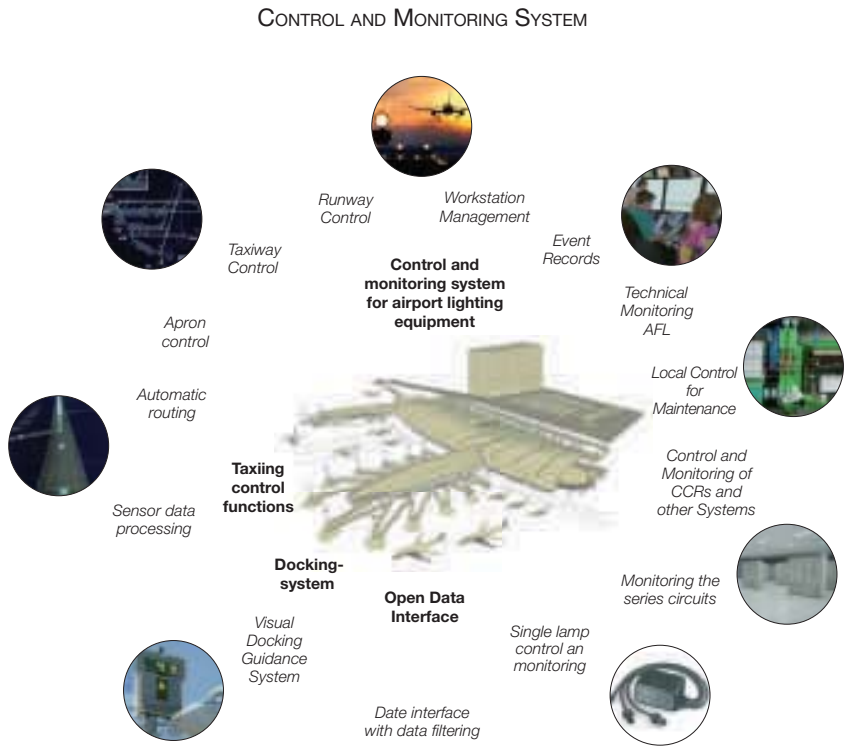
Honeywell

Stay on the Safe Side

Control and Monitoring System

Permanent Control and Monitoring

Today's commercial airports use state-of-the-art technologies to safely and optimally master operating procedures whose complexity is steadily increasing. The lighting system used on the runways, taxiways, and stop bars continues to grow unabated. In order to easily control and monitor this equipment, despite its complexity and the additional strict safety regulations, Honeywell has developed a computerized control and monitoring system for airport lighting equipment. In addition to a comfortable working environment for tower controllers and technicians, this system offers a number of practical functions that make daily work noticeably easier, and ensure that the airport lighting system can be monitored in an ideal way. It goes without saying that this system meets all of the International Civil Aviation Organization's (ICAO) recommendations, including failure monitoring of adjacent lamps through the use of an individual lamp control and monitoring system. The control and monitoring system for airport lighting equipment is a distributed, scalable process computer system which stands out due to its high-speed operation, redundancy, and easy integration with further subsystems.



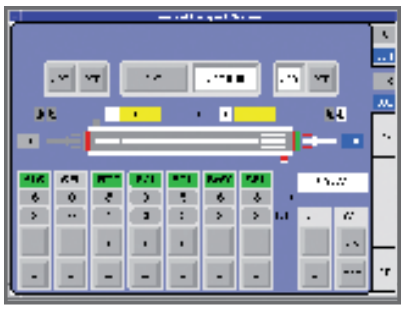
Honeywell Network and System Monitoring

Scalable System Design

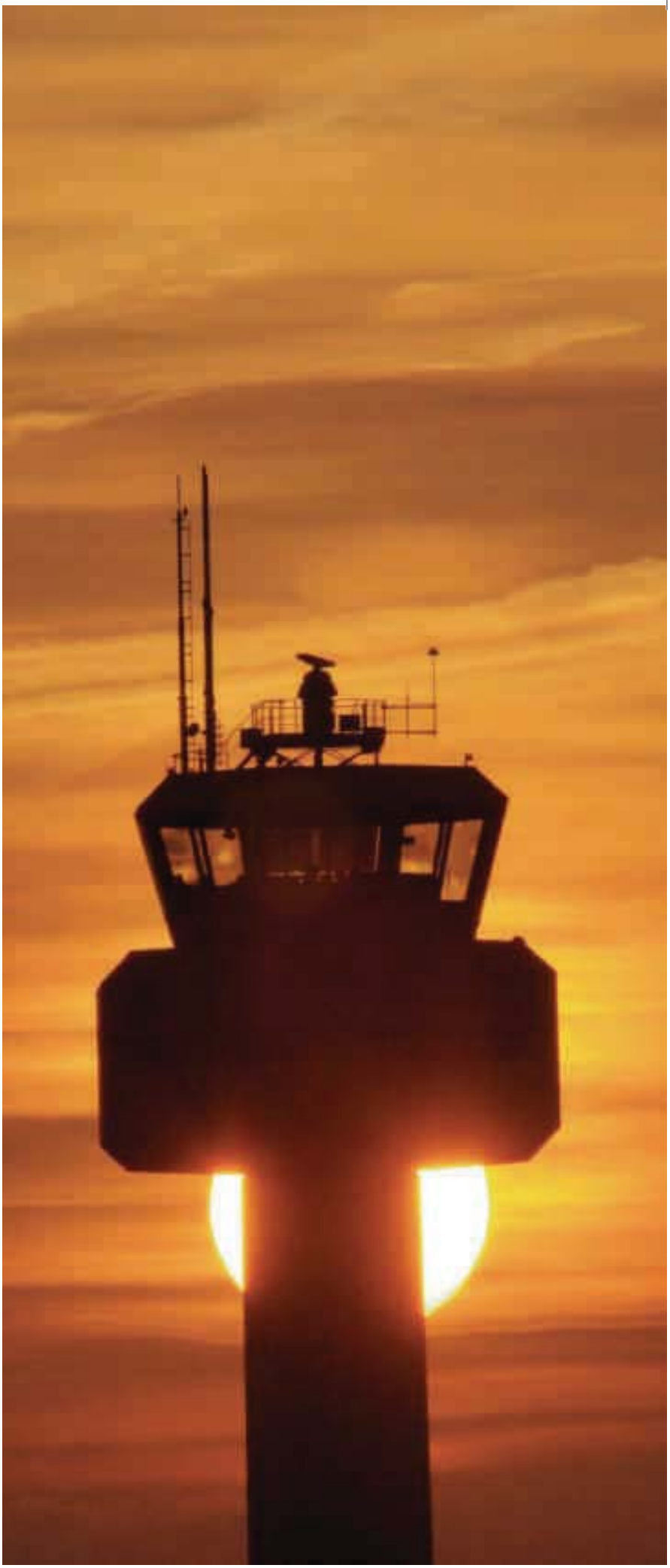
The software is object-oriented and complies with the latest international standards for the communication and design of open system interfaces. Due to its highly modular structure, the system offers cost-effective solutions that meet the needs of both regional airports and large international airports with complete surface movement guidance systems supported by ground lighting systems. The processing power needed for larger airports with time-critical control tasks is supplied by a fail-safe network of computers. Because the system can easily be expanded, it can be adapted to meet future needs, thus protecting the airport's investment over the long term. System performance can be increased through the use of additional computers. The systematic application of CORBA standards for software interfaces guarantees trouble-free software integration over various computer platforms.

Air Traffic Controller Workstations

In addition to the reliability and integrity of the system, efficient workstations are one of the most important characteristics of a practical system. The control and monitoring system differentiates between air traffic controller workstations in the tower, in the apron control, and also those used for technical maintenance. The air traffic controller workstations are optimized for operating and controlling the ground lighting system based on ergonomic aspects, without overloading the controller with technical details.

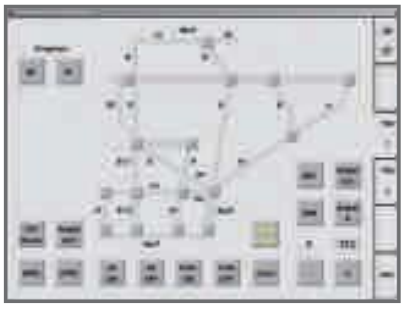


Runway Lighting Control

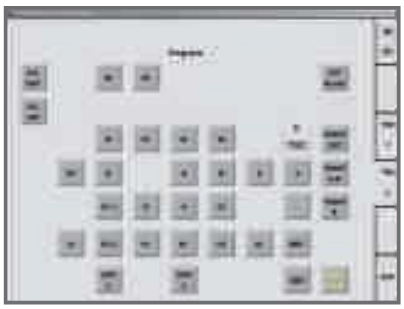


Due to the open architecture of the system, additional functions can be integrated into the workstations besides just the ground lighting system. These include the operation and monitoring of docking systems, video monitoring, illumination systems, as well as an overview of the traffic situation within the scope of a surface movement guidance and control system. It goes without saying that an overview of other systems, such as weather reports and flight plans, can easily be integrated into the system, if needed. New technologies, such as individual lamp control and monitoring, can quickly increase the number of individually switchable lighting elements at an international airport to several thousand. It is reasonable to assume that operating these systems using traditional single-button technology is no longer possible. That's why the control system offers new functions such as a modern, rule-based routing procedure. This allows the air traffic controller to switch on the taxiway lighting in the proper direction simply by entering a starting and an ending point. In order to reduce the controller's workload, the current traffic situation, weather conditions, and any taxiway closures are automatically taken into consideration. Membrane keyboards and color monitors with or without touch-sensitive areas are used as the standard display and operating equipment. Other display and operating equipment, such as pen activation, can be integrated into the system upon request. Extremely bright, high-contrast flat panel displays (TFT) with touch-sensitive areas are also available. These displays are integrated into the air traffic controllers' desk. Through direct access to a layered and hierarchically organized virtual operating area, operating functions as well as picture and text displays are accessible that can normally only be implemented using large control desks separate from the controller's actual workstation. Through the clever ergonomic distribution of the main functions throughout the upper areas, and the placement of seldom used functions on lower areas, overall operational comfort is improved, while at the same time reducing the amount of space required. Since the flat screens offer all functions at every workstation, responsibilities can be easily divided among the controllers depending on operational procedures.

Runway Lighting Control.



Taxiway Lighting Control and ...



... Routing

Technical Workstations

In contrast to the operationally oriented workstations for air traffic controllers in the tower, the technical workstations show all the technical details of both the lighting system and the control and monitoring system.

Using a navigational system which is easy to operate, even large amounts of information can be displayed quickly and clearly. For example, when a particular lighting station is selected, all information regarding the control units and lamps installed in that station is displayed.

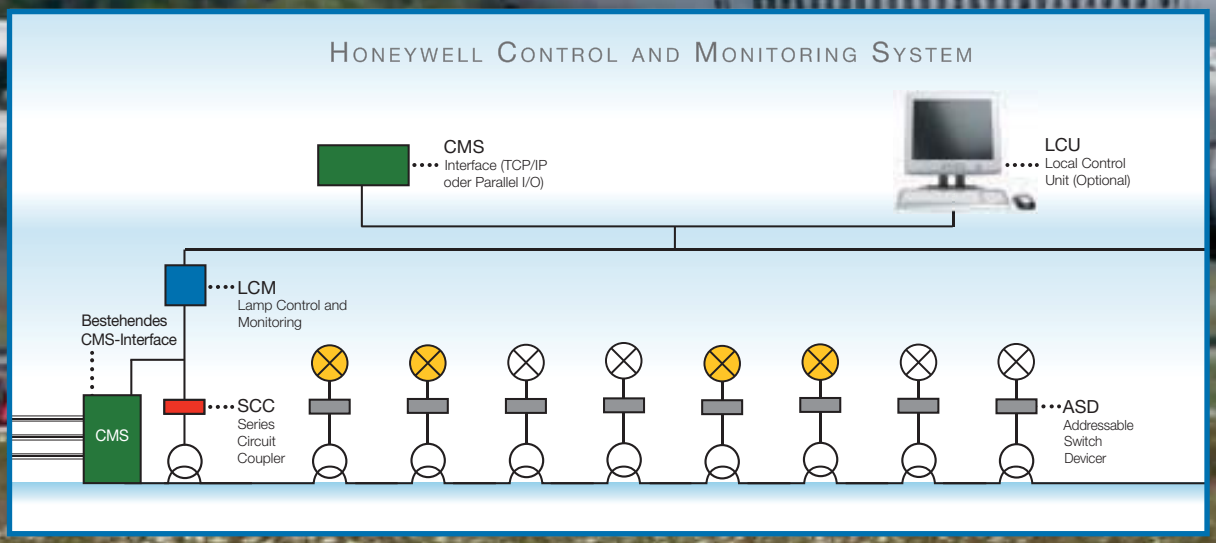
Error messages from all levels are automatically shown on the upper control level in a summarized display. The navigator also allows the lighting system to be controlled at the circuit or individual lamp level.

As an option, technical workstations can be equipped with a scaled airport map which includes all additional status displays. With this option, all failed lamps are shown on the map using the individual lamp monitoring system. Adjacent failed lamps are marked in a particular way that enables easy recognition. Detailed information can be obtained by selecting individual areas of the map. The functions of the technical workstations also include printing out reports or saving them to a hard disk, report analysis, and generation of lists. Mobile technical workstations are also available. All workstations are equipped with an extensive, context-sensitive help system. The display can easily be adapted to most languages.

Individual Lamp Control and Monitoring

- Complete flexibility of control scenarios for the ground lighting system.
- The system makes it possible to guide aircraft using the ground lighting system within the scope of a surface movement guidance and control system.
- Detection of errors in adjacent lighting units.
- Support for preventative maintenance.

Significant benefits result from the complete integration of Honeywell's individual lamp control and monitoring system.
These include the dynamic, rapid control of lighting segments and stop bars in a manner suited to traffic conditions for the purposes of traffic routing as part of a modern surface movement guidance and control system. Another notable benefit is the automatic reporting of adjacent lamp failures under consideration of the operational rather than spatial relationships as an example of the intelligent data processing which occurs during monitoring. In addition, the conditions, errors, and running times of all lamps are monitored by system and recorded in its database.



Configuring the individual lamp control system and the individual lamp control module can be carried out comfortably in the control system and is downloaded automatically, if needed. This means that the automatic configuration of each unit is backed up using the series circuit even after replacing switching modules in the field.
In connection with the Honeywell Control and Monitoring System, the following functions are supported:

- Controlling all lamp groups and switching scenarios.
- Powerful local control for the control and monitoring of lamps from all technical workstations.
- Transfer of all monitoring results from individual lamp monitoring.
- Display of all lamp failures on a scaled airport map.
- Display of adjacent lamp failures.
- Operating hours counter for eight operating levels per lamp.
- Creating configuration data with automatic downloading to the switching units.

Monitoring Functions

Through comprehensive monitoring of the lighting and control systems, maintenance personnel receive early warning of any technical problems. This allows them to promptly begin maintenance work and avoid system malfunctions. The system contains the following monitoring functions:

- Determination of the present switching status of the constant current regulators, plug-in switch units, and pulse generators, and a comparison with their preset switching status.
- Registration of the local operation of the constant current regulators, plug-in switch units, and pulse generators.
- Recording the operating hours of each lighting circuit and each individual lamp.

Operating hours are recorded in real time and are divided into a maximum of eight operating levels (power rates) for each lighting circuit. An assessment of the entire system is carried out and an alert is sent when peak levels are reached. An additional assessment can be carried out using weighted or unweighted values.

- Lamp failure monitoring for each individual lamp or per circuit. The threshold levels for alarms can be freely configured. In the individual lamp monitoring system, the failure location and the failure of adjacent lamps are also reported.
- Monitoring of the lighting circuits' insulation. The threshold levels for alarms can be freely configured for each lighting circuit.
- Calculation of the series circuit current and display of each circuit's current value.
- Monitoring of all integrated equipment and data transmission routes within the control and monitoring system.

The following information is recorded and archived in the sequential log file:

- Technical malfunctions in the lighting system
- Changes to insulation values
- Lamp failures
- Changes to the configuration, for example, to threshold values
- Switching actions
- Technical malfunctions in the control system

Station Equipment

From the perspective of preventing malfunctions, in previous control systems activating the controllers was a critical point. In order to solve this problem we developed a new, redundant interface concept for the current version of our control and monitoring system, which limits a malfunction to a maximum of one circuit. Through the proven use of locking relays as output components, random changes to the lighting system are effectively prevented. The interface concept also supports conventional parallel interfaces between the control system and the controllers. This ensures that all types of controllers can be connected to the system. Besides the parallel interface, the control and monitoring system also provides a serial interface for controllers connected using TCP/IP and Ethernet protocols. In order to maintain the ground lighting system, the system makes all information regarding the lighting system available at a technical workstation located in every substation. The workstation also allows every aspect of the system to be controlled, right down to controlling individual lamps.

Control and Monitoring System for Airport Ground Lighting Equipment

Benefits

■ System Design

- Scalable computer network
- Modular design
- Simple or fully redundant design with identical hardware
- Communication over standard ETHERNET with TCP/IP protocol

■ Air Traffic Controller Tower Workstations

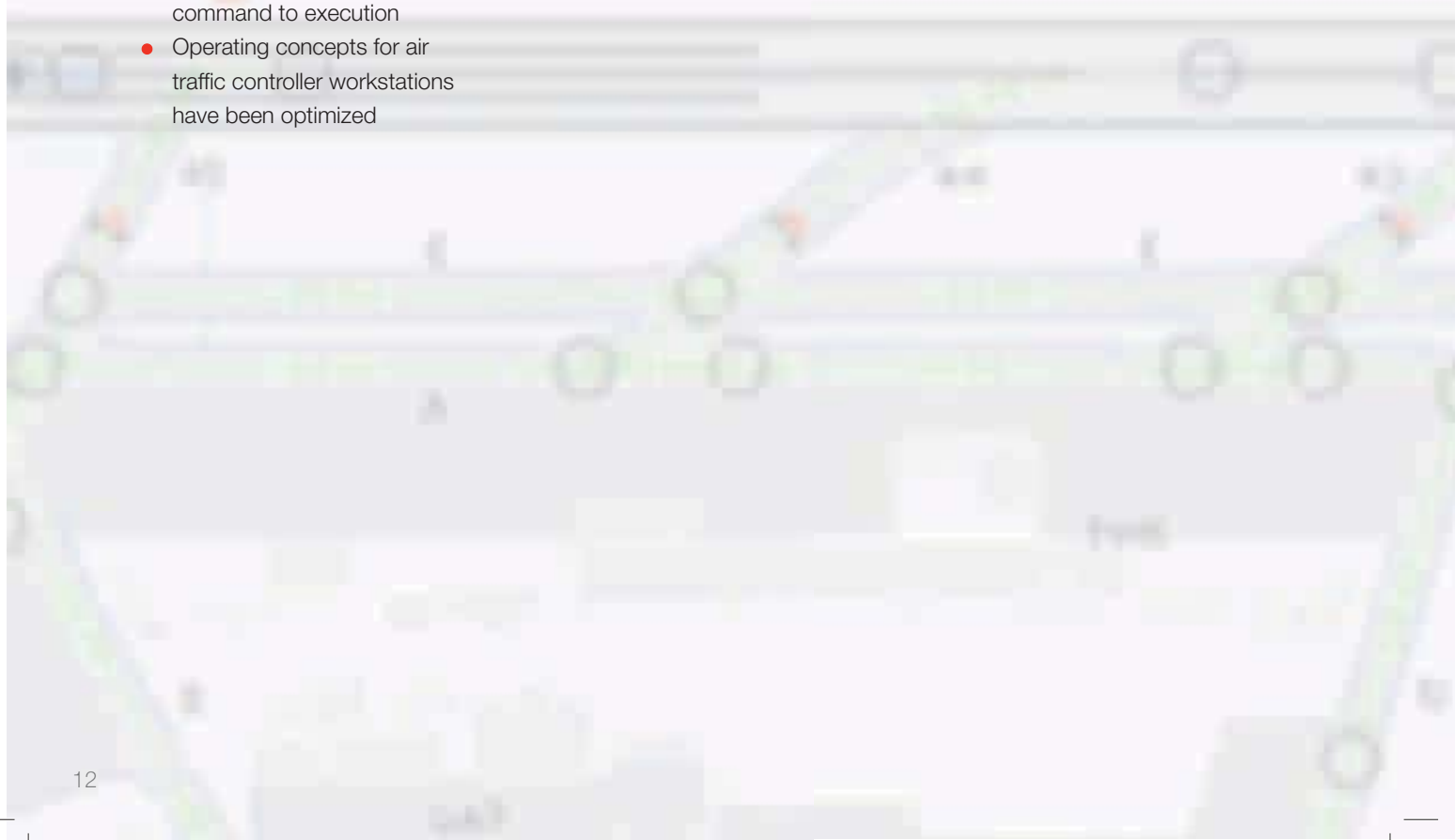
- Scaled airport map which provides an oveview of traffic conditions
- Automatic routing sytem for taxiway lighting
- A switching time of less than one second from command to execution
- Operating concepts for air traffic controller workstations have been optimized

■ Technical Workstations

- Comprehensive technical monitoring of the lighting system
- Full integration of individual lamp control and monitoring
- Monitoring of insulation
- Information on series circuits displayed at all technical working positions
- Operating hours counted for circuits and lamps and classified into ratings eight power

■ Software Design

- Completely object-oriented software (C++, CORBA 2)
- Highly modular design allows for flexible distribution within the network
- Adaptation to specific airport requirements is carried out using configuration lists.
- The software is independent of the hardware platform
- HMI platform for the integration of other subsystems



System architecture

The system architecture of the airport lighting control and monitoring system is based on a modern, distributed, and fully scalable computer system.
The computers are connected over a 10 or 100Mbit/s Ethernet (TCP/IP) connection. Both the individual computers as well as the network can be duplicated in order to increase operational security.

Fiber optic cables are preferred for communication between buildings. The system can also use existing high-speed networks such as FDDI, ATM, etc. as its backbone. PCs or workstations can be used according to the requirements and computing power needed. The software is coded in C++ in a completely object-oriented manner. To ensure that the software remains completely independent of hardware and operating systems, all software interfaces comply with the international CORBA standard. This makes it possible to freely distribute the software modules within the network. The scope of the network is determined by the needs and performance requirements of each project, and is not limited by the software.

The use of the CORBA standards and TCP/IP protocols also offers an internationally standardized interface which allows for easy connection to other systems such as the airport information system (FIS) or a higher guidance system. The Human Machine Interfaces (HMI) are graphic interfaces showing the airport layout or station equipment, and are generated using powerful tools for process visualization. In some parts of the system, Java is already being used as a platform-independent programming language. The actual adaptation of the system to the needs of individual airports is carried out using configuration files (in the form of Microsoft Excel files). These configuration files contain all the individual characteristics of the system and the lighting equipment; and upon first starting the system, they automatically generate the actual operational program based on the existing object class library. The system is equipped with comprehensive software for ongoing self diagnostics. If required, an online diagnostics program is available via the remote data-transfer interface. This interface is also used for changes to the configuration and software.

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