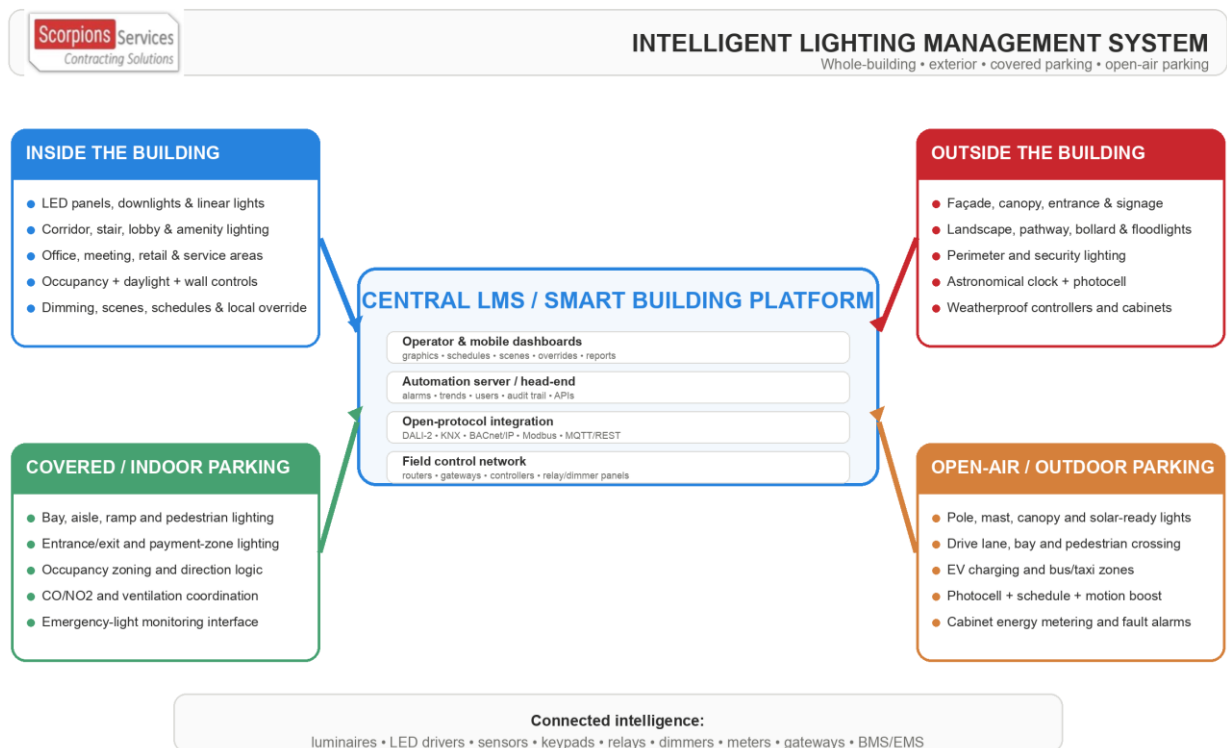




INTELLIGENT LIGHTING MANAGEMENT SYSTEM

Technical Solution • Connected Equipment • Control Strategy

Complete coverage for indoor building areas, external areas, covered/indoor parking and open-air/outdoor parking



Prepared by Scorpions Services

Smart-building integration specialists: BMS • LMS • EMS • VMS • HVAC automation • dashboards • alarms • analytics

Concept document | September 2026

1. Executive Summary

A scalable, open and intelligent lighting platform for the entire property



Central LMS supervision, graphics, alarms and smart-building integration

Scorpions Services proposes a unified Lighting Management System (LMS) that transforms lighting from a collection of fixed electrical circuits into a responsive, measurable and centrally managed building service. The platform connects luminaires, LED drivers, sensors, wall controls, control panels, gateways, meters and software across internal building spaces, exterior areas, covered parking and open-air parking.

Design objective

Deliver the correct light, in the correct area, at the correct time and level—while maintaining safety, user comfort, operational flexibility and measurable energy performance.

Core capabilities

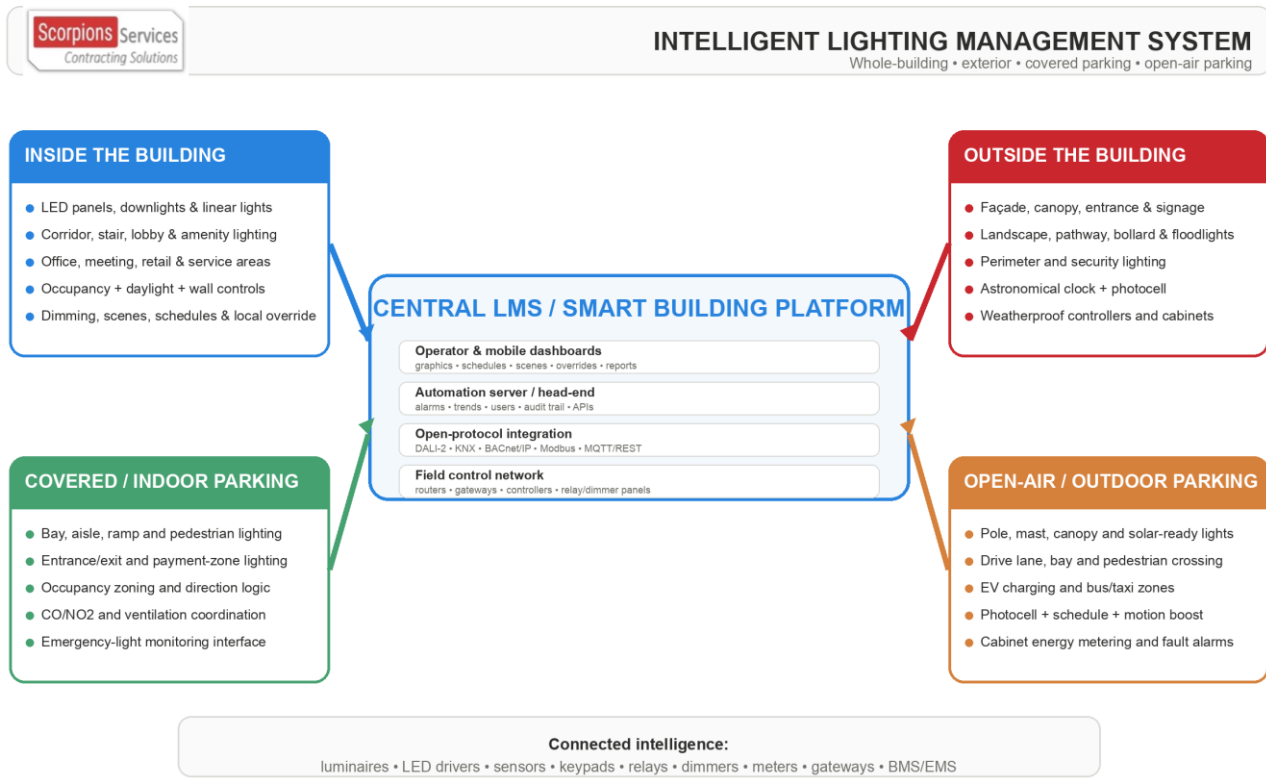
- Central graphical monitoring and control by building, floor, room, parking zone, façade and outdoor area.
- Automatic control using occupancy, daylight, time schedules, astronomical clock, scenes and approved BMS/EMS signals.
- Individual-address, group, zone or circuit-level control depending on the selected architecture and luminaire compatibility.
- Alarm, failure and communications monitoring; runtime, energy and trend reporting; role-based local and remote access.
- Open integration through DALI-2, KNX, BACnet/IP, Modbus TCP/RTU, MQTT/REST/API, dry contacts and approved vendor gateways.
- Scalable design for future floors, buildings, luminaires, parking extensions and new operating schedules.

Design basis and boundaries

- This is a concept and equipment framework based on the Scorpions Services company profile; final quantities, makes/models and circuiting require drawings, lux calculations, load schedules and a site survey.
- Lighting controls do not replace electrical protection, earthing, fire alarm, emergency lighting, central battery, road-lighting or other certified life-safety functions.
- Emergency luminaires may be monitored and automatically tested only through an approved interface; required emergency illumination remains available independently of normal LMS control.
- Final lux levels, uniformity, glare, color temperature, IP/IK ratings and emergency requirements must follow the project specification and applicable codes.

2. Intelligent LMS Architecture

One platform, four coverage domains and open integration



Purpose-built intelligent architecture visual connecting all indoor, outdoor and parking domains

Control hierarchy

Layer	Typical components	Purpose
Management	Server, web clients, mobile access, database, dashboards	Global graphics, schedules, users, alarms, trends and reports
Supervisory	Automation server, IP controllers, head-end gateways	Coordinates zones, stores logic and integrates BMS/EMS
Area / panel	DALI routers, KNX actuators, relay/dimmer panels, room controllers	Executes local schedules, scenes and sensor logic
Field	Luminaires, drivers, sensors, keypads, meters, contacts	Provides light, measurements, user requests and equipment feedback

Resilient operation

Critical schedules and room/area control should continue locally if the head-end server or upstream network is unavailable. Manual override remains available where required by the approved operating philosophy.

3. Lighting Inside the Building

Connected equipment and control by internal space



Intelligent indoor lighting with occupancy sensing, daylight response, dimming and scenes

Area	Typical lighting equipment	Connected controls	Intelligent operation
Office & open-plan areas	LED panels, linear pendants, downlights, task lights	DALI-2 drivers; occupancy; daylight sensor; keypad	Occupancy/daylight dimming, scenes, after-hours override
Meeting / conference rooms	Dimmable downlights, linear lights, wall wash	Scene keypad, occupancy sensor, AV dry contact/API	Presentation, video, meeting, cleaning, off scenes
Lobbies / reception / atriums	Decorative, cove, feature, downlights	DALI/DMX drivers, scheduler, local scene panel	Welcome, event, night, cleaning and energy modes
Corridors / circulation	Linear, downlight, wall light	Presence sensors, schedule, central override	Vacancy setback with safe background level
Stairs / landings	Ceiling/wall lights, emergency fittings	Presence sensor; emergency-light interface	Low standby level, motion boost, no unsafe blackout
Toilets / changing rooms	Downlights, mirror and accent lights	Occupancy sensor, relay/dimmer module	Auto on/off with adjustable delay
Retail / tenant / F&B	Track, spot, display, decorative and task lighting	Scene control, submeter, tenant scheduling interface	Trading/closed/cleaning/display scenes
Plant / electrical / service rooms	Industrial battens, bulkheads	Occupancy sensor, manual override, status contact	Manual-on or auto control per safety review
Hotel / residential rooms (if applicable)	Room lights, bedside, bathroom, wardrobe, balcony	Room controller, key-card/occupancy, thermostat/GRMS link	Welcome, occupied, sleep, away and housekeeping scenes

Typical internal accessories

- Addressable LED drivers; relay and dimming outputs; scene keypads; PIR/microwave presence sensors; daylight sensors; touch panels; room controllers; electrical/lighting panels; emergency-light test interfaces; floor gateways and energy submeters.

User comfort

Automated actions should avoid nuisance switching. Use configurable time delays, manual-on where appropriate, smooth fades, minimum background levels and local override for occupied spaces.

4. Lighting Outside the Building

Façade, entrances, landscape, pathways, security and service areas



Coordinated façade, entrance, pathway, landscape and perimeter lighting

Outdoor area	Typical lighting equipment	Connected control / function
Façade / architectural	Linear grazers, projectors, RGB/RGBW, cove lights	DMX/DALI gateway, astronomical schedule, scenes
Main entrance / canopy	Downlights, strips, feature pendants, signage	Photocell, occupancy, time schedule, manual/event override
Paths / plazas / landscape	Bollards, step lights, in-ground, tree uplights	Photocell, schedule, motion-based boost, zoning
Perimeter / security	Floodlights, wall packs, fence-line lights	Security/VMS event input, photocell, schedule, override
Loading / service yard	High-bay, floodlight, dock light	Occupancy/daylight control, local industrial override
Roof / plant exterior	Bulkheads, floodlights, aviation/obstruction lights where required	Schedule/status monitoring; dedicated safety controls retained
Signage / monument	LED signs, logo and wayfinding illumination	Timer/astronomical clock, power monitoring, fault input

Environmental and installation requirements

- Outdoor luminaires, sensors, junction boxes and enclosures selected for the required IP/IK rating, temperature, humidity, dust, corrosion and UV exposure.
- Photocell and astronomical logic with configurable dawn/dusk offsets; weather or security events may request temporary scenes subject to approval.
- Façade scenes coordinated with local regulations, neighbor light-spill limits, curfew requirements and architectural intent.
- External panel status, feeder trips and energy meters integrated where auxiliary contacts and communication are available.

5. Lighting in Covered / Indoor Parking

Safe navigation with occupancy-based energy reduction



Occupancy-responsive covered parking lighting with safe background illumination

Parking zone	Typical equipment	Control and monitoring
Parking bays	LED battens, linear fixtures	Occupancy zones; dim-to-background; energy monitoring
Drive aisles & ramps	Continuous linear, battens, wall lights	Directional occupancy logic; daylight at entrances
Entrances / exits	Canopy, lane, gate and facial-recognition area lights	24/7 minimum level, photocell, gate-system status input
Pedestrian paths / lift lobbies	Downlights, wall lights, crossing lights	Presence control with priority safety level
Payment / security points	Task and canopy lighting	Local override; CCTV/security event link
Emergency / escape routes	Self-contained or central-battery emergency luminaires	DALI emergency test/monitoring where approved; no unsafe switching
Ventilation coordination	Normal and boosted lighting scenes	Optional CO/NO2 or fan-status link; independent ventilation safeties retained

Recommended parking logic

- Maintain an approved background illumination level; boost the active aisle, adjacent bays and pedestrian route when presence is detected.
- Use directional sensor logic on ramps and aisles to pre-light the next zone before the vehicle or pedestrian arrives.
- Apply daylight harvesting near open façades and entrances without compromising transitions or camera performance.
- Provide local fire-service/security override and status indication where required; emergency and egress lighting remain independent.
- Coordinate high-occupancy events, cleaning, maintenance, ventilation boost and night-security modes through named scenes.

6. Lighting in Open-Air / Outdoor Parking

Pole, canopy, circulation, pedestrian and special-use lighting



Efficient pole, EV-zone, pedestrian and open-air parking illumination

Outdoor parking area	Typical equipment	Control and monitoring
Pole / mast lighting	Area lights, roadway optics, floodlights	Photocell, astro clock, contactor/DALI nodes, metering
Parking bays / aisles	Pole heads, canopy lights, low-level guidance	Scheduled dimming; motion boost by zone; minimum security level
Pedestrian crossings / sidewalks	Bollards, crossing beacons, path lights	Presence boost, schedule, security override
Entry / exit / gatehouse	Canopy and task lighting	Photocell, gate status, manual override
EV charging zones	Canopy/pole lights, charger indicator interface	Occupancy/schedule; optional EMS demand signal; no charger safety control
Taxi / bus / loading zones	Floodlights, pole lights, shelter lights	Schedule, occupancy and operational override
Solar lighting (optional)	Solar pole light, PV panel, battery, charge controller	Independent node monitoring/API where manufacturer supports it

Outdoor parking priorities

- Provide safe, uniform illumination for vehicles and pedestrians while limiting glare, upward light and spill beyond the site boundary.
- Use astronomical scheduling plus a calibrated photocell. Motion may boost selected zones, but approved security minimums remain active.
- Stage contactors or DALI groups to reduce inrush current; monitor feeder status and cabinet energy use.
- Coordinate lighting at EV chargers, accessible bays, gatehouses, bus/taxi areas and pedestrian crossings with the operating schedule.

7. Connected Equipment and Field Hardware

Complete typical equipment list for an intelligent LMS



Lighting controllers, gateways, relay modules, network equipment and energy metering

Equipment	Typical interface	LMS function / points
Addressable LED luminaires / drivers	DALI-2 DT6/DT8 or approved equivalent	On/off, level, color temperature where supported, lamp/driver fault
Relay / contactor modules	DIN-rail or panel modules	Switch non-dimmable circuits; feedback via auxiliary contacts
Phase-cut / 0–10 V dimmers	Controller outputs with isolated interfaces	Dimming of compatible drivers; command and level status
Occupancy / presence sensors	PIR, microwave or dual technology	Occupied/vacant, timeout, sensitivity and test status where available
Daylight / lux sensors	Ceiling, façade or external photocell	Lux value, daylight threshold and daylight-harvesting loop
Wall stations / keypads	Pushbutton, touch panel or scene plate	Local on/off, dim, scene selection and timed override
Astronomical clock	Software or controller function	Sunrise/sunset schedules, seasonal offsets and holidays
Energy meters	Single/three-phase multifunction meter	kW, kWh, voltage, current, PF, demand and alarms
DALI routers / application controllers	DALI-2 certified where specified	Bus power, addressing, groups, scenes, diagnostics and test
KNX / BACnet / Modbus gateways	Protocol interface	Read/write approved points; communications-health alarm
Lighting control panels	MCBs, contactors, relays, controllers, PSU, terminal blocks	Safe circuit distribution, local HOA/override where specified
Server / workstation / web client	Physical/virtual server and authorized clients	Graphics, schedules, alarms, trends, reports, users, backups
Network equipment	Managed switches, fiber/copper, VLAN/firewall interfaces	Secure communication, time sync and monitored connectivity
Emergency-light interface	DALI emergency, central battery or dry contact	Automatic tests/status only where approved; life safety remains dedicated

8. Network, Panels and Third-Party Integration

Open architecture with secure, maintainable interfaces



Secure head-end, server, network and third-party building-system integration

Typical topology

- Field bus: DALI-2 for addressable luminaires, drivers, sensors and emergency devices; KNX or room buses where appropriate.
- Panel level: relay/dimmer modules, application controllers, DALI power supplies/routers and monitored override switches.
- Backbone: managed Ethernet over copper/fiber, segregated VLANs, approved IP addressing, NTP time synchronization and monitored switches.
- Head-end: physical or virtual server, database, engineering workstation, operator web clients and optional redundant/backup environment.
- Integration: BACnet/IP, Modbus, KNX, OPC/MQTT/REST/API or dry contacts, subject to approved protocol schedules and cybersecurity review.

Systems that may exchange data

System	Information to LMS	Information from LMS
BMS	Occupancy mode, fire/security-approved requests, global schedule, demand limit	Lighting status, alarms, occupancy, area power and override state
EMS	Tariff, peak-demand target, demand-response event	kW/kWh, savings baselines, operating hours and load profile
Access control	Authorized entry, after-hours access, area occupancy indication	Area-lighting status and selected alarms
VMS / security	Camera or perimeter event, security mode	Scene status, external/parking lighting alarms
Fire alarm	Approved interface signal only	Optional status acknowledgment; no impairment of emergency lighting
AV / room booking	Meeting start/end, presentation mode	Room-scene status and occupancy
Parking / gate system	Entry/exit or occupancy data	Zone lighting status
Solar / weather (optional)	Irradiance, weather, battery status	Exterior scene or load request

Cybersecurity

- Role-based access and unique accounts; least privilege; encrypted remote access/VPN; network segmentation; firewall rules; backups; audit logs; patching/hardening; approved ports and data flows; controller-level standalone operation.

9. Intelligent Sequences of Operation

Configurable automation without sacrificing safety or local usability



Automated lighting behavior coordinated through sensors, schedules, scenes and local control

Strategy	Sequence
Occupancy control	Auto-on, manual-on or vacancy control by area; adjustable timeout; neighboring-zone pre-lighting; cleaning/maintenance override.
Daylight harvesting	Continuously dim perimeter or skylit groups to maintain the approved target; apply deadband and slow fade to prevent hunting.
Scheduling	Normal, weekend, holiday, event and seasonal calendars; per-zone exceptions; timed after-hours extension.
Scene control	Named scenes for work, presentation, welcome, retail, façade, night, cleaning, security, event and emergency-support modes.
Astronomical control	Sunrise/sunset calculation with geographic location, seasonal offset and photocell validation for external lighting.
Parking logic	Background level plus motion boost; directional pre-light; entrance daylight adaptation; security minimum and manual override.
Demand response	Reduce noncritical decorative or selected area lighting by approved percentages while preserving safety and essential tasks.
Fault response	Alarm for missing device, lamp/driver failure, bus fault, panel trip or communications loss; retain local fallback schedule.
Manual override	Local keypad/HOA command with configurable priority and timeout; all head-end commands recorded in audit trail.
Emergency interface	Automatic test and fault reporting where approved. Normal LMS commands must never remove required emergency illumination.

Control priority concept

Life-safety / statutory requirement → authorized emergency or security override → local manual command → event/operational scene → schedule → occupancy/daylight optimization. Final priorities are confirmed in the approved control philosophy.

10. Monitoring, Alarms, Analytics and Energy

Operational visibility for facility and management teams



Real-time dashboards for lighting zones, alarms, energy, trends and performance

Operator graphics and dashboards

- Campus/building overview; floor plans; room and parking-zone status; outdoor and façade scenes; panel/gateway health.
- Color-coded command/feedback, dimming level, occupancy, lux, overrides, device faults and communications status.
- Energy dashboards by building, floor, tenant, parking, exterior and lighting panel; daily/monthly/yearly comparisons.
- Role-based web/mobile access, multi-language labels where required and configurable favorite views.

Typical alarms

Priority	Examples	Recommended handling
Critical	Loss of major controller/panel, emergency-light system fault interface	Immediate notification, escalation and documented response
High	Lighting panel feeder trip, large-area communications loss, external security zone unavailable	Prompt facilities/security action
Medium	Luminaire/driver failure, sensor failure, meter offline	Maintenance work order and grouped reporting
Advisory	Extended override, schedule exception, unusual runtime or consumption	Review and optimize

Reports and KPIs

- Lighting kWh, kW demand and cost by zone; estimated savings against baseline; load profile and after-hours consumption.
- Lamp/driver failures, device availability, sensor activity, override duration, operating hours and preventive-maintenance indicators.
- Emergency-light automatic test results where the approved emergency system supports digital reporting.
- Exportable daily, weekly, monthly and annual reports; data retention and intervals configured during detailed design.

11. Typical Points List and Control Matrix

Minimum point framework—final schedule to be issued during detailed engineering



Addressable devices and control points organized for testing, alarms and maintenance

Object	Point type	Typical values / commands
Lighting circuit / DALI group	Command	On/Off; 0–100% level; scene; schedule enable
Luminaire / driver	Status/Alarm	Actual level, lamp/driver failure, missing device, operating hours
Occupancy sensor	Input	Occupied/vacant, hold time, last activation
Lux / photocell	Input	Measured lux, threshold, sensor fault
Wall station	Input/Command	Button event, scene request, raise/lower, override timer
Panel / gateway	Status/Alarm	Online, bus voltage, communication fault, override status
Energy meter	Measurement	kW, kWh, V, A, PF, demand, communications status
Schedule	Software	Normal, weekend, holiday, Ramadan/event or client-defined calendars
Emergency lighting	Monitor/Test	Battery/lamp/device status and test result where approved
BMS/EMS interface	Exchange	Area status, power, alarms, occupancy, demand-response request

Area control matrix

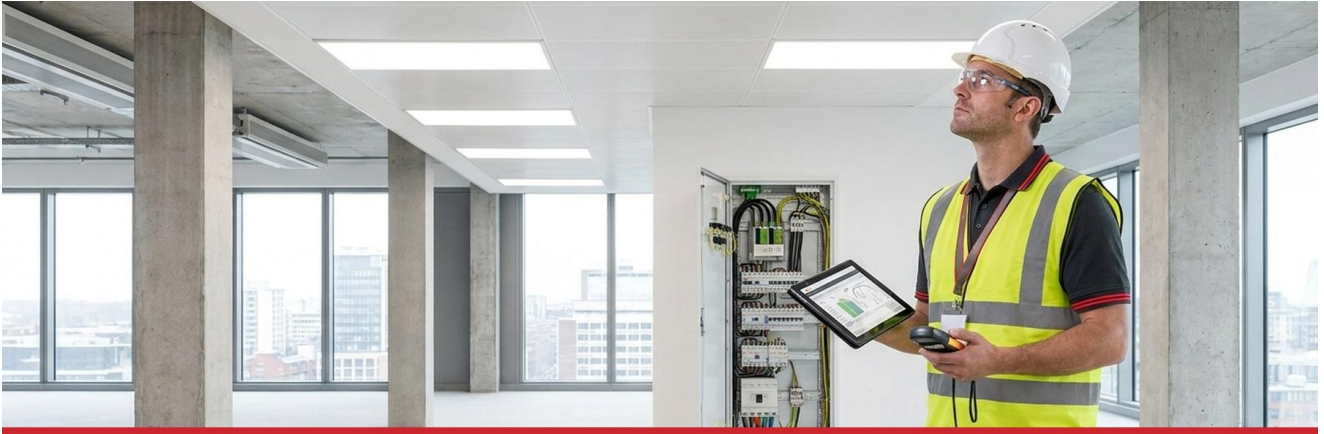
Area	Occupancy	Daylight	Schedule	Scene	Metering	Emergency monitor
Internal offices / rooms	Yes	Yes where applicable	Yes	Yes	Panel/tenant	As specified
Corridors / stairs	Yes	Limited	Yes	Yes	Floor/panel	Yes where specified
Façade / landscape	Optional	Photocell	Astro + calendar	Yes	External panel	By code
Covered parking	Yes	Entrance zones	Yes	Yes	Parking panel	Yes
Open-air parking	Optional boost	Photocell	Astro + calendar	Yes	Parking cabinet	By code

Point naming

Use a structured convention such as Site–Building–Floor–Area–Panel–Circuit/Device–Point so that alarms, trends, reports and maintenance records remain searchable and scalable.

12. Engineering, Installation and Commissioning

End-to-end delivery by Scorpions Services



On-site testing, lux verification, device commissioning and system acceptance

Stage	Key activities / deliverables
Survey & design basis	Review drawings, areas, existing panels, luminaire drivers, circuit loads, emergency-lighting method, networks and integration requirements.
Detailed engineering	Lux/control zoning review, riser/topology, panel schedules, device selection, points list, I/O schedule, integration matrix, shop drawings and sequences.
Supply & installation	Controllers, gateways, panels, sensors, keypads, meters, servers, network equipment, interfaces, labeling and field installation within agreed scope.
Programming	Addressing, groups, scenes, schedules, sensor logic, graphics, alarms, trends, reports, users and third-party interfaces.
Testing	Circuit and device checks, DALI addressing, sensor coverage, lux/daylight tests, scene/schedule verification, panel/network failover and alarm tests.
Commissioning	Point-to-point records, integrated testing, energy baseline, emergency-interface witness tests, snag closure and acceptance.
Handover	As-builts, points list, panel schedules, test sheets, manuals, backups, licenses, training and maintenance plan.
Support	Preventive/corrective maintenance, remote support, reprogramming, expansion, software backup and periodic optimization.

Acceptance criteria

- Correct operation of every controlled circuit/address; confirmed sensor coverage and time delays; verified scene levels and schedules; approved graphics and alarms; meter accuracy/interface checks; network recovery; emergency-lighting interface verification; user training and signed test records.

13. Benefits, Assumptions and Next Steps

A practical roadmap from concept to final engineered solution



A unified, scalable lighting solution for efficient and future-ready properties

Client benefits

Outcome	Value
Lower energy use	Occupancy, daylight, schedules, dimming and demand response reduce avoidable lighting consumption.
Better experience	Consistent illumination, intuitive scenes and local control improve comfort and flexibility.
Safer operation	Background levels, pre-lighting, fault alarms and monitored emergency interfaces improve visibility and response.
Reduced maintenance	Device diagnostics, runtime and failure reports help teams plan work and locate faults.
One operating view	Building, exterior and all parking lighting are managed from a common interface.
Future-ready	Open protocols and modular panels support new floors, areas, luminaires and integrations.

Information required for final design and quotation

- Architectural, reflected-ceiling, landscape, façade, parking and electrical drawings; luminaire and panel schedules; single-line diagrams.
- Project areas, operating hours, tenant boundaries, required scenes, security policies and maintenance strategy.
- Luminaire driver types and dimming protocols; existing LMS/BMS/EMS; network and cybersecurity standards.
- Applicable lighting, emergency, road/parking and energy codes; target lux, uniformity, glare, color and sustainability requirements.
- Required quantities, redundancy, remote access, notification channels, data retention and approved manufacturers.

Recommended next steps

1. Joint technical meeting and site survey.
2. Confirm lighting zones, control philosophy and integration boundaries.
3. Prepare detailed architecture, points list, panel/fixture schedule and sequences.
4. Issue final technical and commercial proposal with quantities, models, programme and service options.

Scorpions Services commitment

We combine practical engineering experience, intelligent technologies, integration capability and customer-focused service to deliver lighting solutions that are reliable, efficient, secure, maintainable and ready for future expansion.