With AUGIER, ensure a perfect management of your airfield lights and their functions...
AUGIER S.A.S. is a French Company specialized for more than forty years in the design and the manufacture of transformers and equipment for transport and distribution of electric power, in the field of airport lighting and public lighting.

Currently, Airfield products from AUGIER are universally known, and used on airports of more than 40 countries around the world.

The principal steps of development of the company in the airport field are as follows:

1974: AUGIER develops a specific epoxy coated transformer for airport lighting for Aéroports of Paris, installed in Roissy.

1984: AUGIER acquires SET, a subsidiary of LEGRAND, in order to add a range of current regulators to its airport offer.


1996: AUGIER launches the STB (Remote control system for Loop control)

2002: AUGIER launches the fist family of CCR fully digital, multi standard and multi protocol, with autocalibration and without any analog setting.

2003: AUGIER launches the ASO (Automatic Switch-Over), major element in airfield lighting secuirisation.

2006: AUGIER launches the 2nd generation of system SCB (Communication system of loop lighting)
CHYPRUS

Larnaca airport (2001)

FRANCE

Vatry airport (2000)
Charles de Gaulle airport (2001)
Nice airport (2001)
Landivisiau airbase (2002)

Greece

Thessalonique airport (2001)

ITALY

Milan Malpensa airport (2001)
Alghero airport (2002)
Bari airport (2002)
Cagliari airport (2002)
Ghedi airport (2002)
Olbia airport (2002)
Napoli airport (2002)
Venezia airport (2003)
Roma Fiumicino airport (2003)
Ancona airport (2004)
Bologna airport (2004)
Brindisi airport (2004)
Cervia airport (2004)
Crotone airport (2004)
Foggia airport (2004)
Grosseto airport (2004)
Lamezia airport (2004)
Lampedusa airport (2004)
Montichiari airport (2004)
Palermo airport (2004)
Piacenza airport (2004)
Tarenta airport (2004)
Parma airport (2005)
Reggio Calabria airport (2005)
Roncchi dei Legionari airport (2005)
Verona airport (2005)
Brescia airport (2006)
Catania airport (2006)
Gioia del Colle airport (2006)

LEBANO

Beirut airport (2001)

SYRIA

Damas airport (2004)
Deir Azzor airport (2004)
Al Kameshly airport (2004)

USA

Grissom airbase (2004)
Visual aids, and thus the lights set up on aprons and runways, play a more and more sophisticated role.

New needs spread on many airport such as:

**Stop bars :**

To make runways and taxiways more safe, preventing intrusions during critical phases as approach or takeoff.

These lights need to be monitored and remotely controlled in order to respect the requirements of ICAO.

**Monitoring the whole AGL installation :**

The needs of a secure exploitation requires an important availability of installations.

The light monitoring provides permanent information to the control tower about the state of the circuits involved in categorization of the airport, and provides a useful help for maintenance services.

**Ground guidance :**

Increase of the traffic on important platforms, and increase of the size of installations, make ground guidance a major issue to ease surface movements.

One of the means given at your disposal is the light control in order to allow guidance of planes on exits and taxiways.
The solution proposed by Augier relies on communication techniques using power line carrier transmission developed by the company since the middle of the Sixties, in the fields of different frequencies and varied applications:

- In the field of very low frequencies, AUGIER builds remote control equipment for the tariff changes of EDF, using transmission currents at 175 and 188 Hz in 20kV networks.
- In the field of the high frequencies, AUGIER uses transmission currents at 130 KHz in order to manage installations of public lighting, supplied with 5500V.
- In the field of medium frequencies (audible), AUGIER developed in the Nineties a complete system intended for stop bars management applications for series circuits. This system was one of the first on the market to being really operational, proposing particularly guaranteed response times.

Due to the evolution of this kind of systems to wider needs, Augier developed a new generation of units using power carrier transmission in order to take into account the functional evolutions related to the market and to the technological evolution related to electronic products, in order to take advantages from the experience feedback of all applications carried out.

**POWER LINE CARRIER**

The principle of power carrier communication is to use the supply circuits of airfield lighting, and the power current as a mean to transmit a communication signal towards receivers located near lights, in order to monitor and control them. This technology allows to limit requirements of wiring and to take advantages from protections related to airfield series circuits.

In order to be able to adapt more easily to the diversity of existing installations, and to the various practices of circuits installation, the new generation system is likely to use several frequency channels distributed between 6kHz and 10kHz. The type of modulation and information coding were thus designed to optimize the reliability of communications, to decrease response times of the system in order to meet the new needs.
The Loop communication system SCB is a group of equipment and software, independent or integrated, which allows the monitoring and the control of airfield lights (including multiple lamps lights).

The SCB Architecture is organized according to the following principle diagram:

It is made of:
Field units: DOLFIN (Direct On Line Field uNit)
Master units: ORCA (pOwer line tRansceiver CAbinet)
**Field level : DOLFIN-xx**

It consists of field units DOLFIN-xx or digital units DOLFIN-Dxx, allowing in the same way to interface, order and monitor detection sensors (UHF barriers, for example). They are electrically inserted between the isolating transformer and the light(s), or the sensor.

*DOLFIN-xx can be used with any type of isolation transformer, but can be particularly fixed on type TSE Augier’s transformers, in order to preserve the simplicity and the clearness of installation permitted by such transformers, while ensuring an IP68 index of the assembly.*

**Substation level : ORCA**

The field units dialog permanently with the station units ORCA. This “loop communication” is carried out simultaneously for all the regulators concerned, by power carrier transmission.

*ORCA units can be delivered integrated into the CCRs type DIAMANT, DIAM4000, 4100 or 4200, (what represents the best compromise cost-wiring-reactivity), either be stacked up, or presented in alone wall mounted cabinets.*

Each ORCA unit is connected to the monitoring system network which will have in charge the management of the airfield lighting.
Data and signal processing

The algorithm of data processing was designed in order to be very robust as regards earth faults problems, specific to airfield lighting. The communication principle allows a reliable transmission even in the case of strongly degraded circuits, as regards with electric noises, nonlinear impedances or in the case of earth faults.

The principle of communication allows to solve cross talk phenomena, by setting up a strategy of frequency hopping, if needed: the system is thus able to choose the most adequate communication channel, taking into account the noise analysis made at the ORCA level.

Due to the thin band-width of airfield circuits, the coding of information was done fully compact in order to minimize transmission time.

Event-driven management

In order to guarantee a minimal response time, an event-driven management of the communication is implemented: in the case of a random event occurring in any place of the monitored loops, the system is able to know it in some communication frames, i.e. generally in less 150ms.

This random “event” can be for example a lamp breakdown, or the activation of a passage sensor.

Protocol

The communications protocol is of master-slave type, the Master being the station unit (ORCA).

Sending frames is always rhythmmed by a synchronization signal, whose mode of management are defined according to the type of equipment which will supply the current loops (technology of the regulator, type of cable, etc)

A message can be distributed on several frames, according to the format of the data used, and each received message is the subject of an acknoledge.

Any transmission error or missing code causes a re-emission of the faulty frame or message by the ORCA substation unit.
Dimensioning
A station unit ORCA manages a loop comprising up to 1024 DOLFIN units maximum, of all types.
Each lamp can belong to one or more groups (4 groups of membership, 64 groups per loop maximum)
Each defined group can contain 256 lamps.

Response time
Seen from an ORCA unit, response time between the dispatch of an order (individual or groups), its execution, and the information feedback about the state of the addressed units is about 50ms, and this whatever the size of the group of addressed units.
On event, the response time is about 150ms, whatever the place of occurrence in the chain of addressable units.
The type of interfaces of communication delivered with ORCA can be RS485 (Jbus/Modbus) TCP/IP (ETHERNET) or LONWORKS (Echelon).

In order to determine the total response time of the system, it is mandatory to take into account the higher software layer, related to the monitoring system.

Constant current regulators
The principle of communication can be efficient on circuits supplied with thyristor regulators (DIAM4000 & 4100 AUGIER) as by IGBTs regulators (sinusoidal waveforms) (DIAM4200 AUGIER).

Channels and frequencies
The use of multiple communication channels of, distributed on a broad frequency band (between 6 and 10kHz) allows to compact information and to avoid any problems of cross talk being able to exist between primary non-screened cables.
This information is thus transmitted more quickly and more clearly, whatever the environment and the state of installations.

Security
The SCB system fits perfectly with installations secured by ASO (Automatic Switch-Over), this equipment allowing, in the event of a breakdown of a CCR, the instantaneous switching of the concerned loop on a stand-by CCR, without incidence on the communication.
Field unit : DOLFIN-xx

Basic functions
One field unit DOLFIN can manage up to three halogen lamps, or a sensor. Their role is to be an interface of communication with respect to the system, and to fulfill the function of control and diagnosis for the lamp, state feedback and diagnosis in the case of a sensor, with the possibility to supply it. These units integrate a specific parameter setting related to the needs of the application (communication or functional parameters).

This parameter setting is programmable and can be modified as well through the network with the monitoring system, as by tools (PDA, laptop PC) designed to this end and using a wireless connection. This wireless connection is also available for any operation of test, startup or maintenance.

Power supply
The internal supply of the modules is reconstituted from the airfield lighting circuit (series circuit with constant current, intensity of the current from 1.8A up to 6.6A). Connection is made downstream from the isolating transformer, using standardized FAA connectors.

The consumption of the field unit DOLFIN is extremely low (approximately 3W). This was made in order to limit the loss of energy at the load of the transformer, and then the loss of brightness of controlled fires. In that, SCB system can be easily be added into any existing installation, without change of isolating transformers.
Connections
They are carried out using moulded cords with plugs and receptacles, compliant with FAA and IEC standards, so as to adapt them to all the models of transformers and lamps existing on the market. The DOLFIN-xx unit fits thus simply between the transformer and the lamp, in order to control and monitor it.

Functionalities of DOLFIN-xx
It fulfills the following functions, dependently of its operating mode:

Management of one (or several) lamp(s))
- Lighting or extinction of lamps (order ON/OFF for each)
- Making a short-circuit when a lamp is out.
- Diagnosis of the lamp.
- Diagnosis of internal electronics.
- Management of the power carrier communication.
- Possibility of activation and inhibition of the unit.
- Communication with maintenance tools.
- Emergency mode.

Sensor management :
- Power supply and control.
- Feedback and state change.
- Back diagnosis of the sensor.
- Management of the power carrier communication.
- Possibility of activation and inhibition of the unit.
- Communication with maintenance tools.
- Emergency mode.
- Control by means of contacts.

The parameter setting of DOLFIN units includes all information necessary to the communication and the realization of the fallback positions for the emergency modes. Addressing is at least defined by a single address and a membership to functional groups.
Types of modules

Lamps Management; Field units
The denomination of the field unit is DOLFIN-xy, with X = number of isolating transformer inputs, and y = a number of lamps.
The range comprises 5 types of units, in order to answer the most current cases of application of any configuration of runways and taxiways:

- **DOLFIN-11**: It is the basic unit equipping one lamp, the transformer being laid out in pit or in a FAA base.

- **DOLFIN-12**: Unit ideal in the case of multiple lamps supplied by the same transformer (approach bars, touchdown zones, centerline bidirectional lights, etc)

- **DOLFIN-13**: Especially designed in the case of triple lamps supplied on the same transformer (touchdown zones, etc).

- **DOLFIN-22 et 33**: These modules allow to optimize the monitoring of lights whose transformers, laid out in the same pit, are different (Stop bars, turns, etc)

  *It is mandatory for this type of module, to have transformers connected to the same primary cable.*

**Sensors management**
The denomination of the Didital Field Unit is DOLFIN-Dx, where x define the version or type of the associated sensor.
Substation equipment : ORCA

Basic functions
The Station unit ORCA is the interface between the field communication part (transmission current) and the monitoring system which will have in charge the management of the AFL.
In this aim, it will have to guarantee the coherence of the state of the lighting loop in regard with the orders received through the monitoring system and to place at its disposal a state of the installation.
He is a Master of the communication with transmission current, and is guaranteeing good execution of the orders received.

ORCA supervises the installation permanently in order to guarantee that its state corresponds to the objective states of the received orders or of the ongoing failsafe mode. It can embark automatisms in order to guarantee a simple functionality in the event of loss of communication with the monitoring system (e.g.: cycle of management of stop bars, step of ground guidance, etc)
These emergency strategies can be de-activated, in which case the field units will apply the programmed backup position, if necessary.

A local data base is integrated, which contains the entirety of the parameter setting of all units of the application.
The available fields of that data base are of two types:

- In connection with the communication : These parameters allow the communication between the units and the station, apart from any functional consideration related to the lighting circuit. These parameters can characterize either DOLFIN or ORCA units, or the configuration of the loop communication.

- In connection with the functionality, these fields are purely related to the application and to the monitoring system, they will allow to make the correlation between the data-processing and the field reality; they also will allow to facilitate to take into account all high level orders (sequence of guidance, lighting of a stop bar bar, etc), while making transparent the physical reality of electric circuits, with respect to operational management.
Interfaces

*Power line carrier communication:*
ORCA is the Master of the communication process of which it manages risks and determines parameters.
It is responsible for sending orders to be performed, as well as the informative requests related to the state of the units and equipment.
ORCA has in charge the management of all equipment installed on the airfield loop and permanently get an image of the loop state (state of the lamps, diagnosis, communication, parameter settings) in order to place it at the disposal of the monitoring system.

*High level Interfaces:*
The module is able to interface itself with the monitoring system by the means of different media (J-bus, ModBus-TCP, Echelon, TCP/IP,…).

The ORCA unit is permanently able to answer the requests of the system as for the state of lights on the loop, the diagnosis of the carrier system, the state of progress of the pending orders, the parameter setting of the system.
A connection with the maintenance tool allows the operations of parametrization as well as the activation of monitoring strategy and/or training, in maintenance mode.

Power supplies

The substation interface is supplied with 230V or 400V according to the supply available in the airfield technical rooms. In integrated version, it is adapted to the supply voltage of the regulators.

Integration

ORCA is designed to be integrated perfectly (electrically and mechanically) in any traditional airfield lighting installation, even made safe by ASO (Automatic Switch-Over), and to allow easy access and maintenance.
In order to take into account field’s problems, the SCB was designed to make the most simple and easy all installation and maintenance procedures. The various aims are time savings during the deployment of this type of system, to facilitate the control by maintenance operators, and to simplify operations of replacement or extension.

With this intention, a certain number of self-learning processes were developed, as well as a dedicated tools.

**Self learning**

Two kinds of self-learning were implemented:

**Self-learnings related to the communication:**

Only relates to the communication parameters, such as unit addresses, the numbers of loop, etc.

These parameters do not have a functional role and can be automatically affected by the ORCA unit, and that for all units which composes the communication loop.

**Self-learnings related to functions:**

If an up to date data base is at disposal in the ORCA unit, it will be able automatically to fill the parameter settings to the units present on the communication, on order of the monitoring system or on order given by the maintenance tool.

**Maintenance**

In the event of replacement of DOLFIN unit, the system will automatically reprogram the replaced unit; in the case of a multiple replacement, the intervention of an operator at the ORCA level will be necessary in order to establish the link between the runway function involved and the physical unit which will have been set up, and that by means of the Goldenfish software.

In the event of extension, the same process will have to be applied.

For all these operations, the user-friendly and the simplicity of the tools placed at the disposal do not require at all the presence of an AUGIER technician.
GOLDENFISH software is intended to be able to communicate with DOLFIN units, ORCA units and with the monitoring system. The application may run either on a PC (Of office, or Portable) or on a pocket-PC, for reasons of convenience on the field.

**Principal functions:**

**General:**
- Initialization of the communication, presentation of Bluetooth objects in the operating range of the PC or the PDA (generally 10m maximum in free field)
- Deployment utilities (access to the data base)
- FAT and SAT utilities (assistance to the identification of lights)
- Creation of the application data base.

**Dialog with field units DOLFIN-xx:**
- Parameter setting Management (insertion of data, reset, data readings and geographical coordinates setting)
  - Control
  - Reprogramming
  - Internal diagnosis

**Dialog with the station unit ORCA:**
- Parameter setting management (Read-write data base, memory reset)
- Configuration management
- Control (general, unit, groups…)
- Reprogramming
- Simulation (mini monitoring)
- Monitoring (according to specific implemented programs)
- Dialog with the monitoring system (according to the implemented interfaces and divers)
ADVANTAGES

- No additional wiring.
- Independence with respect to the existing installation.
- Independence with respect to the primary cable type.
- Reliability of the communication.
- Simplification of the installation and maintenance procedures.
- Convivial management wireless tool.

SERVICES

- The SCB was designed to be installed on any category of airport, in order to work with any type of monitoring system, and under all climates.
- AUGIER places its engineers at your disposal, in order to:
  - To define the bridges and interfaces of communication with the selected or current monitoring system.
  - To make FAT, SAT and comissioning of the installation.
  - To ensure the training of the technician staff for comissioning and maintenance.
  - To make annual controls or to take part in the test routines and preventive controls.
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