Iskra ®

Intelligent street light control system

Traditional implementation and street lighting organization has no possibilities of future improving and development. Dynamic changes in economy, energy supplies and ecology on a national, European and world wide scale require an adequate modernization of street lighting system. However, this is possible only with quite new functional conception which in fact means adaptability of street lighting. Simultaneously ensuring safe traffic conditions and decreasing energy consumption and operational costs can be realized in conformity with ongoing change of environment parameters. In conformity with 24 hours daylight change, highly changeable traffic, variable meteorological conditions and sometimes extreme situations on the roads, intensity of street lighting must change in a dynamic manner. New technical devices and methods offered by technical progress are necessary in order to implement adaptive lightning system.

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![Iskra logo]

Intelligent Street lighting is a new conceptual and technical solution as an adaptive lighting system.

Main reasons for intelligent street lighting system adoption are:
■ to create conditions for safe traffic of motor vehicles;
■ to reduce transportation problems;
■ to reduce energy consumption (to avoid excessive illumination);
■ to reduce light pollution (to prevent light dissipation beyond illuminated road);
■ to reduce operation costs;
■ environmental protection. To reduce noxious emissions (Kyoto Protocol);
■ to restrict the use of harmful substances;
■ crime reduction;
■ longer lamps' life.
■ reduced maintenance costs
■ on – time Key performance indicators information

Intelligent street lighting system consists of several subsystems:
■ roadside equipment,
■ local control system,
　■ Level One includes:
　　■ Luminaires with dimmable electronic ballast with power line modem;
　　■ Controlling high pressure sodium or metal-halide lamps;
　■ Level two includes:
　　■ Substation (SubCentral) with local segment (network) controller;
　　■ Local power line controller (with power line carrier communication).
■ central supervisory system (Control Center) and
■ communication network.

Roadside equipment

Aerolite LSL® LED street lights are currently one of the most advanced LED street lights available on the world market and will provide the best product ratio between quality-price.

They are produced with top quality materials under highest automotive production standards and have acquired all needed certificates for quality and performance. Aerolite LSL® LED street light are currently available in 5 different models: LSL®15, LSL®30, LSL®45, LSL®60, LSL®90.

All standard models are available in basic color (grey), in 3 versions:
■ BV: basic version (without dimming)
■ PR: with power reduction (50 %)
■ DIM: dimming range from 1-100 % (control signals 1-10V)

Aerolite LSL® LED street lights can be used for streets, roads, highways, parks, walking paths, bicycle lanes, parking places, alleys, drive-ins, industrial complexes, airports, etc.

MATRIX 3D LIGHT™ - best possible light uniformity
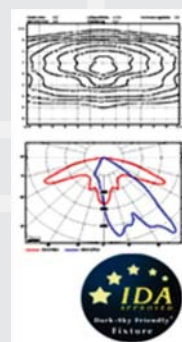
Every single light beam has been controllably directed through our QUADRUM optics™ to distribute individual light beams exactly on the spot where it has been calculated. All lighting spots together form unique MATRIX 3D LIGHT™, which increases the utilization rate of light on the surface, reduces glaring and allows for the best possible light uniformity.

Reduced light pollution and glare

LSL® LED street lights have asymmetric MATRIX 3D LIGHT™ distribution. In addition to covering the road surface, with asymmetric MATRIX 3D light™ which dramatically improves traffic safety, we also vertically illuminate objects next to road and therefore increase safety for pedestrians. The full cutoff feature in combination with asymmetric MATRIX 3D light™ enables reducing the light pollution to zero point, preservation of night sky, serene night sleep - better life quality and satisfies strictest environmental standards of International Dark Sxy Organization.

According to different needs, LCL® LED commercial lights have symmetric MATRIX 3D light™ distribution. Additional angle shading feature in LCL® results in an anti-glare final lighting effect.

Increased traffic safety
- appropriate color temperature

The color temperature of our luminaires was carefully chosen, since it is important that light displays true colors of illuminated objects by night, and is both pleasant and human eye friendly at the same time.
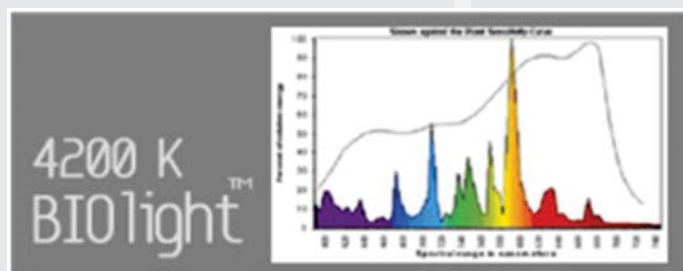
Light color temperature of 4200 K – BIO light™ is used due to its numerous advantages.

This particular color temperature has the best balance between natural color distribution, overall brightness, efficiency, and pleasantness to the human eye at night. Since it shows the real color of illuminated objects, it dramatically increases overall traffic safety.

Certificates

The high quality of products and production line of street lights is backed up with original certificates. All facts are tested, proved and signed by official associations and independent institutes. This represents one of the greatest advantages of Grah Automotive in comparison with competitors.

- Production certificates
    - Automotive ISO/TS 16949
    - ISO 9001:2000
    - ISO 14001:2004

- Products certificates
    - CE
    - VDE
    - RoHS
    - ENEC
    - IEC 60598
    - IDA approved
    - UL
    - Energy star (in process of certification)
    - TUV: Automotive ISO/TS 16949
    - TUV: ISO 9001:2000
    - TUV: ISO 14001:2004
    - CE
    - VDE
    - RoHS
    - ENEC
    - IEC 60598
    - IDA
    - FIXTURE SEAL OF APPROVAL
    - UL
    - ENERGY STAR

Local control system

Local Controller

Through interface lamps are connected to segment controller of the Adaptive lighting system. Connection is established for

- Automatic operation as a communication controller;
- dimming testing;
- smooth dimming of the lamp luminous flux;
- on/off lamp switching;
- monitoring and data collection of:
  - lamp status (on/ off/, % dimming);
  - length of lamp operating time (by dimming levels);
  - number of lamp switching on and off indication;
  - electrical parameters of the luminaire: supply voltage, lamp voltage and current
  - lamp and ballast failures.

Segment controller

Main local lighting installations control unit is developed to perform following functions:

- to act as a router, setting a local area network (LAN) with/between local controllers PLC;
- to store information on the PLC lamp controllers operation over a definite time period (or number of commands, for example the last 100);
- to provide link (direct or through Internet) with control and monitoring devices external to the local system. Access is achieved in a wireless manner (by means of GSM/GPRS/3G/IEEE802.11/IEEE802.16) or through a cable line, depending on available means;
- to protect information exchange with higher levels against unauthorized access.

Local controllers have inbuilt functions for:

- reprogramming capability of the segment controller for changing lamp operating data
- automatic switch over to 100% operation mode upon failure of communication with the segment controller LSC;
- Post-alarm or end-of-life operation programming feature.

Local segment controllers provide road luminance level depending on:

- traffic volume: the roadway luminance levels in case of less busy traffic and reduced travel speed are coordinated with representatives of the traffic control system
- weather conditions: in heavy rain the street lighting operates at 100% power mode irrespective of the traffic volume (according to information from WMC);
- Presence of fog: in the presence of fog the street lighting operates at 100% power mode irrespective of the traffic volume (according to information from a fog detection and determination system at WMC);
- Roadway icing: in presence of roadway icing the lighting installation operates at full (100%) power mode irrespective of the traffic volume (according to information from the SCS system at WMC);
- Road accidents or road repairs: in such cases the lighting system operates at 100% power mode irrespective of the traffic volume.

In addition, the segment controller:

- provide photocell and timer-aided control and dimming of the lighting installation by a real-time clock according to the annual calendar of sunrise and sunset (taking into account the street category)
- store an adequate volume of information, transmitted from lower system level (electrical parameters, times of lamp operation for different dimming levels, number of switching on and off, etc.);
- informs Control Center of events related to parameters exceeding the set limits;
- provide rough metering of power consumption by the lighting installation;
- have an UPS assuring operation after loss of supply (preserve information received from the local controllers);
- reduce lamp power in order to contain the initially higher luminous flux within the limits of the required operating flux;
- have hardware and software support (in lighting installation with electromagnetic ballasts) for the control of a voltage limiter for lamp dimming matched to the mean operating value of the luminous flux and the actual supply voltage level, in order to prevent excessive power consumption in new lamps due to the maintenance.

Control Center

The higher level of the intelligent street lighting system consists of the Control Center; which is Supervisory, Key performance indication and Administration Center.

Communication with/between the Control Center and outdoor lighting units/network is established through Internet with appropriate access authorization measures or with cable line. From a computer connected to Internet, it observes local systems. Control Center has software support for issuing reports on the operation of the local systems.

Most usual use of adaptive street lighting system is its integration into existing Traffic Control Center. Adaptive street lighting system/center is a web-based management system, providing operative information to the operating staff: hours of lamp operation, road accidents (time of occurrence and duration of remedial works), etc. Information from segment controllers are stored in a working station, acting as server.

Computer is used to create a WEB-based data that can be used from a computer connected to Internet (taking the appropriate measures against unauthorized access). It is able to connect to the outdoor units and visualize the information obtained from them.

Two-way real-time communication between local controllers and control center is established for the purpose of:

Transmission of alarm signals: various alerts based on information from the software (such as expiry of a lamp's service life). Post-alarm actions include:
- web site content updating;
- network information updating;
- sending SMS, e-mail, etc. to the monitoring device;
- automatic input of other lighting scenarios.

Data acquisition: information from local controllers are automatically accumulated in the segment controller and transferred to the Control Center at regular intervals.

Lighting installation control is performed:
- on the basis of control center information, received respectively from outdoor units/system;
- by a real-time clock and calendars– in the absence of communication with control center
- manually, by control center dispatcher, using preset priorities and functions.
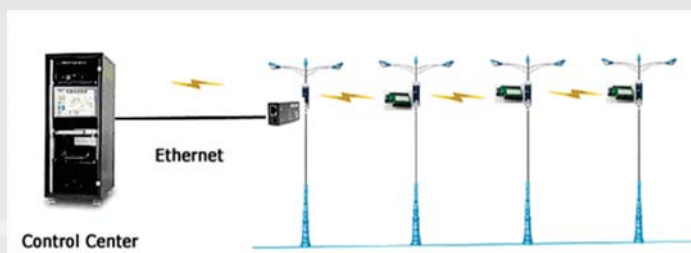
Traffic Division
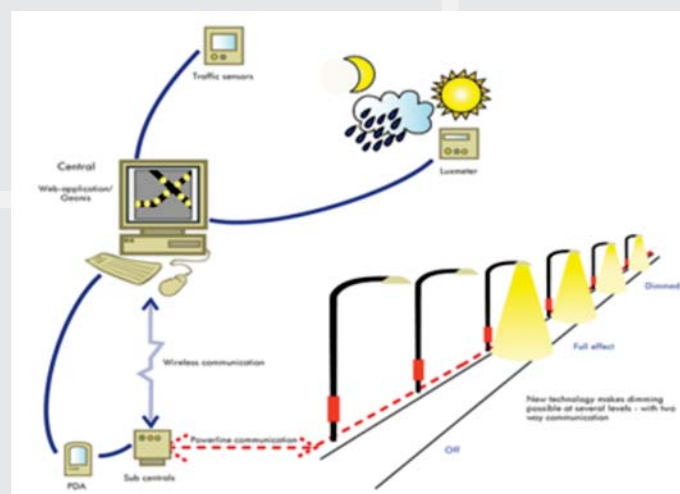
System software

System software consists of four functional modules:

- Configuration and installation performed by means of GUI. Configuration of each light point is fully open.
- The operating module consists of two displays. One is a working display used for communication. The other display presents the status of a selected part of the lighting installation.
- Data collection module is affected by means of the log function recording reports and errors in the automatic system and storing them in the data base. Data collection is effected in the local and segment controllers. At regular intervals data accumulated in the segment controllers are uploaded to the control center
- Manager's package, based on an open structure of the data base, analyses main information in the data base and its analysis are carried out through control center

Main Benefits

- Substantial energy use reduction with real-time requirements adoption.
- Lower maintenance costs with individual lamps tracking and monitoring, replacing components based on actual performance history, automatic failure alarms notifications…
- Less pollution, better performance
- User friendly software, easy to install system, adaptation to existing control centers.
- Adaptation to new technologies
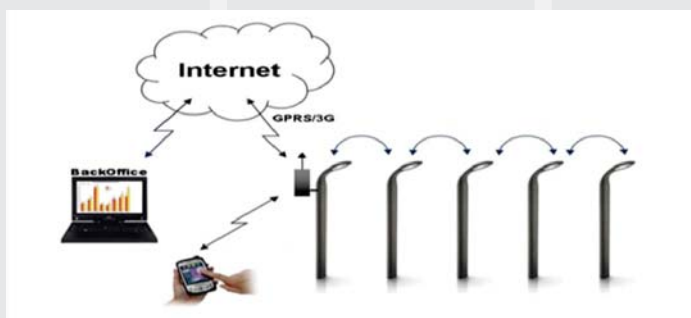- Adaptation to new services
- High reliability

Communication system / network

The communication system/network performs information exchange between different subsystems and collects data for Central supervisory control system and in Lighting sub central. Communications are enabled by two options:

a. use of the power supply network as a communication medium

b. use of wireless communication system

- WiFi (Wireless Fidelity) is a brand originally licensed by the WiFi Alliance to describe the embedded technology of wireless local area networks (WLAN) based on the IEEE 802.11 specifications. WiFi was developed to be used for mobile computing devices, but is now increasingly used for more services, including Internet access, and basic connectivity of consumer electronics. WiMAX (Worldwide Interoperability for Microwave Access) is defined as a technology by the WiMAX Forum, in order to promote conformance and interoperability of the IEEE 802.16 standard, officially known as WirelessMAN. WiMAX aims to provide wireless data over longer distances comparing to WiFi, in a variety of different ways, from point to point links to full mobile cellular type access, providing required quality of service guarantees. Both wireless technologies are developed for data transmission and therefore are suitable for the considered application.

  Wireless microcontrollers are ideally suited to streetlight control, with a very low cost-point and long transmission range. Networking software maintains the network structure, self-healing the network around any nodes that may have suffered a fault. These networks can have up to 1000 nodes and will automatically reform following any power disruptions. Further, with 16 radio channels, multiple networks can co-exist together. The underlying protocols use internationally recognized standards and the license-free 2.4GHz radio band is available across the world.

- LTE (3 GPP Long Term Evolution) is a standard for wireless data communications technology and an evolution of the GSM/UMTS standards. The goal of LTE is to increase the capacity and speed of wireless data networks using new DSP (Digital Signal Processing) techniques and modulations that were developed around the turn of the millennium. Its wireless interface is incompatible with 2G and 3G networks, so that it must be operated on a separate wireless spectrum.