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## **MICROPROCESSOR CONTROLLER OF THE WATER SUPPLY SYSTEM OF A PRIVATE HOUSE**

Quality water supply is an important task both for the industrial sector and for creating comfortable living conditions in private houses and apartments.

**Comfort** is cosiness, convenience (a set of household facilities). This interpretation is present in almost all information sources.

One of the factors that can significantly affect comfort in everyday life is water supply.

Quality water supply provides support for constant water pressure in the pipeline system, regardless of the volume of consumption.

This enables:

- to simultaneously use water at several water outlet points without a substantial influence on each other;
- to use equipment for water heating;
- to use home appliances, which have a requirements to water pressure in the pipeline system;
- to prevent equipment failure due to overpressure;
- to vary the pressure in the pipeline system for maximum comfort;
- to prevent the inconvenience when the pressure differential during rush hour.

There are various ready-made technical solutions for the organization of comfortable water supply. The main ones are:

- pump stations with pressure switch;
- pump stations with frequency converter.

A **pump station with a pressure switch** is a device that includes a pump, a pressure switch and a hydraulic accumulator. The pump is controlled by the relay law: switching when the pressure drops to the lowest limit and switching-off after reaching the upper limit. Most often, such devices are limited to a small adjustment range. In this case, it is mandatory to use a hydraulic accumulator in the system, which serves to compensate for the hydroblow and is able to accumulate a water reserve to reduce the number of on / off cycles.

The advantages of such solutions are:

- ✓ low price;
- ✓ ready-made solution.

Among the drawbacks should be noted:

- ✗ high noise level while working;
- ✗ the equipment takes up a lot of space;
- ✗ the presence of frequent on / off switching while active use of water;
- ✗ low lifetime because of the frequent switchings;
- ✗ noticeable pressure jumps while active use of water.

**A pump station with a frequency converter** is a device including a pump, a pressure sensor, a frequency converter, a hydraulic accumulator, or a hydroblow protection. The pump is controlled by the PI, PD or PID control laws. The implementation of the continuous control law provides for a different intensity of the operation of the performing mechanism (pump), depending on the different deviation from the target value of the controlled value (pressure), which varies due to the different magnitude of the deflecting factor (flow rate). This can be realized using a frequency converter. Most devices of this class on the market have the range of settings that gives possibility to set the desired pressure level.

The advantages of such solutions are:

- ✓ low level of noise;
- ✓ stable pressure that doesn't depend on the consumption value;
- ✓ long lifetime due to smooth working modes;
- ✓ ready-made solution.

Among the drawbacks should be noted:

- ✗ high price;
- ✗ low maintainability.

From the discussion above it can be concluded that cheap pump stations with relay control can provide water supply, but its quality will not be the best, and for in a more expensive pump stations with frequency control can provide it at a high level. It should be noted that both systems can be assembled from separate components. In this case, they favorably have a wide range of possible characteristics and higher maintainability.

The essence of my work is to create a water supply system, which will have all the advantages of a pumping station with a frequency converter, but at the same time will cost not much more than a pumping station with a pressure switch. Such a combination can be achieved by assembling a system from separate ready-made components, and some of them can be self-made.

As a ready-made components the following can be used:

- ✓ pump;
- ✓ pressure sensor;
- ✓ hydraulic accumulator or protection against hydroblow.

The frequency converter and the control unit are subject to development.

The frequency converter converts the initial mains voltage 220 / 380V 50Hz into the voltage and frequency necessary to reach the set parameters at a specific time. The implementation can be based on a scalar or vector laws. Scalar law is applied for the systems which are undemanding to high precision, such as pumps, fans, etc. Unlike vector law, it is much less demanding to computational resources, has a simple implementation of control algorithms and a simpler circuit diagram.

It was decided to develop it using own resources because of the high cost of ready-made solutions, as well as the features of single-phase pump control. Because single-phase pumps have a wide range and an acceptable price.

The control unit will be built on the basis of the microcontroller STM32F103C8T6, which having a comparable price with its analogs has an order of magnitude better characteristics. It will be responsible for taking readings from the pressure sensor, issuing a control signal, outputting information to the control panel.

It should be noted that its computing power is sufficient to perform the functions of both the control unit and the frequency converter simultaneously.

We will highlight the additional advantages of this approach to solving the problem of water supply:

- ✔ the flexibility of the system;
- ✔ the possibility of replacing an individual component in case of its failure;
- ✔ the possibility of installing both surface pumps and submersible pumps;
- ✔ the possibility of further modernization and improvement, as well as the addition of new functions if necessary.

This development in the case of its successful implementation will allow quite cheaply and, at the same time, effectively solve the problem of water supply to consumers, including domestic needs in private houses without a centralized water supply system.