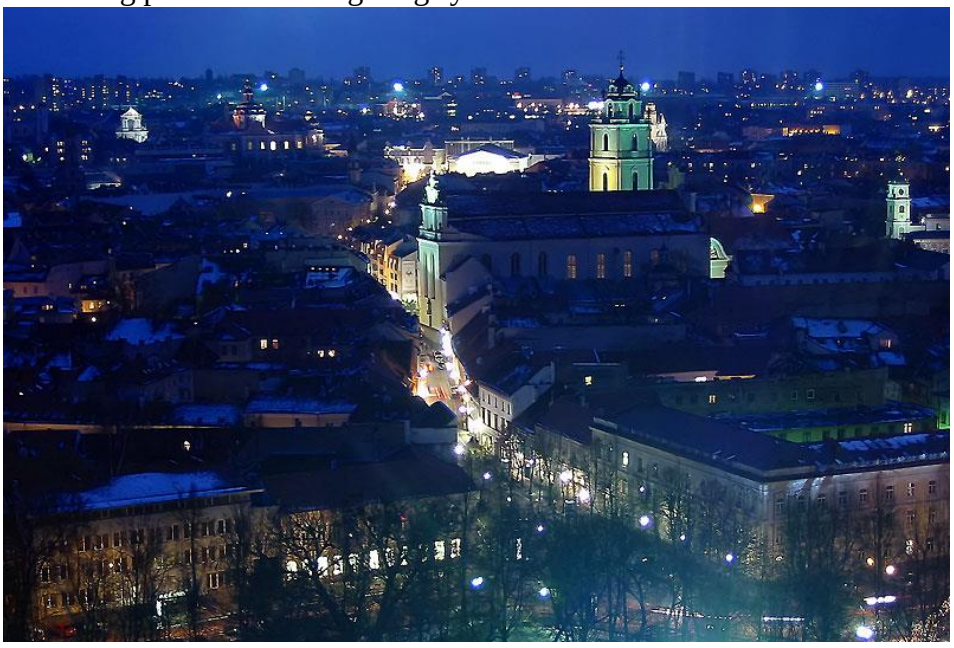
UAB „SIGMA TELAS“

Company code: 110390133
VAT payer code: LT103901314
Address: Kalvarijų str.125, 08221 Vilnius
Republic of Lithuania www.sigmatelas.lt
Tel.: +370 5 276 59 09; fax.: +370 5 270 00 87
Email: info@sigmatelas.lt

AN AUTOMATED STREET LIGHTING CONTROL SYSTEM (ACS SL)

Automation of street lighting control systems is presently an urgent task. This automation system allows us to reach, as far as quality is concerned, a new level of energy media management and, as a consequence, this will bring about a reduction of energy consumption and of operation costs. The analysis of the current status of outdoor lighting networks that was undertaken has shown that the overwhelming majority of outdoor lighting systems is based on outdated components, in which street lighting is at best controlled by using time relays guided by the astronomic time at a given locality, which fact causes untimely switchings on and off of the lighting system and as result it leads to an increase in power consumption. As a rule, there is no possibility for any remote control to be applied, and besides, nearly in all parts there can be no kind of automated monitoring of the status of lighting lines. On the basis of this present analysis it was concluded that there is the necessity to apply a new approach towards the way the managing of energy processes is taking place in street lighting systems.



A group of authors of this system who members of the UAB „SIGMA TELAS“ have elaborated a concept aimed at building a new-generation automated system to control street lighting (ACS SL). Unique structural-algorithmic and software-hardware solutions were developed, which allow to build an ACS SL complex, designed for updating the existing and building up new systems of automatic centralized street lighting control at urban electric power network companies, at industrial plants and at other facilities. Lighting is controlled in a fully automatic mode. However, at any given moment of time the dispatcher staff members have the possibility to carry out ongoing monitoring and control over any of the facilities involved. The availability of continuous monitoring

over the way commands that are aimed at changing the lighting modes are fulfilled, also, the use of automatic devices for switching on and off the lighting system, applying photo relays or time relays governed by the astronomic time, as well as the use of a lighting dimming system by reducing the feed voltage of illuminating bulbs during the night period – all this makes it possible to reduce the irrational usage of electric power bringing it to a minimum. The service functions of this equipment complex, i.e., remote metering, application of an automated power metering system (AMR) allow us to reduce the costs related to the travels the service personnel members have to undertake to reach lighting control facilities, while applying these data projected to past periods allows us to undertake analytical investigations and to optimize the way urban street lighting networks are operated.

The ACS SL that has been developed by the UAB "SIGMA TELAS" can secure the following:

- to supply dispatcher personnel with general information about the status of street lighting control equipment;
- to supply dispatcher personnel with information about individual street lighting control unit in the shape of a separate mimic diagram together with current values of electricity units;
- to supply dispatcher personnel members with information about the quantitative indexes of consumed power;
- access to the system protected with a password, according provided access powers granted (with the possibility to protect remote control functions, the system configuration , etc., from unauthorized access);
- to alert dispatcher personnel about alarm situations and any other critical events, annunciation of emergencies with acknowledgement;
- automatic setting of reports about all the events that are controlled by this equipment complex, including alarm and system situation, switching, presentation of reports on the consumed capacity levels and power consumption (it is also possible to issue other reports according to the requirements of the customer);

- receipt of accounts over local and global networks (the Internet) and their printing;
- automatic issuance of brief messages (SMS) to mobile phones that are in the hands of service personnel in those cases when the ACS SL system issues alarm signal, displays emergency situations etc.;
- creation of data archives of all the events during the operation period or during the reporting period.

This complex of equipment can carry out the following operations:

- either automatic or centralized remote control over the switching on and off of lighting, applying two levels of illumination (evening, night);
- centralized ongoing (both individual and group) remote control of turning on and off the lighting in the manual mode;
- local control of lighting modes by the maintenance personnel manually;
- telemetric measurements of:
  - phase currents;
  - phase voltages;
  - active and reactive phase power;
  - accumulated consumed capacity;
  - metering of electric power – active and reactive;
  - monitoring of phase voltages concerning an excess of rated values;
  - monitoring of phase currents concerning an excess of rated values;
  - the possibility to monitor additional indexes concerning their excess over permissible limits (cos φ, active and reactive power per phase, mains frequency, etc.);
- sustained monitoring of communication channels and the correct status of controllers;
- monitoring the status of street lighting switching units (e.g., switching it off, when protection system activates);
- monitoring the condition of the security system of an object, registering the time of its time of operation and annunciating the dispatcher staff members;

The complete set of this automated system of control of street lighting (ACS SL), manufactured by "Sigma Telas" ***includes:***

- equipment for the central dispatcher point (CDP, software;
- a power supply unit for street lighting;
- a light dimming system for the night time;
- communication facilities.

The said central dispatcher point is built on the basis of a computer and two modems, one of them secures communication with supply units over a GPRS channel, while the other one operates in the reception-transmission mode for processing SMS messages.

This system is supplied with a set of dispatcher programs, allowing to view switching circuits, creating own data bases, and to operate as part of a company LAN. This set of dispatcher programs can be complemented by the user and then the system will acquire extra functions. This system features also the possibility to implement multiple tariff energy- metering.

The system software consists of applications elaborated by "Sigma Telas", written

on the basis of the "Wonderware" software package and it is designed to control and monitor the status of street lighting supply units, and also a software package that was developed by the company to take readings from electricity meters.

A street lighting power supply unit (Fig. 1) incorporates a power automation device with an electricity meter for commercial metering, also a unit to monitor and control power automation devices, and a system of communication with the CDP.

The strong power device is meant for switching lighting lines and for protecting strong current circuits of the supply unit from overloads.

Fig. 1. A street lighting power supply unit

The automation and communication unit that communicates with the central dispatcher point (Fig. 2) provides for the remote monitoring of lighting lines status, for the remote control of power automation devices, for issuing emergency signals (alarms), for summarizing the said information and for its transfer to the CDP. The automation and communication unit includes a programmable GPRS modem with discrete and digital inputs that carry out both the collection, summarizing and transfer of information to the CDP, and the control of the power automation device, the transducer of the RS232/CL interface for establishing a link between the modem and the commercial metering meter, the uninterrupted power supply unit (UPS), a manual control panel controlling the supply unit, a device for switching on and off street lighting automatically.

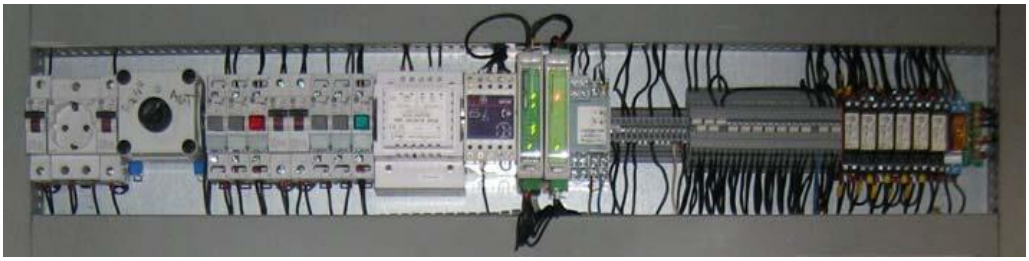


Fig. 2. An automation unit for communication with the central dispatcher point (CDP)

In the EC countries it is forbidden to save electric energy by partially switching off street lighting lamps i.e., by using the lit lamps in turns and the ones that are not on, because that leads to a higher level of personnel fatigue, to the worsening of car drivers' ability to correctly assess the road situation and as consequence, this can lead to a higher number of emergencies on the roads. If this is required by its customers, the company UAB "Sigma Telas" can equip its ACS SL with a street lighting dimming system (Fig. 3), which can reduce feed voltage in lighting lines. The time period and the degree of voltage reduction can be set according to the wishes of the customer. This kind of solution allows to a great extent save energy, while fulfilling all present-day requirements of sanitary regulations.

Fig. 3. The street lighting dimming system

Taking into account the customer's the company UAB "SIGMA TELAS" can design, manufacture and commission lighting control systems of different levels of complexity, with a flexible system of parameter monitoring and lighting control. In simpler devices, a modem made by the Teltonika Company - the Teltonika Box/N12R is used (Fig. 4). This is an integrated modem Nokia 12, which operates in GSM 900/1800 MHz or 850/1900 MHz (GPRS, SMS ...) systems, it has 7 digital input devices, 8 digital outlet devices, 3 analogue input devices and 2 RS232 ports. This instrument is fully

programmable, therefore the user can both write and save special JAVA namelets, thus adjusting the instrument to one's own needs.

Fig. 4. The Teltonika Box/N12R Modem

In more complicated ACS SL arrangements, when it is necessary to monitor a large number of system components, alarm signals, or to implement complicated switching operations, our company uses a "VALSENA" controller (Fig. 5).This is a specialized new generation tool, designed to control street lighting systems. It also has an inbuilt GPRS modem, an RS323, the Etnernet, an USB port, it has 9 digital inputs, 8 controlled digital outputs, 12 inputs of the phase currents control system and 9 phase voltage control inputs of street lighting.

Fig. 5. A "VALSENA" Controller

OPERATION OF THE CENTRAL DISPATCHER POINT

We shall examine the work of a dispatcher on the basis of the ACS SL built in Vilnius. In order to simplify its understanding, only two typical lighting points were taken as an example.

The basis of the control circuit here is made up of the following windows:

- one for the lighting control circuit;
- one for a log book for operative reports;
- a window for events history;
- one for graphs;
- one for the control medium.

When the dispatcher point is switched on, the window "Registration of the Operator" will be opened (Fig. 6).

Регистрация – registration; имя – name; пароль – password; да – Yes; отмена – Reset.

The operator should enter his name and his individual access code. If the name and code prove to be correct, access to the operation elements of the system is allowed. To secure this, a window is opened displaying a map of this city in which mimic symbols are contained: mimic symbols in the form of squares  indicating the locations where control points for lighting are shown, a log book of operation reports and the control organs of the system are shown too (Fig. 7)

Fig. 7. The main window of the street lighting control circuit

The mimic symbol (a square) with the location of a control point can be seen in one of two states: it will either blink, which fact will demonstrate that an irregular or an emergency situation exists at a given point of lighting, or it will not be blinking and this will prove that it is a in a good state of repair and that it operates in a prescribed mode.

Any standard and abnormal changes in the system operation are fixed in the log book for operations reports. In such cases alarm signals are demonstrated in different colors, for example,: red means an alarm signal, black means that the alarm has been received by the dispatcher, while blue means that a normal situation has been restored (Fig. 8).

Fig. 8. A log book of current reports

Журнал – log book; объект – facility; наименование сигнала; значение – meaning; оператор – operator; дверцы – doors; системы пригашения – dimming systems; входной рубильник – inlet cut out; открыты – opened; выключена – switched off; включен – closed.

When it is required to specify the status of a concrete supply unit of street lighting, it is necessary to place the cursor onto the square of the required area on the map. Then a detailed map of the city area where this control point is located will be opened. In such a case the color of the mimic symbol indicating street lighting supply points determines their technical condition. When this mimic symbol of a street lighting supply point is pressed, then an additional information window with the functional diagram of the power automation device and with the switching electricity diagram at a given moment of time will be displayed (fig. 9). In this additional window also inscriptions indicating the status of individual elements of the diagram, control organs in the form of keys and a table with the momentary electric supply parameter values for each lighting line will be displayed. (Fig. 10).

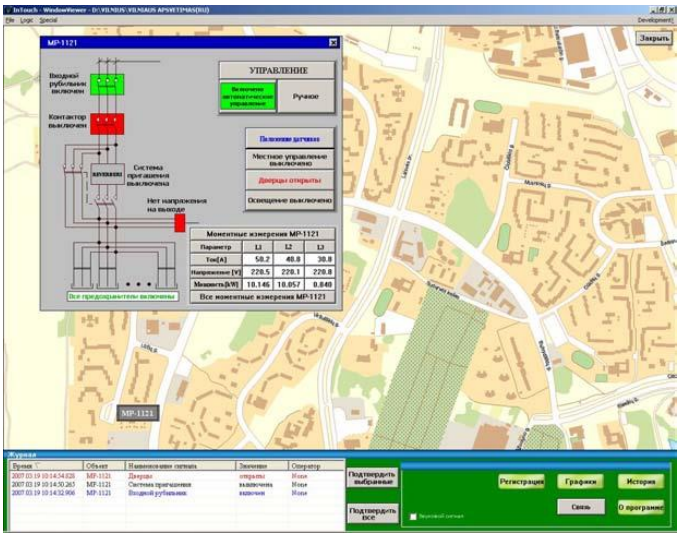
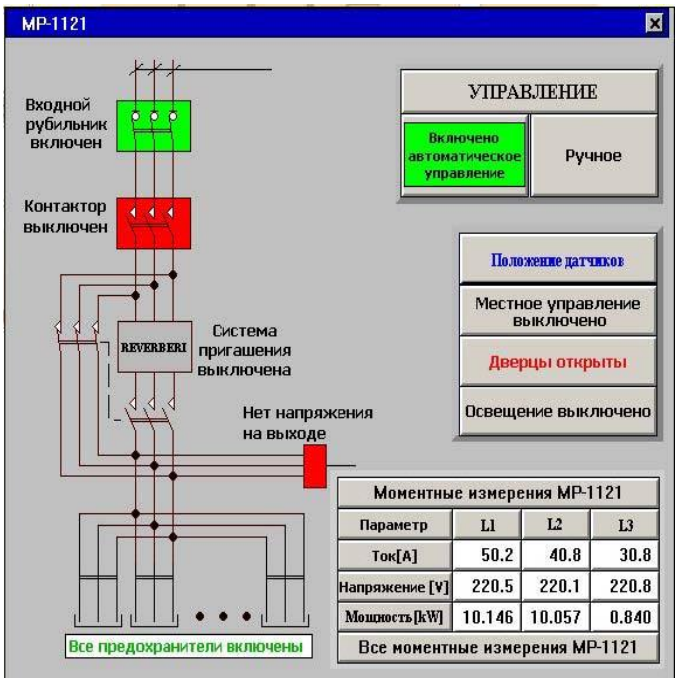
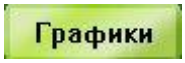


Fig. 9 A detailed city map showing the location of a street lighting supply point



The Main Control Organs

1. Key 1 - 

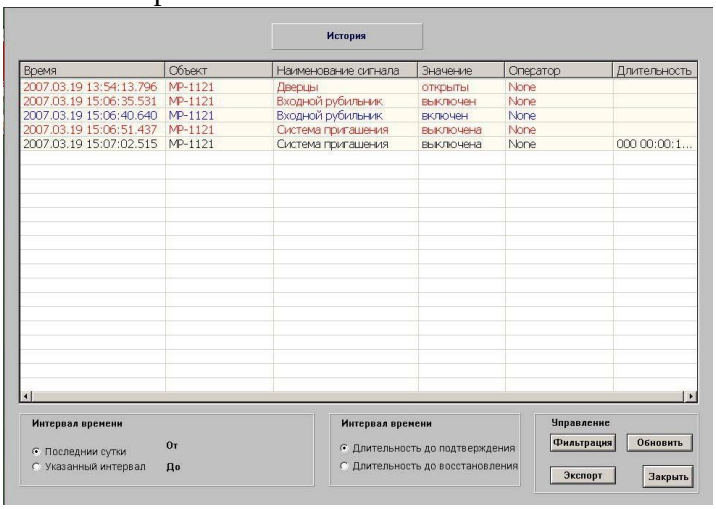
Graphs.

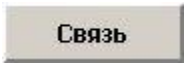
When this key is pressed, a window is opened, in which an operator can see the displayed graph of the momentary values of electric parameters at some lighting point at a given moment of time or parameter graphs for a fixed period of time.

2. Key 2 

- History.

When this key is pressed, a window is opened, which shows information about all standard and alarm messages that took place.



3. Key 3 - 

- Communication.

When this key is pressed, a window is opened, the dispatcher can monitor the status of communicational channels on the basis of data in it, and, if required he can request information from street lighting supply points at a given moment of time.

4. Key 4 - 

- About the program.

In case the maintenance personnel has any questions related to the system operation, they can, by pressing this key, have an information window displayed where contact phone/fax numbers etc. are shown in order to get technical assistance or to invite technical experts who monitor this system operation.

The AMR system developed by UAB “SIGMA TELAS” has been introduced to actual use and it has been operated successfully by a number of companies in outdoor lighting systems in many cities and at industrial plants.

According to many references on the part of our customers and maintenance specialists, this system is simple to manage, it is reliable and convenient to use, it features a vast information stock, it is flexible and well secured.