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AUTOMATED CONTROL SYSTEM OF CLEANROOMS

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Abstract*—The problem of designing control systems clean rooms. The algorithm aided design system select desired items of clean room.*

Index Terms—Cleanroom; computer-aided design system; control parameters.

I. INTRODUCTION

Currently, much attention is paid to high quality products electronic industry. The solution of this problem is possible by using clean room technology.

Cleanroom – a room in which the concentration of aerosol particles is controlled and which is constructed and used so as to minimize the receipt, allocation and retention of particles inside the room, and which, as appropriate, are controlled by other parameters, such as temperature, humidity, pressure, etc. [GOST ISO 14644-1 (2.1.1)].

Control parameters - is an important component of clean room technology, without which accurate and error-free operation of all complex technological sector, which is modern clean rooms.

In this paper is proposed an automated control system, which includes a sensor subsystem to control all the parameters necessary clean room. Another necessary condition for this control system is that it should be linked to other systems, clean room, the task of which is to create and maintain a set of requirements on purity, temperature, pressure, humidity parameters of the process.

This system will optimally choose the technical facilities to optimize it according to the criteria: functionality, accuracy, cost. The system should be user-friendly interface for use by staff clean room.

II. AUTOMATED CONTROL SYSTEM OF CLEANROOM

Cleanroom Technology since its birth faced with the task of periodic monitoring of pollution, especially air. First regular measurements were made by moving fairly large-particle counters clean rooms wheelchair specially designed for use in technological purity. The situation changed only in the early 90's. Emergence of a new class of devices - sensors particle aerosols.

Unlike "normal" particle counters, sensors aerosols tend to have no pneumatic system that is pumping air through the test volume measuring device is carried out by an external source rarefaction (vacuum pump), usually one for the whole system.

In addition, an electronic sensor unit extremely simplified – in fact, it only amplifies the signal from the sensor, which is part of the optical block, and converts it into a form (analog or digital) required for its transfer to the computer. All further data processing and display it (in the form of particles concentration dependence of time or as a histogram particle size distribution) is a computer with appropriate software.

The structure of the monitoring system depends on the task, the type of sensors and features of the clean room.

Modern automated control system parameters cleaner production facilities include not only sensors aerosols. Typically, the computer control systems attempt to use the principle of open architecture, which means the ability to connect sensors of any other options.

Typical schemes of automated control clean room shown in Figs 1, 2.

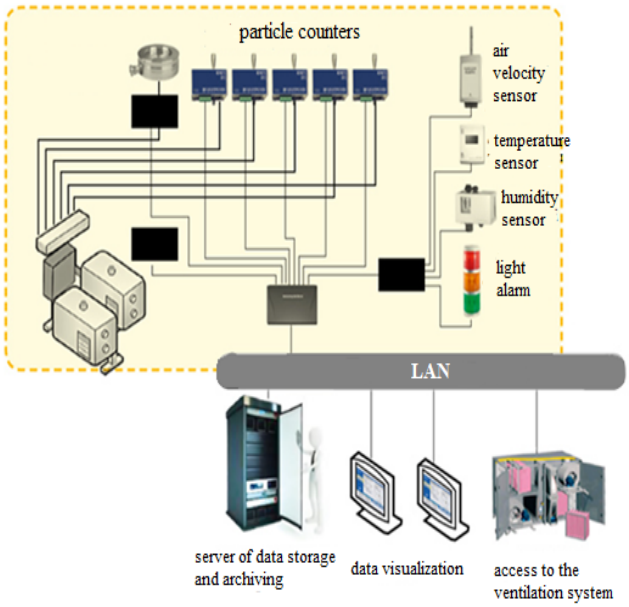

Fig. 1. Structural diagram of the control system (cable connection)

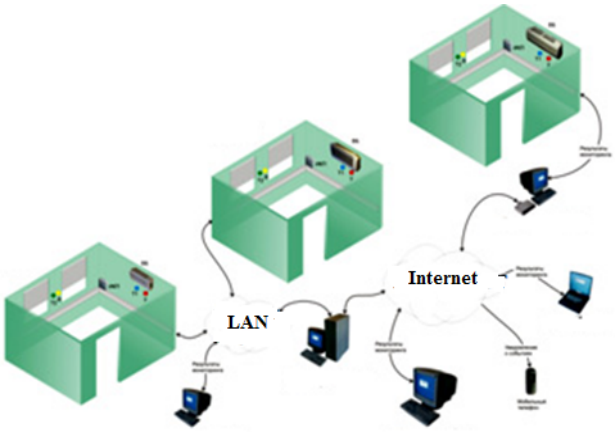

Fig. 2. Structural diagram of the control system (connection via Internet)

III. MEASURING THE CONCENTRATION OF AEROSOL PARTICLES

The most important test, the result of which suggests that the clean room is functioning properly, is to determine the number of aerosol particles in the air. Before proceeding to measure the amount of particles in the air, it is necessary to carry out all the above described measurement. These studies should give positive results.

Only after the final measurement should be carried out in order to ensure that the concentration of aerosol particles does not exceed the allowable values for the corresponding state clean room. To determine the purity premises necessary to analyze such amount of air that allow to verify that the concentration of aerosol particles in the room is within the prescribed standard.

IV. STRUCTURAL CONNECTION DIAGRAM METERS PARTICLES IN CLEAN ROOM CONTROL SYSTEM

There are 3 most common schemes:

– parallel connection of meters with integrated vacuum source (Fig. 3);

– parallel connection of an external vacuum source (Fig. 4);

– connection “star” (Fig. 5).

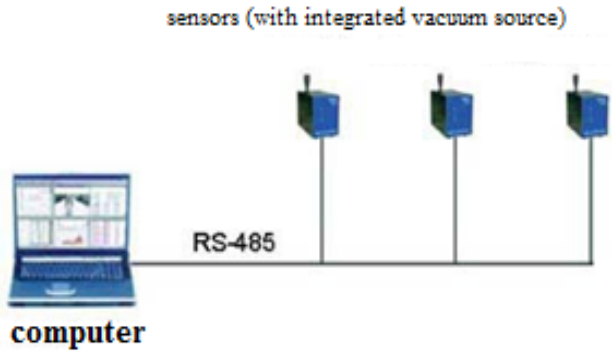

Fig. 3. Scheme of parallel connections with integrated vacuum source

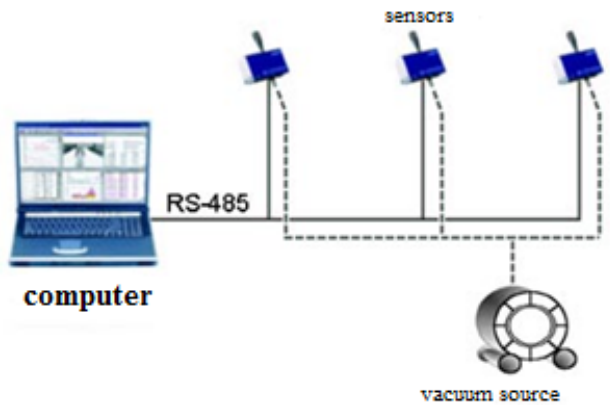

Fig. 4. Scheme of the parallel connection of an external vacuum source

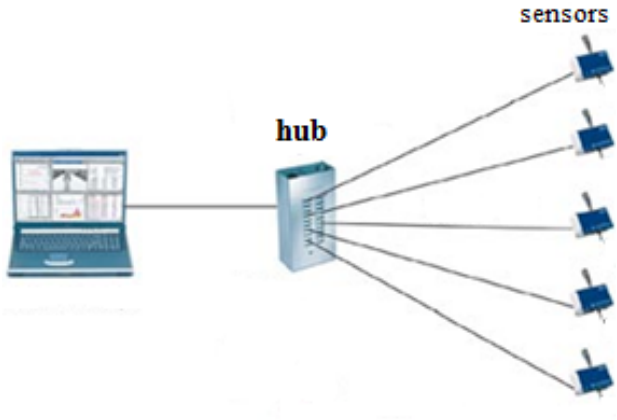

Fig. 5. Connection “star”

V. FEATURES OF SELECTION PARTICLE COUNTERS

There are many manufacturers of meters particles. In this regard vary their features and price. When designing automated systems clean room to look for: a dimensional range of the sensor, the lower limit of the measurement, the rate of breakdown of selection, the maximum inlet concentration of particles, a source of vacuum, alarm output, dimensions and weight equipment.

Selection of counters for each individual system. And an important role in this process is an estimate that can afford the customer. Well, as for the construction of devices can be used only one manufacturer. If this is not possible because of the task, pricing or other reasons, you must also take into account the connection between devices and software, as well as the possible use of adapters or adapters to avoid any compatibility issues of hardware.

VI. ALGORITHMIC SOFTWARE OF CONTROL SYSTEMS CLEAN ROOM

Block diagram of the automated information system design clean room shown in Fig. 6.

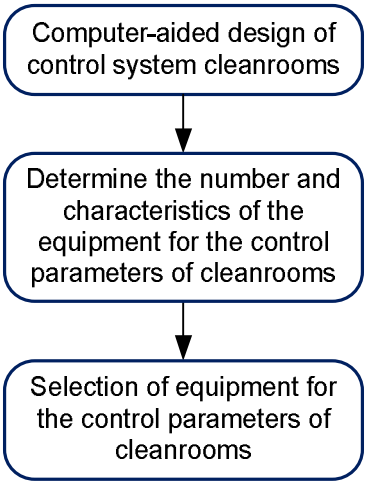

Fig. 6. Block diagram of the computer-aided design system emergency control

The algorithm of this system is presented in Fig. 7.

According to practical experience, it is recommended to monitor for the following terms:

– concentration of aerosol particles;

– differential pressure between rooms of different classes of cleanliness;

– temperature and humidity;

– average air velocity in the room;

– control of additional devices in the room (laminar installation, radio, local emissions), control of air preparation system.

The most important test, the result of which suggests that the clean room is functioning properly, is to determine the number of aerosol particles in the air and drop in air pressure.

To control the deviations from the desired level of purity in clean rooms high-end products which are very sensitive to aerosol pollution, uses continuous monitoring of the purity of the air and the pressure drop.

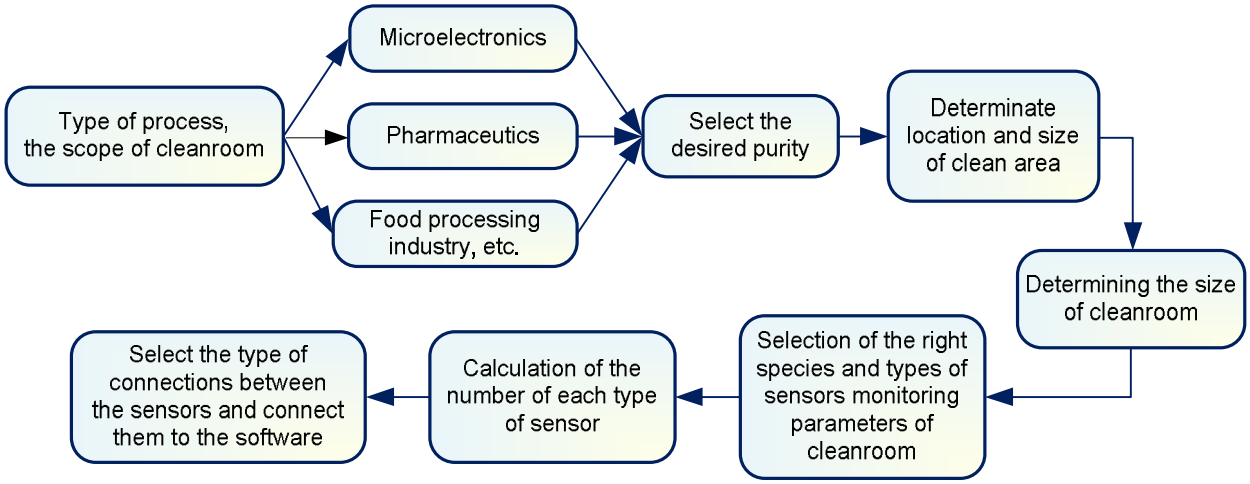

Fig. 7. The algorithm of the automated control system clean room

Control measurements may conduct specialist technician, moving particle counter for clean room. But taken to a specialist time is too expensive and besides their presence in the clean room enhances aerosol air pollution.

To prevent this, apply the system of automatic controls that are ongoing control the size and changing the concentration of aerosol particles in various spots clean room applying the required number of tiny sensors.

Information on the number and size of aerosol particles measured sensor is transmitted by cable in the form of electrical signals to a computer, where it is analyzed by a special software. Parallel computer can analyze the electrical signals from the sensors for pressure, temperature, relative humidity and air control training system.

Also, parallel performance can be controlled assistive devices such as laminar installation, transmission and air locks. If necessary, it is possible to control the parameters of the process equipment. For ease of clean room doors can be installed alarm indicator panel that can display temperature, pressure drop, the relative humidity in each room or space.

The system of simultaneous monitoring of parameters that are monitored are the best solution because the sampling is performed at selected points continuously and over exceeding the specified parameters can not miss.

The measurement is carried out in clean rooms to ensure that the clean room is appropriate and meets the purity level incorporated in the design.

Once established that pure space corresponds imbedded in the design phase purity, there is a need

for periodic monitoring of its parameters, in order to confirm that the clean room continues to meet the standard.

VII. Conclusions

Explore options for block diagrams of control systems clean room. Structural diagram of CAD systems control clean room. The algorithm for the construction of CAD of control systems clean room.

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В. М. Синєглазов, В. М. Федосенко, І. Л. Мошелюк. Автоматизована система контролю чистих приміщень

Розглянуто проблему створення системи контролю чистих приміщень. Запропоновано алгоритм автоматизованого проектування системи вибору потрібних елементів чистого приміщення.

Ключові слова: чисте приміщення; контроль параметрів; система автоматизованого проектування.

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В. М. Синеглазов, В. Н. Федосенко, И. Л. Мошелюк. Автоматизированная система контроля чистых помещений

Рассмотрена проблема создания системы контроля чистых помещений. Предложен алгоритм автоматизированного проектирования системы выбора нужных элементов чистого помещения.
Ключевые слова: чистые помещения; система автоматизированного проектирования; контроль параметров.

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