

Manchester Airport benefits from a building-wide DALI system

Location: Manchester, UK

DiiA Member: LOYTEC electronics GmbH (Delta Electronics)

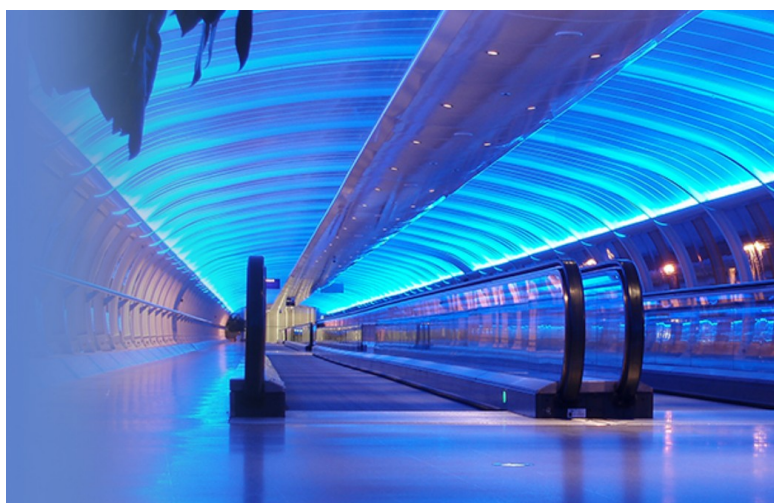
In its continuing quest to reduce its energy usage, the airport in Manchester, UK, upgraded its lighting system. In a first step, all the 9,500 old fluorescent luminaires were replaced by modern LED lighting fixtures with DALI dimmable drivers. In a second step, a DALI lighting-control system based on LOYTEC's L-DALI controllers was installed to further decrease energy consumption. In addition to functioning as DALI application controllers, the L-DALI devices also operate as gateways to the airport's building-management and flight-information systems.

The airport deliberately chose a DALI-based system for lighting control: With DALI being an open standard supported by many vendors across the industry, they are confident that their significant investment is safe for the years to come.

Each L-DALI controller can control four DALI channels with up to 64 luminaires on each channel. To leave room for future extension in case additional luminaires are required, LOYTEC recommends initially connecting a maximum of 60 DALI luminaires on one channel.

DALI luminaires are grouped to form lighting zones. A lighting zone can be a room or – as in case of the open areas in the airport – a certain area where luminaires are independently controlled from other areas. DALI supports a maximum of 16 such DALI groups per DALI channel.

The airport wanted to control the lights automatically based on occupancy information and available natural light. For this purpose a total of 1,200 DALI multi-sensors were installed. Each sensor provides occupancy and lux-level information to the L-DALI controller. The L-DALI allows connecting a maximum of 16 such sensors per DALI channel in addition to the maximum of 64 luminaires.



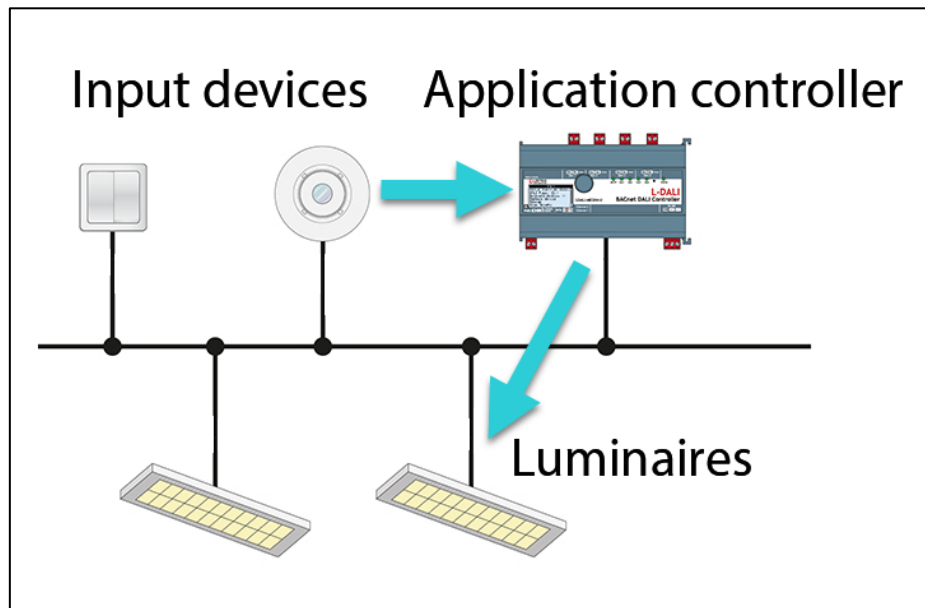


Figure 1: In a DALI-2 system, input devices (sensors, buttons) provide information (lux, occupancy, button press, etc.) to an application controller, which uses this information to control the DALI luminaires.

The L-DALI comes with a standard lighting application to control up to 64 lighting zones. Each of these zones corresponds to one or more DALI groups and thus can span over multiple DALI channels or even multiple L-DALI controllers.

The application supports all common lighting scenarios from simple staircase lighting to different occupancy and daylight-harvesting control strategies. In case of daylight harvesting – sometimes also referred to as constant light control – the luminaires are only switched on if not enough natural light is available. In this case the luminaires are dimmed to the right level to provide enough light to reach the desired lighting level in the room. This light level is selected by a configurable lux-level setpoint parameter.

Configuration of the lighting application for each zone can be done on the L-DALI's web-interface or with a powerful PC-based configuration application, which even allows off-line pre-configuration of a system. The installer simply assigns one or more DALI groups and one or more multi-sensors (if occupancy or lux information is required for the intended control strategy) to the zone. Then, the control strategy and the applicable parameters such as lux setpoint or hold time (how long is the light staying on when the zone becomes unoccupied) are selected. No programming is required.

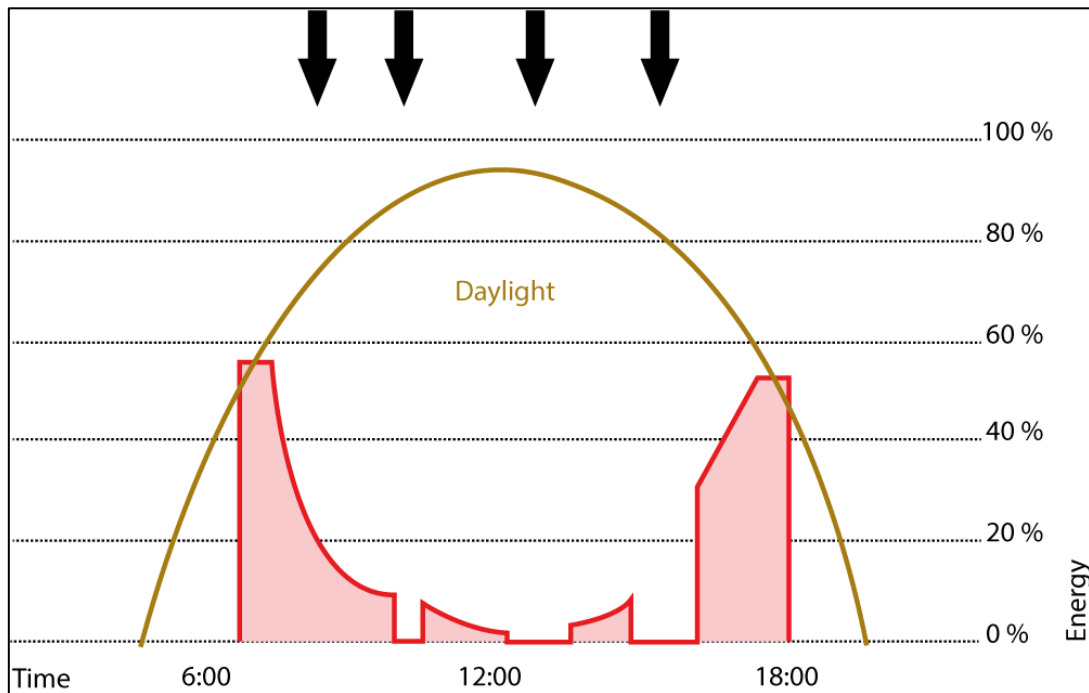


Figure 2: Optimum energy savings are achieved when combining daylight harvesting with presence control. Lights are dimmed or switched off when enough natural light is available and switched off if area is unoccupied.

Integration with building and flight systems

For integration into a building-management system or supervisory software, the L-DALI controller provides all information from the lighting system via standard building-management protocols like BACnet, Modbus/TCP, LonWorks, OPC, etc. This includes access to the parameters of the lighting application (setpoint, control strategy, etc.) and the DALI luminaires, live status information on current dim levels, occupancy, lux level, failures and even run hours. Of course, the automatic operation of the zones can be overridden by switching and dimming lights via this interface.

In Manchester, this interface was used to integrate the lighting control into the BACnet-based building-management system which the airport was already using for the control and supervision of their HVAC equipment. So the same floorplans that show the status of the HVAC system also shows luminaire dim levels and failures, and occupancy and lux-level information, and allows overriding the automatic lighting-control application. Having only one system for all building functions is not only more convenient for the airport's facility-management team, it also significantly reduces operational costs related to training and maintenance contracts.

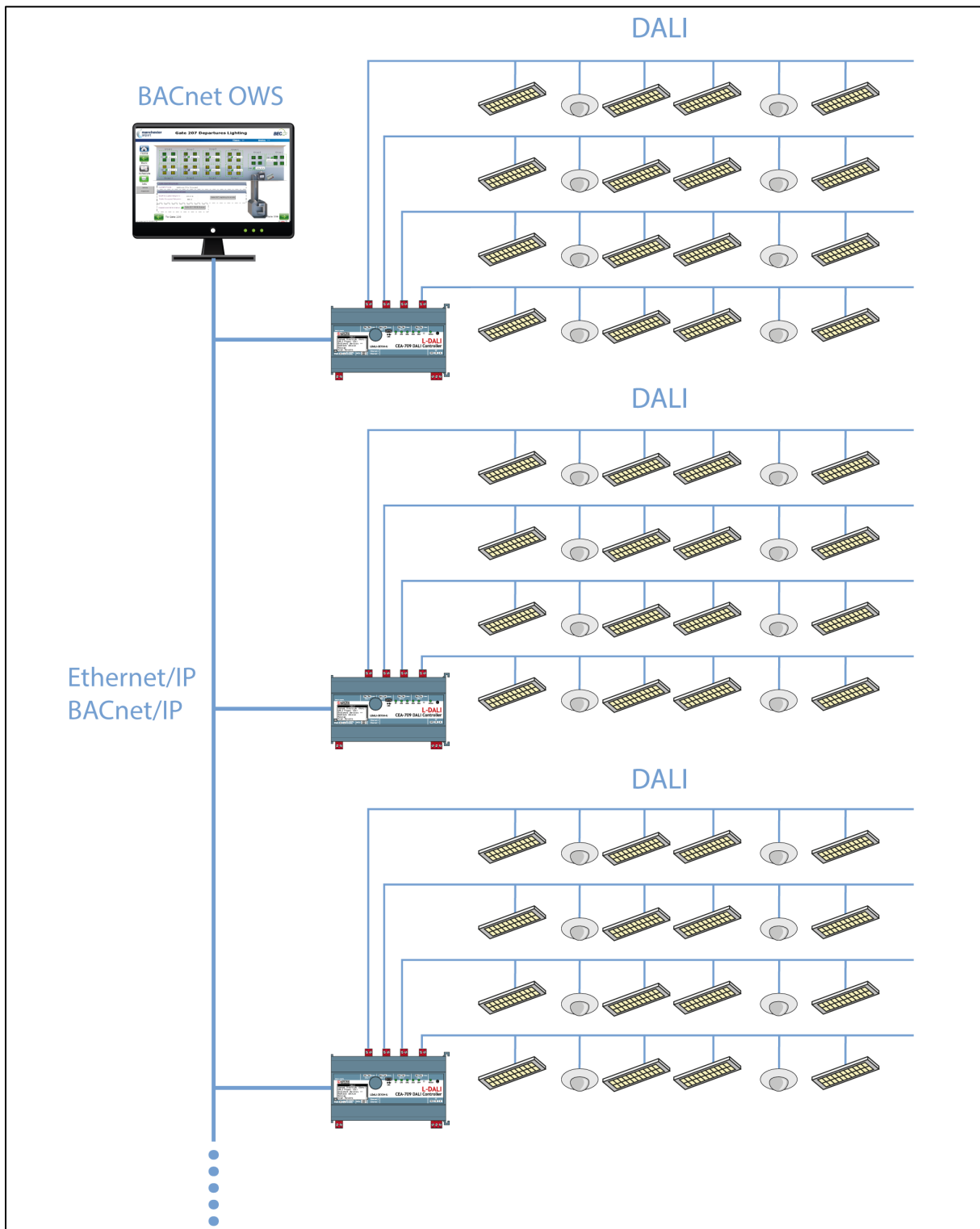


Figure 3: A total of 82 L-DALI controllers are connected via BACnet/IP to the building management system. Each L-DALI can control up to 4 DALI channels with up to 64 DALI luminaires and up to 16 DALI sensors. In total the system contains more than 9,500 DALI luminaires and 1,200 DALI sensors.

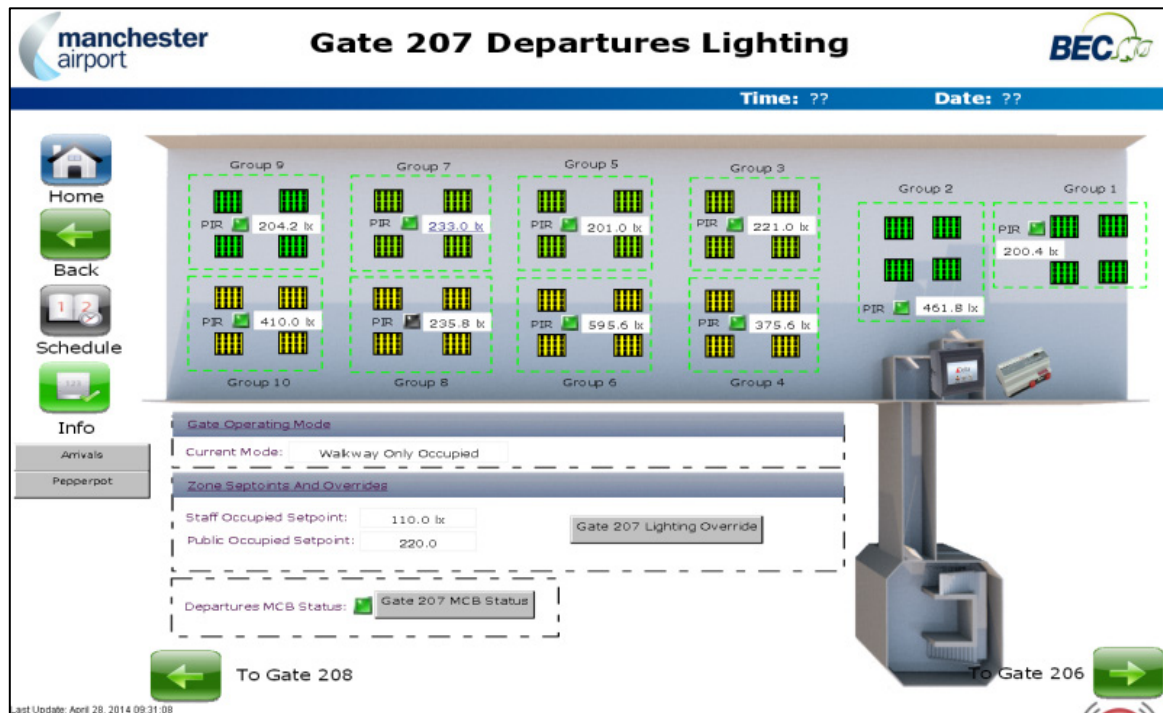


Figure 4: View of the building-management system (BMS) showing status of lighting fixtures, lux levels and occupancy status in a lighting zone.

In addition, the interface was used to link the lighting system to Manchester Airport's flight information system (Chroma), which provided further energy savings by the use of dynamic scheduling. As a result, lux setpoints and hold-time parameters are adjusted based on whether an area is currently used by passengers or not.

Energy savings

Using this dynamic occupancy and lux level based control strategy the airport could achieve an additional 60% energy savings on top of the savings already achieved by replacing the luminaires. Results are quite impressive, with total energy reduction of seven GWh of electrical energy (see Table 1, below).

Further cost reductions are achieved by significantly decreasing the fixtures run-hours as they are switched off when there is enough light or an area is unoccupied. The resulting increase of the luminaires life time is key in a building like the airport where luminaire or lamp replacement is costly and difficult, due to the short closing times and luminaires typically being installed on high ceilings.

	Usage prior to efficiency schemes	Usage following luminaire replacements		Usage after introducing lighting-control schemes		Total annual reduction following luminaire replacement and lighting-control schemes	
Location	MWh	MWh	Reduction	MWh	Further reduction	MWh	Overall reduction
Terminal 1	2942	1112	62 %	440	60 %	2502	85 %
Terminal 2	3739	1514	60 %	576	62 %	3163	85 %
Terminal 3	1657	582	65 %	184	68 %	1473	89 %
Total	8338	3208		1200		7138	

Table 1. Summary of energy savings achieved at Manchester Airport.

Summary of benefits

The main benefits of the Manchester Airport project are:

- Significant energy savings
- Fast return of investment due to relatively low cost
- High investment security due to use of open standard (DALI)
- Full integration with existing building-management system
- Central monitoring for failures
- Central switching if required

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