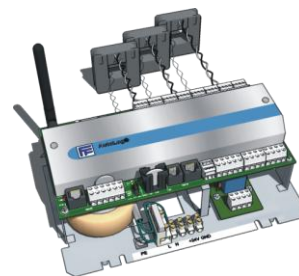




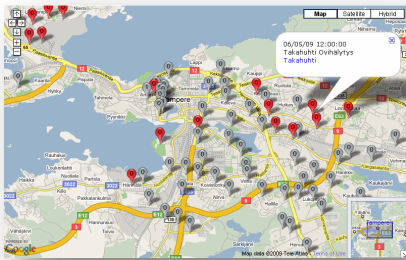
AutoLog® SaveLight Technical Specification



1 Introduction

1.1 Intelligent Street Light Management System

We are pleased to introduce the energy saving features and other benefits of intelligent street light management system called “AutoLog® SaveLight” from Finnish company FF-Automation.



Hosted server with remote web based user interface



Intelligent street light feeder pillars

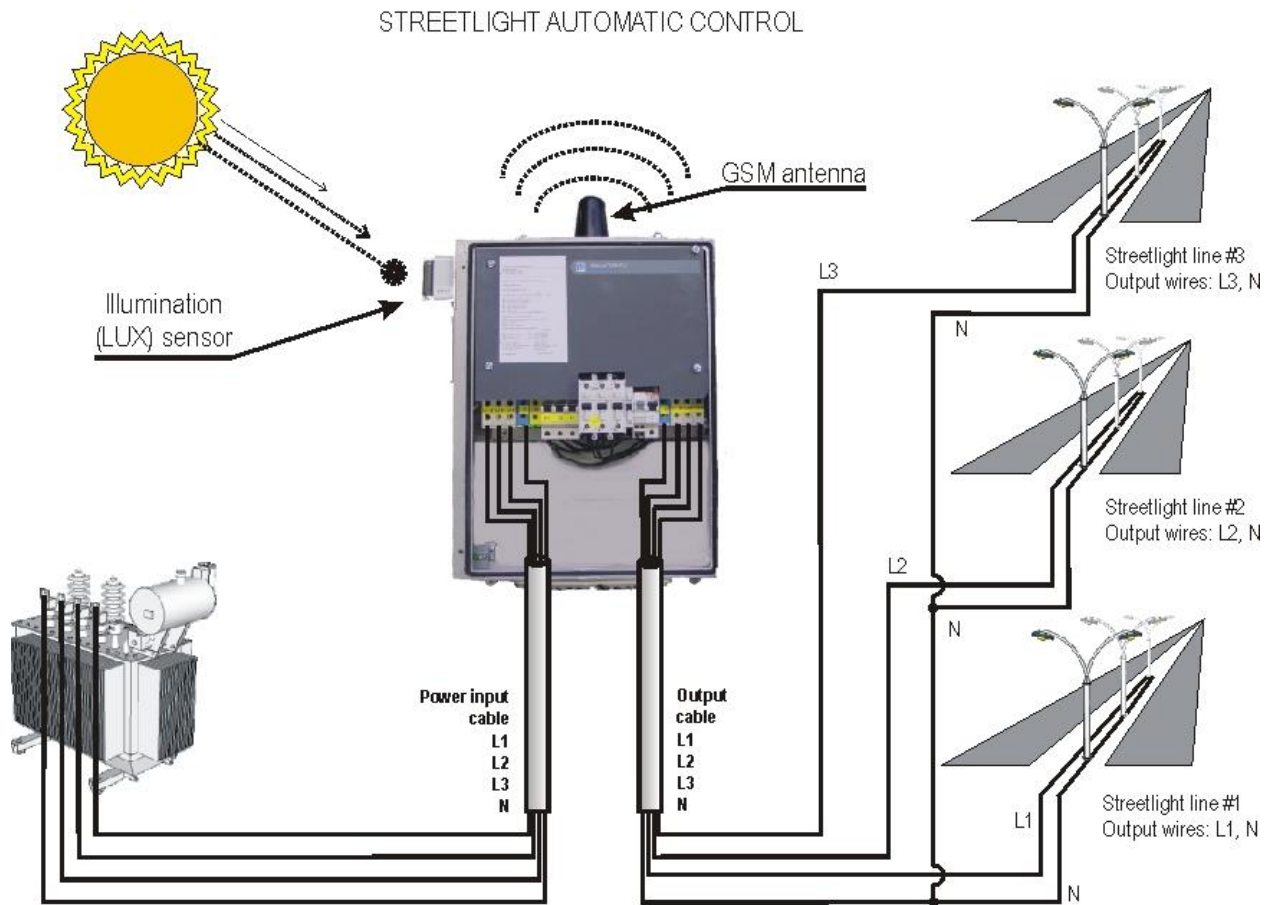
AutoLog® SaveLight is a brand name for complete solution which includes the following main parts: Intelligent street light feeder pillars; Hosted server with remote web based user interface; GSM / GPRS based communication between feeder pillars and the server.

Over 20 cities in Finland are using AutoLog SaveLight system to save energy.



Lowered power consumption leads also to lowered CO₂ emissions!

1.2 Basic Operating Principle

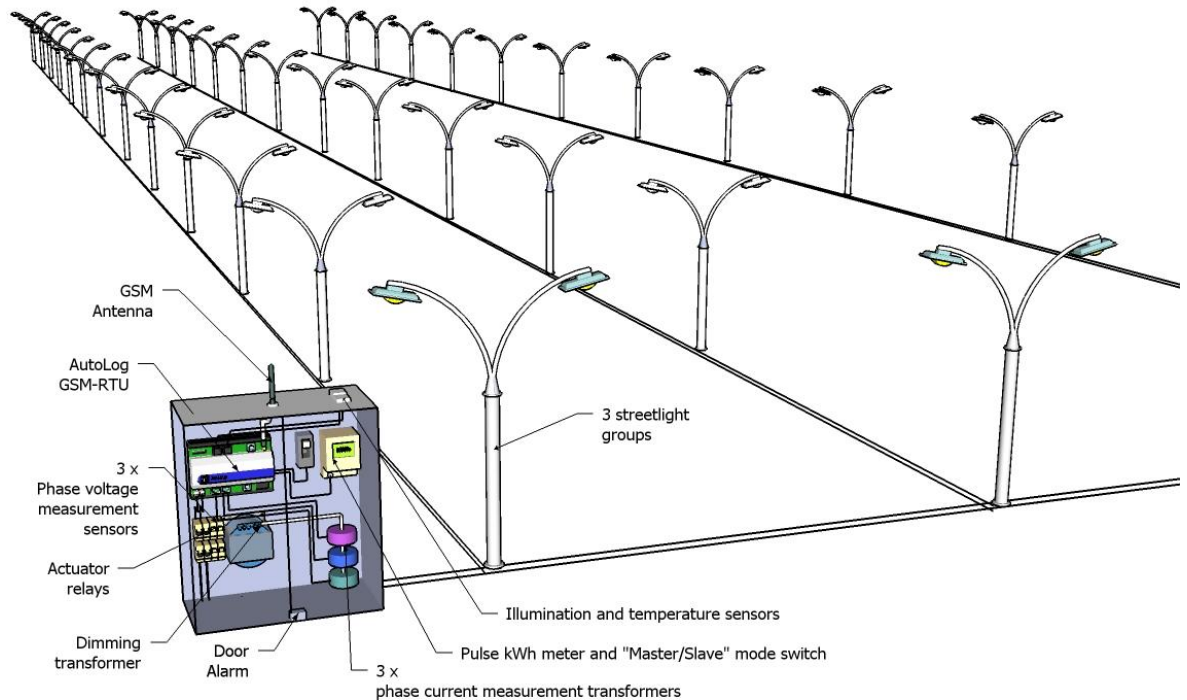


Basic wiring and operation diagram of SaveLight Feeder Pillar

AutoLog SaveLight Feeder Pillar unit controls street lights according to measured lightness and internal clock & calendar. Street lights can be controlled also manually from web interface or with GSM phone.

AutoLog SaveLight feeder pillar gets power input from power grid's transformer station. Normally the power input is 3 x 230 VAC. There are 3-phases called L1, L2 and L3 and also common N. One street light line can include tens or even hundreds of street light poles. Street light lines can be grouped together to have one 3-phase control group or there can be 3 individually controlled street light lines so that every phase is controlled separately.

SaveLight feeder pillar can be equipped with components which allow 50A or 100A current supply per phase. So the feeder pillar can control 3 x 11kVA (3 x 230VAC * 50 A) or 3 x 22kVA (3 x 230VAC * 100 A) street light lines. If for example street light line includes 200 W light bulbs one 11kVA line can control (11000 / 200 =) about 55 light bulbs. It also depends the internal resistance of the cable, how many lights can be controlled per line.



Basic operation diagram of SaveLight Feeder Pillar

In addition AutoLog SaveLight Feeder Pillar can control street light dimming by dropping the supplied voltage e.g. from 230VAC to 200VAC. Dimming needs special dimming transformers. FF-Automation can manufacture and supply feeder pillars which have also dimming transformers.

AutoLog SaveLight unit measures RMS current and voltage from all three phases and sends alarm message if the failure occurs in power supply. It can also detect burned lamps using the special algorithm which detects changes in current and voltage levels.

1.3 Communication

AutoLog SaveLight control units communicate wirelessly with Web Server using wireless GSM network.

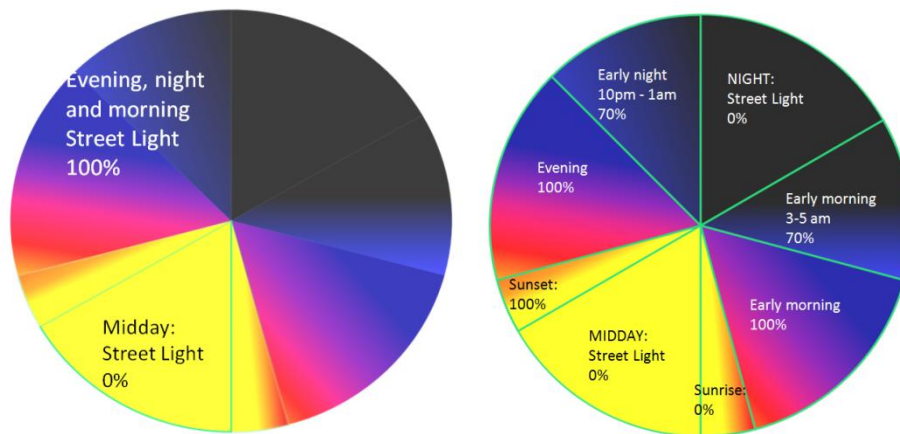
Some of the SaveLight control units operate as masters and others operate as slaves. Only master units have light intensity sensor. One master unit can control several slave units to turn ON/OFF the lights. Master unit uses free call controls for controlling slave units, so there are no communication costs for this.

SaveLight control unit collects and stores measurement and status information from the voltage- and current levels and light switching times etc. into its memory. These files can be sent to Web server using GPRS or SMS messages.

User can send control SMS messages to SaveLight control units using mobile phone.

SaveLight control units have incoming phone number identification method, so it can forbid controls from undefined phone numbers.

1.4 Energy saving methods



Before and after. Using AutoLog SaveLight 20-40% energy savings can be realized.

1.4.1 More accurate switching times

AutoLog SaveLight feeder pillar takes information from light sensors, time tables and adjustment parameters and combines this information to control the lights. It can turn lights on and off more accurately than traditional systems. Switching times can be monitored from web interface and manual adjustments can be made remotely. Traditional controlling is normally tuned so that it will keep the lights burning more than necessary because the adjustments are hard to handle. Traditional system cannot compensate malfunction or dirt in light sensors which normally leads to unnecessary long lighting times.

1.4.2 Turning lights off at certain times

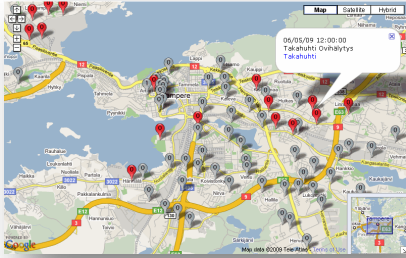
For some places, lighting is only needed at certain times. AutoLog® SaveLight can control all three phases separately so each phase can form own individually controllable light group. Groups can be switched off e.g. at midnight hours during off-peak traffic hours.

1.4.3 Dimming the lights at off-peak traffic hours

Maybe the most significant energy saving feature is that AutoLog® SaveLight can dim the lights during the off-peak traffic hours. Dropping the voltage e.g. from 230-VAC to 195-VAC might not seem significant, but the formula $P=U^2/R$ makes it significant. Only considering the U^2 parameter makes 25% energy savings. In addition when using lower voltage, the resistor temperature decreases, leading higher resistance, which gives also more power savings. It was measured in field tests that 195-VAC dimming can give 40% energy savings. (Hyvinkää and Espoo cities, Finland)

The total energy saving percentage is normally about 20-40% when combining all these methods. Yearly savings are huge and the system will pay itself back very rapidly.

1.5 Remote Web interface



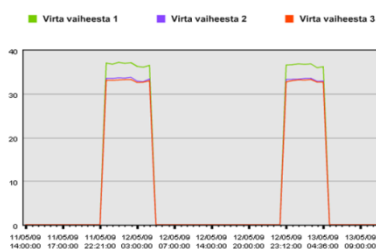
AutoLog® SaveLight feeder pillars communicate bi-directionally with the Web server. Web Server receives valuable feedback information from feeder pillars, like latest and historical lighting status, phase switching times, broken lamps detection etc.

From Web interface, user can configure adjustment parameters to optimize feeder pillar switching times. In special situations like traffic accidents, lights can be switched manually from the web interface.

Web interface includes for example the following features: (1) Dynamic map view, which shows the location and status of feeder pillars, (2) Alarm view, which informs any abnormal conditions. Alarms can be forwarded to maintenance personnel's e-mails or mobile phones. (3) Trend / Report view showing voltages, currents, on-, off- and dimming times etc. (4) Control view for making adjustments for switching times (5) Maintenance views for adding new feeder pillar views to the system.

Web interface can be used anywhere and anytime with web browser. It is based on secure web page technology. Communication between feeder pillars and web server is using GSM/GPRS and Internet network so there's no network investment costs. Communication is designed so that the communication costs are kept minimal.

1.6 Measuring consumed power.



AutoLog SaveLight Control unit measures RMS current and RMS voltage from all 3 phases. Consumed electricity can be calculated in control unit and this information can be seen in Web interface's trend lines. Voltage and current measurements are giving reliable feedback that the feeder pillar and light lines are working correctly and the lights are switched on, off or dimmed accurately when expected.

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When lights are broken, it alters the supplied voltage. These changes are automatically detected in the feeder pillars and “burned lamp” alarm can be send to Web server.

In some areas pilferage (stealing) of electricity can be a problem. Pilferage can be detected when measured current consumption rises above defined alarm limits.

1.7 Using the dimming system with existing lamps



Dimming needs special transformers, which can drop the supplied 230-VAC voltage to suitable dimming level e.g. 195-210-VAC. Suitable dimming level needs to be tested case by case. FF-Automation can supply feeder pillars with dimming transformers.

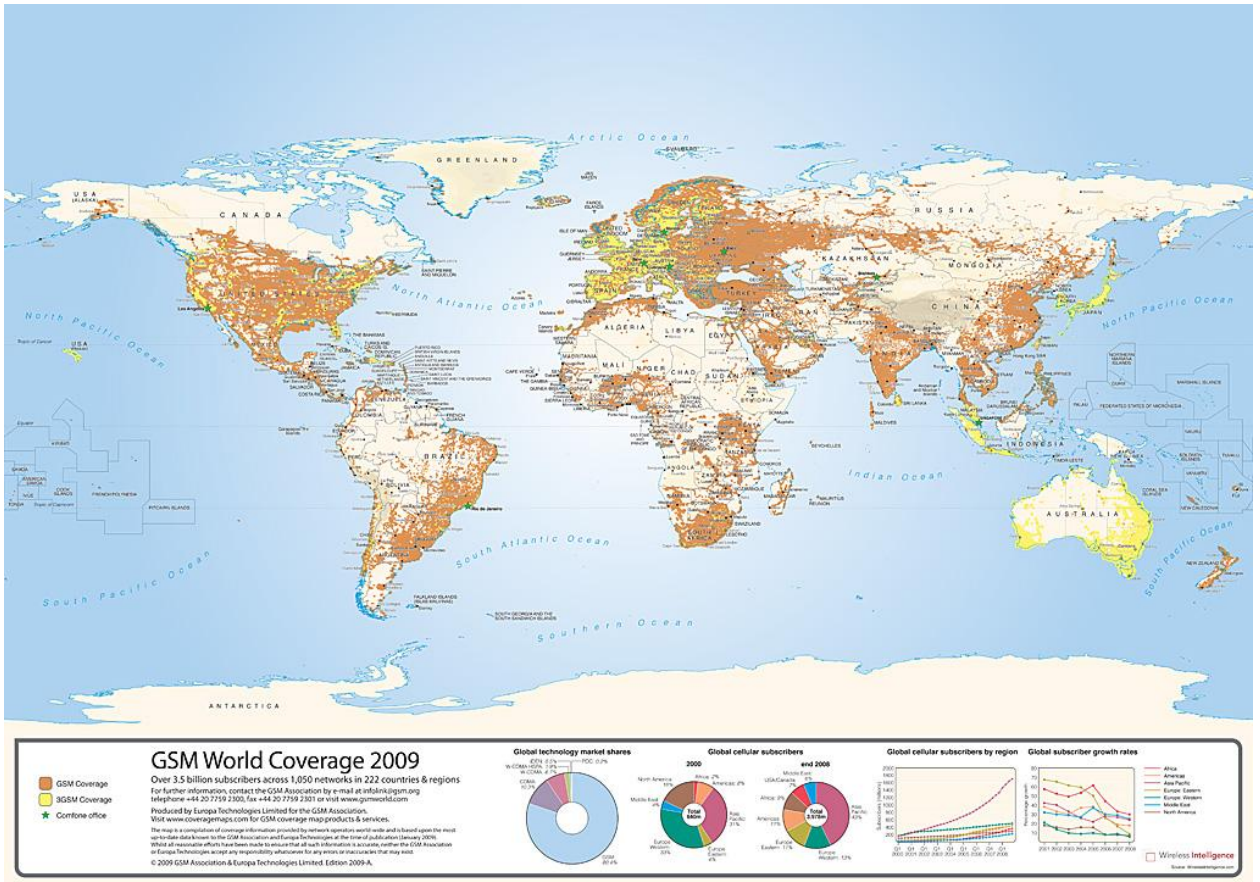
“When it was tested what kind of effect the dimming has to illumination, test group didn’t even notice when the dimming started but when the light were switched back to 100% voltage small change could be noticed.” (Hyvinkää city, Finland, 2010)

FF-Automation got the following feedback from the end-user when they were testing how the lamps withstand the dimming. “Sodium lamps have about 4 years life-time, with dimming it can be increased to 5 years. Mercury lamps life time can be 15 years, but the light efficiency decreases 20-30% per year so normally lamps are changed after 5 years. Mercury lamps consume more electricity and will be prohibited in EU by the year 2015. 10-15% dimming doesn’t have significant affect to mercury lamps life time.”



Every saved kWh reduces CO₂ emissions by about 400g!

1.8 GSM connection



As a communication system for AutoLog® SaveLight it was chosen reliable and widespread GSM (GPRS) network. Being in fact a worldwide standard for mobile communication, GSM networks are working in the most part of countries and cities. It is obvious that GSM has lots of advantages.

- It is reliable and fault tolerant;
- Supported in most countries and cities;
- Supports spurious communication sessions;
- Does not require own network or additional equipment;
- Low-cost communication;
- Easy-to-maintain equipment;

AutoLog® SaveLight control unit has built-in GSM modem which is a reliable communication tool, connected directly to PLC. SIM card (to be provided by customer) have to support basic functions like SMS and GPRS.

Supplied stubby GSM antenna has to be connected to HF_CON connector. GSM LED light shows how GSM connection works. If signal is too weak for normal operation (metal enclosure, long distance from base stations etc.), it is recommended to install outdoor antenna, connected to HF_CON. Antenna type and its place have to be determined according to local installation condition. Various types of antennas and cables can be requested from FF-Automation.

2 Products

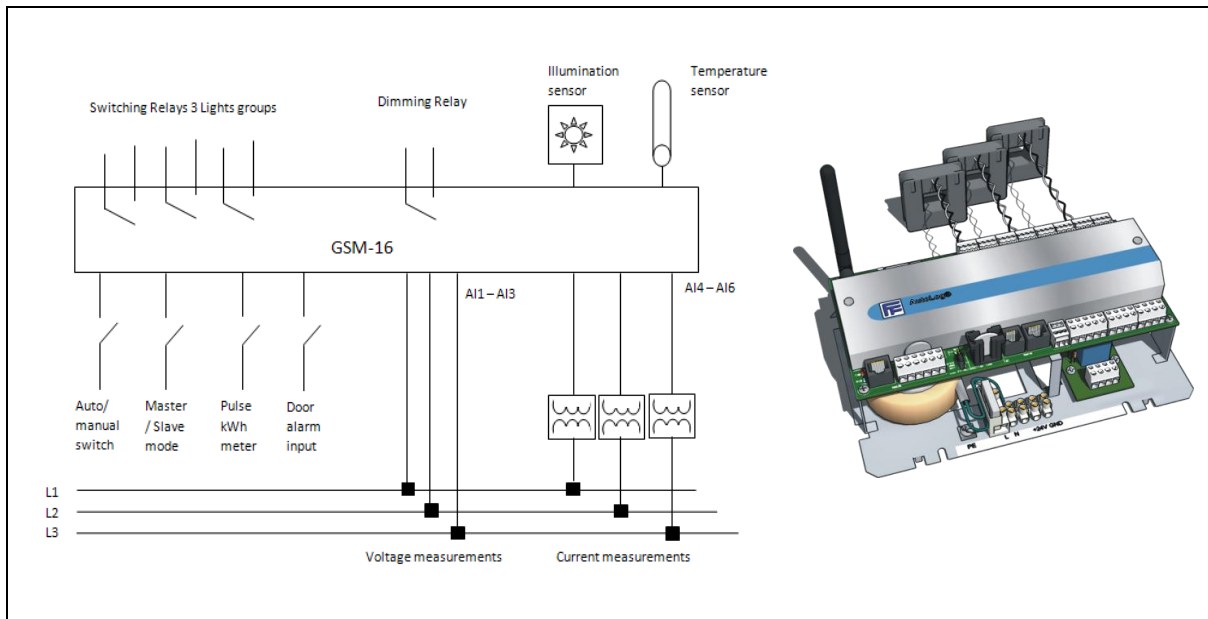
2.1 Street Light Control & Energy Saving System



FF-Automation has delivered AutoLog SaveLight Street Light Management Systems to over 20 cities. The SaveLight system uses AutoLog ControlMan Web SCADA service. With intelligent street light control system cities can have 20-40 % of energy saving.

STREET LIGHT CONTROL & ENERGY SAVING SYSTEM		
Code	Designation	Description
900108	AL SaveLight Control UNIT GSM-16	Needs to be installed inside the existing or new feeder pillar. RMS Current and RMS voltage measuring from all three phases. (includes 900813 and 3 x 900100). Based on GSM-16
900130	AL SaveLight Control UNIT GSM-4	Needs to be installed inside the existing or new feeder pillar. No current or voltage measurement. Based on GSM-4
900133/ 900134	AL SaveLight Feeder Pillar 1CG-Alu-50/100A	Feeder Pillar Unit, One light control group. Aluminum outdoor enclosure IP65, Wall or pole mount, Power 50A, 3 x 11kVA / 100A, 3 x 22kVA (includes 900108), antenna, Weight about 13 kg. Easy-to-install model: Build-in current and voltage measurements.
900135/ 900136	AL SaveLight Feeder Pillar 4CG-PM-50/100A	Pole mount, IP56 / NEMA 4X Power 50A, 3 x 11kVA / 100A, 3 x 22kVA Contactors for three light control groups (includes 900108)
900137/ 900138	AL SaveLight Feeder Pillar 4CG-FS-50/100A-Dimming	Floor Standing, IP56 / NEMA 4X Power 50A , 3 x 11kVA / 100A, 3 x 22kVA, Contactors for three light control groups 3 x dimming transformers (includes 900108)
900115	AL Light Intensity Sensor	Light intensity sensor. Only master unit needs Light Intensity Sensor. One master unit can control several slave units.
900813	RMS VOLT.MEASUR.UNIT 3C	RMS Voltage measurement Unit 3C. This is included in standard products.
900100	CURRENT MEASUR 50A	On cable measurement. No need to cut cables! Max 50A. Three of these are included in standard 50A products.
900101	CURRENT MEASUR 100A	On cable measurement. No need to cut cables! Max 100A. Three of these are included in standard 100A products.
N/A	AutoLog ControlMan	Web SCADA service

2.2 AutoLog SaveLight Control UNIT GSM-16 (Code: 900108)



- Needs to be installed inside the existing or new feeder pillar.
 - o Doesn't include enclosure
- RMS Current and RMS voltage measuring from all three phases.
 - o includes RMS Voltage Measurement Unit
 - o includes RMS Current Measurement 50A or 100A
- Based on AutoLog GSM-16
 - o Build-in GSM modem
 - o SIM card is not included. Customer should buy SIM card locally.
- GSM-16 can be powered using 230 VAC or 12-30VDC or 12-24VAC
 - o includes power transformer (230VAC to 18 VAC)
- 8 Analog Inputs (3 x RMS current, 3 x RMS voltage, 1 x Light intensity , 1 x temperature sensor)
 - o Light Intensity sensor is not included.
 - o Temperature sensor is not included.
- 4 Relay outputs (3 control groups, 1 reserved for controlling dimming)
 - o Contactors are not included (relays cannot be used directly to control light groups.)
 - o Dimming transformers are not included.
- 4 Digital inputs (1 reserved for door open alarm, 1 for Auto/Manual switch)
 - o Door open switch or Auto/Manual switch are not included
- includes GSM antenna
 - o Depending on the signal level antenna can be installed inside or outside enclosure.
- Manual CD and AlproWin Programming software CD is included.

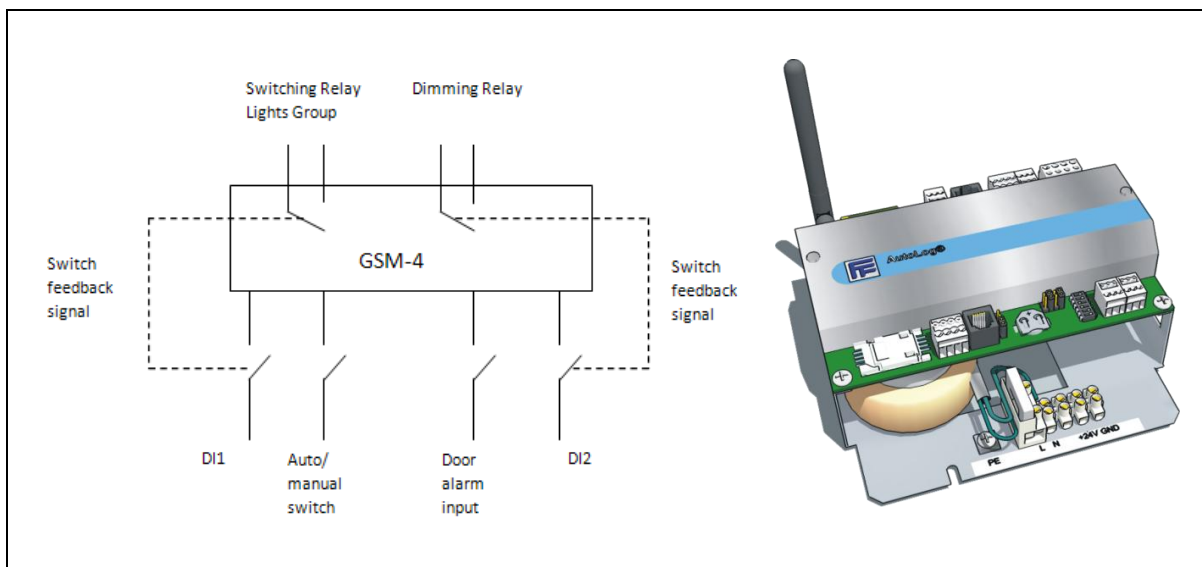
2.2.1 Functionality (900108):

- Controls Lights ON / OFF according to light intensity sensor and internal clock.
 - o The switching levels can be set.
- Receives control commands from master Unit through GSM network
 - o Only master unit has light intensity sensor
 - o There can be several master units in the network

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- Master unit can control several slave units to switch ON/OFF the lights using free GSM call controlling.
- Unit can operate as slave or master unit. Selection can be made using jumper cable.
- Can turn OFF the lights in the midnight at off-peak traffic hours.
- Measures RMS voltage and RMS current to detect any failure and to get feedback that the lights are turned on / off.
 - Algorithm detects burned lamps.
- Sends measurement and status information to ControlMan Web service
 - GSM-16 can log measurement data into its memory
 - Data can be send using SMS or GPRS/FTP

2.3 AutoLog SaveLight Control UNIT GSM-4 (Code 900130)



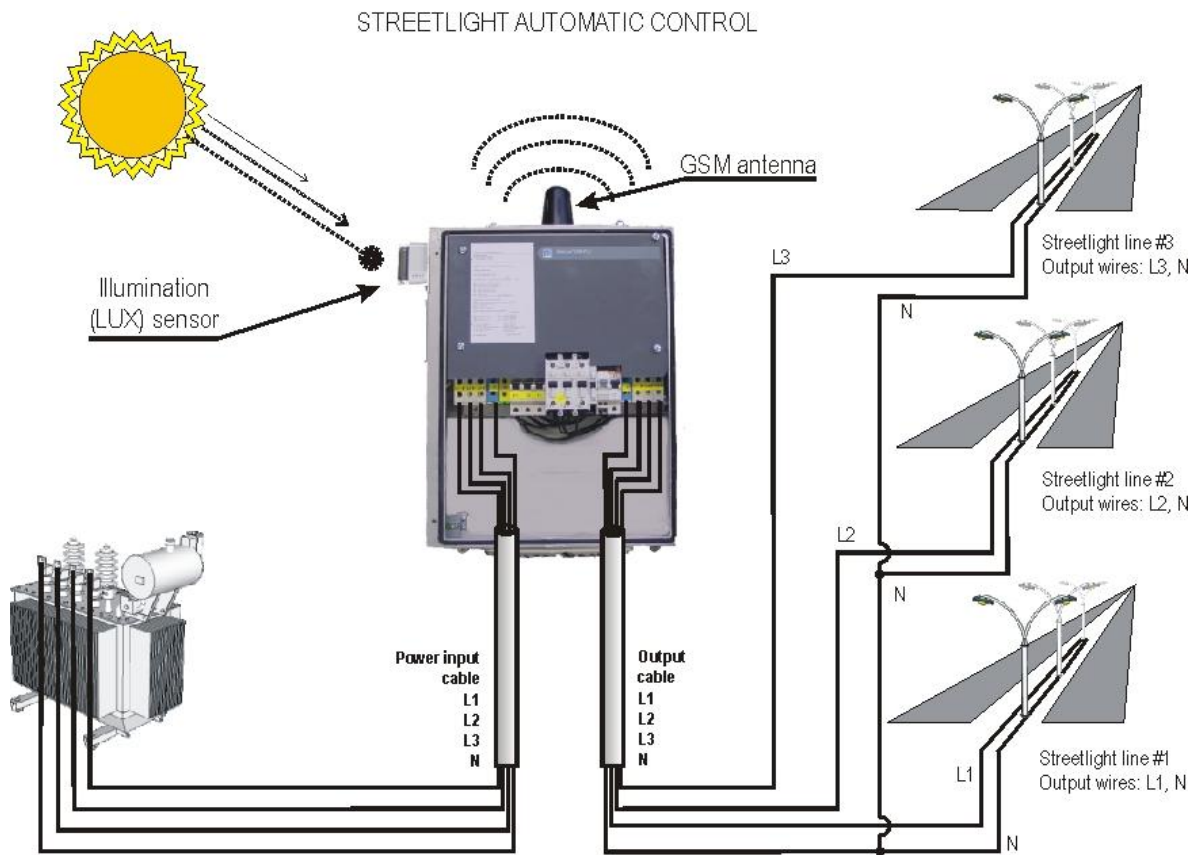
- Needs to be installed inside the existing or new feeder pillar.
 - Doesn't include enclosure
- Based on AutoLog GSM-4
 - Build-in GSM modem
 - SIM card is not included. Customer should buy SIM card locally.
- GSM-4 can be powered using 230 VAC or 12-30VDC or 12-24VAC
 - includes power transformer (230VAC to 18 VAC)
- No Analog Inputs
 - No current or voltage measurements.(Broken lamps cannot be detected, Street light line power interruptions cannot be detected.)
 - No light sensor (Unit cannot operate as master unit)
- 2 Relay outputs (2 control groups or 1 control group and 1 reserved for controlling dimming)
 - Contactors are not included (relays cannot be used directly to control light groups.)
 - Dimming transformers are not included. If you use dimming, GSM-16 is suggested to get feedback from voltages and current levels.
- 4 Digital inputs (1 reserved for door open alarm, 1 for Auto/Manual switch)
 - Door open switch or Auto/Manual switch are not included
- includes GSM antenna

- Depending on the signal level antenna can be installed inside or outside enclosure.
- Manual CD and AlproWin Programming software CD is included.

2.3.1 Functionality (900130):

- Controls Lights ON / OFF according to light intensity sensor and internal clock.
 - The switching levels can be set.
 - Allows max. 2 control groups. Normally only one control group is used.
- Receives control commands from Master Unit through GSM network
 - Unit can operate only as slave unit. Master unit need to be GSM-16.
- Can turn OFF the lights in the midnight at off-peak traffic hours.
- Sends status information to ControlMan Web service
 - GSM-4 can log status data into its memory
 - Data can be send using SMS or GPRS/FTP

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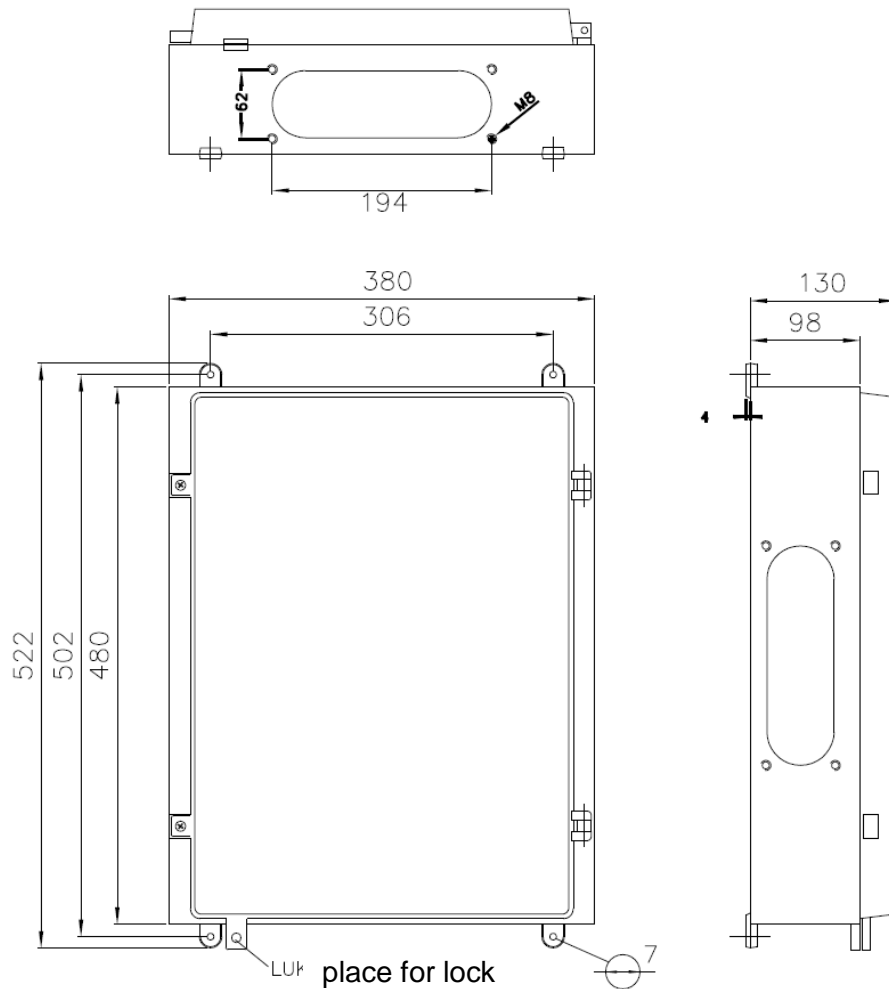
2.4 AutoLog SaveLight Feeder Pillar 1CG-ALU-50A/100A (Code: 900133 / 900134)

- includes 900108
- RMS Current and RMS voltage measuring from all three phases. (installed inside)
 - includes RMS Voltage Measurement Unit
 - includes RMS Current Measurement 50A (or optionally 100A)
- Allows only one control group. (All phases/street light lines are controlled ON/OFF at the same time.)
- Aluminum enclosure. (Smaller enclosure than AL SaveLight Feeder Pillar PM. No free space for energy meter)
- Optional Light intensity sensor for master unit only
- includes GSM antenna
 - Depending on the signal level antenna can be installed inside or outside enclosure.
- No input or output cables (picture is just an example, how to connect cables)
- Normally 3-phase output controls only one street light line, but each phase can also control own street light line.
- Easy-to-install

2.4.1 Functionality: AL SaveLight Feeder Pillar 1CG-ALU-50/100A

Same as 900108, but device is equipped to control only one light control group.

2.4.2 Dimensions: AL SaveLight Feeder Pillar 1CG-ALU-50/100A



- IP65 aluminum outdoor enclosure. Includes cover with hinges, screws to close the door and place for lock.



2.5 AL SaveLight Feeder Pillar 4CG-PM-50A/100A (Pole Mount) (Code: 900135 / 900136)

- Order code: 900135: 50A / 3 x 11kVA
- Order code: 900136: 100A / 3 x 22kVA
- Pole not included
- No dimming transformers

- includes 900108
- free space for energy meter
- 4 control groups equipped with separate contactors
- RMS Current and RMS voltage measuring from all three phases
 - o includes RMS Voltage Measurement Unit
 - o includes RMS Current Measurement 50A (or optionally 100A) (External installation)
- IP56 outdoor enclosure
- Optional Light intensity sensor for master unit only
- includes GSM antenna
 - o Depending on the signal level antenna can be installed inside or outside enclosure.



2.6 AL SaveLight Feeder Pillar 4CG-FS-50A/100A-Dimming (Floor Standing) (Code: 900137 / 900138)

- Order code: 900137: 50A / 3 x 11kVA
- Order code: 900138: 100A / 3 x 22kVA
- Includes Dimming Transformers for all 3 phases

- includes 900108
- free space for energy meter
- 4 control groups equipped with separate contactors
- RMS Current and RMS voltage measuring from all three phases
 - o includes RMS Voltage Measurement Unit
 - o includes RMS Current Measurement 50A (or optionally 100A) (External installation)
- IP56 outdoor enclosure
- Optional Light intensity sensor for master unit only
- includes GSM antenna
 - o Depending on the signal level antenna can be installed inside or outside enclosure.

3 Contact details

Would you have any questions, requests or you need any help or assistance, please contact us. Our specialists, who have developed and produced all our equipment will give you all needed information and advises.

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