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THE INDUSTRIAL CONTROL SYSTEM OF HEAT SOLAR SUPPLY

Frantisek Hruska
Tomas Bata University in Zlin, Faculty of Applied Informatics,
Nad Stráněmi 4511, CZ-760 05 Zlin
Czech Republic

ABSTRACT
The requirements for industrial control system asks for a new solving and design a industrial control system of heat solar supply. The main keystones of our new industrial control system of heat solar supply for industry are: hierarchy of four subsystems, optimalization, connection to extern systems, communication, using of ADuC electronic. Our developed control system has the structure: a head control system, a solar supply subsystem, a bivalent supply subsystem, a accumulation and consumption subsystem. The optimization task has a criteria: a maximum energy from sun, a minimum cost of energy. The possibility of new microcontrollers helps and supports it very much. The system uses a new integrated circuits ADuC. The one has integrated a analog part with PGA and microcontroller with up 24 bit ADC and standard communication.
Keywords: control, heat solar supply, measurement.

1. INTRUDUCTION
In this time we interest in renewable source of energy. The sun gives a lot of energy in every day on Earth, when some clouds are not. There is about 1200 W/m2 heat energy by good condition. There is a question to use solar energy in industry too.
Solar energy supply utilizing in industrial technologies requires a solving with bivalent or trivalent energy system for its specific conditions. Whole system has to be designed to prefer the exploitation of solar energy directly or from accumulation and then to second supply. These requirements demand to solve a control system for heat supply by the help of specific programmable system.
A theoretical apparatus is prepared to solving of solar supply for industry. There are:

- calculation of solar radiation on the Earth surface for all places of the Earth globe,
- model of solar collector,
- economical efficiency of solar supply projects.

2. HEAT SOLAR ENERGY FOR INDUSTRY PLANT
An optimum utilizing of solar energy we can solve according to four schemes. There are the systems with liquid system. The simple system is in the fig.1. The solar energy is transports from collector (1) direct to using in the consumer (2). The difference of the variants a) and b) is in the surge tanks.
The heat solar system with secondary bivalent supply and accumulation tanks is in the fig.2. The heat energy flows from collector (1) in the first into tanks (2a, 2b,..). Then the energy can go into consumer according to the energy balance of the system. If the sun energy is only a little and energy in tanks is not enough, the bivalent source (3) is started. The small surge tank (4) is in the system too.
The industry system with large energy capacity is in the fig. 3. It has the more accumulation tanks (2a, 2b, .. 2n). The output energy to consumer is only from tank (2a). The system has a secondary source (3).

In industry there is used energy for air opened tanks, show in fig.4. The system has the accumulation tanks (2a, 2b) heated from solar collector. The sun energy flows into the open heating tank (5) too.

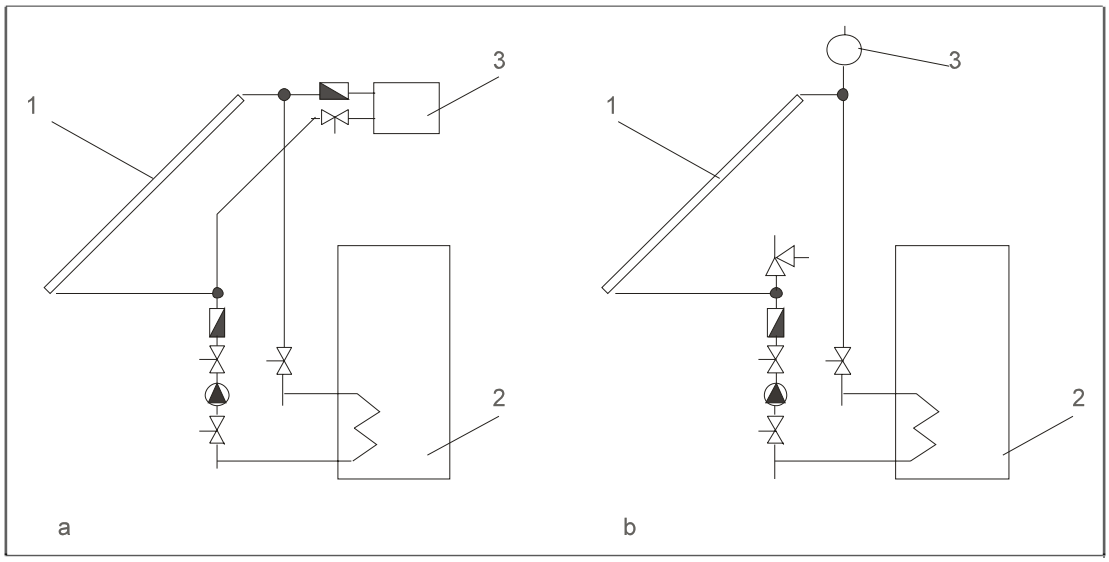

Figure 1. Schema of heat solar system with direct consumer

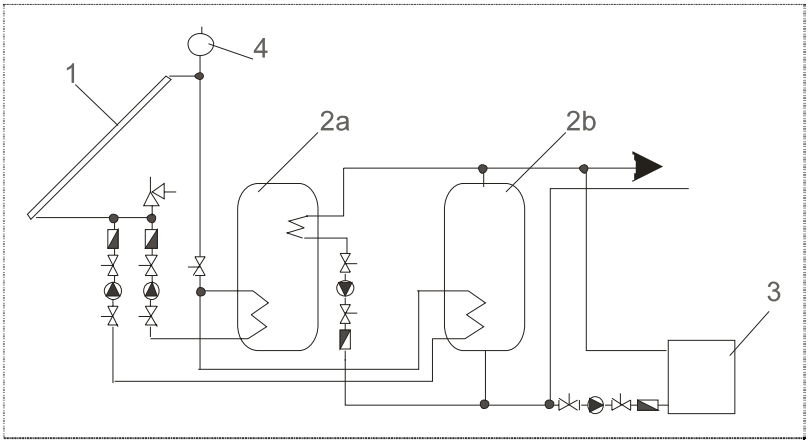

Figure 2. Schema of heat solar system with accumulation

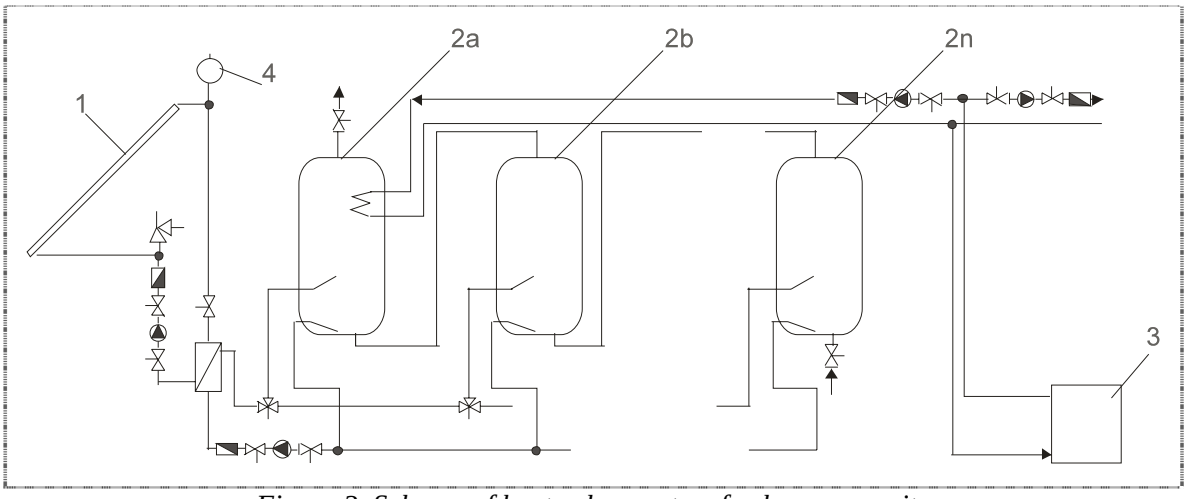

Figure 3. Schema of heat solar system for large capacity

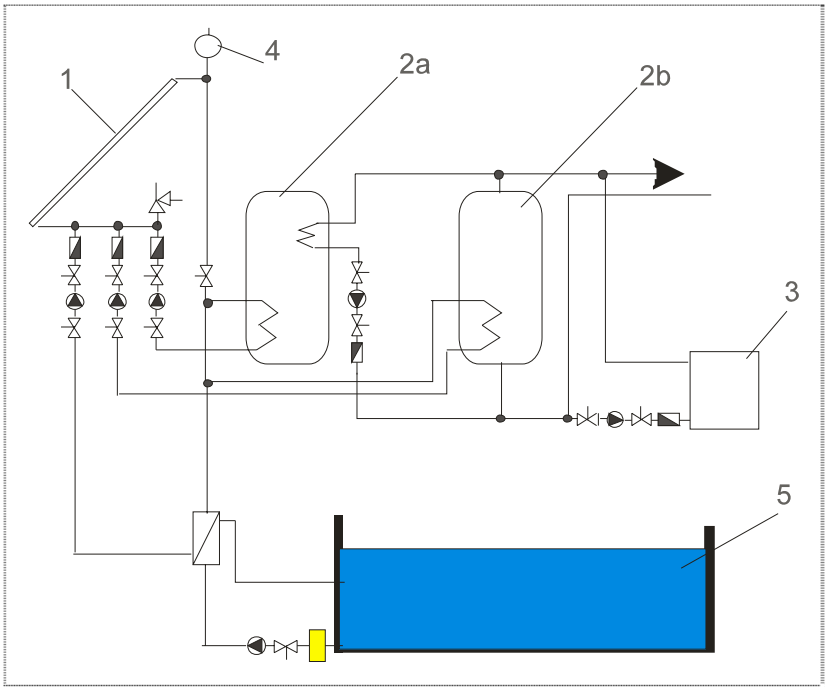

Figure 4. Schema of heat solar system for open tank

3. CONTROL AND MEASURENT SYSTEM

The control and measurement system is necessary for optimum operation funds, priority utilizing of solar energy by near minimum economic load.

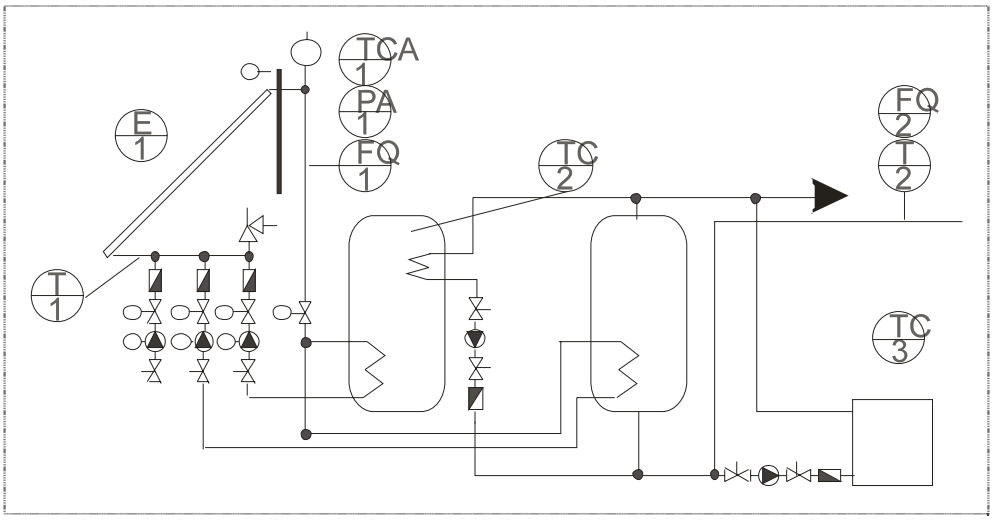

Figure 5. Measurement and control loops of the solar system

We have solved a general measurement and control system in our model plant. On fig.5 is showed general measurement and control loops for combination according to a kind of consumer plant:

- TCA1 temperature of output from collector
- T1 temperature of output from absorber
- E1 radiation power
- FQ1 flow of water from collector
- PA1 pressure in collector
- TC2 temperature in absorber
- TC3 temperature of output from kettle

- T2 temperature of back of water from consumption, measurement
- FQ2 flow of water from consumption
- FQ3 flow of water from kettle.

The central unit of system is designed with ADuC circuit. The selection is to have flexible for standard hardware and reliability. Scheme of the modern ADuC unit is in the fig.6.

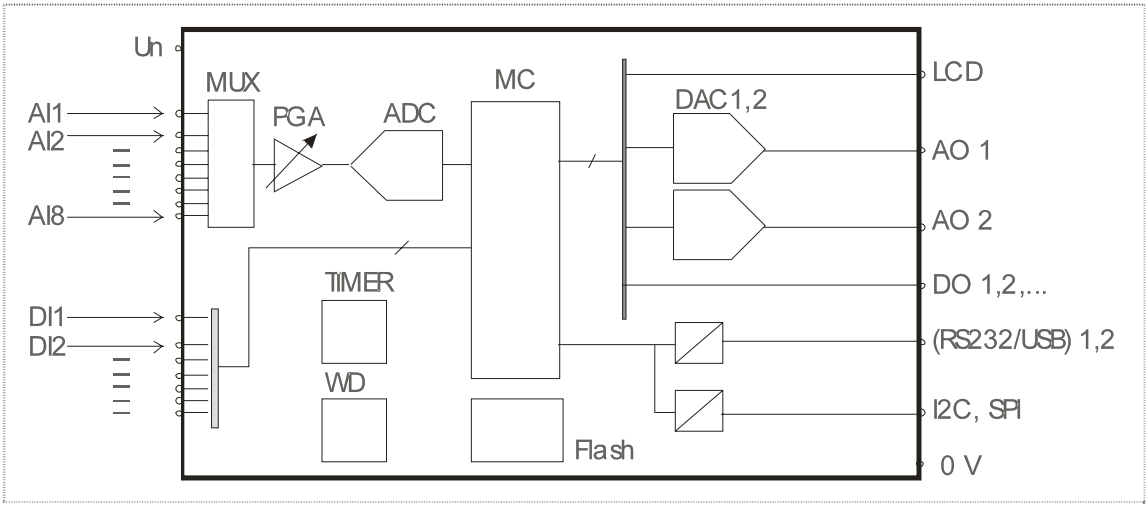

Figure 6. Block scheme of ADuC

The central unit with ADuC has eight analogue inputs (AI1,..AI8), eight digital inputs (DI1,…DI8), two impulse inputs. The outputs are: two analogue outputs, eight digital outputs, communication outputs and autput for LCD. A priority of the one is a hight integration, a PGA block, the 24bit ADC resolution, the MC of the base of the Intel 8051.

4. CONCLUSION

The proposed measurement and control system gives possibility of right projecting of power parameters of more valuable supply of heat energy with by using solar supply. The one ensures the optimum functions of source with good economic efficiency and expressive upholds functionality and application of such source system in industry.

The model equipment of solar supply for research a development of control task is very important aid. We can test the all measuring and control devices, the control system with its all function. The most important test results are expected for loop of control temperature in collector and into accumulation tanks, of control of extremely temperature into collector with rotation of collector according to position of sun and security tasks.

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