application guide • office

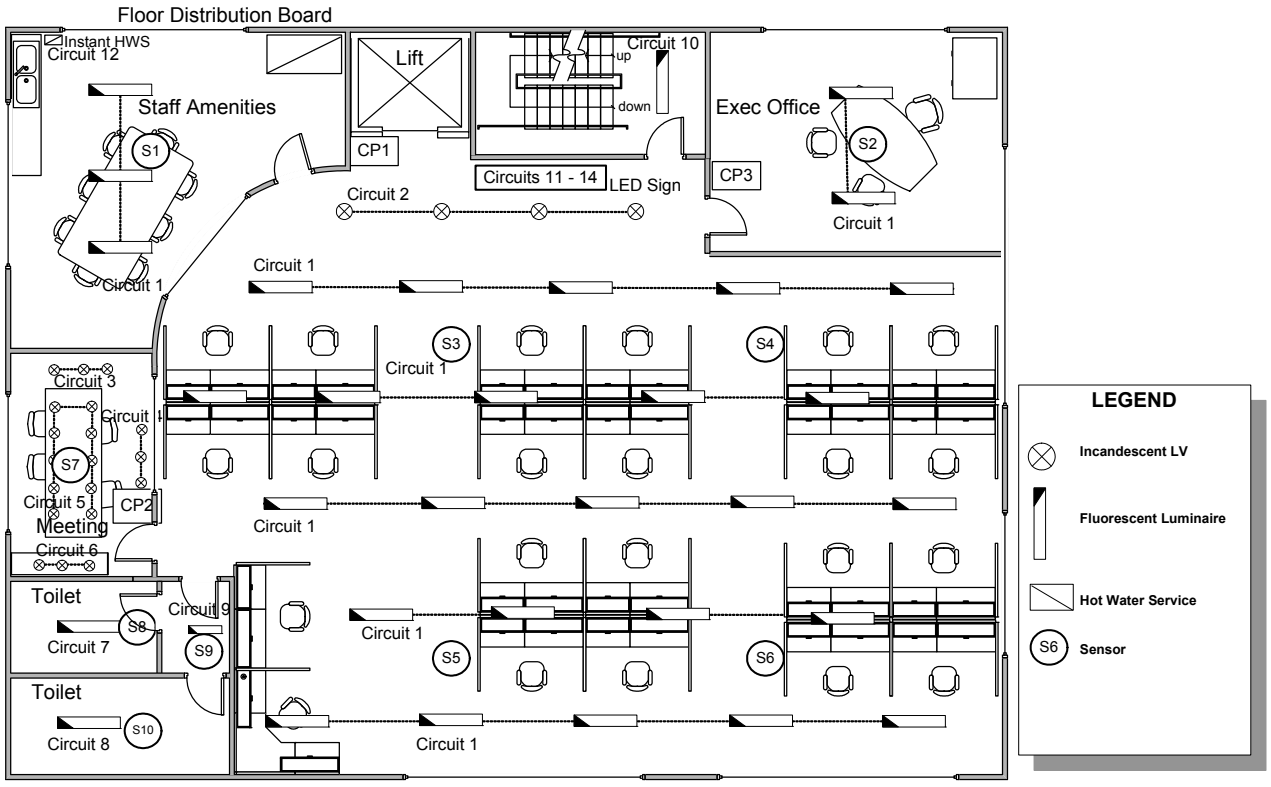
This application guide contains information on:

- Providing workspace lighting using dimmable DALI HF fluorescent ballasts
- Using existing PCs and LAN for user control in open plan office space
- Automatic control using occupancy sensing
- Daylight harvesting of natural light
- Dynamic LED signage
- Interfacing to a building management system (BMS) using DCOM over TCP/IP

Lighting control plays a strategic role in the operation of a modern office environment. It ensures that the visual performance of the lighting equipment is appropriate to the needs of the occupants, while simultaneously conserving energy. By day, illumination levels can be maintained dynamically, both to comply with relevant lighting and energy codes, and to ensure optimum worker performance. After hours, the control is more aggressive toward energy conservation, but still accommodates the needs of maintenance and security staff and late night workers. It is no longer socially acceptable or commercially astute to burn all of the lighting throughout the day and for half the night, yet a feeling of personal security and well being must be protected.

Workstations co-exist with traditional enclosed offices in many buildings. Appropriate strategies for the lighting controls must be determined according to the specific needs of each application. The workstations typically share an array of fluorescents overhead while corridors, lobbies, meeting rooms and amenities can have a variety of local lighting types and technologies.

typical layout



system outline

A typical office suite could be a single office or just one floor of many that is tenanted by a large organisation. Entry areas are accessible to visitors and clients, hence track or downlights would be found here, in addition to dynamic LED signage that highlights the company logo.

The open plan area would have fluorescent luminaires that are laid out in a regular pattern to achieve uniformity. They are often wired in large blocks and inefficiently switched the same way (this is inevitable where the design is based on an empty floorplan). For undimmed installations, the cabling would at least be run parallel to windows, enabling a row of edge luminaires to be daylight switched by the control system.

The evolution of addressable fluorescent ballasts has made it possible to treat individual luminaires as a dynamic component of the space, with lighting over workstations controlled individually, or in small numbers. This is becoming cost-effective considering the frequent rearrangement that takes place in many organisations. The layout appears to be conventional, but the unique response from individual lamps is achieved electronically. In corridors and entry foyers, identical lighting troffers can be treated in an entirely different manner to those above the desks of employees. They might also be found in staff amenities areas, where their purpose is different again, due to the low occupancy of the space. The meeting room shows four circuits of downlights, while the fringe areas including staff amenities have just a few essential lights that could be of almost any type.

Operation of a typical office would be;

Entry Lobby

The first person to arrive would be detected by the nearby DUS703 sensor, or would be required to initiate a system response by pressing the 'ARRIVAL' button of an adjacent wall panel. Typically, 2 channels of a DDRC620FR relay controller would activate the entry downlights. This lighting could be interleaved so that half-switching is implemented outside normal hours. Dynalite controllers have the intelligence to rotate lamp usage to equalise the operating hours of the lamps and reduce maintenance costs. ELV downlights might also be included to provide an attractive feature at the reception counter. The appropriate Dynalite controller would be a leading-edge or trailing-edge dimmer, depending on the type of lighting transformer used. Increasingly, specifiers are using digitally-controlled transformers that can be matched to standard Dynalite ballast controllers. Innovative display panels are available using LED or fluorescent panels that drift through the spectrum. Dynamic colour sequences can be programmed into the DDLEDC401 LED Controller. When the system is in it's 'normal' day mode, the selected sequence can then be initiated.

Fluorescent lights are generally the most numerous throughout an office installation. The choice of internal components is fundamental to the selection of the Dynalite system components to control them. Depending on the budget, a degree of sophistication is now available. Dimmable office lighting is becoming more

common for both ergonomic and energy-conscious applications. The ability to dim has a direct bearing on the aesthetics and comfort of the space and is also significant in conserving energy. A luminaire that can be switched on and off electronically has a wide range of control possibilities. It can also eliminate the expensive practice of physically modifying the electrical wiring each time the office fit-out changes.

Executive Offices

These are often as elaborate as a fully-featured conference room. Multifunction sensors and wall mounted user control panels may be used in combination to provide full architectural control, depending on the complexity of the lighting scenes required. As this is also a working office, PC desktop access to the Dynalite network might be appropriate, as well as wall mount control panels.

Small Offices

Small offices don't consume a great deal of energy but collectively the total energy of many small offices is significant. In a refurbishment that includes individual offices, it is not cost-effective to hard-wire a conventional switch for just two or three luminaires. Increasingly though, it is becoming mandatory for a local control device to be made available. Desktop PC access can economically enable each user to control his or her local environment as there is no additional hardware required.

Open Plan Offices

A variety of approaches are available, subject to the luminaire control gear and to local energy regulations. Networked DyNet sensors may be used to provide saturation coverage of open plan areas. All lights might be kept 'ON' during a normal day, and be progressively allowed to dim and extinguish after hours as staff leave. Multifunction sensors read the value of illuminance in their field of view. This can be harnessed to provide stepless dimming control; both to maintain a pre-determined light level and to capitalise on the availability of natural light.

Staff Amenities

In these areas, occupancy sensing is usually appropriate with long delay times. The luminaires might be the conventional office type, or any combination of aesthetic creations. If toilet lights are to be simply switched, they can share a common relay channel. If some of the lighting is extra low voltage halogen, however, it should be managed by a leading-edge or trailing-edge dimmer as appropriate, to enable soft starting and voltage regulation to the lamp. An alternative approach is to have the lights 'ON' during normal hours and to enable a DUS703 sensor or single 'one shot' push button panel after hours. In this event, the lights can be flashed off momentarily as a warning, before they are extinguished.

Conference Rooms

Architectural lighting control is required to adjust the lighting of the space to it's many different applications. A 10-button wall mounted control panel provides the required scene and fade rate. A hand-held infrared remote control might be appropriate to adjust the lighting from anywhere in the room during presentations or meetings. Most Dynalite controllers have an optional DMX interface that enables inter-operability with audio-visual devices, while many AV systems natively support the DyNet protocol. Multifunction sensors are used to detect when rooms have been vacant for a period of time.

Staircases

Local regulations must always be adhered to. Aside from this, common sense should prevail. The staircase lighting would usually remain on during 'normal' hours, with a single push-button made available for timed override after hours. If appropriate, stairway lighting could be made to flash briefly as a warning before lights are extinguished. If regulating ballasts are used, they could be ramped down over 30 seconds before switching off.

Demand Load Shedding

Many parts of the world experience peak electricity loads that their infrastructure is unable to deliver. The solution is to defer some of the load at those critical moments. A Dynalite control system can have it's load prioritised for such an event. Low requirement loads can be partially shed, almost transparently when dimming is available. Depending on the urgency of the request to load shed, a hierarchy of switching can be implemented. Unlike air-conditioning, lighting can be made granular, enabling corridors, for example, to respond to a greater extent than the adjacent workstations.

Out-of-Hours

This may be determined by the BMS or by a Dynalite DTC602 stand-alone timeclock. On an individual office floor, it is common for just one or two workers to be at their workstations when everyone else has gone home. Manual control regimes leave the entire office alight, while many automated systems create a feeling of insecurity by switching off all the lights in the immediate vicinity of the occupant/s. In a Dynalite controlled environment, lighting in the corridors and amenities can be kept on when any one of the local zones is active. Cleaners and security personnel often waste energy after hours. Dynalite systems can allow transient personnel to gain lighting access using infrared remote controls. These can be programmed to provide an appropriate duration of local or corridor lighting. For example, a cleaner may have local workstations illuminated for ten minutes, while a security guard might just activate the corridor lighting for five minutes. The remote only needs to be pointed at any of the DUS703 sensors in the local area.

Day Lighting Strategy

This is a topic for separate detailed analysis, as each application is unique. During daylight hours, the ingress of natural light can be selectively harvested within parts of the space that have a component of natural light. Some designers always switch off perimeter lighting, while an increasing number apply some degree of open or closed-loop dimming. This action must be carefully undertaken to avoid issues that reduce the comfort of those occupying the space. In particular, care should be exercised where window blinds are in use due to the possibility of fragmenting a light detection zone. As with other issues of 'granularity', the solution might be to deploy a greater number of sensors. The challenge of harnessing daylight is to attenuate the artificial light without creating discomfort that is associated with bright windows and dull interiors. Dynalite's networked DUS703 sensors detect illuminance as well as occupancy. They each contain embedded intelligence, enabling their response to be varied at different times of the day. When excess natural light falls on a perimeter row, the occupancy sensor might allow dimming to a very low level in the absence of motion, but dim to 50% when occupancy is detected. This is often necessary to avoid shadowing and provide adequate horizontal illuminance on desk surfaces. DALI ballasts provide an appropriate vehicle for daylight response, as there is no longer a physical connection between the hard-wired circuitry and the ability of individual luminaires to be dimmed. Luminaires that run parallel to the windows may be switched or dimmed, irrespective of their physical wiring.

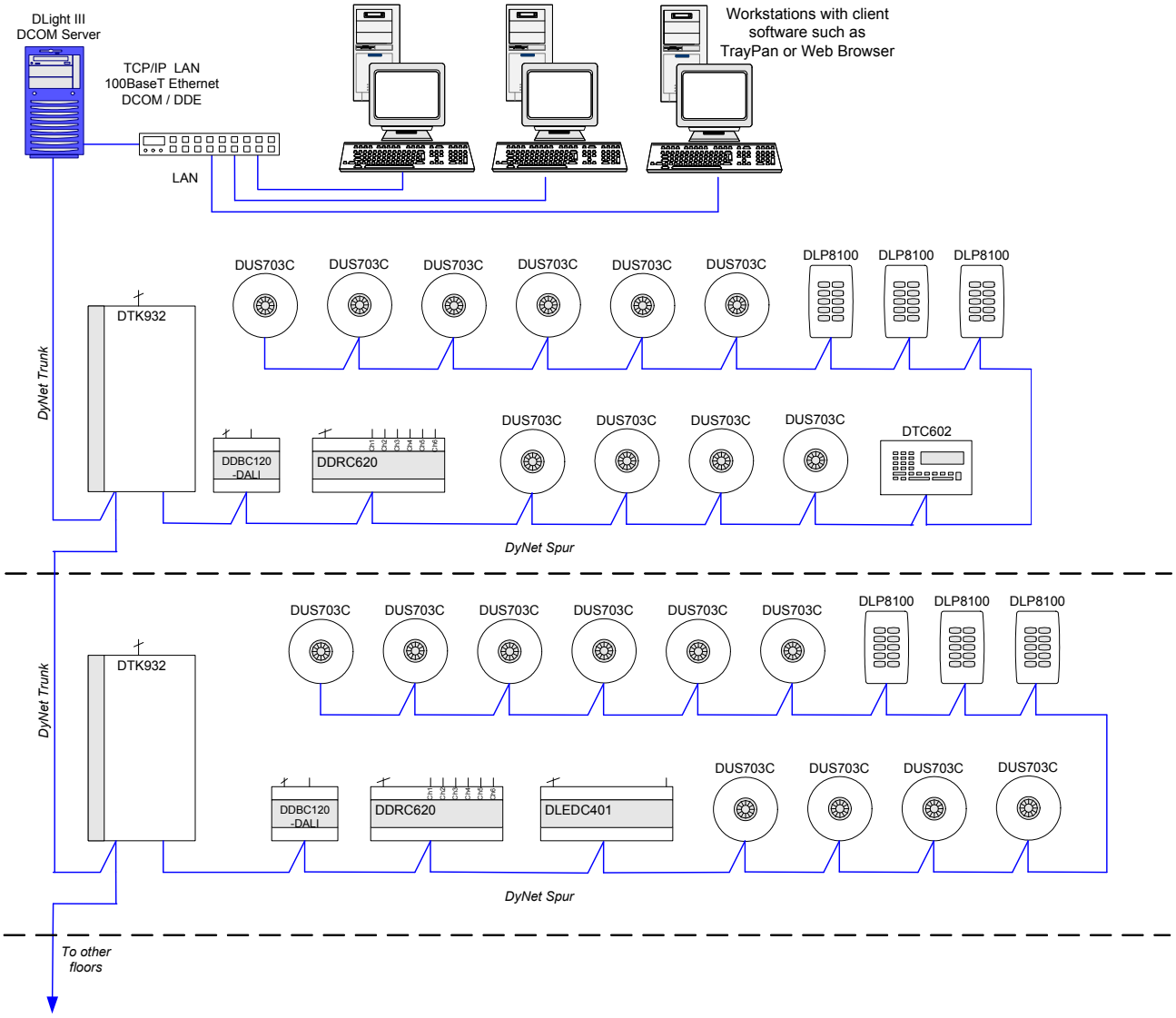
Maintained Illuminance

This strategy can offer greater savings than daylight harvesting, as previously discussed. In the absence of any natural light (late at night for example), the Illuminance levels of many workstations and corridors are far greater than is recommended in lighting standards. This can be harvested by the stepless dimming of controllable fluorescent lighting. Once a target level has been established, a desirable light level will be maintained irrespective of environmental changes in the space. Savings of 10-20% are typical, while greater than 50% is not uncommon in the retrofit of '70s buildings.

Maintenance Reporting

Intelligent lighting control gear has enabled Dynalite systems to collect data about individual lamps and luminaire components in real time. Lamp run-time tracking is available, which assists with scheduled lamp replacement. The strategic use of this resource can reduce life cycle operating costs and avoid the drift into a sub-standard installation. Individual component ballast or lamp failures may be reported to management from a Dynalite controller, or an informed GSM message may be sent directly to maintenance personnel.

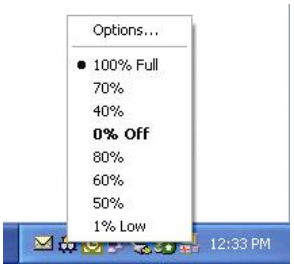
the equipment



This diagram outlines the equipment required for a typical multi-story application. Each floor is connected to the others by a DTK932 network bridge. This enables a higher speed trunk to communicate filtered messages between the floors. It also provides optical isolation as a protection measure.

the system in operation

PC Control



Example of simple PC control software from an icon in the system tray

Desktop PC Access is available to locally control individual workspace lighting, blinds and possibly airflow using each occupant's desktop PC. DLight III Server establishes an interface between the Dynalite RS485 network and the corporate IP network. The physical location of individual clients on the LAN is logically linked to the occupants' local lighting hardware. Functions made by a desktop slider or icon selection are immediately processed in the DyNet system, invoking a personalised response. Outside normal hours, the availability of local lighting can be linked to whether or not the local PC is active. If it is hibernating or switched off, the office lighting can be extinguished. DLight III Server also provides bi-directional access to the BMS, which enables centralised monitoring and scheduling of the lighting control system that has been tailored to the specific installation.

Smaller applications might only operate locally, not through a BMS. A simpler dry-contact interface (DDMIDC8) might then be used to transfer some basic instructions to another system. For example, the alarm output level of a security or EWOS (Emergency Warning) system might be used to enable a panic mode in the lighting system, or occupancy detection from the lighting system might be passed on to the security system after hours via a spare relay output channel. In most instances, a single interface on the RS485 trunk makes the hardware connection between the two systems, either simply or at a high level.

Sensors

Sensors S1-S10 are all DUS703, which combine motion detection, PE measurement and IR reception. In this scenario, IR reception would not be used. Some sensors, such as S8, S9, S10 in the staff amenities, would be configured permanently for motion detection and would ensure lighting is switched off when the space was not occupied. Others would be configured to do different things at different times of the day.

S5 and S6 are adjacent to windows so that during the day they could be configured to dim the row of fixtures near the windows whenever sufficient natural light was available. This practice is commonly referred to as "Daylight Harvesting". After hours, the sensors would automatically switch over to motion detection mode.

Load Controllers

Circuits 7-10 are switched fluorescent loads and are controlled by a relay controller. The DDRC620FR shown in our example has 20 Amp inductive load capability and bi-stable latching relays. This one device has 6 independent outputs; hence it is cost-effective to also switch the toilets and stairwell lighting, as well as having the capacity to control the instant hot water heater.

A DDBC120-DALI controller enables individual dimming and soft switching of commercial fluorescent DALI troffers on Circuit 1. When all troffers connected to the controller are switched off it automatically removes the power to the troffers to save energy, as DALI ballasts continue to consume a few Watts, even when switched off.

Circuits 2-6 are controlled by a DDMC801 Multipurpose Controller, which incorporates modular control cards. A 4 x 1A dimming module (LSDM401) controls four circuits of downlights and a 1 x 5A dimming module (LSDM105) controls 10 LV downlight fittings over the boardroom table.

A DDLEDC401 LED controller is part of our demonstration to highlight the growing use of dynamic display items in commercial venues, in this case dynamic signage displaying the company logo.

Load Schedule

Load Controller	Cct Capacity	Drawing Designator	Fixture	Qty	Load
DDBC120-DALI Box 1 C1	4800W	Circuit 1	2x36W Fluorescent Troffer	29	2088W
DDMC801 Box 2 C1	240W	Circuit 3	50W Downlight	3	150W
DDMC801 Box 2 C2	240W	Circuit 4	50W Downlight	3	150W
DDMC801 Box 2 C3	1200W	Circuit 2	50W Downlight	4	200W
DDMC801 Box 2 C4	1200W	Circuit 6	50W Downlight	3	150W
DDMC801 Box 2 C5	1200W	Circuit 5	50W Downlight	10	500W
DDMC801 Box 2 C6	1200W	Spare			
DDMC801 Box 2 C7	1200W	Spare			
DDMC801 Box 2 C8	1200W	Spare			
DDRC620FR Box 3 C1	4800W	Circuit 7	1x36W Fluorescent Batten	1	36W
DDRC620FR Box 3 C2	4800W	Circuit 8	1x36W Fluorescent Batten	1	36W
DDRC620FR Box 3 C3	4800W	Circuit 9	1x18W Fluorescent Batten	1	18W
DDRC620FR Box 3 C4	4800W	Circuit 10	1x36W Fluorescent Batten	1	36W
DDRC620FR Box 3 C5	4800W	Circuit 12	Instant Hot Water Heater	1	2400W
DDRC620FR Box 3 C6	4800W	Spare			
DDLEDC401 Box 4 C1	24V 1A	Circuit 11	LED Signage – Red channel	1	0.75A
DDLEDC401 Box 4 C2	24V 1A	Circuit 11	LED Signage – Green channel	1	0.75A
DDLEDC401 Box 4 C3	24V 1A	Circuit 11	LED Signage – Blue channel	1	0.75A
DDLEDC401 Box 4 C4	24V 1A	Circuit 11	LED Signage – White channel	1	0.75A