

**O. P. Sheremeta, Cand. Sc. (Eng), Assist. Prof.; V. M. Mizernyi, Cand. Sc. (Eng), Assist. Prof.; A. I. Vlasiuk, Cand. Sc. (Eng), Assist. Prof.**

## **ASTRONOMIC TIME REGISTER AT4-700/1**

*The paper describes the advantages of astronomic time registers used for automatic regulation of lightning. There had been given the basic parameters of astronomic timer AT4-700/1, developed in training and manufacturing center "Innovative Technologies of VNTU". Is financial efficiency had been substantiated.*

**Key words:** *astronomic time register, light adapter, energy saving*

### **The problem preface and the paper aim**

One of the basic methods of energy saving is the usage of light adapters. For organization of automatic control of lighting in places where light is required only in dark period of day, devices which switch on and off the lamplight depending on the quantity of natural lighting of the object are widely used. Such devices are called photosensitive devices. They have a sensor of luminosity which controls natural lighting.

However, the astronomic timers, which enquire the loading switching on and off in accordance with the time of sunrise and sunset are more frequently used instead of photosensitive devices. Volatile memory contains this information.

In comparison with photosensitive devices astronomic time registers have such advantages:

- they do not require the use of light adapter and its further recalibration measurement in case its properties change in due course;
- there is no need in constant servicing of the sensor observation space;

Today the market offers astronomic timers of high functionality manufactured by Legrand, Orbis [1, 2]. Their cost ranges from 450 to 1200 hrn.

Applying new approaches and modern element base, we succeeded to develop specialized astronomic time register AT4-700/1 with 4 channels, total cost of which is 600 hrn, which makes up correspondingly 150 hrn per channel. High functionality of astronomic timer does not yield to photosensitive devices but their essential features are reliable functioning and operating costs.

### **Application domain**

Astronomic time register AT4-700/1 (Fig.1) is intended for switching on the lighting in the night-time and can be used for illumination control of entrances, streets, advertisements, as well as for of temper prevention.

The principle of operation of astronomic time register is based on switching the loading on and off in accordance with astronomic events (sunrise and sunset).

Microprocessor of astronomic timer contains everyday information on the time of sunrise and sunset. The transitional period (twilights) is also taken into account, when lighting is switched on one hour before the sunset and switched off one hour after the sunrise. The timer automatically takes into account the daylight-saving.

.Nonvolatile microprocessor memory is provided by a lithium battery.



Fig. 1. Photo of astronomic time register AT4-700/1

Technical characteristics of astronomic time register are presented in Table 1.

Table 1

**Technical characteristics of astronomic time register AT4-700/1**

Operating supply voltage, frequency	220 V, 50 Hz
Number of channels	4
Ultimate output of loading	4×700 VA
Self consumption of electric energy	1,2 W
Environment temperature	from –10 °C to +40 °C
Discreteness of time set	1 min
Lithium battery replacement time	5 years
Exactness of clock motion	±3 min./year
Overall sizes	260×225×42 mm
Weight	220 gr.

The timer has protection against exceeding the loading power that allows tamper prevention. As soon as timer loading exceeds the set capacity plus some extra energy discharge, the energy supply automatically goes out until the loading normalizes.

Astronomic time register AT4-700/1 provides operation with any combination of phases that allows distributing the loading equally on phases.

If there's the necessity in connecting more powerful loading to the timer, it is required to be realized by contractor starters.

To prove the efficiency of using the astronomic time register AT4-700/1, there had been conducted the calculation of economic indexes when timer is used for automatic lighting in entrance of multi-stories building.

#### Calculation of economic indexes

The parameters of nine-storied building entrance are considered to be the initial data, that is:

– the incandescent 60 W power lamps (this power is assigned by technical requirement for the lamp and by sanitary norms for entrance lighting);

- energy saving is two times is average within a year if compared to the continuous mode of entrance lighting;
- power rate is 0,25 hrn/kW-h.;
- one time costs (production/installation) makes 620 hrn..

Taking into account some vagueness concerning the number of lamps used in the entrance for its lighting, the calculations of economic indicators of astronomic time register in cases with 3, 5 and 9 lamps applied are suggested.

Calculations are presented in Table 2.

Table 2

Calculations of economic criteria of astronomic time register AT4-700/1

The number of lamps in the entrance.	3	5	9
Energy saving in the entrance for a month, kW/h.	64,8	108	194,4
Efficiency from one entrance in a month, hrn.	16,2	27	48,6
Payback time of astronomic time register, month	9,6	5,7	3,2

Real economic criteria of astronomic time register AT4-700/1 are higher due to the advantage of tamper prevention.

New system of entrance lighting which applies automatic timer AT4-700/1 depending on the number of lamps used in the entrance, will be recompensed in the period from 3 to 10 months and in future gives the monthly economy of electric power from  $194,4 \cdot N$  { kW/h.} to  $64,8 \cdot N$  { kW/h.}, (where  $N$  is the number of lamps).

### Conclusion

The paper presents advantages of application of astronomic time registers for automatic control of lighting. The basic parameters of astronomic timer AT4-700/1 developed in training and manufacturing center «Innovative Technologies» of Vinnytsia National Technical University are suggested in the paper. Its financial efficiency is substantiated.

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**Sheremeta Oleksandr** – Cand. Sc.(Eng), Associate professor of the Department of Computer and Telecommunication Equipment Design;

**Mizernij Victor** – Cand. Sc.(Eng), Associate professor, Head of the Department of Integration of Studies with Production;

**Vlasiuk Anatoliy** – Cand. Sc. (Eng), Associate professor, of the Department of Integration of Studies with Production;

Vinnytsia National Technical University