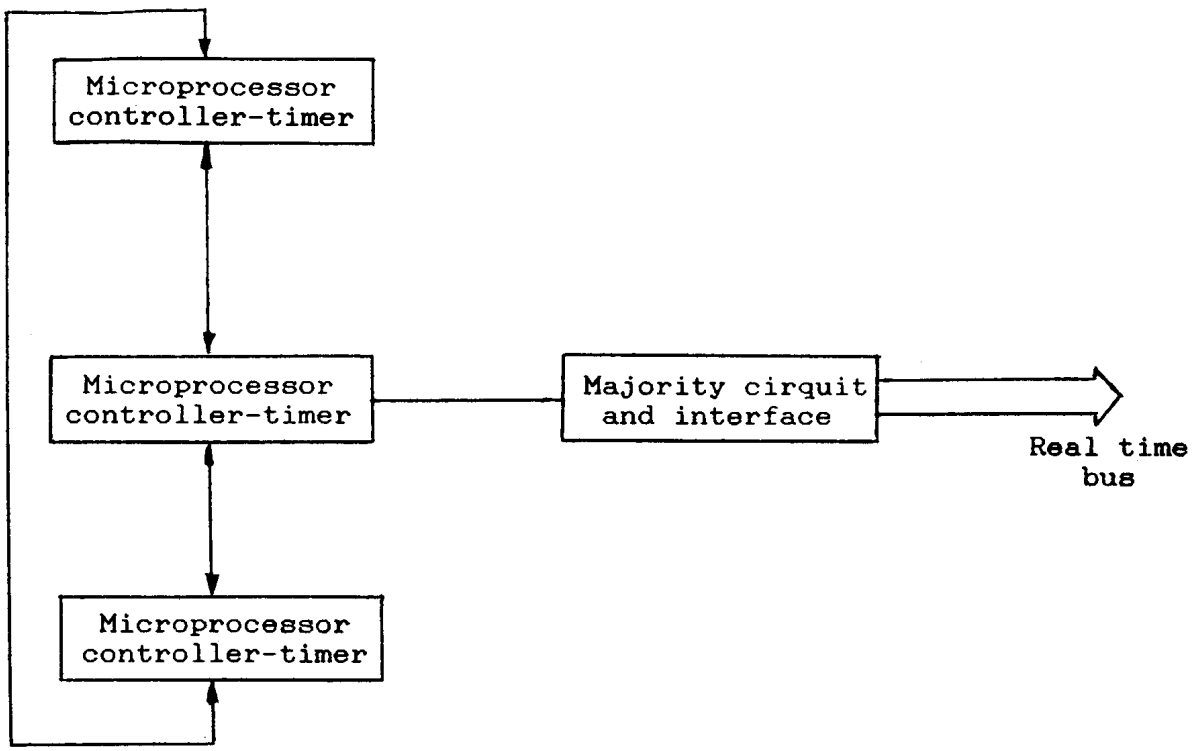

Fig.2. Structure circuit of real time system

From the point of view of failure-safe design, CMS are devided into two groups: triplet station and duplicated ones. Triplet CMS register those parameters (signals) of reactor, for which required reliability is higher than for the other ones. This is an emergency and precautionary signalling system, main analog signals. All CMS are bases on the CM 1810.42 computers. Gate station of the top level, except main function, works as a majority block for signals CMS, filling a database with values of these signals, located in these stations. This base reflects current significance of all gauges of reactor measured CMS and those received from other systems due to special channels of communication.

Each gate station is connected with each diagnostic computer with a high-speed channel of communication. The diagnostic computers "look" after one another through the network. If one computer fails, the second will execute tasks of its "neighbour". Up to this moment each of diagnostic computers executed various tasks.

Monitor stations shows necessary information for operators on displays with high resolution. Each monitor station can display all kinds of information in spite of failure of one of them.

High perfomance IBM PC AT-486 DX compatible computers are chosen for the subsystem of the top level. The division of phisycal and tehnology of reactor PNPI develops a failure-safe system of real timer (RT) for supply the real time CMS and other computering systems of the reactor. The structure RT is shown in Fig 2. Real timer is a triplet system.

The basis RT is microprocessor controller - timer with the built-in circuit of self-diagnostics. The controllers have a circuit of synchronization of quartz resonators of processors and timers. Each controller is connected with "neighbours" with a high-speed channel for initialisation of work and synchronization of processes proceeding in RT. Besides, the devices makes the control of "neighbours" work with these channels.

Probability of non-failure RT there should not be below this parameter for IC and makes 0,996 for reactor campaign (720 hours) against 0,99 for IC.