Lighting

Technical Guide 2019

How to Control and Protect Lighting Circuits?

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Life Is On | Schneider Electric

Legal informations

Purpose of the document

This document contains all the knowledge of Schneider Electric around lighting technology with the exception of LEDs. It is built for our professional customers to be used as a reference document, to be shared with newcomers on your field, to be spread around your engineering teams in order to help you raise the best architectures.
Our engineers are working every day to provide smart solutions to a constantly evolving world.

For LED lighting technology, please consult our dedicated LED Lighting Technical Guide 2019:
How to Control and Protect LED Lighting Circuits? - CA909008

Contents

[The future of energy]

50%

The required reduction in greenhouse gas emissions to stabilize greenhouse effect by 2050.

30%

Possible savings using today's technology to reduce emissions or electrify the part of the world that is not yet electrified.

1 A commitment…

Why the pressure on energy use will not go away

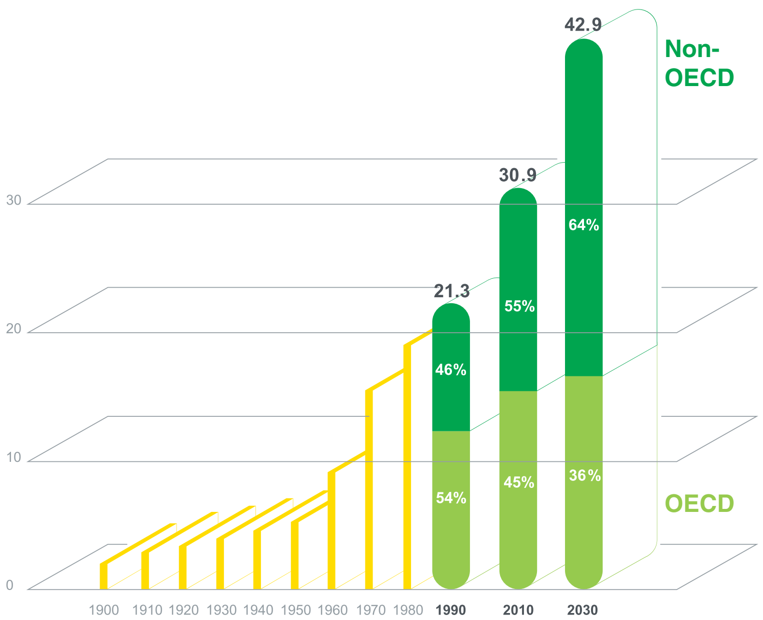
● World energy consumption has risen 45% since 1980. It is projected to be 70% higher by 2030.

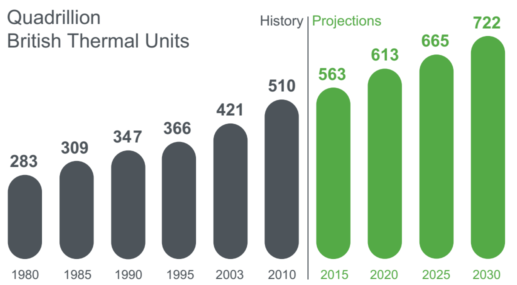
● Emerging markets (including China and India) account for more than 75% of new energy demand, placing new pressures on global resources. Meanwhile, mature markets such as North America, Europe and Japan will also face increased demand and limited resources. These mature markets will continue legislating to reduce consumption, shift to alternative energy sources, and improve energy security.

● According to forecasts, increased competition for resources and political instability will cause oil and natural gas prices to remain at or above current levels for the foreseeable future. Coal will continue to be a cheap and plentiful resource, especially in emerging markets. This will maintain the pressure to reduce emissions and will increase the need for global action to mitigate climate change.

● More than ever, global warming is at the top of the agenda. Environmental concerns and public opinion on climate change will drive continued actions by legislators, opinion leaders and special interest groups, forcing industry to respond.

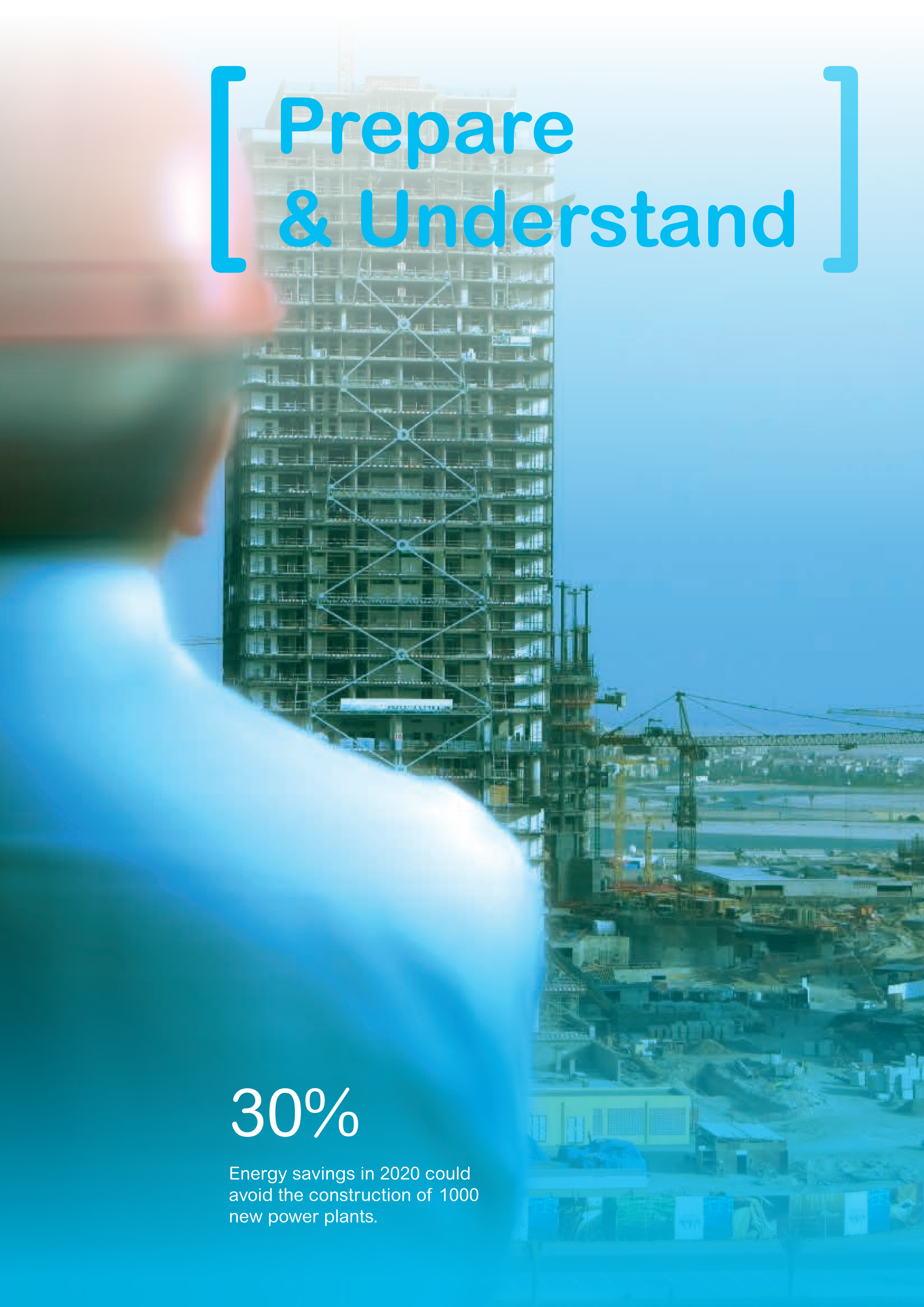
The trends we see now will continue for the next 25 years.





" We must learn to adapt and manage energy consumption, energy costs and pollutant emissions."

[Prepare & Understand]



30%

Energy savings in 2020 could avoid the construction of 1000 new power plants.

1 A commitment…

We can all adapt to the new energy world

Energy use reduction and management will be a continued focus of policy makers. Key targets for future policies will be:

- Limiting final energy consumption in all sectors;
- Measuring and tracking energy use to establish benchmarks and targets;
- Promoting alternative green energy sources and technologies;
- Opening markets to promote emissions trading and a reduction in energy demand.

Building and Industry are the sectors offering the largest and most accessible opportunities for savings.

Make a commitment to understand the environmental impact of your business and opportunities for savings.
Energy efficiency is the quickest, cheapest, cleanest way to extend our world's energy supplies.

Industry

- More than 30% of energy consumed.
- Motors account for 60% of electricity consumption.
- A medium-sized facility can reduce its energy consumption by 10% to 20%.

Buildings

- More than 20% of energy consumed (EU and US).
- 3 key areas: HVAC, lighting & integrated building solutions.
- Technical projects can result in up to 30% energy savings.

Residential

- More than 20% of energy consumed (EU and US).
- Using energy-efficient products may give electricity savings of 10% to 40%.

"Schneider Electric has made this commitment and we can help you."

Enabling energy savings

30%

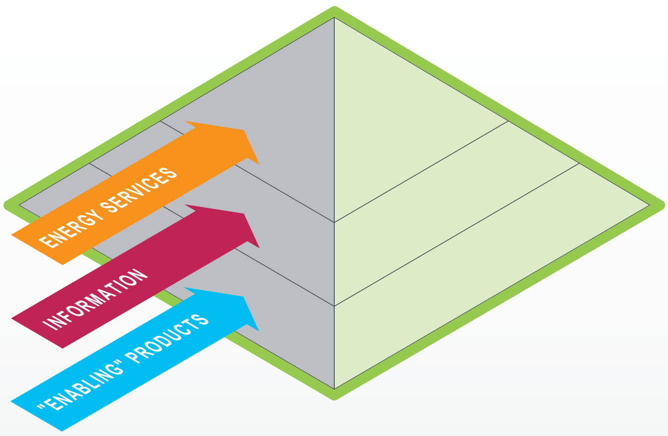
Energy savings is feasible now with today's technologies.

Solutions...

Solutions that enable and sustain energy efficiency

Our products and solutions are on every link in the energy chain, enabling energy savings of 10% to 30% or more to be achieved.

- Technology is crucial to achieving energy efficiency.
Smart innovations in energy will continue to have a significant impact on enabling energy and emissions reduction.
- Information, expertise and knowledge are crucial to apply technologies in practical and economically feasible ways.
- Behavioral and procedural rules facilitate the ability to initiate and sustain all savings.



Help customers make the right decisions to manage energy.
Provide information that allows confident decision making.
Provide technologies and solutions to enable sustainable energy savings.

Solutions & Knowledge

- **HVAC and lighting control and management.**
- **Pump and compressor control, motor control and management.**
- **Power management, critical power solutions.**
- **Facility management, process optimization.**
- **Energy information services, audits and assessments.**
- **Energy services, etc.**
- **Emergency lighting system low consumption with LED light source and LiFePO4 batteries for an extended lifetime**

Enabling technology

- Metering, Monitoring & Control, Automation & Sensors.
- Drives and motor control, Lighting control systems.
- Building automation systems, Electrical distribution.
- Power factor correction, power filtering.
- New lighting technology permitting smart management (LED, OLed).
- Uninterruptible Power Systems.
- SCADA, information systems.
- Management tools, etc.

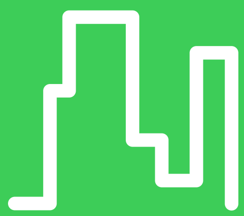
"Schneider Electric helps its customers stand out!"

Lighting accounts for a considerable proportion of electricity consumption, whatever the sector.

Residential

40%

Service sector

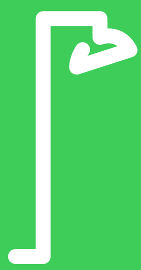


25% to 50%

Industry

10%

Urban authorities



40% (outdoor lighting)

Careful consideration should therefore be given to the technologies used, in order to strike the best balance between usage and total cost.

Contents

Lighting circuit equipment dimensioning and selection guide

Step-by-step procedure

Introduction

Project specifications and financial constraints

The lighting design depends on:
- The field of application,
- The use of the premises,
- The initial investment,
- Operation and maintenance.

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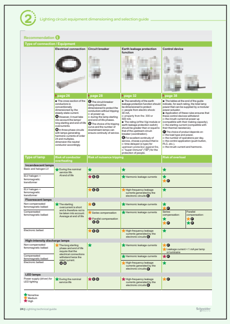
Recommendations



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Type of lamps

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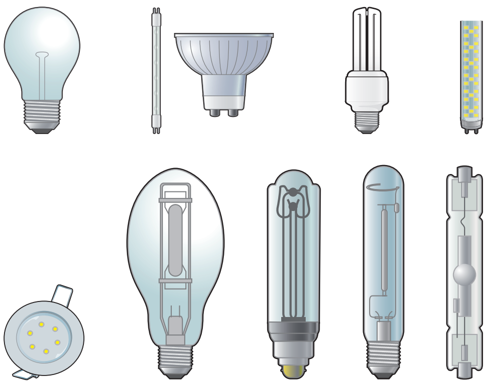
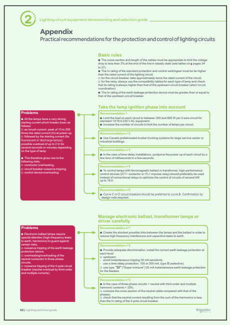
- General characteristics
- Electrical constraints



Practical recommendations



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Power supply and control

- Protection
- Single control
- Automatic control
- Remote management

Energy Efficiency

Selection of devices for energy savings and improved comfort.

Cables and networks

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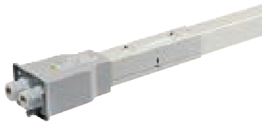
• Cable cross section dimensioning factors

• Prefabricated busbar trunking, Canalis type



Dimensioning:
pages 30 to 33

Protective devices

• Circuit breakers

• Earth leakage protection devices

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• Surge protective devices

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Dimensioning:
pages 30 to 33

Control devices

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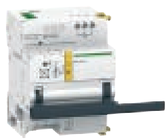
• Impulse relay, Contactor, Relay

• Reflex iC60

• RCA circuit breaker remote control



Dimensioning:
pages 30 to 33

Management and remote management devices

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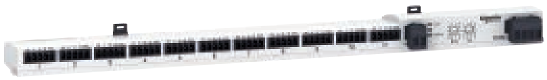
• IHP, IC, MIN, etc.

Acti 9 Smartlink, BMS, etc.



Dimensioning:
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Emergency lighting

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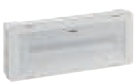
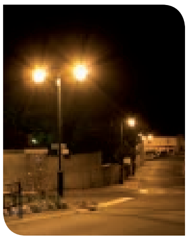


Dimensioning:
pages 30 to 33

Project specifications and financial constraints
Selection criteria

The application

Outdoors

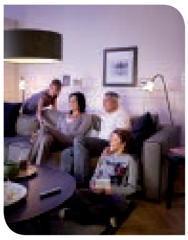


5...70 lux

Warehouse

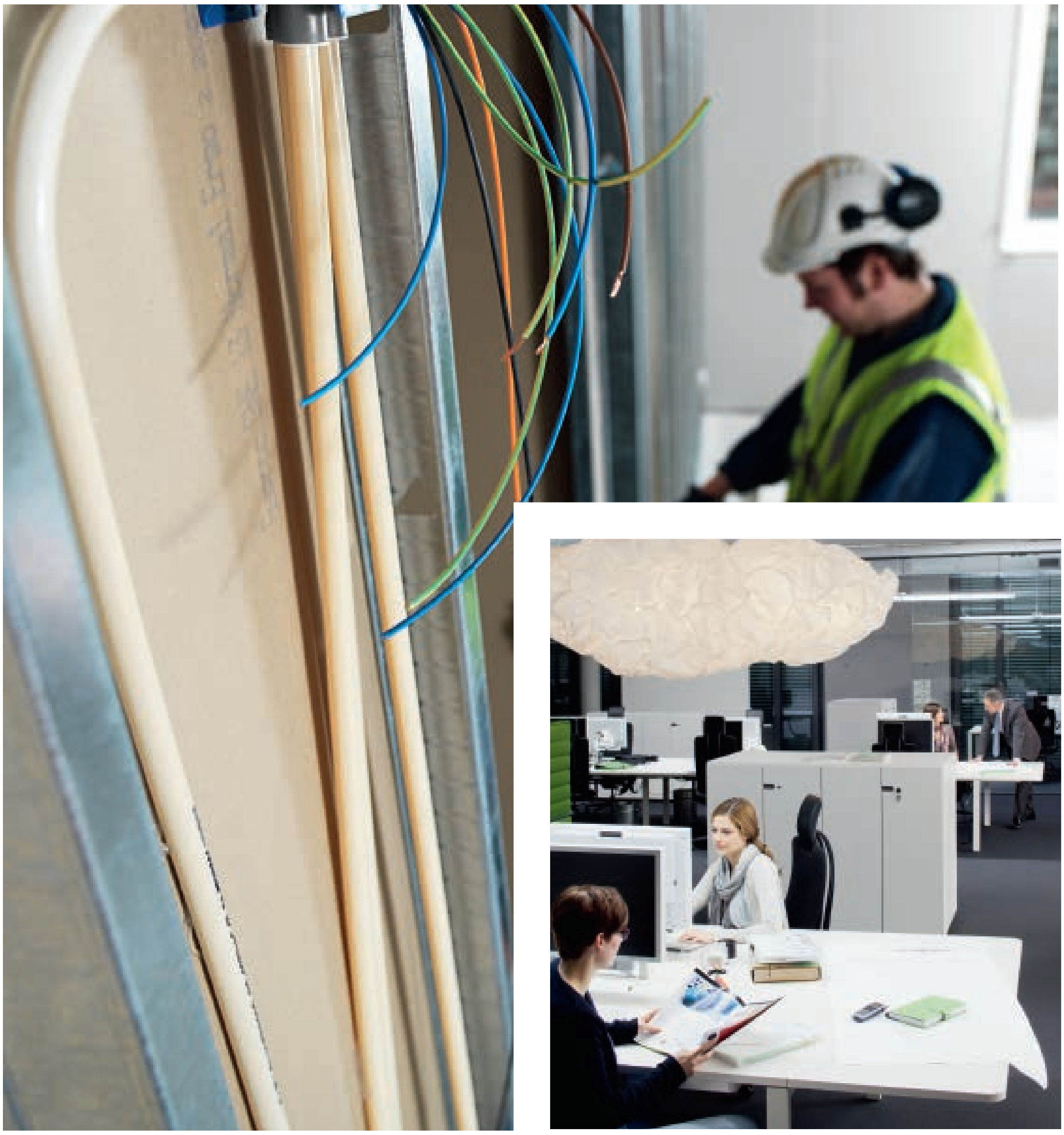
125...300 lux

Home

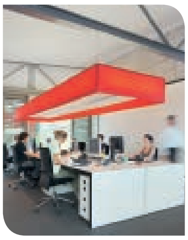


200 lux

The work of the lighting designer involves creating specific lighting atmospheres using different types of lamps.

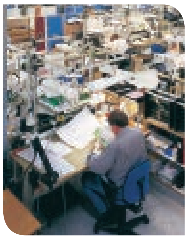


Office



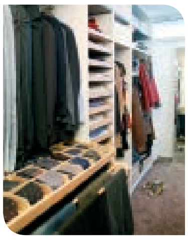
400…500 lux

Workshop



300…1000 lux

Shop



500…1000 lux

Studio

2000 lux

Illumination level and quality

Lamp power output

Varies according to the chosen technology and is influenced by the color of the premises and the amount of natural light.

Distance (d) between the lamps and the area to be lit

The illumination level is proportional to $1/d^2$.

Luminaire

The shape and efficiency of the reflector create a more or less focused light beam. For example, a spot lamp has a small angle which generates a stronger but more localized light.

The initial investment

Electrical architecture

The number of lamps used, their output and geographical distribution determine the number of circuits, the cross-section and length of electrical connections, the control and protection devices and the associated lighting components (transformer, ballasts, possible reactive compensation, etc.).

Cost of lamps

The cost varies according to the technology chosen.
Generally, lamps with high lighting efficiency and long-life lamps are expensive, and vice versa.

Cost of luminaires

The luminaire depends mainly on the application.
Other criteria can be used to narrow down the choice: attractiveness, price, climatic conditions, etc.

Operation and maintenance

Consumption

Consumption depends on:
- the lighting efficiency and the output, type and number of lamps used,
- optimization of ignition times.

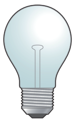
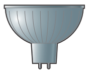
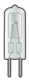
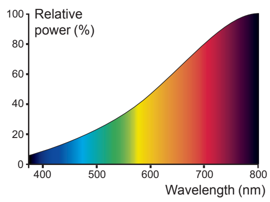
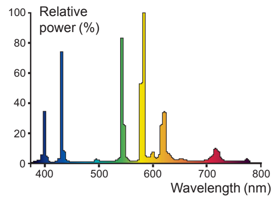
Service life

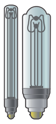
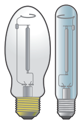
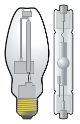
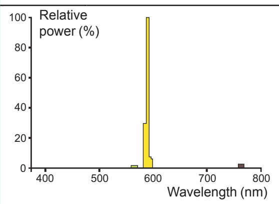
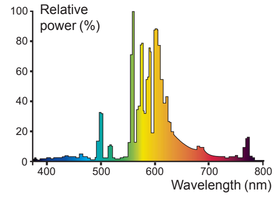
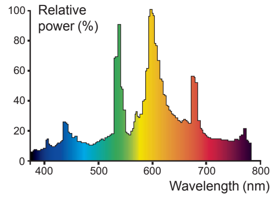
The service life varies according to the chosen technology.
Lamps with a long service life are expensive, but require less frequent maintenance.

Accessibility

Accessibility determines the number of man-hours and whether lifting equipment is required (basket). It must be taken into consideration, depending on the required continuity of service and the operating environment (vehicle traffic, presence of the public, opening hours, etc.).

The various types of lamp
General characteristics

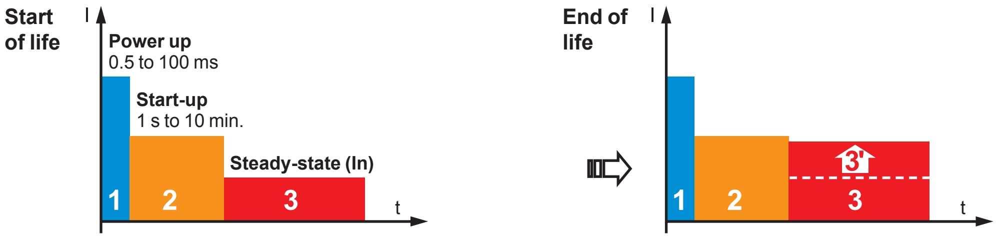
Types of lamps		Incandescent lamps			Fluorescent lamps	
		 Basic lamps	 LV halogen lamps Replacing incandescent lamps 	 ELV halogen lamps 	 Compact fluorescent lamps	 Fluorescent tubes T5, T8
Associated component required for operation		-	-	Electromagnetic or electronic transformer	Integral or external electronic ballast (same as for fluorescent tube)	Ferromagnetic ballast + starter + possibly a capacitor or electronic ballast
The application						
Lamp power output (most common rated powers)		400 to 1000 lm (40 to 100 W)	2000 to 10,000 lm (100 to 500 W)	400 to 1000 lm (20 to 50 W)	300 to 1600 lm (5 W to 26 W)	850 to 3500 lm (14 to 58 W)
Lighting efficiency (lm/W)		5 to 15	12 to 25		45 to 90	40 to 100
Lighting quality	**Lighting spectrum** It determines the quality of the light (the fuller the spectrum, the closer it is to sunlight)					
	Color rendering	★★★★★			★★ or ★★★ according to the price and type of lamp	
	Ambience	Warm			Variable from cold to rather warm	
Installation	**Height**	2 to 17 m	Average	2 to 17 m	Average	17 to 12 m
	Comments		Direct or indirect lighting			Suspended, flush mounted or surface-mounted
Number of switching operations (on/off)		★★★★ (high)			★★ (several times each hour)	
Ignition time		Instantaneous			A few seconds (almost instantaneous with some electronic ballasts)	
Use	**Interior lighting**	■ Homes, shops, restaurants	■ Projector, spotlight, indirect lighting in housing or shops	■ Homes ■ Shops: spotlights, window displays ■ Lighting in humid locations: bathroom, swimming pool	■ Homes ■ Offices, showrooms ■ Shops	■ Offices, schools, clean rooms ■ Industry: warehouses, workshops ■ Large commercial areas: supermarkets, garages, shops, gymnasia
	Exterior lighting				■ Under shelter, at the entrance to buildings	■ Lighting for a pedestrian path on bridges and foot bridges
The initial investment						
The lamp	**Price range** (most common rated powers)	\$0.5 to \$10 (40 to 100 W)	\$5 to \$30 (100 to 500 W)	\$2 to \$50 (20 to 50 W)	\$2 to \$50 (5 to 26 W)	\$2 to \$30 (14 to 58 W)
	Max. price	\$25	\$120	\$55	\$100	\$70
Associated components		-	-	■ Transformer: □ electronic: \$10 to \$50 □ ferromagnetic: \$7 to \$20	■ Electronic ballast: from \$15 to \$200 ■ Ferromagnetic ballast: from \$7 to \$20 + starter: from \$0.5 to \$15	
Luminaire	**Price range**	\$10 to \$30			\$15 to \$60	
Operation and maintenance						
Service life	**Range**	1000 to 2000 h	2000 to 4000 h		5000 to 20,000 h	7500 to 20,000 h
	Comments	Service life divided by two in the event of overvoltage > 5%			50% longer with external electronic ballasts by comparison with ferromagnetic ballasts	
Average consumption to emit 10,000 lm during 10 h		10 kWh	5 kWh	5 kWh	1.7 kWh	1.7 kWh
Analysis						
Strengths ★ **Weaknesses** ★		★ Instant ignition ★ Frequent switching possibility ★ Lower investment costs ★ Low efficiency, 95% of energy dissipated in the form of heat, which requires good ventilation ★ High consumption ★ High operating cost: frequent maintenance		★ Dimensions of the transformer	★ Low operating cost: little maintenance ★ Energy savings ★ Does not withstand frequent switching ★ Single-tube versions with magnetic ballast and entry-range compact lamps generate visible flicker ★ Useful replacement for basic incandescent lamps	★ Requires numerous luminaires, size ★ Unattractive basic version
Notes		Declining technology. As part of their energy saving programs, some countries and regions (Australia, California, Canada, Cuba, China, Europe, etc.) are planning to phase out the use of incandescent lamps.			Most widely used technology for a large number of uses. Excellent value for money.	

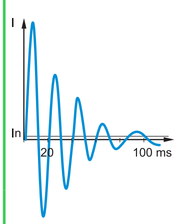
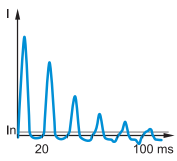
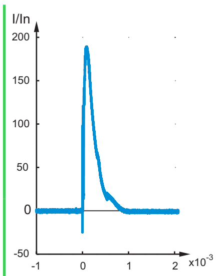
	High-intensity discharge lamps		
	 Low-pressure sodium vapor lamps	 High-pressure sodium vapor lamps	 ■ Metal-iodide lamps ■ Metal-halide lamps
	Ferromagnetic ballast + starter + possibly a capacitor or electronic ballast (for lamp up to 150 W)		
	3900 to 20,000 lm (26 to 135 W)	7000 to 25,000 lm (70 to 250 W)	7000 to 40,000 lm (70 to 400 W)
	110 to 200	40 to 140	70 to 120
			
	★	★★★	★★★★
	Monochromatic orange	Dominant yellow	Dominant white
	-	> 3 m	> 3 m
	At a height or on the ground		
	★ (several times each day)		
	Several minutes to reach the nominal illumination level		
		■ For white sodium only: shopping malls, warehouses, showrooms	■ Shopping malls, showrooms, gymnasia ■ Factories, workshops ■ Horticulture ■ Theatre, stage
	■ Tunnels, motorways ■ Safety lighting ■ Runway lighting	■ Public lighting ■ Roads, monuments ■ Tunnels, airports, docks, car parks, parks	■ Public lighting ■ Pedestrian streets, stadiums ■ Safety lighting ■ Worksite lighting ■ Airports
	$40 to $150 (26 to 135 W)	$20 to $90 (70 to 250 W)	$30 to $150 (70 to 400 W)
	$170 (180 W)	$290 (1000 W)	$500 to $1000 (2000 W)
	■ Ferromagnetic ballast: from $20 to $200 (high power: from $80 to $600) + starter: from $15 to $100		
	$100 to $200		
	12,000 to 24,000 h	10,000 to 22,000 h	5000 to 20,000 h
	50% longer with external electronic ballasts by comparison with ferromagnetic ballasts		
	0.7 kWh	1 kWh	1 kWh
	★ Low operating cost: little maintenance ★ Energy savings ★ Very powerful lighting ★ High investment cost ★ Long or very long ignition time (2 to 10 minutes)		
		★ Operate down to -25°C emitting very little heat	
	Becoming obsolete Good energy efficiency, poor IRC	Most frequently used technology for outdoor public lighting Gradual replacement by LEDs	The trend is to use them as a useful replacement for high-pressure sodium lamps

The various types of lamp

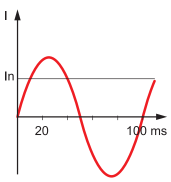
Impacts of selected lamps on the choice of components

Current profile of a lamp in its various phases, over time

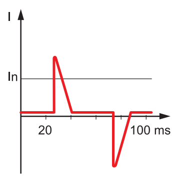


Lamp selected	Induced electrical constraints			
Page 16	1 **Inrush current at power up**			2 **Starting current**
	 Very low resistance of the filament when cold	 Initial saturation of ferromagnetic circuits	 Initial loading of circuit capacitors	All discharge lamps (fluorescent and high intensity) require a phase of gas ionization before ignition which causes higher consumption (starting) Intermediate phase of driver start-up
Incandescent lamps				
Basic and halogen LV	■ 10 to 15 In for 5 to 10 ms			
ELV halogen + ferromagnetic transformer		■ 20 to 40 In for 5 to 10 ms		
ELV halogen + electronic transformer			■ 30 to 100 In for 0.5 ms	
Fluorescent lamps				
Non-compensated ferromagnetic ballast		■ 10 to 15 In for 5 to 10 ms		■ Duration: from a few tenths of a second to a few seconds ■ Amplitude: from 1.5 to 2 times the rated current In
Compensated ferromagnetic ballast			■ 20 to 60 In for 0.5 to 1 ms	
Electronic ballast			■ 30 to 100 In for 0.5 ms	
High-intensity discharge lamps				
Non-compensated ferromagnetic ballast		■ 10 to 15 In for 5 to 10 ms		■ Duration: from 0.5 to 1.5 s ■ Amplitude: from 1.1 to 1.6 times the rated current In
Compensated ferromagnetic ballast			■ 20 to 60 In for 0.5 to 1 ms	
Electronic ballast			■ 30 to 100 In for 0.5 ms	

3 Steady-state current



Non-deformation on passive impedances



Distortion created by electronic converter rectification / filtering

3' End of life

Higher consumption beyond the nominal service life (time after which 50% of the lamps of a given type are at end of life)

Power factor

- Power consumed (W) / apparent power (VA)
- < 1 in the presence of non-compensated reactive circuits (dominant inductance or capacitance)
- Determines the rated current of the circuit according to the lamps' power output and losses

Non-deformation on passive impedances	Distortion created by electronic converter rectification / filtering	End of life	Power factor
■		Up to two times the rated current	1
■			Close to 1 at full load
	■		> 0.9
■		Up to two times the rated current	0.5
■			> 0.9
	■		> 0.9 with external ballast 0.5 with integral ballast
■		Up to two times the rated current	0.5
■			> 0.9
	■		> 0.9

The various types of lamp

Recommendation 1

Type of connection / Equipment

Electrical connection	Circuit breaker	Earth leakage protection function	Control device
			
page 22	page 24	page 28	page 34
■ The cross section of the conductors is conventionally dimensioned by the steady-state current. **A** However, it must take into account the lamps' long starting and end-of-life overcurrents. **B** In three-phase circuits with lamps generating harmonic currents of order 24 and multiples, dimension the neutral conductor accordingly.	**C** The circuit breaker rating should be dimensioned to protect the conductors without tripping: □ at power up, □ during the lamp starting and end-of-life phases. **D** The choice of its tripping curve and the number of downstream lamps can ensure continuity of service.	■ The sensitivity of the earth leakage protection function should be dimensioned to protect: □ people from electric shock: 30 mA, □ property from fire: 300 or 500 mA. ■ The rating (of the Vigi module or earth leakage protection switch) should be greater than or equal to that of the upstream circuit breaker (coordination). **E** For excellent continuity of service, choose a product that is: □ time-delayed (s type) for upstream protection against fire, □ "super immune" ("*SI*") for the protection of people.	■ The tables at the end of the guide indicate, for each rating, the total lamp power that can be supplied by a modular power actuator. ■ Application of these rules ensures that these control devices withstand: □ the inrush current at power up (compatible with their making capacity), □ the starting current (compatible with their thermal resistance). **F** The choice of product depends on: □ the load type and power, □ the number of operations per day, □ the control application (push button, PLC, etc.), □ the inrush current and harmonic.

Type of lamp	Risk of conductor overheating	Risk of nuisance tripping		Risk of overload
Incandescent lamps				
Basic and halogen LV	★ (None/low) During the nominal service life. At end of life	★ (None/low)	★ (None/low)	★ (None/low)
ELV halogen + ferromagnetic transformer		★ (High) **C** **D**	★ (None/low) Harmonic leakage currents	★ (None/low) ★ (Medium) **F**
ELV halogen + ferromagnetic transformer		★ (Medium) **C** **D**	★ (Medium) High-frequency leakage currents generated by the electronic circuits **E**	★ (None/low)
Fluorescent lamps				
Non-compensated ferromagnetic ballast	★ (None/low) The starting overcurrent is short and is therefore not to be taken into account. Average at end of life	★ (Medium) **C**	★ (None/low) Harmonic leakage currents	★ (None/low) ★ (Medium) **F**
Compensated ferromagnetic ballast		★ (Medium) Series compensation ★ (High) Parallel compensation **C** **D**	★ (None/low) Harmonic leakage currents	Series compensation: ★ (None/low) ★ (Medium) **F** Parallel compensation: ★ (Medium) **F** ★ (None/low) **F**
Electronic ballast		★ (Medium) **C** **D**	★ (Medium) High-frequency leakage currents generated by the electronic circuits **E**	
High-intensity discharge lamps				
Non-compensated ferromagnetic ballast	★ (Medium) The long starting phase and end of life require that the electrical connections withstand twice the rated current. **A** **B**	★ (None/low)	★ (None/low) Harmonic leakage currents	★ (Medium) **F** ★ (Medium) Leakage current < 1 mA per lamp or luminaire
Compensated ferromagnetic ballast			★ (None/low) Harmonic leakage currents	★ (High) **F**
Electronic ballast			★ (Medium) High-frequency leakage currents generated by the electronic circuits **E**	★ (None/low)

★ None/low
★ Medium
★ High

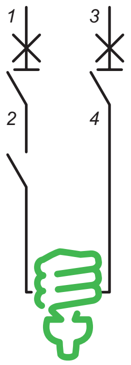
Recommendation 2

A lighting circuit can be powered up/down with a simple wall- or panel-mounted switch.
Very often this switch will not be appropriate or sufficient:

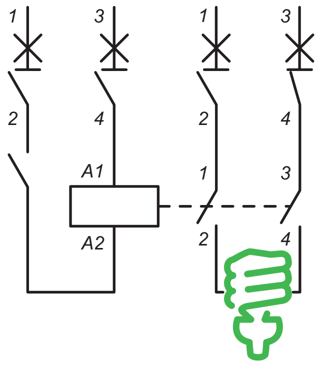
- Powering up of high-power lighting loads.
- Distribution with cables of large cross section up to the control circuit apparatus.
- Three-phase distribution.
- Control with a safety voltage.
- Multiple controls above 2 control points.
- Need for automatic management control.

To meet these needs, circuit control by a power relay (contactor or impulse relay) is necessary.

Standard layout



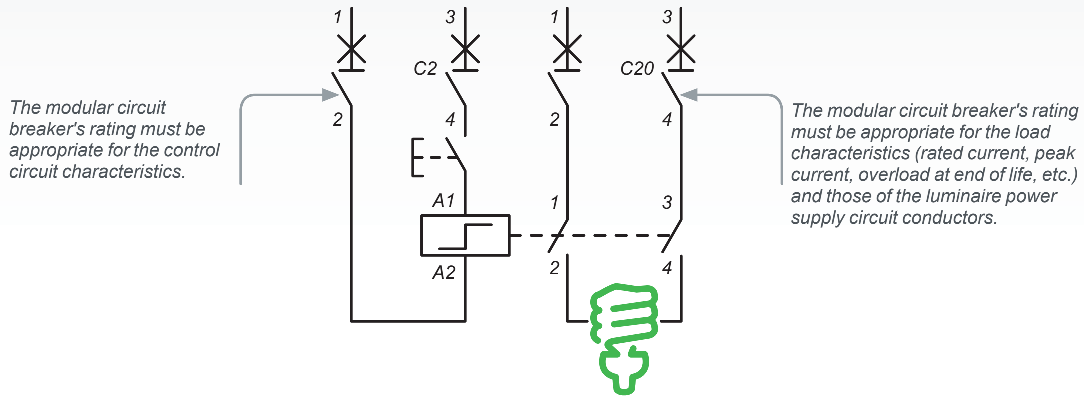
Layout with power relay



Recommendation 3

Separation of protection from the control circuit.
It should be ensured that the control circuit protection is appropriate for the circuit's characteristics and specific features:

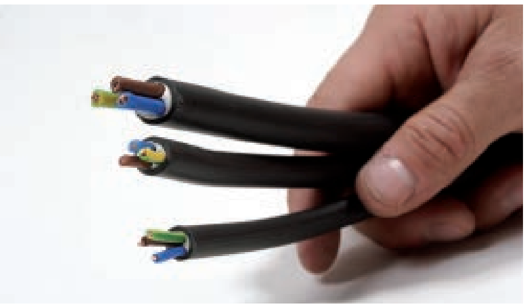
- Conductor cross section.
- Permissible rated current for control functions (switch, PLC output, push button, etc.).



- Generally, the two circuits should be protected separately, with appropriate circuit breaker ratings and curves.
- The control circuits for several lighting feeders can be protected by the same circuit breaker.

Selection of electrical distribution systems

Principles for selection of cables and prefabricated busbar trunking



Power connections

■ The electrical power connections have the role of transporting energy from the electrical switchboard to the lighting loads.
■ They can be formed of cables or prefabricated busbar trunking.
■ Where large areas have to be lit, they comprise a main circuit and branch circuits to the luminaires.
■ Their selection depends on various constraints:
□ safety (insulation, little overheating, mechanical strength, etc.),
□ efficiency (limited voltage drop, etc.),
□ installation environment (location, installation procedure, temperature, etc.),
□ investment cost.

Cable cross section dimensioning factors

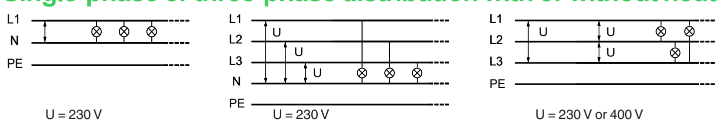
Rated current of circuits

■ The total circuit power must be analyzed and calculated:
□ lamp power consumption,
□ any lamp ballast or transformer losses.
■ Depending on the type of load and any compensation, a power factor must be applied. A poor power factor, for example, can double the current flowing through the circuits.
■ For electrical connection dimensioning, one should allow for the fact that the lamps consume 1.5 to 2 times their rated current:
□ at end of life for all lamps,
□ during the long starting phase for high-intensity discharge lamps.

Length of electrical connections

The cable resistance causes a voltage drop proportional to the cable length and the current. It can cause malfunctions when the lamps are switched on or reduce the luminosity in steady state. The length of the circuits and the distributed power require an appropriate cable cross section.

Single-phase or three-phase distribution with or without neutral



In most buildings used for tertiary or commercial purposes, the lighting system is distributed via a single-phase circuit. To optimize the cabling, especially for high-power applications over large areas, three-phase distribution is sometimes used: 230 V between phase and neutral or between phases, or 400 V between phases for high-power lamps (2000 W).

Conductive material

Copper is less resistive but more expensive than aluminum.
The use of aluminum is reserved for high-current electrical connections.

Installation procedure

Buried or otherwise, on cable trays or embedded, etc.

Mutual interference in the case of adjacent circuits

Type of insulating material

Ambient temperature

1% to 2% derating per °C above the nominal temperature.

Derating factors to prevent overheating of electrical connections

Loaded neutral correction factor

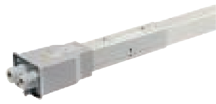
In the case of three-phase circuits supplying discharge lamps with electronic ballasts, harmonic currents of the third order and multiples of three are generated. They flow through the phase conductors and combine in the neutral cable, possibly causing an overload. The circuit must therefore be sized according to this harmonic content.

Conductor cross section

Canalis: fast dimensioning ▸ page 30

Usual values

■ Power output per phase of a lighting circuit:
□ common values: 0.3 to 0.8 kW,
□ maximum values:
- 110 V: up to 1 kW,
- 220 to 240 V: up to 2.2 kW.
■ Power factor: > 0.92 (compensated circuit or electronic ballast).
■ Maximum permissible voltage drop (ΔU) in steady state:
□ 3% for circuits of less than 100 m,
□ 3.5% tolerated above 200 m.
■ Cable cross section:
□ most commonly (< 20 m): 1.5 or 2.5 mm^2,
□ very long (> 50 m) high-power circuit, to limit voltage drops: 4 to 6 mm^2, or even 10 mm^2 (> 100 m).

Type of electrical connections	Cables	Canalis busbar trunking
		
Criteria to be taken into account for selection		
Installation procedure (generating possible overheating)	■	
Mutual interference in the case of adjacent circuits	■	
Ambient temperature	■	■
Type of electric insulating material	■	
Loaded neutral correction factor (three-phase circuit with high harmonic distortion factor)	■	■
Conductive material	■	
Length of electrical connection	■	■
Rated current of circuits	■	■ Simplified selection according to the type of lamp
Halogen-free material	■	■

Canalis prefabricated busbar trunking

These systems meet the needs of all applications in commercial, tertiary and industrial buildings.

Canalis: fast dimensioning ▶ page 30

Advantages in every stage in the life of a building

Design

■ Simplified electrical circuit diagram.
■ Direct selection of the model according to the type and number of lamps.
■ Direct correspondence between the circuit breaker rating and that of the duct.
■ Guaranteed performance irrespective of the installation (in accordance with the IEC 604279-2 standard).
■ Suitable for all environments: IP55 standard.
■ Protects the environment: RoHS.
■ No halogen: releases no toxic fumes in case of fire.

Implementation

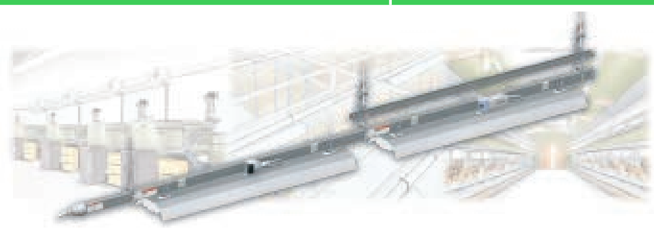
■ Ease of installation: no risk of wiring error.
■ Can be installed by unskilled personnel (connection by connectors, polarizing, etc.).
■ Reduction in worksite time, control of completion times.
■ Prefabricated, pretested: operates immediately on commissioning.

Operation and maintenance

■ Quality of contacts of clamp type active conductors.
■ Long service life, maintenance-free (up to 50 years).
■ Continuity of service and safety: servicing can be performed on live lines.
■ Significant reduction in radiated electromagnetic fields.

Changes in the building

■ Modular, hence dismountable and reusable.
■ Refitting of premises and their light fittings facilitated by the branch connections available at regular intervals.
■ Legibility of the installation for servicing operations and upgrades.

		Canalis KBA	Canalis KBB
			
Installation	Type	Rigid	Very rigid
	Installation procedure	■ Suspended (installation spacing up to 3 m)	■ Suspended (installation spacing up to 5 m)
Luminaire attachment to the duct		Yes	Yes
Power circuits	Quantity	1	1 or 2
Single-phase: 2 conductors + PE *Three-phase: 4 conductors + PE*	Type	■ Single-phase ■ Three-phase	■ Single-phase ■ Three-phase ■ Single-phase + single-phase ■ Single-phase + three-phase ■ Three-phase + three-phase
Lighting control circuit (0-10 V, Dali)		Optional	Optional
Rating		25 or 40 A	25 or 40 A
Protection by fuses		With tap-off KBC 16DCF..	With tap-off KBC 16DCF..
Tap-off spacing		0.5 - 1 - 1.5 m	0.5 - 1 - 1.5 m

Selection of protection systems

Circuit breaker selection principles

iC60N / iC40 circuit breakers *Reflex iC60*

■ Circuit breakers are used to:
□ guard against fires that might be caused by a faulty electric circuit (short-circuit, overload, insulation fault),
□ protect people against electric shock in the event of indirect contact.
■ The choice of circuit breakers must be optimized to provide absolute protection while ensuring continuity of service.
■ Although the circuit breakers are sometimes used as lighting circuit control units, it is recommended to install:
□ separate control devices (switch, contactor, impulse relay ▶ page 34)
□ or an integrated control circuit breaker designed for lighting applications (Reflex iC60 ▶ page 35) which withstands a larger number of switching operations.

Protection of electrical connections

against short circuits and overloads

Choice of breaking capacity

■ The breaking capacity must be greater than or equal to the presumed short-circuit current where circuit breaker must be installed.
■ However, in the event of use in combination with an upstream circuit breaker limiting the current, this breaking capacity can possibly be reduced (cascading).

Choice of rating

■ The rating (In) is chosen above all to protect the electrical network:
□ for cables: it is chosen according to the cross section,
□ for Canalis prefabricated busbar trunking: it must be simply less than or equal to the rating of the busbar trunking according to manufacturer recommendation.
■ Generally, the rating should be greater than the rated current of the circuits. But in the case of lighting circuits, to ensure excellent continuity of service, it is recommended that this rating correspond to **about twice the rated current** of the circuit, by limiting the number of lamps per circuit.
■ The rating of the upstream circuit breaker must always be less than or equal to that of the control device located downstream (on-off switch, residual current circuit breaker, contactor, impulse relay, etc.).

Choice of tripping curve

■ Electricians always use the same curve for lighting circuits: B or C depending on habits.
■ However, to prevent nuisance tripping, it may be advisable to choose a less sensitive curve (2) (e.g. go from B to C)

Continuity of service

Nuisance tripping can be generated by:

■ the inrush current which could be very high during circuit closing with LED luminaires,
■ the overload current during the lamp starting phase,
■ and sometimes the harmonic current flowing through the neutral of three-phase circuits (1).

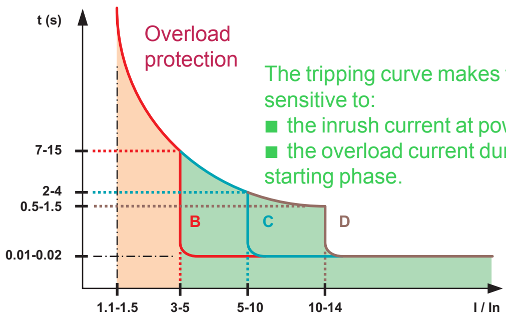
Three solutions

■ **Choose a circuit breaker with a less sensitive curve:** change from B curve to C curve or from C curve to D curve (2).
■ **Reduce the number of lamps per circuit**
■ **Start up the circuits successively,** using time delay auxiliaries on the control relays (▶ page 42 and example ▶ page 43).

Under no circumstances may the circuit breaker rating be increased, as the electrical connections would then no longer be protected.

Reflex iC60

The Reflex iC60 devices (▶ page 35) are integrated control circuit breakers which combine the following main functions in a single device:
■ circuit breaker for cable protection,
■ remote control by latched and/or impulse-type order,
■ remote indication of product status,
■ interface compatible with Acti 9 Smartlink and programmable logic controller (remote control and indications).



The tripping curve makes the protection more or less sensitive to:
■ the inrush current at power up;
■ the overload current during the short (< 1 s) lamp starting phase.

Usual values

Circuit breaker: fast dimensioning ▶ page 30

Optimized calculation: ▶ "My Ecodial" software

■ Circuit breaker rating: 10, 13, 16, 20, 25, 32 A
■ Curve: B or C depending on habits.

(1) In the particular case of three-phase circuits supplying discharge lamps with electronic ballasts, harmonic currents of the third order and multiples of three are generated and combined in the neutral conductor. The neutral cable must be sized to prevent it from overheating. However, the current flowing through the neutral cable may become greater than the current of each phase and cause nuisance tripping.
(2) In the case of installations with very long cables in a TN or IT system, it may be necessary to add differential protection to protect human life. In all cases, the choice of curve must be confirmed by a design note.

Selection of protection systems

Number of lamps according to the circuit breaker rating and curve

The table is produced for C-curve circuit breakers:
- for B-curve circuit breakers, the number of lamps should be reduced by 50%,
- for D-curve circuit breakers, the number of lamps should be increased by 50%.

Maximum number of lamps according to the circuit breaker rating and curve

Products			Circuit breaker (C curve)				
Type of lamp			10 A	16 A	25 A	40 A	63 A
Standard incandescent lamps, LV halogen lamps, replacement mercury vapor lamps (without ballast)							
	40 W		28	46	70	140	207
	60 W		23	36	55	103	152
	75 W		29	31	46	80	121
	100 W		15	23	33	60	88
ELV 12 or 24 V halogen lamps							
Ferromagnetic transformer	**20 W**		11	19	27	50	75
	50 W		8	12	19	33	51
	75 W		7	10	14	27	43
	100 W		5	8	10	22	33
Electronic transformer	**20 W**		47	74	108	220	333
	50 W		19	31	47	92	137
	75 W		15	24	34	64	94
	100 W		12	20	26	51	73
Fluorescent tubes with starter and ferromagnetic ballast							
1 tube without compensation (1)	15 W		16	26	37	85	121
	18 W		16	26	37	85	121
	20 W		16	26	37	85	121
	36 W		15	24	34	72	108
	40 W		15	24	34	72	108
	58 W		9	15	21	43	68
	65 W		9	15	21	43	68
	80 W		8	12	19	36	58
	115 W		6	9	12	24	38
1 tube with parallel compensation (2)	15 W	5 µF	11	19	24	48	72
	18 W	5 µF	11	19	24	48	72
	20 W	5 µF	11	19	24	48	72
	36 W	5 µF	11	19	24	48	72
	40 W	5 µF	11	19	24	48	72
	58 W	7 µF	8	12	19	36	51
	65 W	7 µF	8	12	19	36	51
	80 W	7 µF	8	12	19	36	51
	115 W	16 µF	4	7	9	17	24
2 or 4 tubes with series compensation	2 x **18 W**		23	36	56	96	148
	4 x **18 W**		12	20	29	52	82
	2 x **36 W**		12	20	29	52	82
	2 x **58 W**		8	12	20	33	51
	2 x 65 W		8	12	20	33	51
	2 x 80 W		7	11	15	26	41
	2 x 115 W		5	8	12	20	31
Fluorescent tubes with electronic ballast							
1 or 2 tubes	**18 W**		56	90	134	268	402
	36 W		28	46	70	142	213
	58 W		19	31	45	90	134
	2 x **18 W**		27	44	67	134	201
	2 x **36 W**		16	24	37	72	108
	2 x **58 W**		9	15	23	46	70

(1) Circuits with non-compensated ferromagnetic ballasts consume twice as much current for a given power output. This explains the small number of lamps in this configuration.

(2) The total capacitance of the power factor capacitors in parallel on a circuit limits the number of lamps that can be controlled by a contactor. The total downstream capacitance of a modular contactor of rating 16, 25, 40 or 63 A should not exceed 75, 100, 200 or 300 µF respectively. Allow for these limits to calculate the maximum acceptable number of lamps if the capacitance values are different from those in the table.

Maximum number of lamps according to the circuit breaker rating and curve (cont.)

Products			Circuit breaker (C curve)				
Type of lamp			**10 A**	**16 A**	**25 A**	**40 A**	**63 A**
Compact fluorescent lamps							
External electronic ballast	**5 W**		158	251	399	810	Infrequent use
	7 W		113	181	268	578	
	9 W		92	147	234	463	
	11 W		79	125	196	396	
	18 W		49	80	127	261	
	26 W		37	60	92	181	
Integral electronic ballast (replacing incandescent lamps)	**5 W**		121	193	278	568	859
	7 W		85	137	198	405	621
	9 W		71	113	160	322	497
	11 W		59	94	132	268	411
	18 W		36	58	83	167	257
	26 W		25	40	60	121	182
Low-pressure sodium vapor lamps with ferromagnetic ballast and external ignitor							
Without compensation [1]	**35 W**		4	7	11	17	29
	55 W		4	7	11	17	29
	90 W		3	4	8	11	23
	135 W		2	3	5	8	12
	180 W		1	2	4	7	10
With parallel compensation [2]	**35 W**	20 µF	3	4	7	12	19
	55 W	20 µF	3	4	7	12	19
	90 W	26 µF	2	3	5	8	13
	135 W	40 µF	1	2	3	5	9
	180 W	45 µF	0	1	2	4	8
High-pressure sodium vapor lamps **Metal-iodide lamps**							
Ferromagnetic ballast with external ignitor, without compensation [1]	35 W		12	19	28	50	77
	70 W		7	11	15	24	38
	150 W		3	5	9	15	22
	250 W		2	3	5	10	13
	400 W		0	1	3	6	10
	1000 W		0	0	1	2	3
Ferromagnetic ballast and external ignitor, with parallel compensation [2]	35 W	6 µF	14	17	26	43	70
	70 W	12 µF	8	9	13	23	35
	150 W	20 µF	5	6	9	14	21
	250 W	32 µF	3	4	5	10	14
	400 W	45 µF	2	3	4	7	9
	1000 W	60 µF	0	1	2	4	7
	2000 W	85 µF	0	0	1	2	3
Electronic ballast	35 W		15	24	38	82	123
	70 W		11	18	29	61	92
	150 W		6	9	14	31	48

Note:
High-pressure sodium vapor lamps
For the 10 A and 16 A B-curve ratings, the number of lamps should be reduced by 10% to limit unwanted magnetic tripping.

Selection of protection systems

Earth leakage protection device selection principles


iID


iC60N + Vigi iC60

■ Earth leakage protection devices are used to:
□ guard against fires that might be caused by an electric circuit with an insulation fault,
□ protect people against electric shock (direct or indirect contact).
■ The choice of protective devices must be optimized to provide absolute protection while ensuring continuity of service.
■ The implementation of earth leakage protection on lighting circuits varies according to standards, the earthing system and installation customs.

Protecting the installation
against fires generated by a cable insulation fault

Protecting people
against electric shock

Choice of sensitivity

■ For protection against fire only: 300 mA.
■ For protection against electric shock: 30 mA.

Choice of rating

■ The rating must be greater than or equal to the total consumption of the circuit. This consumption can be as much as twice the rated current of the lamps:
□ in the case of discharge lamps, due to the long starting time (several minutes),
□ higher consumption by lamps that have exceeded their nominal service life.
■ The rating of the earth leakage protection function (Vigi module or earth leakage protection switch) should always be greater than or equal to the rating of the upstream circuit breaker.

Continuity of service

Protective device discrimination
■ For a two-level earth leakage protection system, the following are recommended:
□ upstream time-delayed earth leakage protection with sensitivity greater than or equal to three times the downstream protection (for example, 100 or 300 mA S type protection),
□ one or more instantaneous 30 mA earth leakage protection devices downstream.

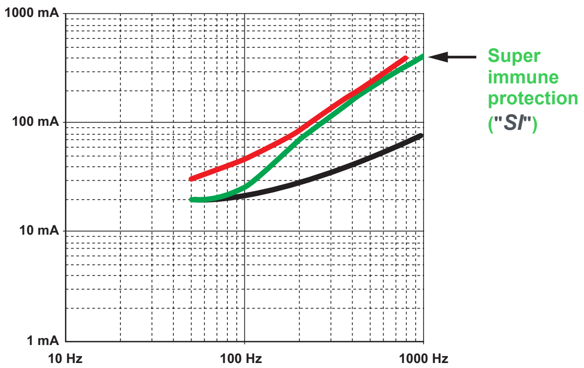
Super immune protection

"*SI*" type super immune protection
■ Compact fluorescent lamps and high-intensity discharge lamps with electronic ballast generate high-frequency currents (several kHz) that flow between conductors and earth in the ballast input filters and through stray capacitance in the installation.
■ These currents (up to several mA per ballast) can trip standard earth leakage protection devices.
■ **To avoid such problems and maintain excellent continuity of service, "*SI*" type earth leakage protection is recommended.**

"*SI*" type technology

■ Red curve : international standard IEC 479 determines the limit current for earth leakage protection tripping according to the frequency. This limit corresponds to the current that the human body is capable of withstanding without any danger.
■ Black curve : standard earth leakage protection devices are more sensitive to high-frequency currents than "*SI*" type and could reduce continuity of service..
■ Green curve : "*SI*" type "super immune" protection devices are less sensitive to high-frequency disturbance while ensuring personal safety.

Tripping curve of a 30 mA earth leakage protection function



Selection of protection systems
Principle for selection of surge protective devices

PRF1 Master   *iPRD*   *iQuick PRD*

■ Surge protective devices are used to:
□ limit overvoltages so prevent fires which could be generated by the destruction of loads due to the effects of lightning,
□ ensure the continuity of service of the most sensitive loads.
■ The choice of protective devices must be optimized to provide absolute protection while ensuring continuity of service.
■ Implementation: surge protective devices are used at all levels of the electrical installation, and on communication networks.

Choice of the type of surge protective device

Type 1
Installed in the main electrical switchboard when the building is equipped with a lightning protection system. For more effective protection of loads, it should be combined with a type 2 surge protective device to absorb residual overvoltages.

Type 2
Installed in the main electrical switchboard, it is designed to discharge the currents generated by indirect lightning strokes and causing induced or conducted overvoltages on the power distribution network.

Type 3
Installed to complement the Type 2 surge protective device if the distance between the surge protective device and the load is >10 m.

Choice of surge protective device dimensioning

Type 1
The discharge capacity is limp = 12.5 kA or 25 kA depending on building risk analysis.

Type 2
There are different discharge capacities for each of these categories (Imax = 20, 40, 65 kA (8/20 µs); this choice depends mainly on the exposure zone (moderate, average, high).

Type 3
They are designed to reduce overvoltage across the terminals of sensitive equipment.

Choice of breaking capacity

The surge protective device should be combined with a "circuit breaker or fuse" short-circuit protective device. This device will be chosen according to the installation’s short-circuit current.

The use of surge protective devices with an integrated disconnect circuit breaker ensures good coordination of the circuit breaker and surge protective device.

Street lighting
Given the widespread use of electronics in luminaires, it is recommended to establish a type 3 fine protection system at the level of each luminaire.

Continuity of service

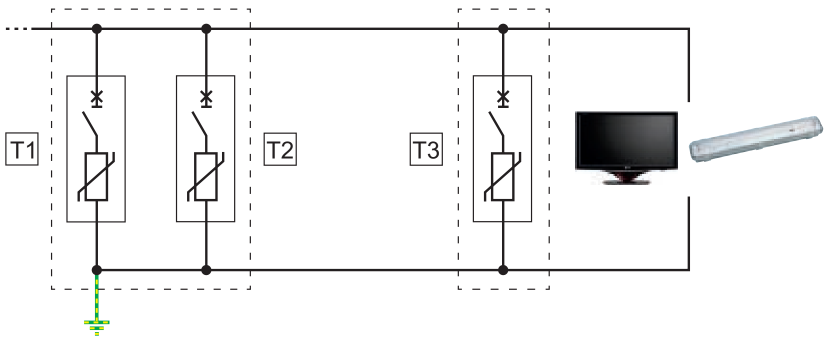
Precaution against nuisance tripping:
In a TT system, a residual current device of the "***SI***" type or delayed "S" type should be installed upstream of the surge protective device. This type of device is immune to the risks of unwanted tripping due to lightning. The other solution is to install the residual current device downstream of the surge protective device.

Coordination between the protection system and the surge protective device

Good coordination between the protection system and the surge protective device can prevent tripping on lightning waves and ensure isolation for the installation network at its end of life.

Surge protective device cascading

Terminal protection and fine protection
■ To effectively protect an electrical installation, the discharge capacity of the surge protective devices to be installed should be determined according to the characteristics of the installation.
■ Protection should be provided at the installation terminal (terminal protection) and, if necessary, near sensitive equipment (fine protection).
■ The terminal protection system protects the whole installation, whereas the fine protection system protects only the loads with which it is associated.



Quick dimensioning of electrical distribution and pro
Cable cross-section, circuit breaker rating

From the main characteristics of the installation (lighting power, distance from electrical switchboard), these tables can be used to determine:
■ the cross-section of the conductors on the power supply line for a voltage drop less than 3% at the lamps (NFC 15100 or IEC 60364), whatever the installation method and insulating material used for the conductors,
■ the circuit breaker rating for protection and continuity of service with a design margin, whatever the type of lamps.

230 V AC single-phase copper cable

- Infrequently used
- Recommended
- Acceptable
- Not recommended (high inrush currents)
- Risk of overheating/overloading the cable

- Example described at bottom of page

(1) If the voltage or power factor is different, the lighting power and the cable length must be recalculated (the value of the nominal load current (A) does not change):
■ for a voltage of 110-115 V: divide the values by 2.
■ for a different power factor,
see the table below:

Cos φ	Multiplying factor to be applied for	
	Power	Length
0.85	0.895	1.118
0.5	0.526	1.9

(2) Maximum values not to be exceeded to guarantee cable protection.

Rule for design: for circuit breaker rating selection, in order to limit nuisance tripping, it's recommended to use a minimum of 2 x Nominal load current.

Characteristics of the installation
at 40°C, 230 V AC, Cos φ = 0.95 **(1)**

Lighting power (kW) including any ballast losses	**Nominal load current (A)**	**Maximum cable length (m)** for a 3% voltage drop (the value shown is the average distance between the electrical switchboard and the lamps)						
0.2	1	294	489	783				
0.4	2	147	245	391	587			
0.7	3	98	163	261	391	652		
1.3	6	49	82	130	196	326	522	
2.2	10	29	49	78	117	196	313	489
3.5	16	18	31	49	73	122	196	306
4.4	20		24	39	59	98	157	245
5.5	25			31	47	78	125	196
7.0	32			24	37	61	98	153
8.7	40				29	49	78	122
10.9	50					39	63	98
13.8	63						50	78
Cable								
Cross section of each conductor (mm²)		**1.5**	**2.5**	**4**	**6**	**10**	**16**	**25**
Circuit breaker								
Rating (A)	**Recommended**	Twice the nominal load current of the lighting circuit	2 x 6 A = 12 A: 13 A or 16 A rating to be used					
	Maximum (2)							
	Cable with PVC type insulation	13	16	25	32	40	50	63
	Other insulating material more efficient at high temperature.	16	20	32	40	50	63	80

Example of an open-plan office

Characteristics of the installation
■ 30 luminaires with 2 x 18 W 230 V single-phase fluorescent lamps.
■ Power factor (Cos φ): 0.95.
■ Average distance from the switchboard: 60 m.

Calculations
■ Lamp power: 30 x 2 x 18 = 1080 W.
■ Ballast losses, estimated at 10% of the lamp power: i.e. 108 W.
■ Lighting power (P): 1080 + 108 = 1188 W = 1.2 kW; the next highest value in the table, i.e. **1.3 kW**, is selected.
■ Corresponding nominal load current (I = P/U Cos φ): = 1188 W/(230 V x 0.95) = 5.4 A. The next highest value in the table, i.e. **6 A**, is selected.
■ Average distance from luminaires: 60 m; the next highest value in the table, i.e. **82 m**, is selected.

Cable and protection values selected
■ The recommended cable cross-section so as not to exceed a 3% voltage drop at the end of the line is therefore: **2.5 mm²**
■ Minimum recommended circuit breaker rating: 2 x 6 A = 12 A, equivalent to the next highest normalized value of **13 A** or **16 A**. This rating is effectively less than or equal to the maximum authorized rating (16 or 20 A) to ensure that the cable is protected.

230 V AC three-phase copper cable between phase and neutral or 400 V AC between phases

(grey)	Infrequently used
(light green)	Recommended
(light orange)	Acceptable
(orange)	Not recommended (high inrush currents)
(red)	Risk of overheating/overloading the cable
(blue)	Example described at bottom of page (with correction of the values in the table taking into account a power factor of 0.85)

(1) If the voltage or power factor is different, the lighting power and the cable length must be recalculated (the value of the nominal load current (A) does not change):
- for a different voltage, multiply the lighting power and the cable length by:
  - 0.577 for a voltage of 230 V between phases,
  - 0.5 for a voltage of 110-115 V between phase and neutral.
- for a different power factor, see the table below:

Cos φ	Multiplying factor to be applied for	
	Power	**Cable length**
0.85	0.895	1.118
0.5	0.526	1.9

(2) Maximum values not to be exceeded to guarantee cable protection.

Rule for design: for circuit breaker rating selection, in order to limit nuisance tripping, it's recommended to use a minimum of 2 x Nominal load current.

Characteristics of the installation

Balanced three-phase circuit, at 40°C, Cos φ = 0.95
230 V AC between phase and neutral or 400 V AC between phases **(1)**

Lighting power per phase (kW) including any ballast losses	**Nominal load current per phase (A)**	**Maximum cable length (m)** for a 3% voltage drop (the value shown is the average distance between the electrical switchboard and the lamps)						
0.2	1	587	978	1565				
0.4	2	294	489	783	1174			
0.7	3	196	326	522	783	1304		
~~1.3~~ x 0.895 = 1.2	6	~~98~~ 110	~~163~~ 182	261	391	652	1044	
2.2	10	59	98	157	235	391	626	978
3.5	16	37	61	98	147	245	391	611
4.4	20		49	78	117	196	313	489
5.5	25			63	94	157	250	391
7.0	32			49	73	122	196	306
8.7	40				59	98	157	245
10.9	50					78	125	196
13.8	63						99	155
Cable Neutral conductor cross-section equal to the phase cable cross-section								
Cross section of each conductor (mm²)		**1.5**	**2.5**	**4**	**6**	**10**	**16**	**25**
Circuit breaker								
Rating (A)	**Recommended**	Twice the nominal load current of the lighting circuit	2 x 6 A = 12 A: 13 A or 16 A rating to be used					
	Maximum (2)							
	Cable with PVC type insulation	13	16	25	32	40	50	63
	Other insulating material more efficient at high temperature	16	20	32	40	50	63	80

Example of a warehouse

Characteristics of the installation
- 39 x 70 W 230 V sodium vapor lamps with compensation, connected to a three-phase circuit between phase and neutral.
- Power factor (Cos φ): 0.85.
- Average distance from the switchboard: 120 m.

Calculations
- Lamp power per phase: (39 x 70)/3 = 910 W.
- Ballast losses per phase, estimated at 10% of the lamp power: i.e. 91 W.
- Lighting power per phase (P): 910 + 91 = 1001 W = 1 kW.
- Corresponding nominal load current (I = P/U Cos φ): = 1001 W/(230 V x 0.85) = 5.1 A.

The next highest value in the table, i.e. **6 A**, is selected.
- Correction of the values in the table for the maximum cable length to take into account the power factor:
  - 98 x 1.118 = 110 m,
  - 163 x 1.118 = 182 m

The next highest corrected value in the table after 120 m, i.e. **182 m**, is selected.

Cable and protection values selected
- The recommended cable cross-section per phase so as not to exceed a 3% voltage drop at the end of the line is therefore: **2.5 mm².**
- Minimum recommended circuit breaker rating: twice 6 A, i.e. **13 A** or **16 A** as a normalized value.

This rating is effectively less than or equal to the maximum authorized rating (16 or 20 A) to ensure that the cable is protected.

Quick dimensioning of electrical distribution and pro
Type of Canalis, circuit breaker rating

Step 1: choice of busbar trunking rating

Definition and layout of lighting lines

↓

Location of luminaires on CANALIS lines

↓

Definition of the type and number of luminaires (determination of total power)

↓

Lighting power determined:
- by type
- by line
- by distributed phase

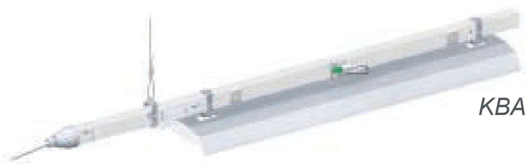
Study performed by the engineering office

↓

Determination of the line protection characteristics (rating)

≤ 25 A → **KBA/KBB 25 A**

≤ 40 A → **KBA/KBB 40 A**



KBA

KBB

Step 2: confirmation of the busbar trunking rating according to the length of the circuit and to the choice of circuit breaker rating

Single-phase Canalis 230 V AC busbar trunking

Characteristics of the installation
at 35°C, Cos φ = 0.95 **(1)**

Lighting power (kW) including any ballast losses	**Nominal load current (A)**	**Maximum busbar trunking length (m)** for a voltage drop < 3% at the end of the busbar trunking. Lamps evenly spaced along the busbar trunking (most common case)	
0.2	1		
0.4	2		
0.7	3	375	
1.3	6	188	384
2.2	10	113	231
3.5	16		144
4.4	20		115
Prefabricated busbar trunking			
Type of busbar trunking		Rigid (KBA or KBB)	
Rating (A)		25	40
Circuit breaker			
Rating (A)	**Recommended**	Twice the nominal load current of the lighting circuit 2 x 6 A = 12 A: 13 A or 16 A rating to be used	
	Max.	25	40

Infrequently used
Recommended
Overloaded busbar trunking or circuit breaker rating not compatible with busbar rating

Rule for design: for circuit breaker rating selection, in order to limit nuisance tripping, it's recommended to use a minimum of 2 x Nominal load current.

Three-phase 230 V AC Canalis busbar trunking between phase and neutral or 400 V AC between phases

Characteristics of the installation
at 35°C, Cos φ = 0.95
230 V AC between phase and neutral or 400 V AC between phases **(2)**

Lighting power per phase (kW) including any ballast losses	**Nominal load current per phase (A)**	**Maximum busbar trunking length (m)** for a voltage drop < 3% at the end of the busbar trunking. Lamps evenly spaced along the busbar trunking (most common case)	
0.2	1		
0.4	2		
0.7	3	751	
1.3	6	375	769
2.2	10	225	461
3.5	16		288
4.4	20		231
Prefabricated busbar trunking			
Type of busbar trunking		Rigid (KBA or KBB)	
Rating (A)		25	40
Circuit breaker			
Rating (A)	**Recommended**	Twice the nominal load current of the lighting circuit 2 x 6 A = 12 A: 13 A or 16 A rating to be used	
	Max.	25	40

(1) If the voltage or power factor is different, certain values in the table are to be recalculated (the value of the nominal load current (A) does not change):
- for a voltage of 110-115 V: divide the values by 2,
- for a different power factor, see the table below:

Cos φ	**Multiplying factor to be applied for**	
	Power	**Busbar trunking length**
0.85	0.895	1.118
0.5	0.526	1.9

(2) If the voltage or power factor is different, the lighting power and the busbar trunking length must be recalculated (the nominal load current (A) does not change):
- for a different voltage, multiply the lighting power and the busbar trunking length by:
  - 0.577 for a voltage of 230 V between phases,
  - 0.5 for a voltage of 110-115 V between phase and neutral.
- for a different power factor, see the table below:

Cos φ	**Multiplying factor to be applied for**	
	Power	**Busbar trunking length**
0.85	0.895	1.118
0.5	0.526	1.9

Control devices

Principles for selection of modular remote control equipment

■ Their role is to control luminaire switching on and off.
■ Their technology allows a very large number of switching operations to be performed without adversely affecting their performance, in normal operating conditions.
■ The installation of a control relay (impulse relay, contactor) allows:
□ remote control of a high-power lighting circuit,
□ easy performance of sophisticated functions (central control, timer, programming, etc.),
□ control of three-phase circuits.
■ The iCT+ and iTL+ are especially suitable for lamps with a high inrush current (LED lighting, lamps with electronic ballast).

Choice of control relay

		Impulse relay		Modular contactor	
		iTL, *iETL*	*iTL+*	*iCT*	*iCT+*
Type of power circuit architecture (modular/monobloc)		■ Circuit protection is provided by a separate circuit breaker. ■ The control and power circuits are separate. They can also relay the management devices (▶ page 46), which often have a limited switching capacity and do not allow multi-polar switching (phase/neutral or three-phase).			
Installation		In enclosure and panel			
Control	Number of points	Multiple	Multiple	Single (as standard) or multiple (with auxiliary)	Single
	Type	Impulse-type, by push button		Latched-type by switch (as standard) or impulse-type by push button (with auxiliary)	
	Consumption	0	1 VA	1 to 2 VA	1 VA
Remote status indication	Protections	Auxiliary on circuit breaker			
	Control	Auxiliary on contactor or impulse relay	–	Auxiliary on contactor or impulse relay	–
Control circuit	Push button, selector switch	12 to 230 V AC	230 V AC	12, 24, 48, 110, 230 V AC	230 V AC
	PLC	6 to 130 V DC	–	24 V AC, 24 V DC by TI24 iACT interface and iATL 24 V DC	–
Remote reclosing of the protective device		–	–	–	–
Number of switching cycles per day (on average)		< 100	< 1000	< 100	< 1000
Flexibility of control		By combining auxiliaries	With relay circuitry	By combining auxiliaries	With relay circuitry
Additional functions		Many functions due to the use of auxiliaries: ■ time delay ■ illuminated push-button control ■ step-by-step control ■ signaling ■ latched-type control ■ centralized multi-level control ■ control by PLC	–	Many functions due to the use of auxiliaries: ■ time delay ■ illuminated push-button control ■ step-by-step control ■ signaling ■ latched-type control ■ centralized multi-level control ■ control by PLC	–
Rating (commonest values in bold)		16 or 32 A	16 A	16, 25, 40, 63 A	20 A
Controlled power		Several kW			
Type of circuit controlled		Single-phase (1 or 2 P) or three-phase (3 or 4 P monobloc or in conjunction with iETL extension)	Single-phase (1P) Conducting neutral	Single-phase (1 or 2 P) or three-phase (3 or 4 P)	Single-phase (1P) Conducting neutral
Number of lamps controlled		▶ pages 39 and 41	No derating: ■ 16 A cos φ in steady-state conditions	▶ pages 38 and 40	No derating: ■ 20 A cos φ in steady-state conditions
Favorite applications		■ Residential ■ Service sector and industrial buildings (offices, corridors, shops, workshops, etc.)	■ Residential ■ Service sector buildings (hotels, hospitals)	■ Service sector and industrial buildings (offices, open-space offices, warehouses, supermarkets, indoor car parks, etc.) ■ Infrastructure (tunnels, outdoor car parks, public lighting, etc.)	■ Residential ■ Service sector buildings (hotels, hospitals)

Reflex iC60

Solution for lighting control and protection applications

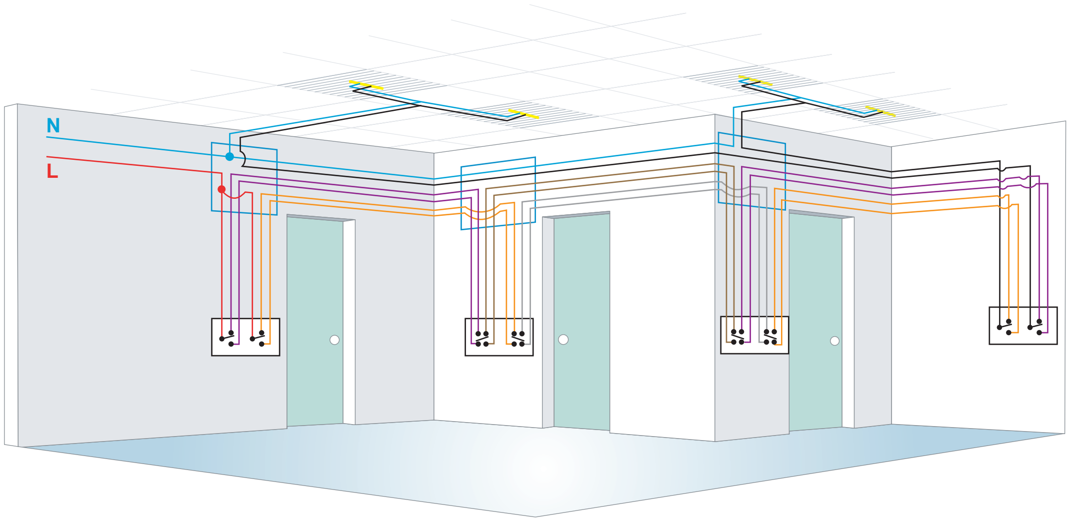
- Total safety of the installation.
- Easy wiring.
- Reduced consumption and heating in the switchboard.
- Bistable solution.
- Ready for interfacing with an Acti 9 Smartlink interface or integrated PLC.

Reflex iC60 integrated-control circuit breaker	RCA iC60 remote control
 *Reflex iC60*	 *RCA iC60*
Monobloc The circuit protection and power switching functions are incorporated in a single device	**Monobloc** The circuit breaker combined with the RCA performs the circuit protection and power switching functions
In enclosure and panel	In enclosure and panel
Multiple	Multiple
Pulse or latched	Pulse or latched
5 VA	1 VA
Incorporated	■ Incorporated ■ By MCB auxiliary
Incorporated	■ Incorporated ■ By MCB auxiliary
230 V AC 24/48 V AC/DC with iMDU auxiliary	230 V AC 24/48 V AC/DC with iMDU auxiliary
24 V DC with Ti24 interface	24 V DC with Ti24 interface
–	Yes
<10	1 to 2 on average
Integrated auxiliary functions	Integrated auxiliary functions
Numerous functionalities incorporated: ■ choice of control order interpretation mode ■ control and indication interface compatible with 24 V DC programmable logic controller standards ■ compatibility with Vigi iC60 residual current protection auxiliaries ■ control orders time delayed by time delay relays or PLCs	Numerous functionalities incorporated: ■ remote reclosing possible, following an electrical fault ■ choice of control order interpretation mode ■ control and indication interface compatible with 24 VDC programmable logic controller standards ■ control orders time delayed by time delay relays or PLCs ■ compatibility with the auxiliaries of the iC60 and Vigi protection product offering (iOF, iSD indications and iMN, iMX tripping, etc.)
10, 16, 25, 40, 63 A	1 to 63 A
Several kW	Several kW
Single-phase (2P) or three-phase (3 or 4P)	Single-phase (1 or 2P) or three-phase (3 or 4P)
▶ pages 39 and 41	▶ page 30
■ Service sector and industrial buildings (offices, open-space offices, warehouses, supermarkets, indoor car parks, etc.) ■ Infrastructure (tunnels, outdoor car parks, public lighting, etc.)	■ Infrastructure (tunnels, indoor/outdoor car parks, public lighting, etc.)

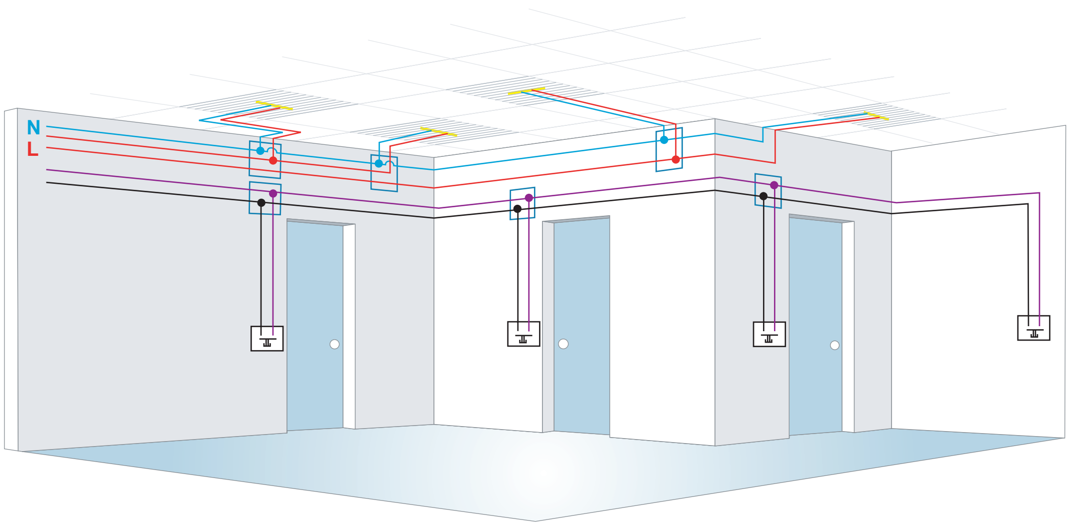
Control devices
Example

Simplification of the conventional cabling by using an impulse relay

Without control device
■ Conventional cabling with two-way switches and changeover switch(es).



With impulse relay or impulse control device: Reflex iC60, RCA
■ **Lower investment costs:**
□ fewer cables,
□ small control circuit cross section,
□ faster installation (simplified cabling).
■ **Upgradeable circuits:**
□ easy to add a control point,
□ potential for adding auxiliaries (time delay, timer, centralized multi-level control, etc. ▶ page 42) and management functions.
■ **Energy savings:**
□ no power consumption in the control circuit (impulse relay)
□ automated management of switching on/off (movement detector, programmable time switch, dusk-to-dawn switch, etc., ▶ page 46).

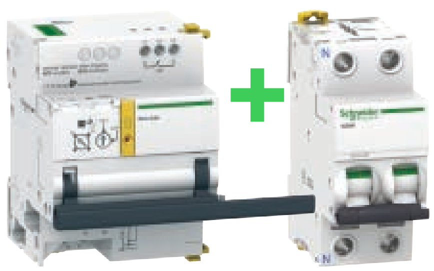


Control devices
Choice of rating

iTL

iCT

Reflex iC60



RCA iC60

iTL+

iCT+

Ventilation spacer

■ The rating printed on the front of the products never corresponds to the rated current of the lighting circuit.
■ The standards that determine the ratings do not take into account all the electrical constraints of the lamps due to their diversity and the complexity of the electrical phenomena that they create (inrush current, starting current, end-of-life current, etc.).
■ Schneider Electric regularly conducts numerous tests to determine, for each type of lamp and each lamp configuration, the maximum number of lamps that a relay with a given rating can control for a given power.

iTL impulse relays and iCT contactors

■ The rating should be chosen according to the tables on the following pages.
■ The rating of the iTL and iCT must be equal to or greater than the protective device's rating.

Reflex iC60 and RCA iC60

■ The rating is determined by the cable characteristics in the same way as for the circuit breaker.
■ The switching capacity is defined in the following tables.

Thermal dissipation

■ **Modular iTL+ impulse relays and iCT+ contactors,** due to their operating principle, constantly dissipate heat (several watts) due to:
□ electronic dissipation,
□ power contact resistance.
Where several modular contactors are installed side by side in a given enclosure, it is therefore recommended to insert a side ventilation spacer at regular intervals (every contactor). Heat dissipation is thus facilitated. If the temperature inside the enclosure exceeds 40°C, apply to the rating a derating factor of 1% per °C above 40°C.
■ **The impulse relays, Reflex iC60 and RCA,** can usefully replace the modular contactors:
□ they consume less energy and dissipate less heat (no permanent current in the coil). They require no spacer,
□ depending on the application, they allow a more compact installation with less wiring.

iCT+, iTL+, due to their electronic components, dissipate heat.
Where several iCT+ contactors or iTL+ impulse relays are installed side by side in a given enclosure, it is therefore recommended to insert a side ventilation spacer at regular intervals.

iTL+ Spacer MCB

or

iTL+ Spacer iTL+

or

iCT+ Spacer iCT+

Control devices

Rating performance according to the type and number of lamps

General comments

Modular contactors and impulse relays do not use the same technologies. Their rating is determined according to different standards and does not correspond to the rated current of the circuit.

Relay rating

- The tables below show the maximum number of lamps for each relay, according to the type, power and configuration of the lamp in question. As an indication, the total acceptable power is also mentioned.
- These values are given for a 230 V circuit with two active conductors (single-phase phase/neutral or two-phase phase/phase). For 110 V circuits, divide the values in the table by 2.

Selection table

Products			iCT contactors								iCT+ contactors
Type of lamp			Maximum number of lamps for a single-phase circuit and maximum power output per circuit								
			16 A		25 A		40 A		63 A		20 A
Standard incandescent lamps, LV halogen lamps, replacement mercury vapor lamps (without ballast)											
	40 W		38	1550 W	57	2300 W	115	4600 W	172	6900 W	
	60 W		30	to	45	to	85	to	125	to	4660 W x Cos phi
	75 W		25	2000 W	38	2850 W	70	5250 W	100	7500 W	
	100 W		19		28		50		73		
ELV 12 or 24 V halogen lamps											4660 VA x Cos phi
Ferromagnetic transformer	**20 W**		15	300 W	23	450 W	42	850 W	63	1250 W	
	50 W		10	to	15	to	27	to	42	to	
	75 W		8	600 W	12	900 W	23	1950 W	35	2850 W	
	100 W		6		8		18		27		
Electronic transformer	**20 W**		62	1250 W	90	1850 W	182	3650 W	275	5500 W	
	50 W		25	to	39	to	76	to	114	to	
	75 W		20	1600 W	28	2250 W	53	4200 W	78	6000 W	
	100 W		16		22		42		60		
Fluorescent tubes with starter and ferromagnetic ballast											
1 tube without compensation (1)	15 W		22	330 W	30	450 W	70	1050 W	100	1500 W	
	18 W		22	to	30	to	70	to	100	to	
	20 W		22	850 W	30	1200 W	70	2400 W	100	3850 W	
	36 W		20		28		60		90		
	40 W		20		28		60		90		
	58 W		13		17		35		56		
	65 W		13		17		35		56		
	80 W		10		15		30		48		
	115 W		7		10		20		32		
1 tube with parallel compensation (2)	15 W	5 µF	15	200 W	20	300 W	40	600 W	60	900 W	
	18 W	5 µF	15	to	20	to	40	to	60	to	
	20 W	5 µF	15	800 W	20	1200 W	40	2400 W	60	3500 W	
	36 W	5 µF	15		20		40		60		
	40 W	5 µF	15		20		40		60		
	58 W	7 µF	10		15		30		43		
	65 W	7 µF	10		15		30		43		
	80 W	7 µF	10		15		30		43		
	115 W	16 µF	5		7		14		20		
2 or 4 tubes with series compensation	2 x **18 W**		30	1100 W	46	1650 W	80	2900 W	123	4450 W	
	4 x **18 W**		16	to	24	to	44	to	68	to	
	2 x **36 W**		16	1500 W	24	2400 W	44	3800 W	68	5900 W	
	2 x **58 W**		10		16		27		42		
	2 x 65 W		10		16		27		42		
	2 x 80 W		9		13		22		34		
	2 x 115 W		6		10		16		25		
Fluorescent tubes with electronic ballast											
1 or 2 tubes	**18 W**		74	1300 W	111	2000 W	222	4000 W	333	6000 W	
	36 W		38	to	58	to	117	to	176	to	
	58 W		25	1400 W	37	2200 W	74	4400 W	111	6600 W	
	2 x **18 W**		36		55		111		166		
	2 x **36 W**		20		30		60		90		
	2 x **58 W**		12		19		38		57		

■ To obtain the equivalent values for the entire 230 V three-phase circuit, multiply the number of lamps and the maximum power output:
□ by √3 (1.73) for circuits with 230 V between phases without neutral,
□ by √3 for circuits with 230 V between phase and neutral or 400 V between phases.

Note: the lamp power ratings most commonly used are shown in bold. For power ratings not mentioned, use a proportional rule with the nearest values.

Reflex iC60

Solution for lighting control and protection applications
■ Total safety of the installation.
■ Easy wiring.
■ Reduced consumption and heating in the switchboard.
■ Bistable solution.
■ Ready to be connected with an Acti 9 Smartlink or a PLC.

iTL impulse relays				iTL+ impulse relays	Reflex iC60 C curve									
Maximum number of lamps for a single-phase circuit and maximum power output per circuit														
16 A		32 A		16 A	10 A		16 A		25 A		40 A		63 A	
40	1500 W to 1600 W	106	4000 W to 4200 W	3680 W x Cos phi	28	1120 W to 2175 W	46	1840 W to 2600 W	70	2800 W to 3600 W	140	5600 W to 6800 W	207	8280 W to 9800 W
25		66			23		36		55		103		152	
20		53			29		31		46		80		121	
16		42		3680 VA x Cos phi	15		23		33		60		88	
70	1350 W to 1450 W	180	3600 W to 3750 W		11	220 W to 500 W	19	380 W to 800 W	27	540 W to 1050 W	50	1000 W to 2200 W	75	1500 W to 3300 W
28		74			8		12		19		33		51	
19		50			7		10		14		27		43	
14		37			5		8		10		22		33	
60	1200 W to 1400 W	160	3200 W to 3350 W		47	940 W to 1200 W	74	1480 W to 2000 W	108	2160 W to 2600 W	220	4400 W to 5100 W	333	6660 W to 7300 W
25		65			19		31		47		92		137	
18		44			15		24		34		64		94	
14		33			12		20		26		51		73	
83	1250 W to 1300 W	213	3200 W to 3350 W		16	244 W to 647 W	26	390 W to 1035 W	37	555 W to 1520 W	85	1275 W to 2880 W	121	1815 W to 4640 W
70		186			16		26		37		85		121	
62		160			16		26		37		85		121	
35		93			15		24		34		72		108	
31		81			15		24		34		72		108	
21		55			9		15		21		43		68	
20		50			9		15		21		43		68	
16		41			8		12		19		36		58	
11		29			6		9		12		24		38	
60	900 W	160	2400 W		11	165 W to 640 W	19	285 W to 960 W	24	360 W to 1520 W	48	720 W to 2880 W	72	1080 W to 4080 W
50		133			11		19		24		48		72	
45		120			11		19		24		48		72	
25		66			11		19		24		48		72	
22		60			11		19		24		48		72	
16		42			8		12		19		36		51	
13		37			8		12		19		36		51	
11		30			8		12		19		36		51	
7		20			4		7		9		17		24	
56	2000 W	148	5300 W		23	828 W to 1150 W	36	1296 W to 1840 W	56	2016 W to 2760 W	96	3456 W to 4600 W	148	5328 W to 7130 W
28		74			12		20		29		52		82	
28		74			12		20		29		52		82	
17		45			8		12		20		33		51	
15		40			8		12		20		33		51	
12		33			7		11		15		26		41	
8		23			5		8		12		20		31	
80	1450 W to 1550 W	212	3800 W to 4000 W		56	1008 W to 1152 W	90	1620 W to 1798 W	134	2412 W to 2668 W	268	4824 W to 5336 W	402	7236 W to 8120 W
40		106			28		46		70		142		213	
26		69			19		31		45		90		134	
40		106			27		44		67		134		201	
20		53			16		24		37		72		108	
13		34			9		15		23		46		70	

Control devices

Rating performance according to the type and number of lamps (con

Selection table (cont.)

Products			iCT contactors								iCT+ contactors
Type of lamp			**Maximum number of lamps for a single-phase circuit and maximum power output per circuit**								
			16 A		**25 A**		**40 A**		**63 A**		**20 A**
Compact fluorescent lamps											
External electronic ballast	**5 W**		210	1050 W	330	1650 W	670	3350 W		Non testé	3600 VA x Cos Phi
	7 W		150	to	222	to	478	to			
	9 W		122	1300 W	194	2000 W	383	4000 W			
	11 W		104		163		327				
	18 W		66		105		216				
	26 W		50		76		153				
Integral electronic ballast (replacing incandescent lamps)	**5 W**		160	800 W	230	1150 W	470	2350 W	710	3550 W	
	7 W		114	to	164	to	335	to	514	to	
	9 W		94	900 W	133	1300 W	266	2600 W	411	3950 W	
	11 W		78		109		222		340		
	18 W		48		69		138		213		
	26 W		34		50		100		151		
Low-pressure sodium vapor lamps with ferromagnetic ballast and external ignitor											
Without compensation (1)	**35 W**		5	270 W	9	320 W	14	500 W	24	850 W	
	55 W		5	to	9	to	14	to	24	to	
	90 W		3	360 W	6	720 W	9	1100 W	19	1800 W	
	135 W		2		4		6		10		
	180 W		2		4		6		10		
With parallel compensation (2)	**35 W**	20 µF	3	100 W	5	175 W	10	350 W	15	550 W	
	55 W	20 µF	3	to	5	to	10	to	15	to	
	90 W	26 µF	2	180 W	4	360 W	8	720 W	11	1100 W	
	135 W	40 µF	1		2		5		7		
	180 W	45 µF	1		2		4		6		
High-pressure sodium vapor lamps **Metal-iodide lamps**											
Ferromagnetic ballast with external ignitor, without compensation (1)	35 W		16	600 W	24	850 W	42	1450 W	64	2250 W	
	70 W		8		12	to	20	to	32	to	
	150 W		4		7	1200 W	13	2000 W	18	3200 W	
	250 W		2		4		8		11		
	400 W		1		3		5		8		
	1000 W		0		1		2		3		
Ferromagnetic ballast and external ignitor, with parallel compensation (2)	35 W	6 µF	12	450 W	18	650 W	31	1100 W	50	1750 W	
	70 W	12 µF	6	to	9	to	16	to	25	to	
	150 W	20 µF	4	1000 W	6	2000 W	10	4000 W	15	6000 W	
	250 W	32 µF	3		4		7		10		
	400 W	45 µF	2		3		5		7		
	1000 W	60 µF	1		2		3		5		
	2000 W	85 µF	0		1		2		3		
Electronic ballast	35 W		24	850 W	38	1350 W	68	2400 W	102	3600 W	
	70 W		18	to	29	to	51	to	76	to	
	150 W		9	1350 W	14	2200 W	26	4000 W	40	6000 W	

(1) Circuits with non-compensated ferromagnetic ballasts consume twice as much current for a given power output. This explains the small number of lamps in this configuration.
(2) The total capacitance of the power factor capacitors in parallel on a circuit limits the number of lamps that can be controlled by a contactor. The total downstream capacitance of a modular contactor of rating 16, 25, 40 or 63 A should not exceed 75, 100, 200 or 300 µF respectively.
Allow for these limits to calculate the maximum acceptable number of lamps if the capacitance values are different from those in the table.

t.)

iTL impulse relays				iTL+ impulse relays	Reflex iC60 C curve									
Maximum number of lamps for a single-phase circuit and maximum power output per circuit														
16 A		32 A		16 A	10 A		16 A		25 A		40 A		63 A	
240	1200 W	630	3150 W	3680 W x Cos phi	158	790 W	251	1255 W	399	1995 W	810	4050 W	Infrequently used	
171	to	457	to		113	to	181	to	268	to	578	to		
138	1450 W	366	3800 W	3680 VA x Cos Phi	92	962 W	147	1560 W	234	2392 W	463	4706 W		
118		318			79		125		196		396			
77		202			49		80		127		261			
55		146			37		60		92		181			
170	850 W	390	1950 W		121	605 W	193	959 W	278	1390 W	568	2840 W	859	4295 W
121	to	285	to		85	to	137	to	198	to	405	to	621	to
100	1050 W	233	2400 W		71	650 W	113	1044 W	160	1560 W	322	3146 W	497	4732 W
86		200			59		94		132		268		411	
55		127			36		58		83		167		257	
40		92			25		40		60		121		182	
Not tested, infrequently used					4	153 W	7	245 W	11	385 W	17	595 W	29	1015 W
					4	to	7	to	11	to	17	to	29	to
					3	253 W	4	405 W	8	792 W	11	1198 W	23	2070 W
					2		3		5		8		12	
					1		2		4		7		10	
38	1350 W	102	3600 W		3	88 W	4	140 W	7	245 W	12	420 W	19	665 W
24		63			3	to	4	to	7	to	12	to	19	to
15		40			2	169 W	3	270 W	5	450 W	8	720 W	13	1440 W
10		26			1		2		3		5		9	
7		18			0		1		2		4		8	
Not tested, infrequently used					12	416 W	19	400 W	28	980 W	50	1750 W	77	2695 W
					7	to	11	to	15	to	24	to	38	to
					3	481 W	5	750 W	9	1350 W	15	2500 W	22	4000 W
					2		3		5		10		13	
					0		1		3		6		10	
					0		0		1		2		3	
34	1200 W	88	3100 W		14	490 W	17	595 W	26	910 W	43	1505 W	70	2450 W
17	to	45	to		8	to	9	to	13	to	23	to	35	to
8	1350 W	22	3400 W		5	800 W	6	1200 W	9	2200 W	14	4400 W	21	7000 W
5		13			3		4		5		10		14	
3		8			2		3		4		7		9	
1		3			0		1		2		4		7	
0		1			0		0		1		2		3	
38	1350 W	87	3100 W		15	525 W	24	840 W	38	1330 W	82	2870 W	123	4305 W
29	to	77	to		11	to	18	to	29	to	61	to	92	to
14	2200 W	33	5000 W		6	844 W	9	1350 W	14	2100 W	31	4650 W	48	7200 W

Note: **Reflex iC60**
High-pressure sodium vapor lamps
For the 10 A and 16 A B-curve ratings, the number of lamps should be reduced by 10% to limit unwanted magnetic tripping.

iCT+, iTL+ !

Cos φ	Pc (W)	
	iTL+	iCT+
0.95	3500	4420
0.85	3120	3960
0.5	1840	2330

Where the standard contactors or impulse relays can only control a very limited number of lamps, the iCT+ and iTL+ are an alternative to be considered. They are especially suitable for lamps with a high inrush current consuming up to 16 A (iTL+) or 20 A (iCT+) in steady state (for example: lamps with ballast or ferromagnetic transformer). The following table shows the controllable power **Pc** according to the power factor. For high-intensity discharge lamps divide the power by 2 (long starting current).

Example: how many compensated 58 W fluorescent tubes (power factor of 0.85) with ferromagnetic ballast (10% loss) can be controlled with a 20 A iCT+? Number of lamps N = controllable power **Pc**/(power output of each lamp + loss of ballast), i.e. in this case **N** = 3900/(58 + 10%) = 61. By comparison, a 16 A iCT is limited to 10 x 58 W tubes, a 25 A iCT to 15 lamps, and a 63 A iCT to 43 lamps.

Control auxiliaries
Overview

iATEt iACT24 iRTA iATLc+s Mounting clips

Control auxiliaries

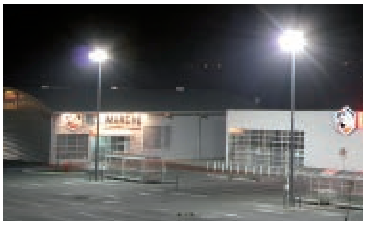
■ These auxiliaries can perform a great variety of functions:
□ from the simplest (signaling, timer, illumination delay, etc.),
□ to the most sophisticated (centralized multi-level control, step-by-step control, etc.).
■ Moreover, some auxiliaries make it possible to overcome electrical disturbance which may detract from satisfactory switching operation.
■ Schneider Electric has the most comprehensive and coherent product offering in the market.
All the auxiliaries in a family (modular contactor or impulse relay) are compatible with all the devices in that family.
■ They are very easy to install thanks to their integral mounting clips which simultaneously provide electrical and mechanical connection.

Choice of auxiliaries
or pre-auxiliary control devices

Function		Pre-auxiliary impulse relay or impulse relay + auxiliary	Modular contactor + auxiliary	Reflex iC60 integrated-control circuit breaker	RCA iC60 remote control
Centralized control	Centralized control (1 level) for a group of circuits while maintaining separate control of each of them. Example: control of a whole storey or room by room	iTLc or iTL + auxiliary iATLc	-	Integrated	Integrated
	Centralized control (1 level) + signaling	iTL + auxiliary iATLc+s	-	Integrated	Integrated
	Centralized control (2 levels) Example: control of a whole storey, a zone or room by room	iTL + auxiliary iATLc+c	-	Via PLC	Via PLC
	Impulse-type local control + latched-type centralized control	-	iCT + auxiliary iACTc	Integrated	Integrated
Interface with PLC	Allows control from Acti 9 Smartlink or a PLC	Auxiliary iATL24	Auxiliary iATL24	Reflex iC60 Ti24 version	Reflex iC60 Ti24 version
Signaling	Remote signaling of lamp status (lit or extinguished)	iTLs or iTL + auxiliary iATLs	iCT + auxiliary iACTs	Integrated	Integrated
Timer	Return to rest position after an adjustable time delay	Auxiliary iATEt + iTL	Auxiliary iATEt + iTL	Time delay relays (iRT) + PLC	Time delay relays (iRT) + PLC
Step-by-step control	Allows control of 2 circuits with a single control unit	Auxiliary iATL4 + 2 impulse relays iTL	Via PLC	Via PLC	Via PLC
Illuminated push button compensation	Allows fault-free control by illuminated push buttons	1 or more iATLz auxiliaries for each iTL	-	Max. leakage current: 1.35 mA on Y2 input	Max. leakage current: 1.35 mA on Y2 input
Change in type of control	Operates on latched orders coming from a changeover contact (selector switch, time switch, etc.)	iTLm or iTL + auxiliary iATLm	Standard operation	Yes	Yes
	Impulse-type local control + latched-type centralized control	Standard operation without auxiliary	Auxiliary iACTc + iCT	Integrated	Integrated
Time delay	Illumination delay (see example on ▶ page 43). Allows the inrush current at the head of the network to be limited by powering the circuits in succession	Auxiliary iATEt + iTL	Auxiliary iATEt + iCT	Time delay relays (iRT) + Reflex iC60	Time delay relays (iRT) + RCA iC60
Disturbance suppressor	Can prevent disturbance generated on the electrical network at power off	Not applicable	1 iACTp auxiliary per iCT	Not applicable	Not applicable
Voltage adaptation for control	Allows 24 V or 48 V AC/DC control	Possible in V AC and V DC	■ Possible in V AC ■ With auxiliary iMDU in V DC	Possible with an auxiliary iMDU	

Example
Dimensioning an installation

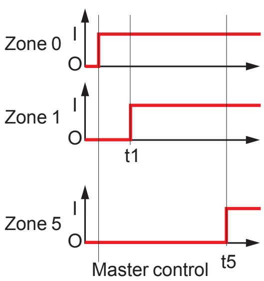
Supermarket: main lighting circuits



Requirement	Product enhancement			Car park lighting		
Circuit	Single-phase 230 V AC			Single-phase 230 V AC		
Number of lines	3 (1 per display)			10		
Number of lamps per line	Four 150 W metal-iodide lamps with ferromagnetic ballast and parallel compensation			Nine 70 W high-pressure sodium vapor lamps with ferromagnetic ballast and parallel compensation		
Electrical connections						
Main lines	Three 20-m lines with Canalis KBA 25 A			10 buried lines of 100 m with 10 mm² cables		
Branch to each luminaire	-			5 m of cables of 1.5 mm²		
Monitoring/Control						
Protection						
Residual current circuit breaker	2P - 25 A - 300 mA 1 for all the 3 lines			2P - 40 A - 300 mA 1 per group of 2 lines		
Possible solutions	**1**	**2**	**3**	**1**	**2**	**3**
Circuit breaker	2P 16 A C curve 1 per line	2P 16 A C curve 1 per line	Reflex iC60 2P 16 A C curve 1 per line The auxiliary centralized control (Y3) and indication (OF, SD) functions are integrated	2P 16 A B curve 1 per line	2P 16 A B curve 1 per line	Reflex iC60 2P 16 A B curve 1 per line The auxiliary centralized control (Y3) and indication (OF, SD) functions are integrated
Control devices						
Impulse relay, contactor or integrated-control circuit breaker	Impulse relay ITL 2P 16 A 1 per line	Contactor iCT 2P 16 A 1 per line		Impulse relay ITL 1P 16 A 1 per line	Contactor iCT 2P 25 A 1 per line	
Control auxiliaries						
Signaling in the control panel	1 iATLc+s per impulse relay	1 iACTs per contactor		1 iATLc+s per impulse relay	1 iACTs per contactor	
Centralized control		1 iACTc per contactor			1 iACTc per contactor	
Inrush current limited by successive illumination of groups of lines	-			-		
Management devices						
Servo control by outside luminosity, timetable and calendar	-			1 programmable twilight switch IC2000p+		

Successive illumination of 6 zones

Use of one iATEt per group of lines to limit the inrush current.

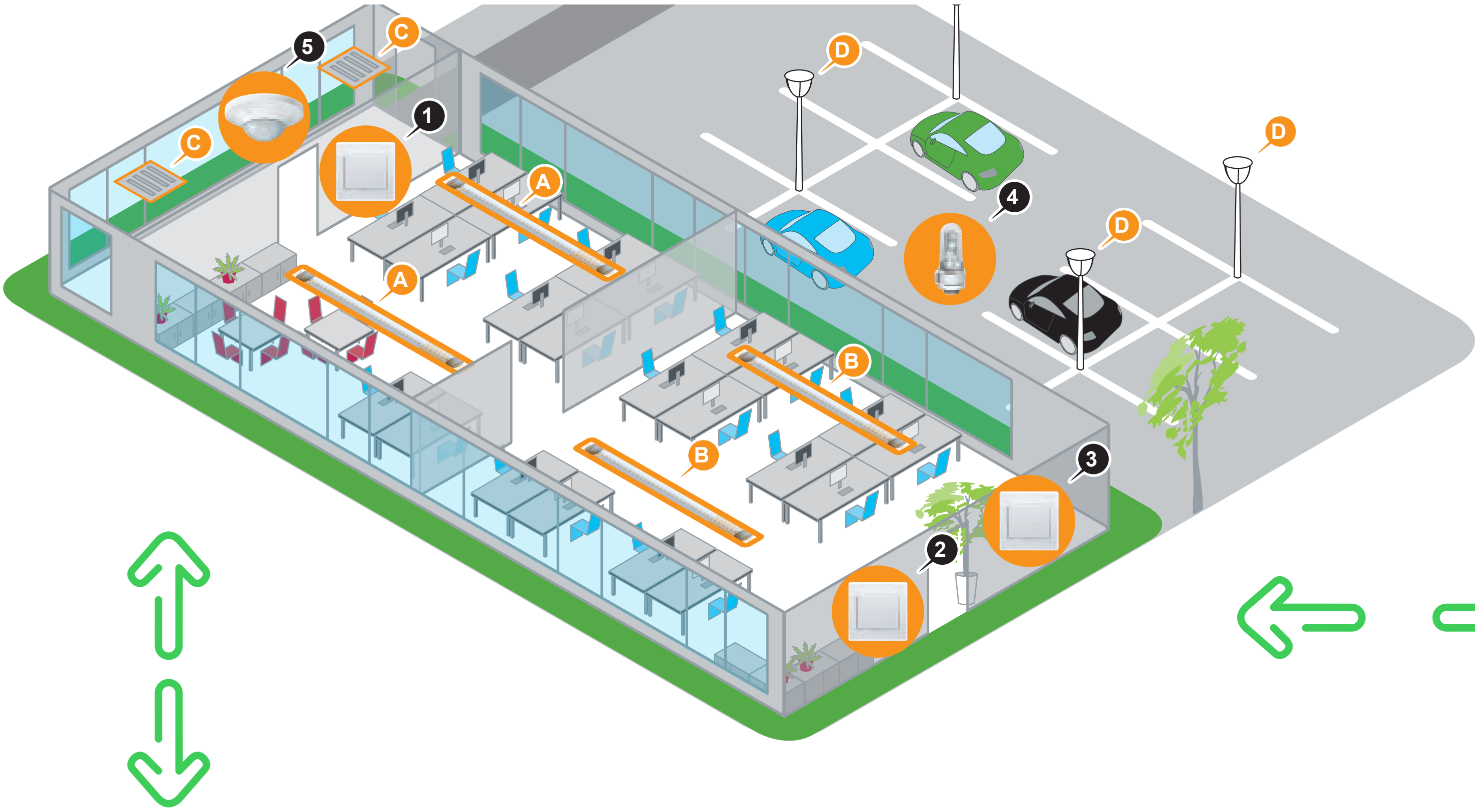


Canalis KBB with DALI system

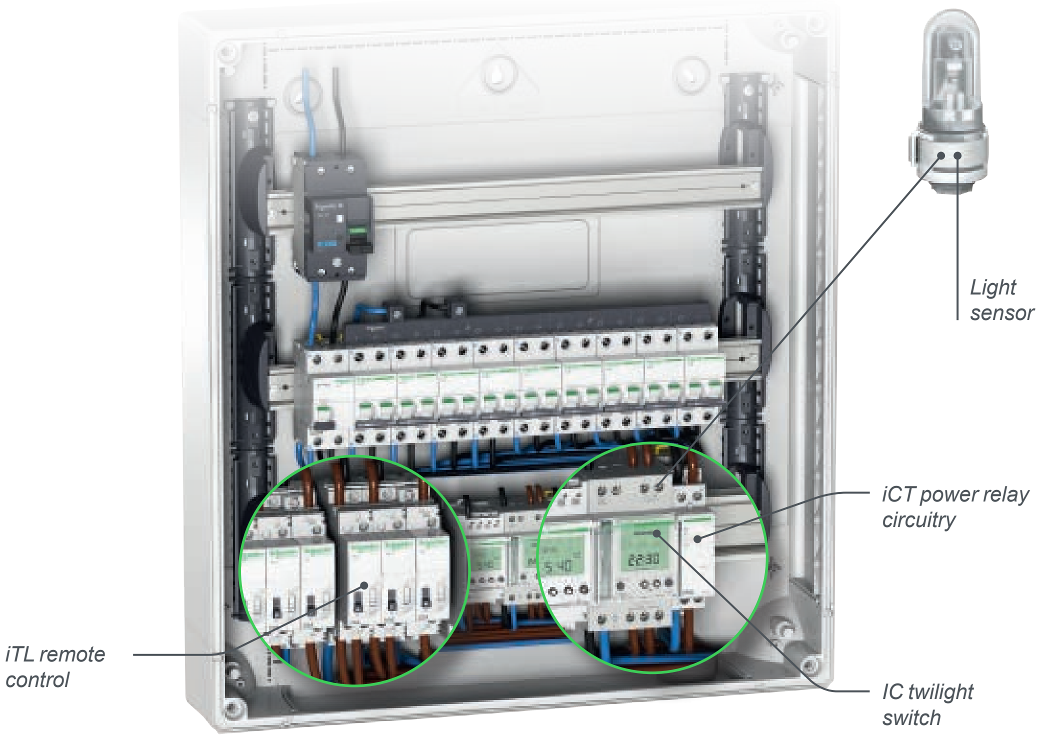
The winning solution for controlling and supplying power for supermarket lighting.

Example

Lighting management, a simple solution or a remote management solution



Simple solution

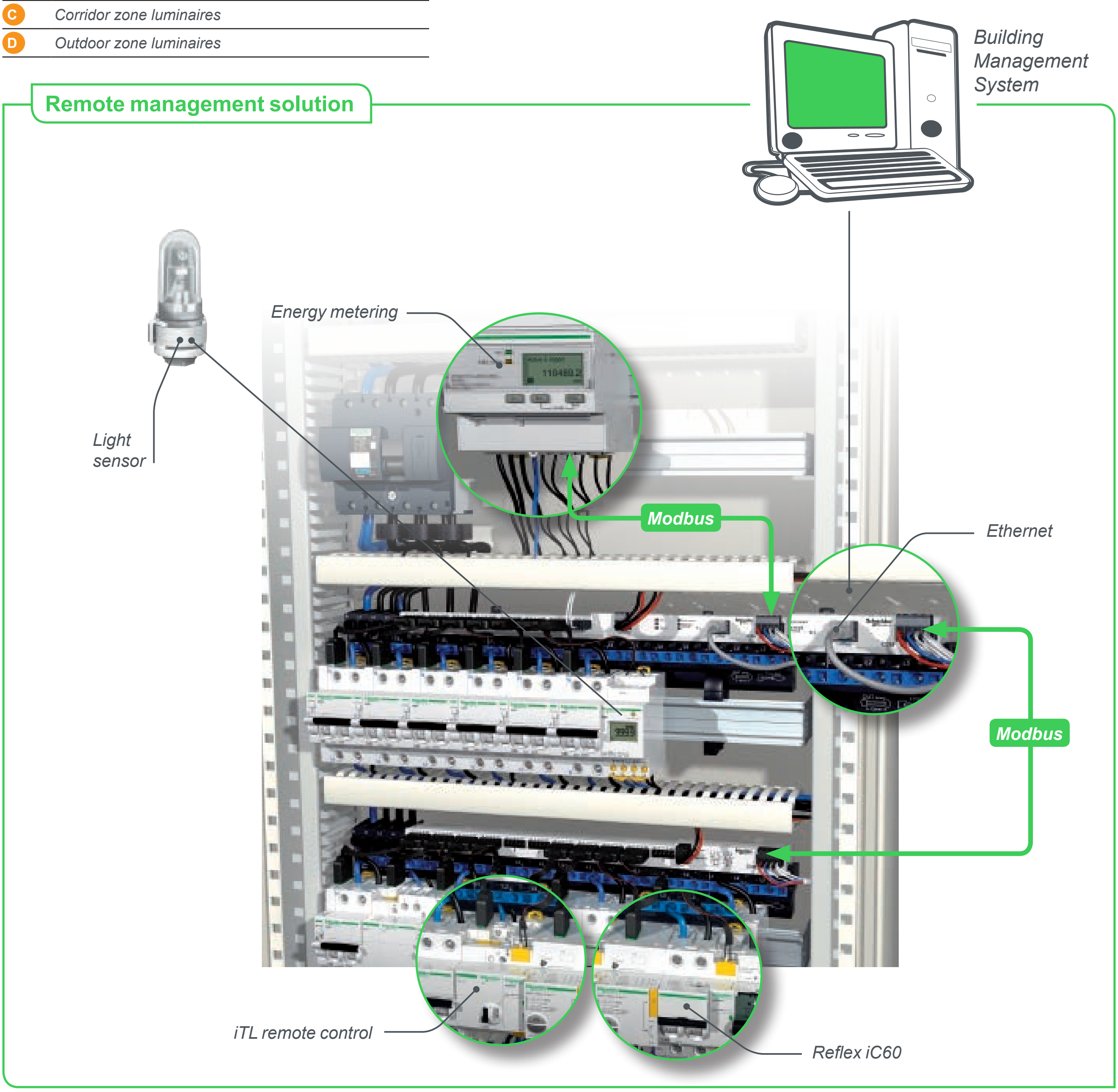


Zones	Contracting authorities	Power relays	Type of lamp
Passageways	Automatic by movement detector	-	LED
Offices	Manual by local push button	Impulse relay	Fluorescent T5
Car parks	Automatic control by detection of the luminosity level and time programming	Contactor	High pressure sodium

1. *Zone 1 local lighting control*
2. *Zone 2 local lighting control*
3. *Centralized control of zone 1 and zone 2*
4. *Automatic control of outdoor lighting by presence detection*
5. *Automatic control by movement detection*

- A *Zone 1 luminaires*
- B *Zone 2 luminaires*
- C *Corridor zone luminaires*
- D *Outdoor zone luminaires*

Remote management solution



Zones	Contracting authorities	Power relays	Type of lamp
Passageways	Automatic by movement detector	-	LED
Offices	Manual by local push button	Impulse relay with remote management	Fluorescent T5
Car parks	Automatic control by detection of the luminosity level and time programming	Reflex iC60 with remote management interface	High pressure sodium
Additional functions			
	• Remote display of satisfactory operation (state of circuit breakers, contactors, etc.)		
	• Fault indication		
	• Luminaire operating time		
	• Number of switching operations performed by power relays		

Time management devices



IHP IC2000

MIN

- These devices chiefly make it possible to optimize power consumption by managing lighting control according to various parameters:
  - time, day or date,
  - a given limited duration,
  - movement or the presence of personnel,
  - level of luminosity,
  - the amount of natural light.
- They can also improve everyday comfort through:
  - automation of the tasks of switching on/off,
  - manual or automatic adjustment of the illumination level.

Choice of management devices

for energy optimization and improved comfort

Products	Potential energy savings	Functions	Compatibility			
			Incandescent lamps	**Fluorescent lamps**	**High-intensity discharge lamps**	**LED lamps (unit power 2 to 8 W)**
IH Electromechanical time switches	**50%**	■ Hourly, daily or weekly ■ 1 or 2 circuits ■ With or without power reserve (operation in the event of mains failure)	1000 W	600 to 700 W	See Note	15 to 50 W
IHP Digital programmable time switches	**50%**	■ Daily, weekly or annual ■ 1 or 2 circuits ■ With or without conditional input ■ Switching interval: at least 1 min.	1000 to 2600 W	1000 to 2300 W		25 to 200 W
IC Light sensitive switch	**30%**	■ Controlled by: □ astronomical clock (automatic sunrise and sunset calculation) □ luminosity detection (adjustable from 2 to 2000 Lux) ■ With or without programmable clock function	2300 to 3600 W	2300 to 3600 W		30 to 200 W
MIN Timer	**30%**	■ 30 s to 1 h ■ 50% reduction of luminosity before extinction of incandescent lamps with PRE auxiliary	2300 to 3600 W	2300 to 3600 W Not recommended for time delays of less than a few minutes	Not recommended for time delays of less than one hour	55 to 150 W

Note: **IH/IHP/IC**
To control lighting loads, whenever the power is significant and the type of lamp generates major inrush stress, it is recommended to combine a power actuator with each circuit:
- a contactor
- an impulse relay with its latched-type control auxiliary
- a Reflex iC60
or
- a RCA iC60 (low rate of switching)

Emergency lighting

Exit Sign luminaire

Antipanic Emergency light

■ Emergency lighting is designed to avoid or minimize the panic during an event of a serious problem as a fire or an earthquake, and even merely a power cut.
■ Suitable for all types and sizes of buildings (schools, hotels, shopping centers, hospitals, offices, shops, museums, etc.), Schneider Electric emergency lighting is essential to occupants' safety and mandatory for building owners.
■ The anti-panic devices give out a light that enables people to see where they are and avoid obstacles, while the exit signs clearly show the escape route of the premises.

Various technologies and characteristics

■ These new luminaires are based on LED light source and a battery to supply power in the event of mains failure, managed by an electronic circuit board. The selection of the right luminaire is made on the features: luminous flux, duration, IP & IK protection, maintained or non-maintained depending on the application.
■ There is also another step of selection, maintainability:
□ standard luminaires: functional and duration test must be carried out manually and checked one by one,
□ Activa/self-test luminaires: they periodically test itself automatically giving a feedback status by means of colored LED,
□ Dicube/addressable units: a control unit supervise all the luminaires connected and display remotely the status of the emergency lighting system and record the logs,
□ Central Battery system: a complete system with supervision and power supply grouped in a unique cabinet. Using powerline technology, this system is able to light all the emergency luminaires connected, send command and receive feedback status using the same cables.

Installation of emergency lightings and Exit signs

■ Any point on an escape route, or leading to it, must have an exit sign, so that the direction of escape is not in doubt. Exit signs should clearly identify the full extent of the escape route, including any changes of direction.
■ Emergency Lighting must be provided along escape routes, and in the open areas leading to them, to enable people to move quickly to an exit. EN1838 gives the minimum requirement.
□ antipanic areas: 0.5 lux at ground level,
□ escape route: 1 lux at ground level,
□ maximum Exit sign distance is stated as "visibility distance" of the pictograms which should be given from the manufacturer accordingly to EN1838 rules.

The installation rules and diagrams are given for information only. They vary according to the country.
Only the rules in force in each country must be observed.

Appendix

Practical recommendations for the protection and control of lighting circuits

Basic rules

■ The cross-section and length of the cables must be appropriate to limit the voltage drop to less than 3% at the end of the line in steady state (see tables on ▶ pages 30 to 33).
■ The In rating of the standard protection and control switchgear must be far higher than the rated current of the lighting circuit:
□ for the circuit breaker, take approximately twice the rated current of the circuit,
□ for the relay, always use the compatibility tables for each type of lamp and check that its rating is always higher than that of the upstream circuit breaker (short circuit coordination).
■ The In rating of the earth leakage protection device must be greater than or equal to that of the upstream circuit breaker.

Take the lamp ignition phase into account

Problems

■ All the lamps have a very strong starting current which breaks down as follows:
□ an inrush current: peak of 10 to 250 times the rated current (In) at power up,
□ followed by the starting current (for fluorescent or discharge lamps): possible overload of up to 2 In for several seconds or minutes depending on the type of lamp.

■ This therefore gives rise to the following risks:
□ conductor overheating,
□ circuit breaker nuisance tripping,
□ control device overloading.

Recommendation 1

■ Limit the load on each circuit to between 300 and 800 W per 2-wire circuit for standard 10/16 A 230 V AC equipment.
■ Increase the number of circuits to limit the number of lamps per circuit.

Recommendation n°2

■ Use Canalis prefabricated busbar trunking systems for large service-sector or industrial buildings.

Recommendation n°3

■ In the case of time-delay installations, postpone the power up of each circuit by a few tens of milliseconds to a few seconds.

Recommendation n°4

■ To control lamps with ferromagnetic ballast or transformer, high-performance control devices (iCT+ contactor or iTL+ impulse relay) should preferably be used instead of conventional relays to optimize the control of circuits of several kW up to 16 A.

Recommendation n°5

■ Curve C or D circuit breakers should be preferred to curve B. Confirmation by design note required.

Manage electronic ballast, transformer lamps or driver carefully

Problems

■ Electronic ballast lamps require special attention (high-frequency leaks to earth, harmonics) to guard against certain risks:
□ nuisance tripping of the earth leakage protection device,
□ overheating/overloading of the neutral conductor in three-phase circuits,
□ nuisance tripping of the 4-pole circuit breaker (neutral overload by third-order and multiple currents).

Recommendation n°1

■ Create the shortest possible links between the lamps and the ballast in order to reduce high-frequency interference and capacitive leaks to earth.

Recommendation n°2

■ Provide adequate discrimination, install the correct earth leakage protection at each level:
□ upstream:
- avoid instantaneous tripping 30 mA sensitivity,
- use a time-delay protection: 100 or 300 mA, type S (selective).

□ use type ***"SI"*** ("Super immune") 30 mA instantaneous earth leakage protection for the feeders.

Recommendation n°3

■ In the case of three-phase circuits + neutral with third-order and multiple harmonic contents > 33%:
□ oversize the cross-section of the neutral cable compared with that of the phases,
□ check that the neutral current resulting from the sum of the harmonics is less than the In rating of the 4-pole circuit breaker.

Save energy without increasing maintenance costs

Problems

■ Discharge lamps significantly reduce energy consumption but create additional problems both for the user and with respect to their management:
□ ignition is not instantaneous due to their starting time (a few seconds for fluorescent lamps to several minutes for high-intensity discharge lamps);
□ repeated switching accelerates ageing by a factor of 3 to 5,
□ their higher investment cost requires careful management.

Recommendation n°1

■ To meet an instantaneous and/or temporary lighting requirement, an additional circuit with halogen or LED lamps may be useful for premises lit by discharge lamps.

Recommendation n°2

■ To limit the ageing of fluorescent lamps: set the timers or presence detectors to a minimum value of 5 to 10 minutes.

Recommendation n°3

■ Use LED lamps for frequent switching or when hot re-ignition is needed.

Recommendation n°4

■ Set the lighting to remain on continuously in corridors and offices at peak times rather than use presence detectors that will switch it on and off repeatedly.

Recommendation n°5

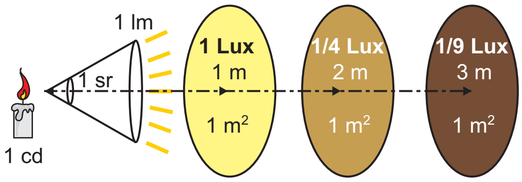
■ Regularly, at the end of the lamps' average service life, replace all the lamps and their ignitor for a given area to reduce maintenance costs.

Recommendation n°6

■ Use the impulse relay or Reflex iC60 rather than the contactor to prevent energy losses in the coils (a few Watts/relay).

Appendix
Definition of light-related units

Candela (cd)
■ Old definition: luminous intensity (luminosity) of 1 candle.
■ Modern definition (standard international unit): luminous intensity of light at a wavelength of 555 nm over 1.46 10^{-3} W/steradian.

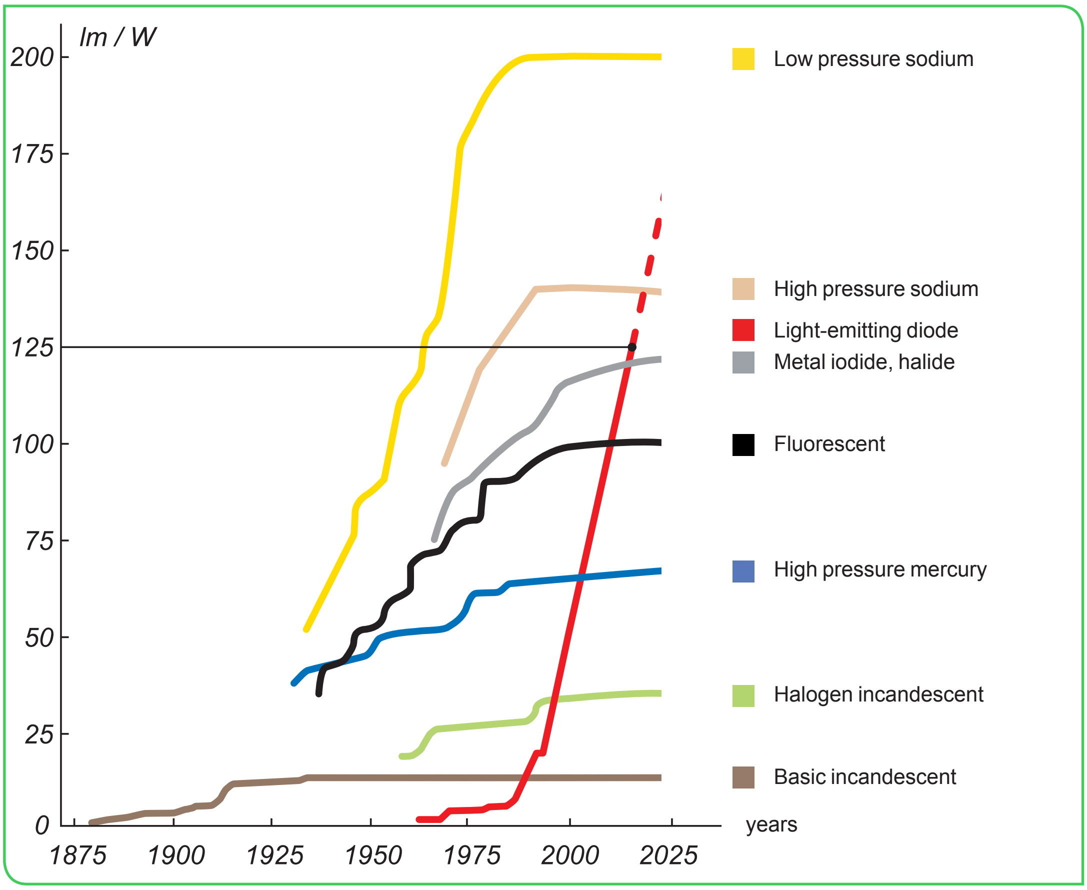


Lumen (lm)
Luminous flux of 1 cd in a 1 steradian cone (1 sphere/4π).

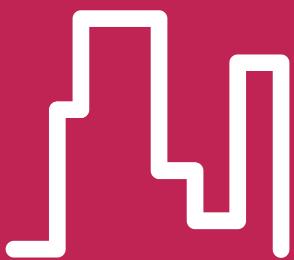
Lux (lx)
Illumination (quantity of light/m²) of 1 lumen/m².

Lighting efficiency (lm/W)
Ratio of the luminous flux emitted to the electrical power consumed. The energy that is not converted into light is dissipated in the form of heat.
The lighting efficiency decreases by 30% to 70% towards the end of the life of the lamp.

Progress in the performance of each technology over time
The graph below illustrates:
■ the low efficiency of incandescent lamps despite the halogen technology,
■ the obsolescence of the mercury technology, usefully replaced by sodium or metal iodide,
■ the good performance of fluorescent lamps,
■ the constant progress of light-emitting diodes, with a regular increase in performance (power LED, luminous efficiency, CRI, etc.).



Energy savings with Lighting Control



Lighting can represent

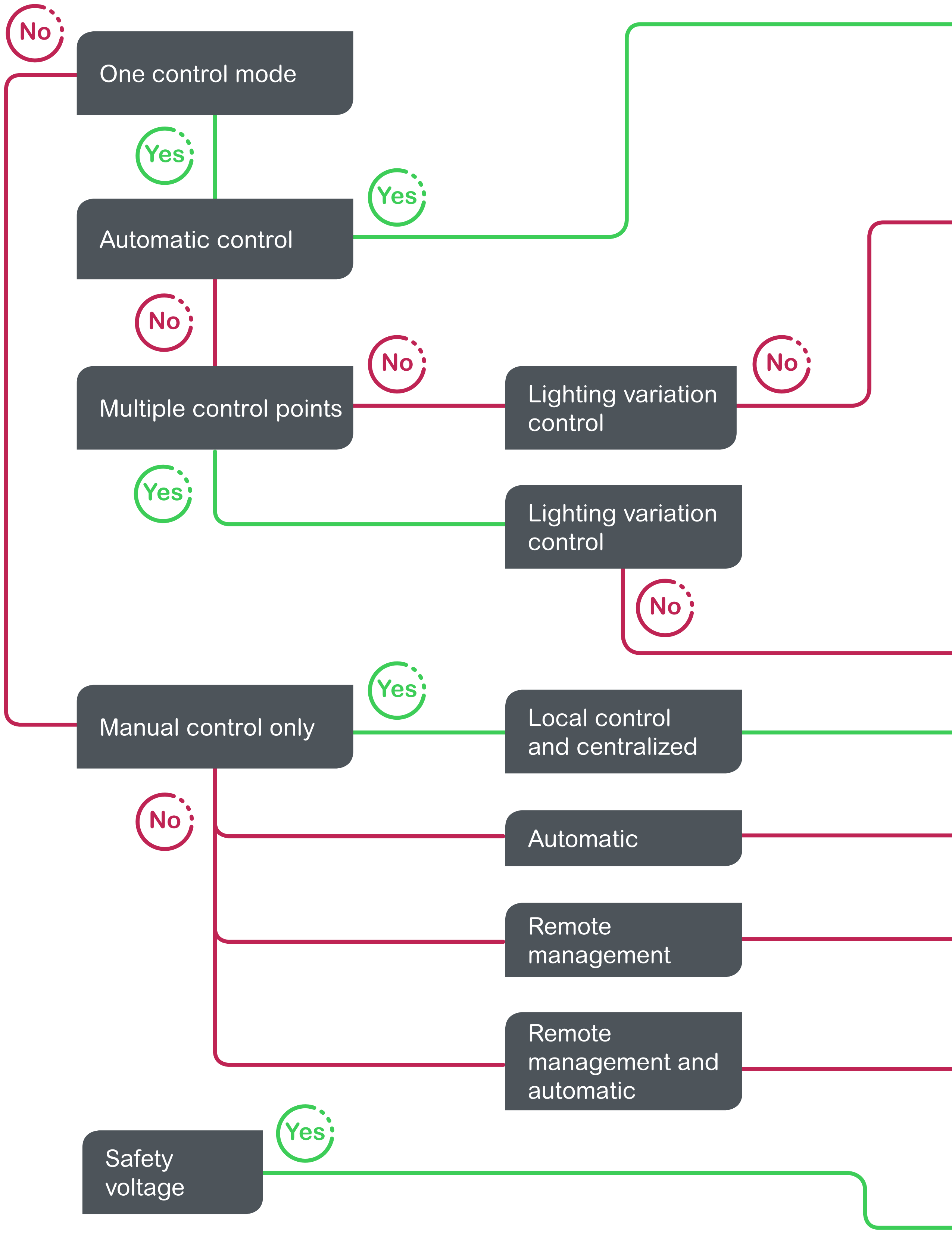
25% to 50%

of energy consumption in buildings depending on the business.

"Smart" lighting control is **one way** of quickly cutting the energy bill **without detracting from essential comfort**!

3 Lighting Control simple solutions

Content



"Check that the types of protection (1P, 1P+N, 2P... and earth leakage protection) conform to the installation regulations in force in the country concerned"

Time programming	Management of the lighting period and bells in a school	ISC00884EN	54
	Managing the lighting of a convenience store or superette	CA9SS038E	56
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	Automate public lighting according to sunrise and sunset with reduced light feature	ISC01572EN	60
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Local control + remote management	Control the power of a hotel room with keycard	A9 FA 03-01E	88

Remote management + Automatic	Ensuring the satisfactory functioning of loads critical for human protection	CA9SS002E	84
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Impulse relay 24 V	Lighting for a humid room	CA9SS037E	104

Emergency lighting

Emergency lighting	Emergency lighting in a public building: junior high school	LSB02301EN	106

Management of the lighting period and bells in a school

ITA

"Efficiency at your fingertips!"

Customer case

The engineering departments want to optimize the operating costs of the local body's educational institutions by achieving savings on lighting, and also achieve automatic actuation of the school bells at the appropriate time.

Override control of the lighting may be performed for maintenance or servicing purposes.

Benefits

- **Ease of programming:** changes in time switch programming in case of special events or holiday periods can be made using the programming tool on a computer; a memory key allows the changes to be duplicated simply in each educational institution.
- **Reduced maintenance:** thanks to GPS time reception and automatic summer time/winter time changing.
- **Lighting override control:** a remote push button allows override control of the lighting for maintenance or servicing operations.

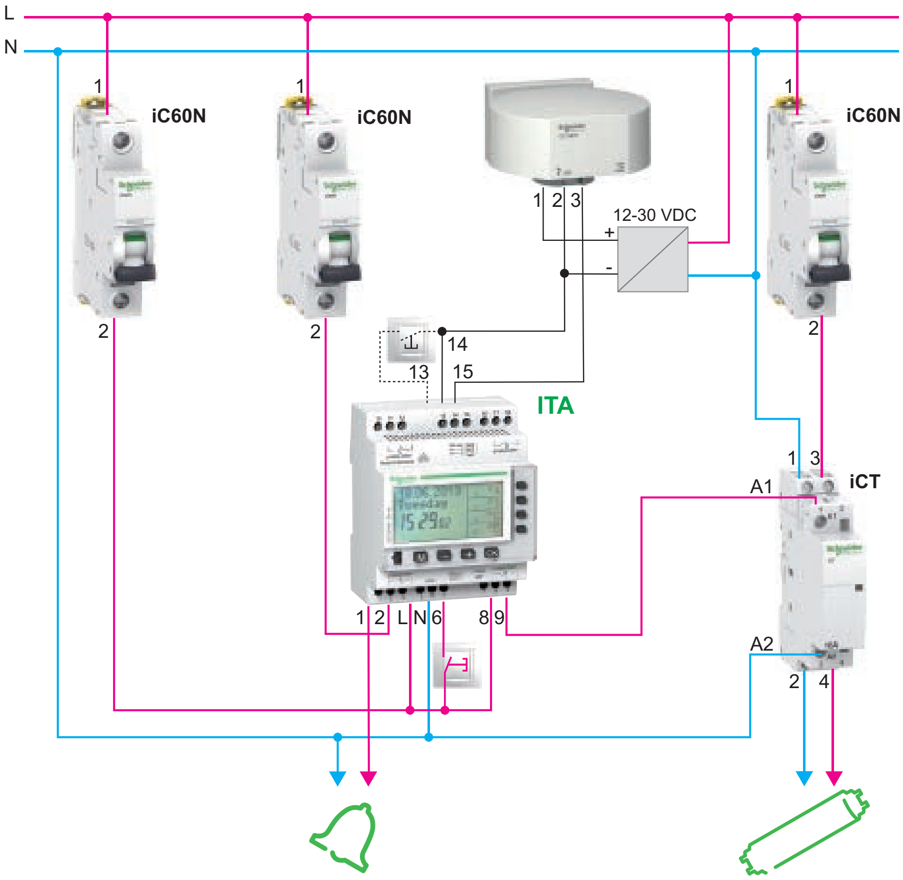
Our recommendation

The use of the ITA makes it possible to:
- limit the use of lighting by programming its operation at times during which the classrooms and common areas must be lit,
- program bell ringing times,
- have override control of the lighting by push button.

Duplication of the program in each educational institution is performed by using a programming kit and the duplicate is transferred by means of a memory key.

Solution

Diagram



Specifications

- The lighting and bell will be activated by a programmable time switch.
- A programming key and programming kit will be used to create and copy the program to another time switch, or save it.
- No deviation from timetable thanks to synchronization performed by GPS clock.
- Override control of the lighting will be performed via a switch or push button.

Products used			
Product	Function	Quantity	Reference
Acti9 ITA 4c	Yearly programmable time switch, 4 channels	1	CCT15940
GPS or DCF	GPS or DCF antenna (optional)	1	CCT15970 or CCT15960
Programming kit and key	Programming kit for PC and memory key (optional)	1 + 1	CCT15950 and CCT15955
Acti9 iC60N 1P	MCB	3	Depend on rating
Acti9 iCT 2P	Modular contactor	1	Depend on rating

More about ITA 4c

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35, rue Joseph Monier - CS 30323
F92506 Rueil-Malmaison Cedex

Managing the lighting of a convenience store or superette

Lighting in the right place at the right time thanks to pre-cabling and time programming

Customer case

The manager of a convenience store wants to automate its lighting system. His store comprises two separate lighting areas: storage and sales.

In addition, the lighting must be optimized: one luminaire out of three during delivery, after closing and at cleaning time, while full lighting must be ensured during opening hours.

The layout of the shelves in the sales area could be reorganized, and the reallocation of luminaires should be performed with minimum works.

Benefits

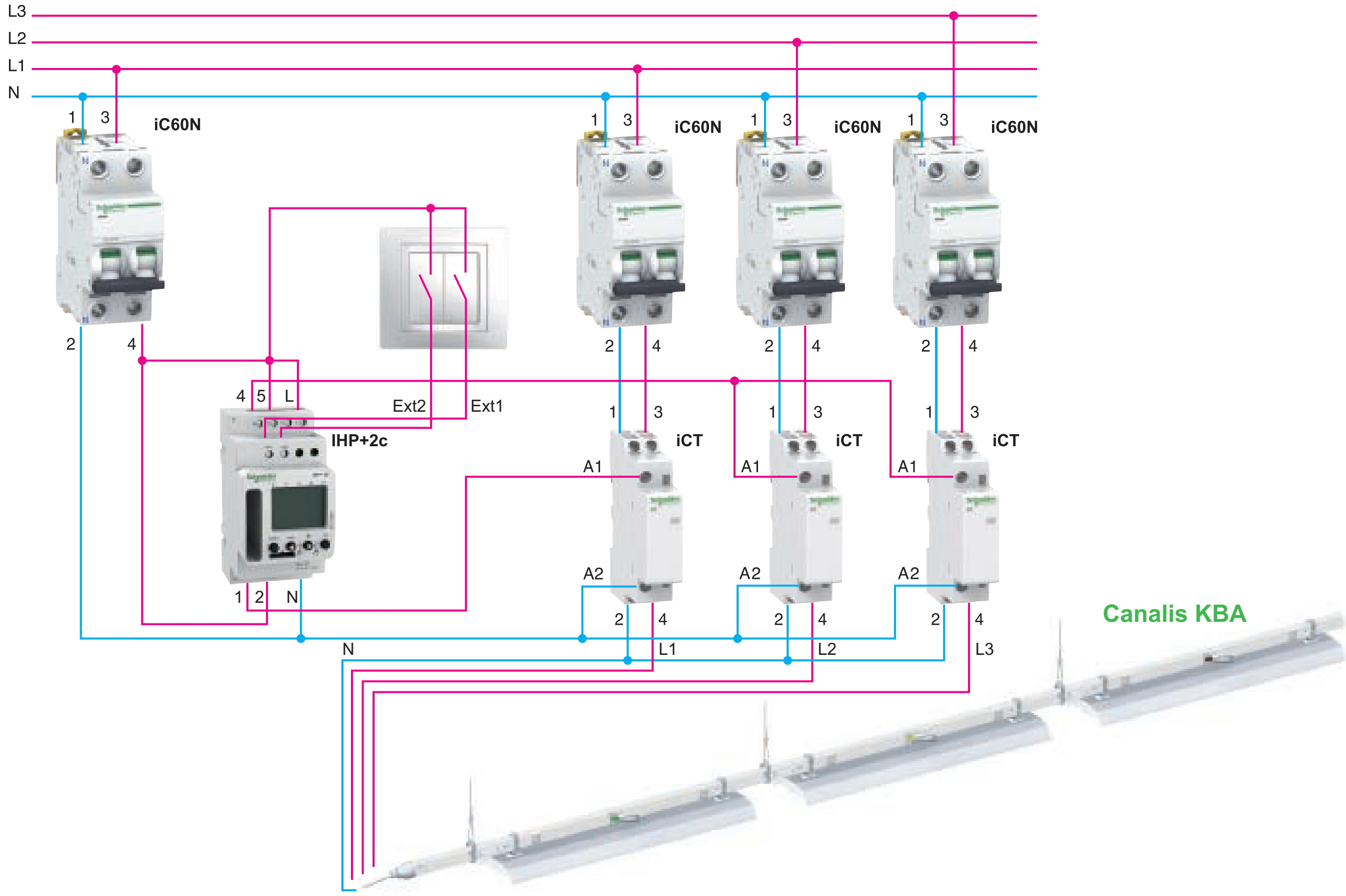
- **Simplicity and speed of execution:** from design to installation, no constraints, "Canalis" adapts to all store configurations.
- **Attractiveness:** the white-colored Canalis components ensure consistency with the colors of the luminaires.
- **Cost optimization:** automation of the installation reduces electricity consumption.
- **Flexibility:** no works required when reorganizing the store or changing the sales area.

Our recommendation

The system chosen is 25 A KBA Canalis busbar trunking, and the luminaires shall be installed directly under Canalis KBA by means of KBA40ZFUW fasteners.
An Acti9 IHP+ 2c clock combined with contactors ensures lighting scripting, and a manual override control of the lighting will be performed from the electrical switchboard.
The alteration of the installation during reorganization of the shelves will be simplified by the modularity and extreme ease of assembly and disassembly of the Canalis components.

Solution

Diagram



Specifications

- The decentralized lighting electrical distribution architecture shall be prefabricated.
- The lighting layout should possibly be reorganized without altering the electrical installation.
- A busbar trunking system should ensure simplification of office rearrangement.

Products used			
Product	**Function**	**Quantity**	**Reference**
Canalis KBA	25 A straight element	-	KBA25ED4303W
Canalis KBA	25 A power supply box	1	KBA25ABG4W
Canalis KBA	Fasteners	-	KBA40ZFUW
Canalis busbar trunking	Tap-off connectors	-	KBC10DCS101, 201, 301
Acti9 iC60N	MCB 2P	1	Depend on rating
Acti9 IHP+ 2c	Programmable time switch with 2 output contacts	1	CCT15553
Acti9 iC60N	MCB 2P	3	Depend on rating
Acti9 iCT	25 A 2P contactor	3	Depend on rating

More about KBA

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Lighting management for a car park of a large tertiary site

IC Astro 2C - SMART

Control lighting duration

Customer case

The facility manager of a large tertiary site wants to automate the lighting system of the outdoor car park according to the time and position of the sun, without connecting a light sensor.

For cost saving reasons, after a certain time, only one lamp post out of two should remain lit.

He needs the lighting system to be programmed to operate only on working days.

He also wants the possibility to remotely override control of the lighting if necessary for maintenance operations.

Benefits

- No need for a brightness detector, so greater operating reliability and easier maintenance and installation.
- The liquid crystal display permanently shows: hour and minutes, day of the week, current operating mode and current program.
- Manual override of temporary or permanent On and Off status is possible.
- The change to summer / winter time is automatic.
- Easy to program via PC KIT LTS software.

Our recommendation

The use of the Acti9 IC Astro 2C - SMART astronomical twilight switch allows:
- car park lighting according to the sun position without any sensor to wire,
- the control of 2 independent lighting circuits,
- the programming of lighting days and times,
- the possibility of override control of the lighting via a simple push button.

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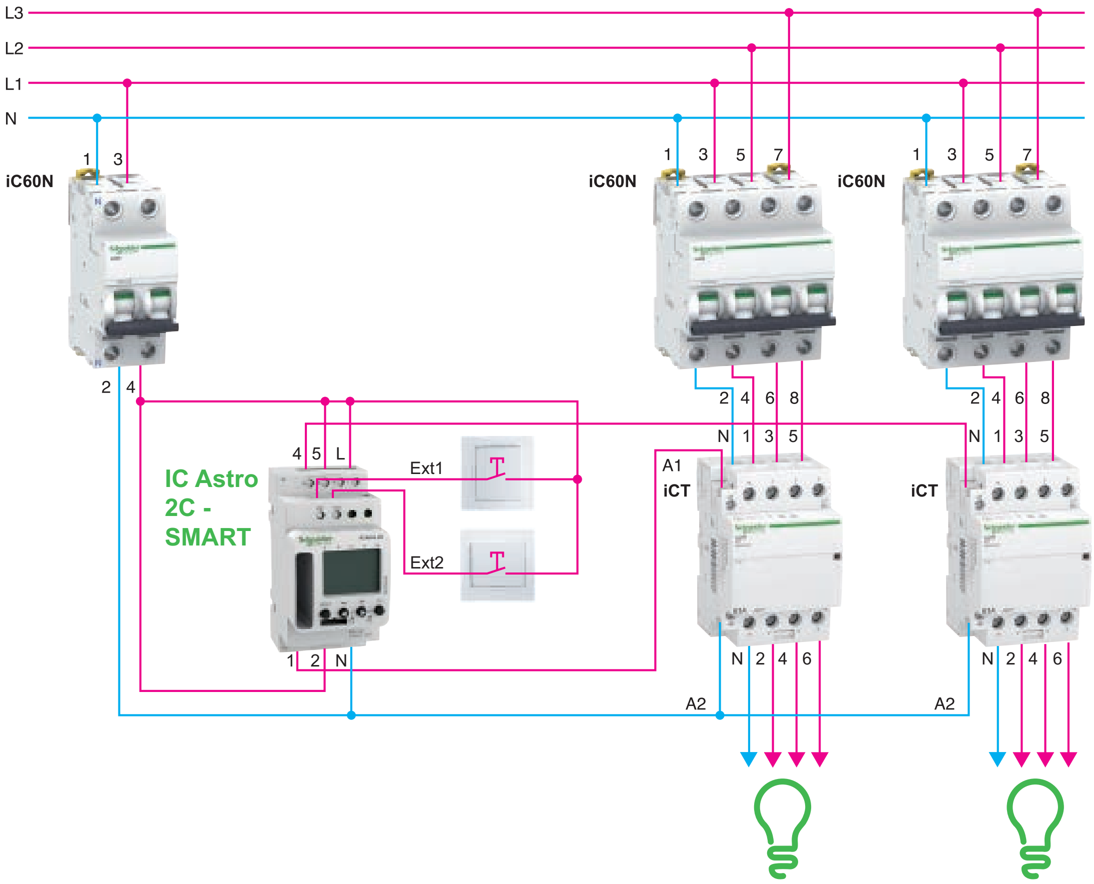
Solution

Diagram



Specifications

- The programmable twilight switch is configured only according to the place of installation either by selection of a country or town or by its geographical coordinates, latitude and longitude.
- Programming shall be done with software for PC.

Products used			
Product	Function	Quantity	Reference
Acti9 iC60N	MCB 1P+N	1	Depend on rating
Acti9 iC60N	MCB 3P+N	2	Depend on rating
Acti9 IC Astro 2C - SMART	Programmable twilight switch with 2 output contacts	1	CCT15245
Acti9 iCT	63 A 3P+N contactor	2	A9C24763

More about IC ASTRO 2C -SMART

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Automate public lighting according to sunrise and sunset with reduced light feature

"Lighting control: IC Astro 2C – SMART twilight switch"

IC Astro 2C - SMART

Customer case

The mayor of the commune wants to improve the reliability of public lighting operation to increase the comfort of his citizens. But in the meantime he wants to monitor lighting operation time to make energy savings.

He also wants to further reduce the light level by 50 % to save more energy in the off-peak period in the evenings.

Benefits

- No need for a brightness detector so greater operating reliability and easier maintenance and installation.
- The liquid crystal display permanently shows: hour and minutes, day of the week, current operating mode and current program.
- Manual override of temporary or permanent On and Off status is possible.
- The change to summer / winter time is automatic.

Our recommendation

Use a programmable two-channel astronomical twilight switch for switch-on and switch-off of lighting according to sunrise and sunset times.
Use the two channel outputs to manage the whole public lighting and only an half in peak-out periods.

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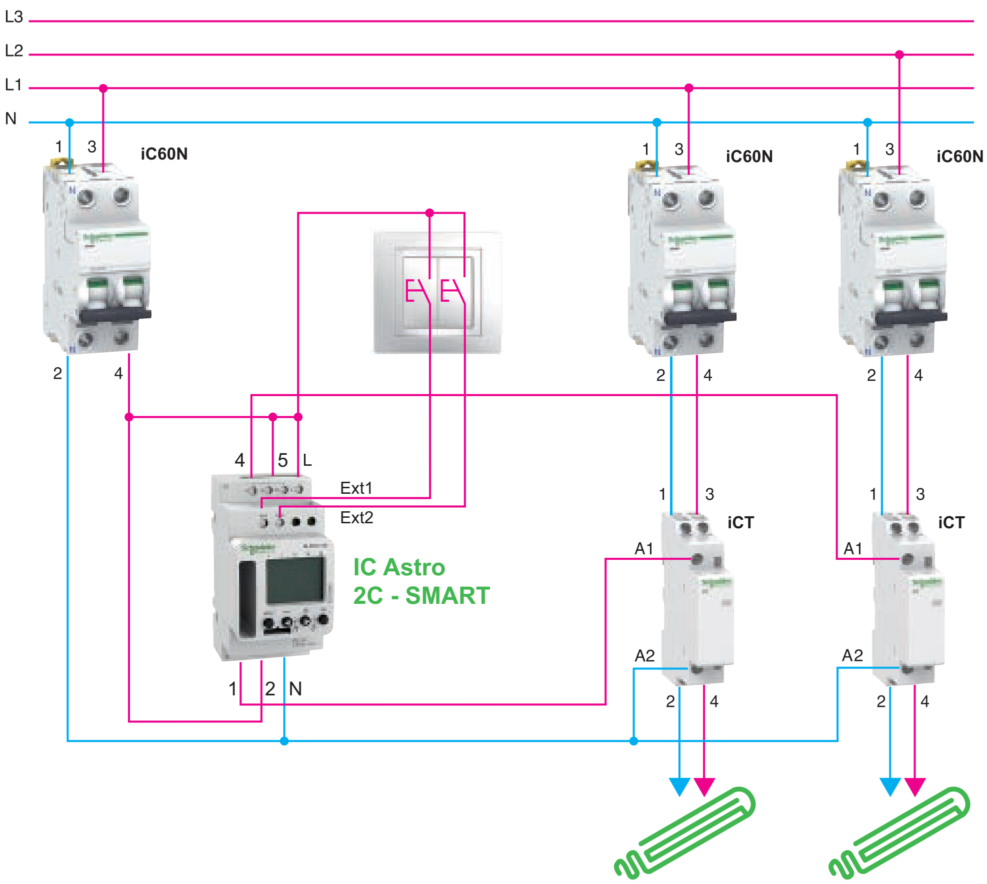
Solution

Diagram



Specifications

- The programmable astronomical twilight switch is configured only according to the place of installation either by selection of a country or town or by its geographical coordinates, latitude and longitude.
- Easy and fast programming with software for PC.
- The rating of the contactors and MCB protection circuit-breakers depends on the installed power and load type.

Products used			
Product	Function	Quantity	Reference
Acti9 IC Astro 2C - SMART	Programmable astronomical twilight switch, 2 channels	1	CCT15245
Acti9 iC60N 1P+N	MCB	1	Depend on rating
Acti9 iC60N 1P+N	MCB	2	Depend on rating
Acti9 iCT 2P	Modular contactor	2	Depend on rating

More about IC Astro 2C - SMART

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Schneider Electric Industries SAS
35, rue Joseph Monier - CS 30323
F92506 Rueil-Malmaison Cedex

Lighting for a hotel lobby

Argus 360

Motion sensor and luminosity measurement for comfortable experience

Customer case

In an hotel lobby, it's important to ensure lighting for people's movement if the natural luminosity is insufficient.
The lighting should automatically be extinguished after a certain time, once the people have left.
Also, It must be possible to switch on the lighting by remote override control to be able to check the condition of the lamps in daytime.

Benefits

- **Energy efficiency:** lighting is ensured in case of low luminosity and persons presence. This can optimize power consumption while ensuring the comfortable movement of people. It is also possible to adjust the time during which the lighting will remain lit after the last detection of a movement.
- **Comfort:** automatic switching on without having to look for the lighting control.

Our recommendation

The Argus 360 allows detection of people in movement. In the event of insufficient luminosity, the lighting comes on automatically for a given period.
Relaying by a contactor makes it possible to increase the control power.
In addition, a two-position wall switch, located at the reception desk for example, can be used to switch on the lighting by override control if necessary.

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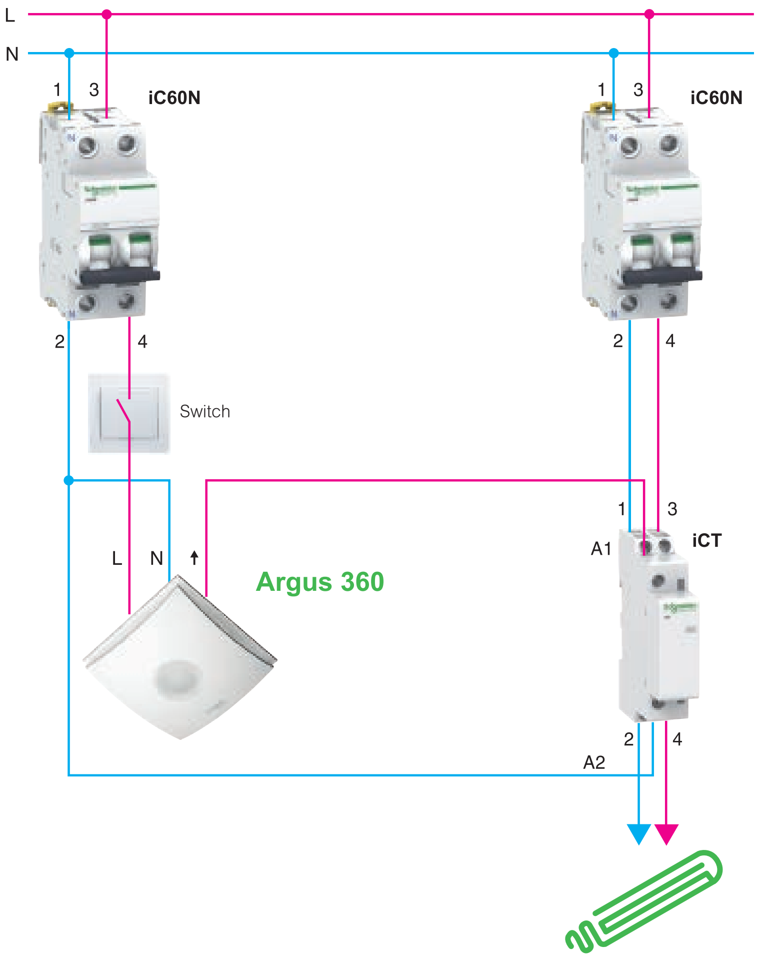
Solution

Diagram



Specifications

- The lighting system for an area is activated by movement detection and according to the luminosity.
- If necessary, the lighting can be switched on during 6 hours by a manual operation on the switch.

Products used			
Product	**Function**	**Quantity**	**Reference**
Acti9 iC60N	MCB 1P+N	1	Depend on rating
Acti9 iC60N	MCB 1P+N	1	Depend on rating
Argus 360	360° movement detector	1	CCT56P002
Acti9 iCT	25 A 2P contactor	1	A9C20732

More about Argus

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Lighting management for an office space

Lighting in the right place at the right time

Customer case

The manager of an office space needs to organize the lighting layout. He also wants to achieve energy savings by implementing automatic switching on/off of the lighting according to the presence of people and the level of luminosity.

In addition, each office lighting must be switched off automatically after a certain period of time in the absence of people.

As the offices are regularly rearranged, the installation must be easy to modify.

Our recommendation

The system chosen is Canalis busbar trunking incorporating a DALI architecture without programming.
Automatic lighting is provided by master and slave DALI presence detectors, and adjustment of the constant luminosity level office by office is an integral function of the master Argus detectors.
These detectors are fastened directly to the busbar trunking or are simply connected to it according to the layout of the offices.
Information is transferred uniformly to all the ballasts connected to the master detector network, and an override control of the lighting is performed by push buttons connected to the (master) DALI detector.

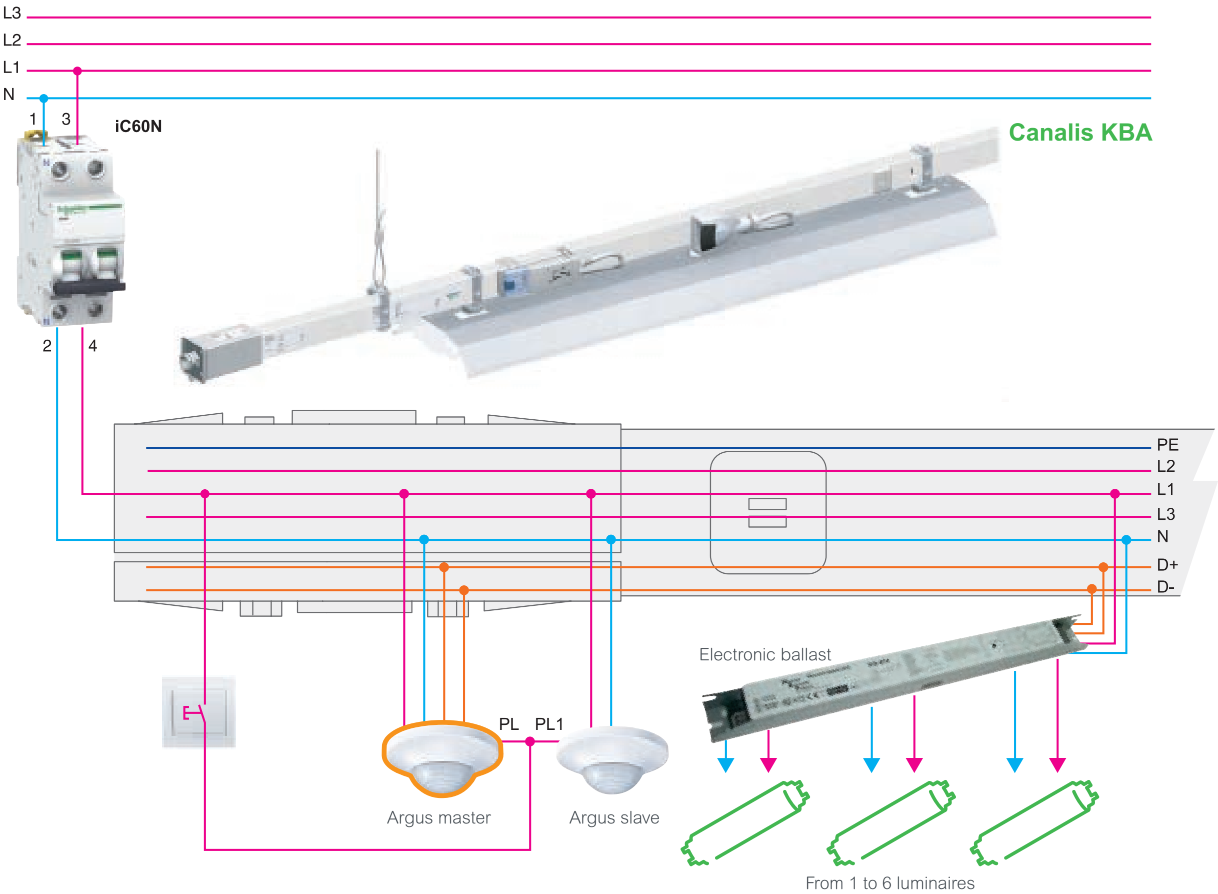
* DALI: Digital Addressable Lighting Interface.

Benefits

- Fewer cables: a single duct incorporates the power and the DALI communication buses for the master and slave Argus detectors and DALI ballast (option T of the KBA product ranges).
- Communication between the master and slave Argus devices and override control push buttons uses the power supply conductor (power line carrier).
- The prefabricated lighting electricity distribution system allows flexibility of installation for arrangement or rearrangement of space, without altering the electrical structure.
- Modification of the installation will be easy thanks to the modularity and extreme ease of assembly and disassembly of the Canalis components.

Solution

Diagram



Specifications

- Decentralized DALI lighting system without programming must be used to control the lighting.
- The use of a busbar trunking system should insure simplification of office rearrangement.

Products used

Product	Function	Quantity	Reference
Canalis busbar trunking	Tap-off connectors	1	KBC16DCB21+KBC16ZT1
Canalis busbar trunking	Connectors for Argus master detector	1	KBC16DCB40+KBC16ZT1
Canalis busbar trunking	Connectors for Argus slave detector	1	KBC10DCB40
Canalis KBA	40 A straight element (with communication bus)	-	KBA40ED4303TW
Canalis KBA	40 A power supply box	1	KBA40ABG4TW
Canalis KBA	Fasteners	-	KBA40ZFUW
Acti9 iC60N	MCB 1P+N	1	Depend on rating

More about KBA

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Optimizing hotel car park lighting

IC2000

"Lighting control: Twilight switch IC2000"

Customer case

The hotel manager wants to optimize lighting for a car park with a simple solution ensuring sufficient lighting irrespective of the natural luminosity level.
He wants to improve the hotel guests' comfort.

Benefits

- **Customer better comfort:** lighting is ensured in case of darkness.
- **Energy savings:** setting of the tripping threshold can optimize the lighting period.
- **Easy access to settings** on the twilight switch located in the electrical distribution panelboard.

Our recommendation

Use a twilight switch to automatically control the car park lighting (On or Off) according to the external brightness and the predetermined twilight switch threshold.

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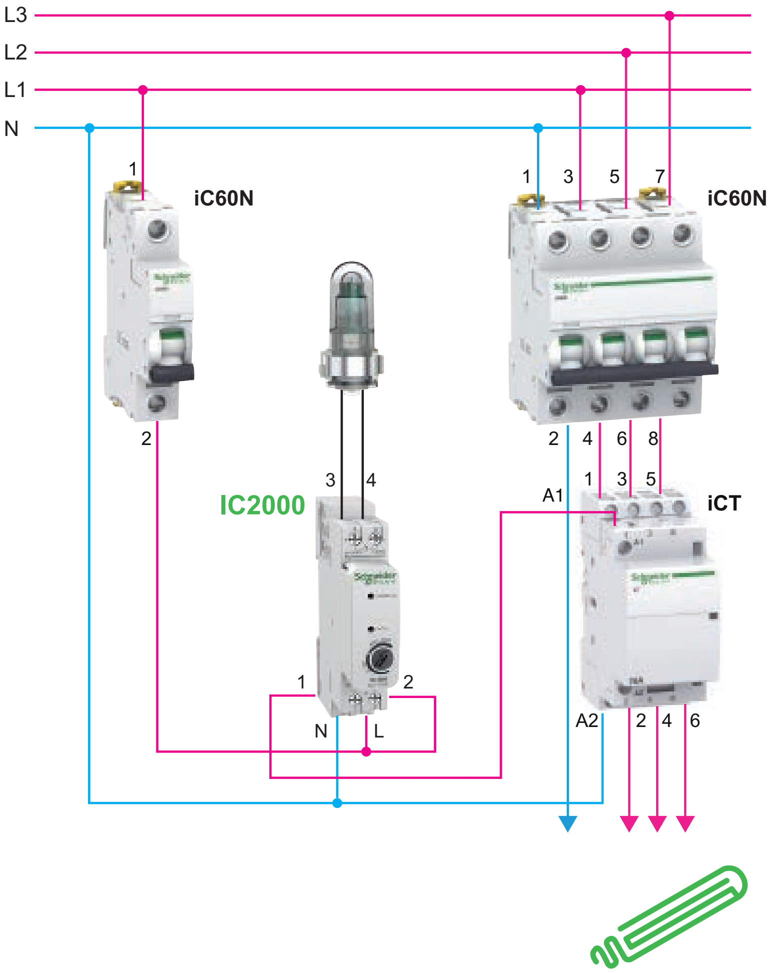
Solution

Diagram



Specifications

- The characteristics of protection circuit-breakers and contactor depend on the installed power and type of load.
- Modular contactor needed if power consumption exceeds 2600 W.
- The lighting will be activated through a command from the twilight switch according to the external brightness.

Products used			
Product	Function	Quantity	Reference
Acti9 IC2000	Twilight switch (supplied with a wall cell)	1	CCT15369
Acti9 iC60N 1P	MCB	1	Depend on rating
Acti9 iC60N 4P	MCB	1	Depend on rating
Acti9 iCT 3P	Modular contactor	1	Depend on rating

More about IC2000

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Optimizing the lighting of a shop window

“Light comes with the night!”

IC2000P+

Customer case

The owner of the shop, set up in a shopping mall, wants to light his shop window automatically when luminosity is low.
Also, he wants to improve energy savings by automatic extinguishing of this lighting at closing time, and on non-working days.

Benefits

- **Ease of installation:** thanks to intuitive configuration.
- **Flexibility of settings:** has a luminosity level adjustable from 2 to 2000 Lux and an adjustable time delay to prevent unwanted switch-on of the lighting in case of brief change in luminosity.
- **Ease of use:** override control of lighting by remote control switch, as well as automatic summer time/winter time changing.

Our recommendation

The use of an IC2000P+ programmable twilight switch makes it possible to automatically control lighting of the shop window according to the level of outside luminosity and opening hours.
Also, the non-working days can be programmed to inhibit lighting, and a remote override control can be possible by simple switch.

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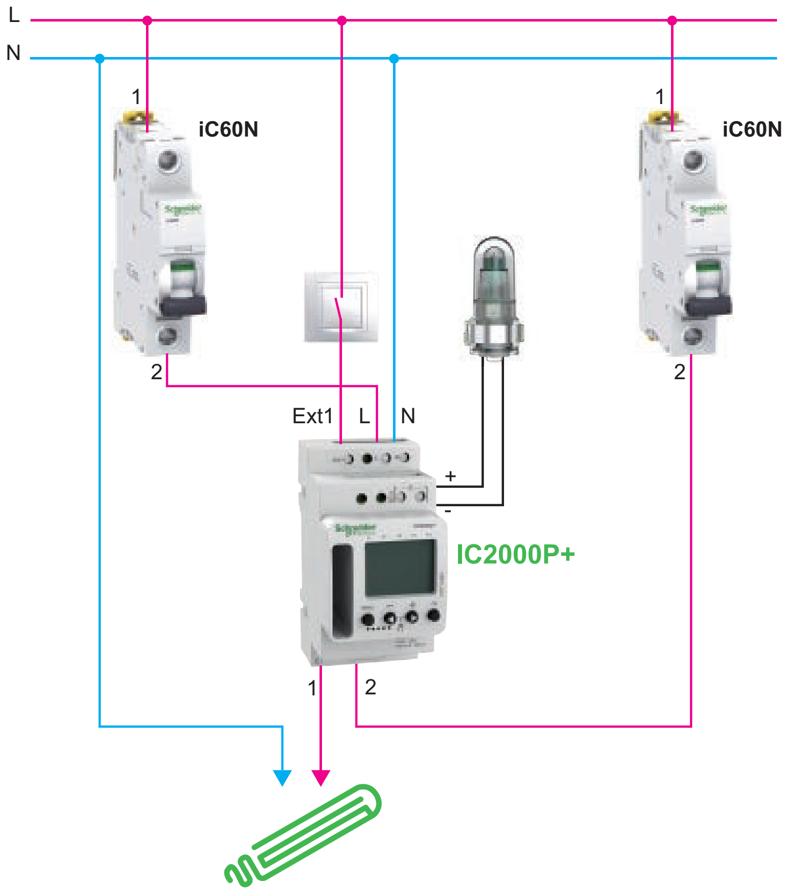
Solution

Diagram



Specifications

- The twilight switch must be combined with a wall cell.
- The operating period settings must be configured according to the shopping mall opening hours.
- It must be possible to adjust the lighting tripping threshold according to the level of outside luminosity, from 2 to 2000 lux.
- It must be possible to override the lighting settings by remote control.

Products used			
Product	Function	Quantity	Reference
Acti9 IC2000P+	Programmable twilight switch (supplied with a wall cell)	1	CCT15483
Acti9 iC60N 1P	MCB	1	Depend on rating
Acti9 iC60N 1P	MCB	1	Depend on rating

More about IC2000P+

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Schneider Electric Industries SAS
35, rue Joseph Monier - CS 30323
F92506 Rueil-Malmaison Cedex

Improving management of a public lighting system in a town

RCA iC60 with Ti24 interface

Remote & automatic management for higher quality of service and maintenance savings

Customer case

The quality of lighting power network is of prime importance for a town. The installation provides management of public lighting and a power supply for the power sockets distributed over the public space to allow the holding of special events (markets, street entertainment).
The objective is to ensure the following functions by remote management:
- switching public lighting on and off,
- energizing or de-energizing a power socket circuit,
- information on equipment operating states, so as to plan repair operations,
- remote restarting following an electrical fault.
In case of a remote management failure, a function designed for better service continuity is performed by a local PLC for switching the public lighting on and off.

Our recommendation

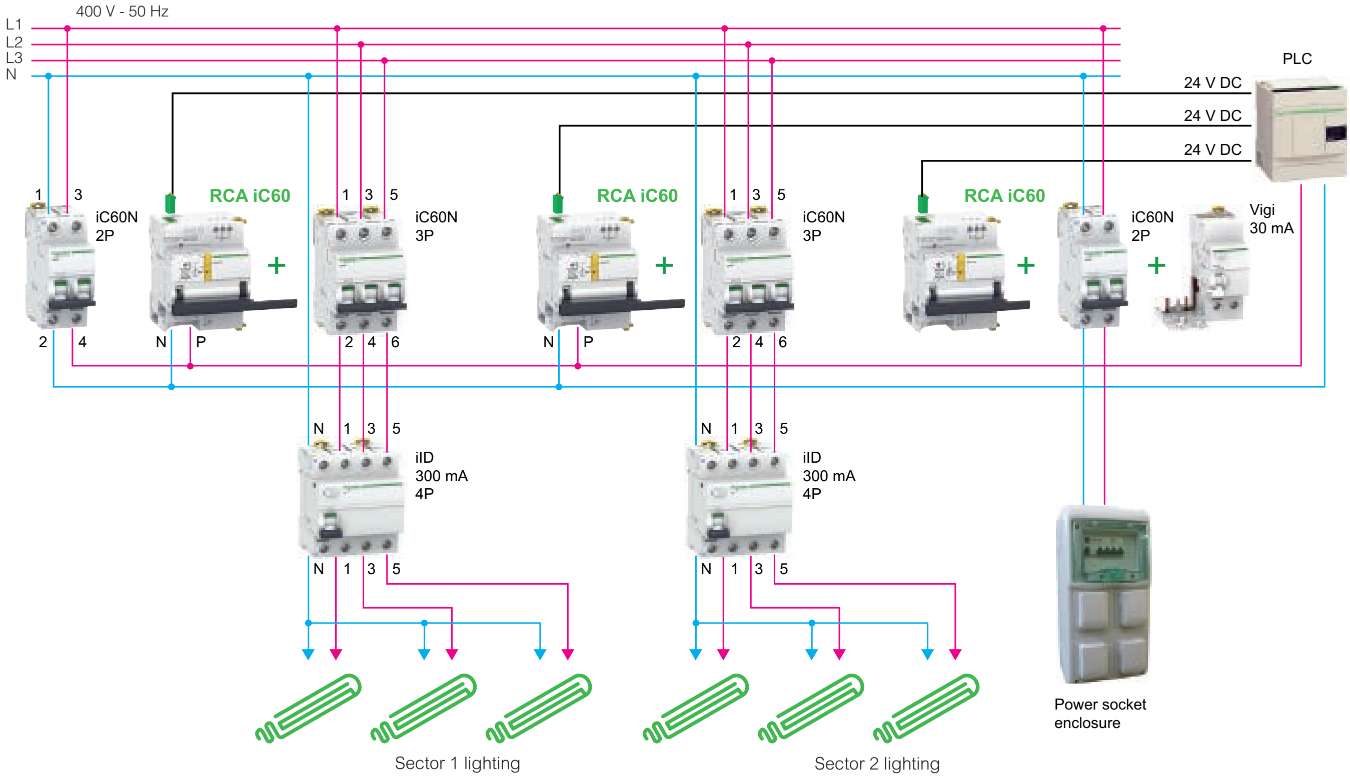
The functional units are installed in street cabinets along the roads, or in equipment rooms located near the area to be powered.
The Remote Control Auxiliary (RCA) device allows the PLC to switch off the power supply by actuating the Acti9 iC60 circuit breaker.
Each cabinet has a local automatic control system interfacing with the central system.
In addition, the RCA remote control is configured in "1-A" mode to give priority to the management PLC input and enable reclosing of the circuit breaker following a fault.

Benefits

- **Simplicity**: automated, secure solution for switching the power supply on and off, indications on the front panel of the product and remote signaling.
- **Protection**: padlocking possible without any additional accessory.
- **Continuity of service**: enabling of automatic reclosing upon an electrical fault.
- **Energy efficiency**: no permanent consumption because the RCA iC60 remote control is a bistable actuator.

Solution

Diagram



Note: to insure closing of neutral before phases the control of lightings must be realized by RCA and not by iID.

Specifications

- The lighting and power socket feeders must be powered by a modular circuit breaker combined with a remote control and an earth leakage protection auxiliary.
- This circuit breaker is remote controlled automatically via a connection with a PLC without any additional interface.
- The state of the circuit breaker (open/closed) and the presence of an electrical fault must be indicated at the PLC level.
- After tripping of the protective device, remote reclosing is enabled.

Products used			
Product	**Function**	**Quantity**	**Reference**
Acti9 iC60N	MCB 3P	2	Depend on rating
Acti9 iC60N	MCB 2P	1	Depend on rating
Acti9 RCA iC60	230 V AC remote control aux with Ti24 for iC60 3P-4P	2	A9C70124
Acti9 RCA iC60	230 V AC remote control aux with Ti24 for iC60 1P-1PN-2P	1	A9C70122
Acti9 iID	4P 300 mA RCCB	2	Depend on rating
Acti9 Vigi iC60	2P 30 mA earth leakage protection device	1	Depend on rating

More about Acti9 RCA iC60

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Schneider Electric Industries SAS
35, rue Joseph Monier - CS 30323
F92506 Rueil-Malmaison Cedex

Lighting for a storage warehouse

iTLm

Impulse remote control and switch brings visibility of lighting status

Customer case

Lighting control must be ensured by a simple switch.
Also, a feedback on the lighting circuit state must be obtained (ON or OFF).
The lighting power may be significant depending on the case.

Benefits

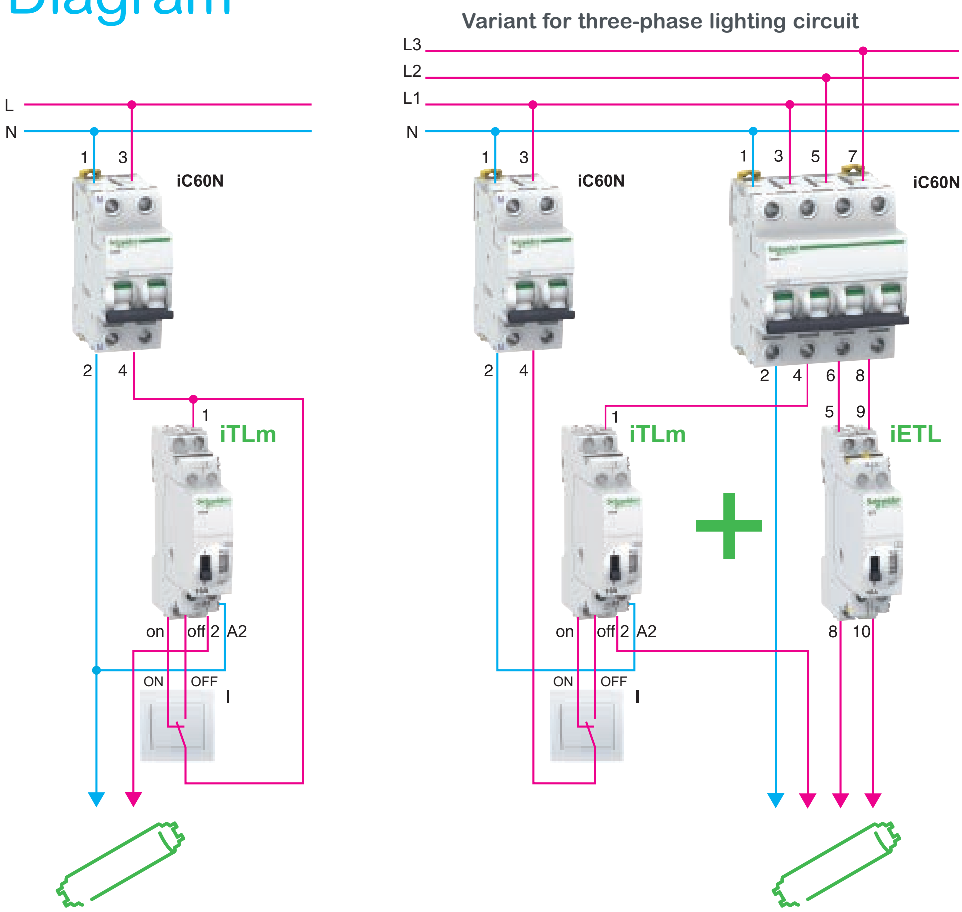
- **Reduced consumption and heating in the switchboard:** use of the impulse relay avoids permanent consumption by the coil of a contactor.
- **Simplified control:** the latched-control impulse relay makes it possible to use a simple switch.
- **Lighting override control:** the controls on the front panel of the product can be used to switch the lighting on or off by override control for specific needs.

Our recommendation

The latched-control impulse relay Acti9 iTLm is a bistable relay that can be controlled by means of a changeover switch.
The Acti9 iTLm opens or closes its contact according to the application of a voltage to the ON or OFF terminal. The voltage can be applied via a changeover contact of a simple switch, a time switch, etc…

Solution

Diagram



Note: to insure closing of neutral before phases, the control of lightings must not be realized by switch but with iTLM + iETL (maximum available rating 16 A).

Specifications

- The lighting system for an area is activated by an impulse relay controlled by a simple two-position switch.
- Lighting remote control must be able to be inhibited easily.

Products used			
Product	Function	Quantity	Reference
Acti9 iC60N	MCB 1P+N	1	Depend on rating
Acti9 iTLm	Impulse relay with integral latched function	1	A9C34811
Variant for three-phase circuit			
Acti9 iC60N	MCB 1P+N	1	Depend on rating
Acti9 iC60N	MCB 3P+N	1	Depend on rating
Acti9 iTLm	Impulse relay with integral latched function	1	A9C34811
Acti9 iETL	2P extension for impulse relay (for 3P lighting circuit option)	1	A9C32816

More about Acti9 iTLm

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F92506 Rueil-Malmaison Cedex

Lighting for a meeting room with remote reporting

Impulse remote control and signalling brings visibility of lighting status

Customer case

The meeting room's lighting must be able to be controlled from several points.
Also, the receptionist must be able to check switch-off when the room is not in use, to avoid any waste of energy if users have forgotten to turn off the light.

Benefits

- **Space saving:** the iTLs impulse relay saves space due to integration of the remote signaling function. The total width is still 18 mm.
- **Reduced consumption and heat loss:** a "bistable" solution, which consumes no energy to hold the lighting circuit in closed position.
- **Comfort:** the impulse relay offers continuous, silent operation compared with similar applications using contactors. The distribution board can be installed in bedrooms, offices, etc. without any discomfort for the users.

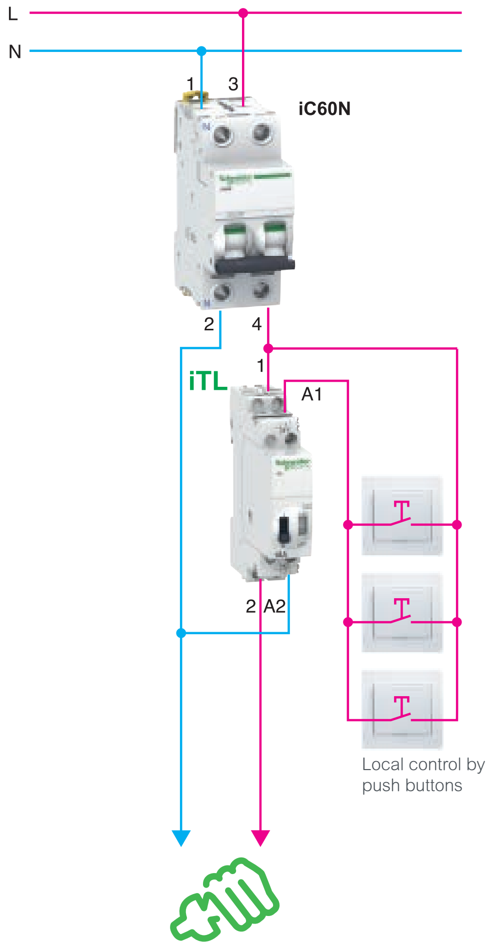
Our recommendation

The Acti9 iTL, iTLs impulse relay closes or opens the circuit whenever a control pulse is applied. The pulse is generated by pressing one of the push buttons.
All the push buttons are connected in parallel.
For the purpose of remote signaling, a lighting status report is produced by the signaling function of the iTLs.

Solution

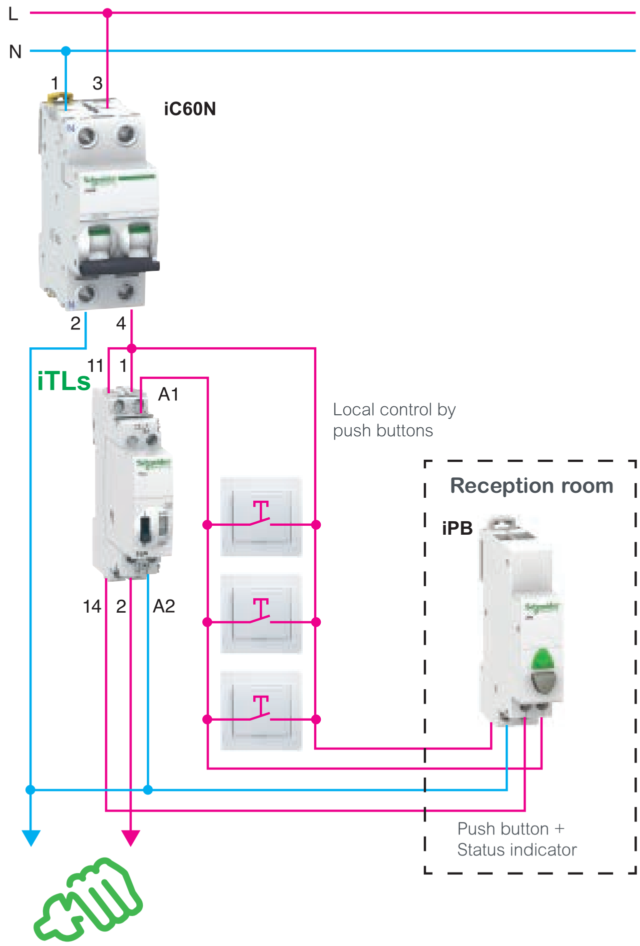
Diagram

Lighting for a meeting room



Lighting for a meeting room

Variant with remote reporting (circuit status)



Specifications

- The lighting system for an area is activated locally via several push buttons. Override setting of the lighting to ON or OFF for maintenance purposes must be able to be performed easily from the distribution board.
- On option, it must be possible to remotely indicate the circuit status.
- Depending on the rating of the power circuit protection circuit breaker, additional protection for the control circuit may be necessary.

Products used

Product	Function	Quantity	Reference
Acti9 iC60N	MCB 1P+N	1	Depend on rating
Acti9 iTLs	16 A impulse relay with remote indication	1	A9C32811
Acti9 iTL	16 A impulse relay	1	A9C30811
Acti9 iPB	4P impulse relay	1	A9E18036

More about Acti9 iTL

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Lighting management for a house

iTLc

Impulse remote centralized control
Improve energy efficiency & user comfort

Customer case

The lighting system must be able to be turned on locally by the residents, and it must be possible to switch off all the lighting areas by means of a centralized control in a single action, to ensure extinguishing of the whole house.
For practical reasons, all the lighting areas can also be switched on in a single action.

Benefits

- **Energy savings:** centralized control allows extinguishing of all the rooms in the house to prevent leaving rooms lit when there are no residents.
- **Comfort:** all the rooms in the house can also be switched on in a single action.
- **Ease of installation:** the small size
- (18 mm) of the Acti9 iTLc is equivalent to that of a simple impulse relay.

Our recommendation

The use of Acti9 iTLc impulse relays allows bothlocal control of each room and centralized control of the whole house.
The centralized control is provided by ON/OFF push buttons, remotely from every rooms to be managed.

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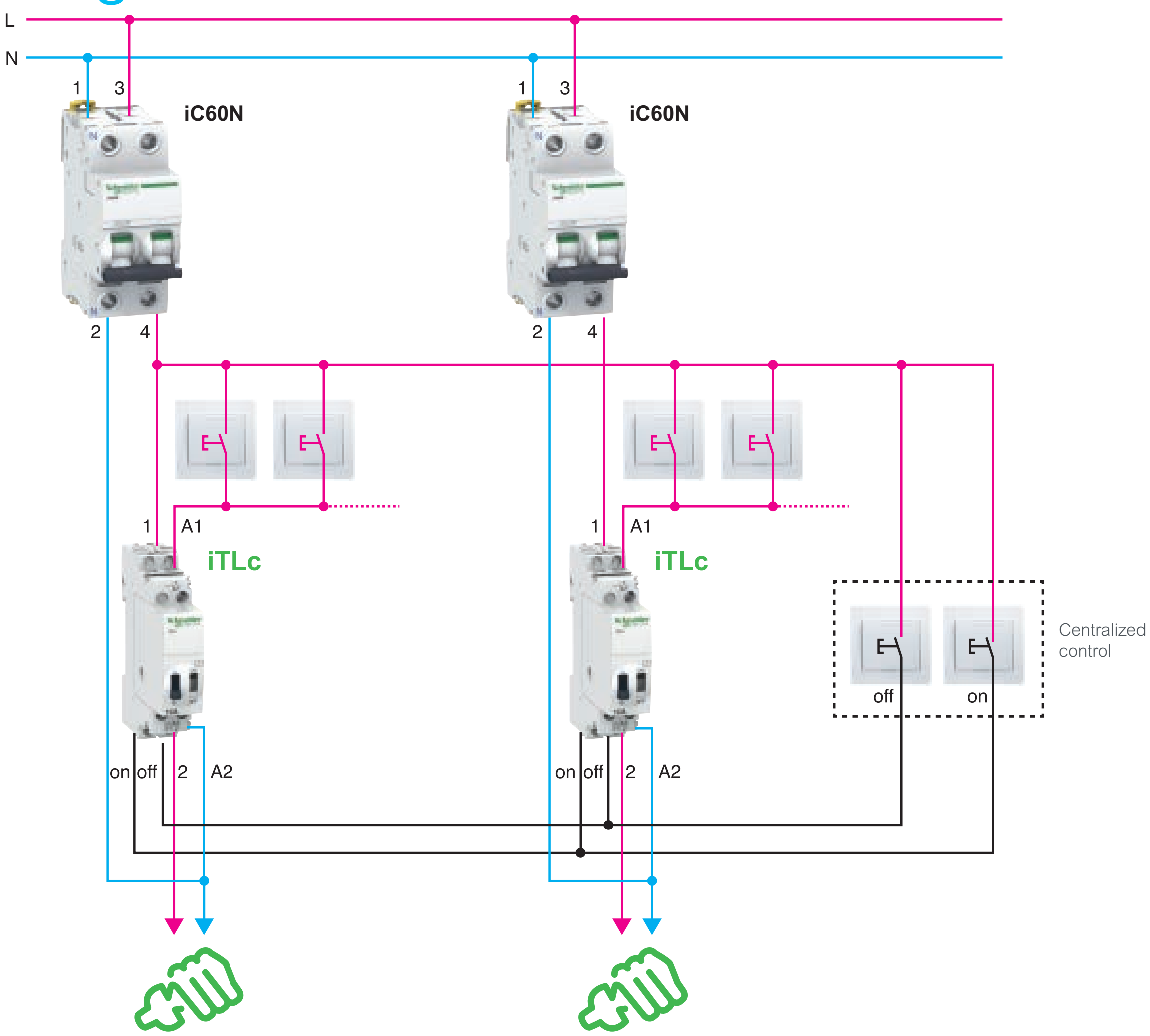
Solution

Diagram



Specifications

- Each lighting circuit is controlled locally via push buttons.
- All the lighting in the house is switched On and Off via a single push button.

Products used			
Product	Function	Quantity	Reference
Acti9 iC60N	MCB 1P+N	2	Depend on rating
Acti9 iTLc	Centralized-control impulse relay	2	A9C33811

More about
Acti9 iTLc

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Renovation of the lighting for a Town Council

Energy optimization and ease of use

Customer case

In order to optimize the existing lighting of a Town Council, the engineering department wants to upgrade the installation, while keeping the local controls in place.

They also want to have a centralized control, located by the Town Council's reception desk, allowing all the offices, the Council meeting room and the reception to be extinguished in a single action.

Benefits

- **Energy optimization and protection**: the lighting for each area can be activated and deactivated locally by the users and also centrally at the reception desk: no more light-on after working hours.
- **Ease of connection**: thanks to its integral centralized control function, the iTLc impulse relay allows savings of wiring and space. The total width is still 18 mm. The iATLc centralized control auxiliary is compatible with the standard iTL impulse relay to upgrade the existing installations (iATLc + iTL is equivalent to iTLc).

Our recommendation

For each office an Acti9 iTLc will be used for lighting control via push buttons.
In addition, for the lighting control in the lobby and meeting rooms, for reasons of installed capacity, a 32 A impulse relay combined with an Acti9 iATLc remote control auxiliary is necessary.
The Acti9 iTLc and Acti9 iATLc allow centralized control via a push button installed by the reception desk which switches-off all the building's lighting.

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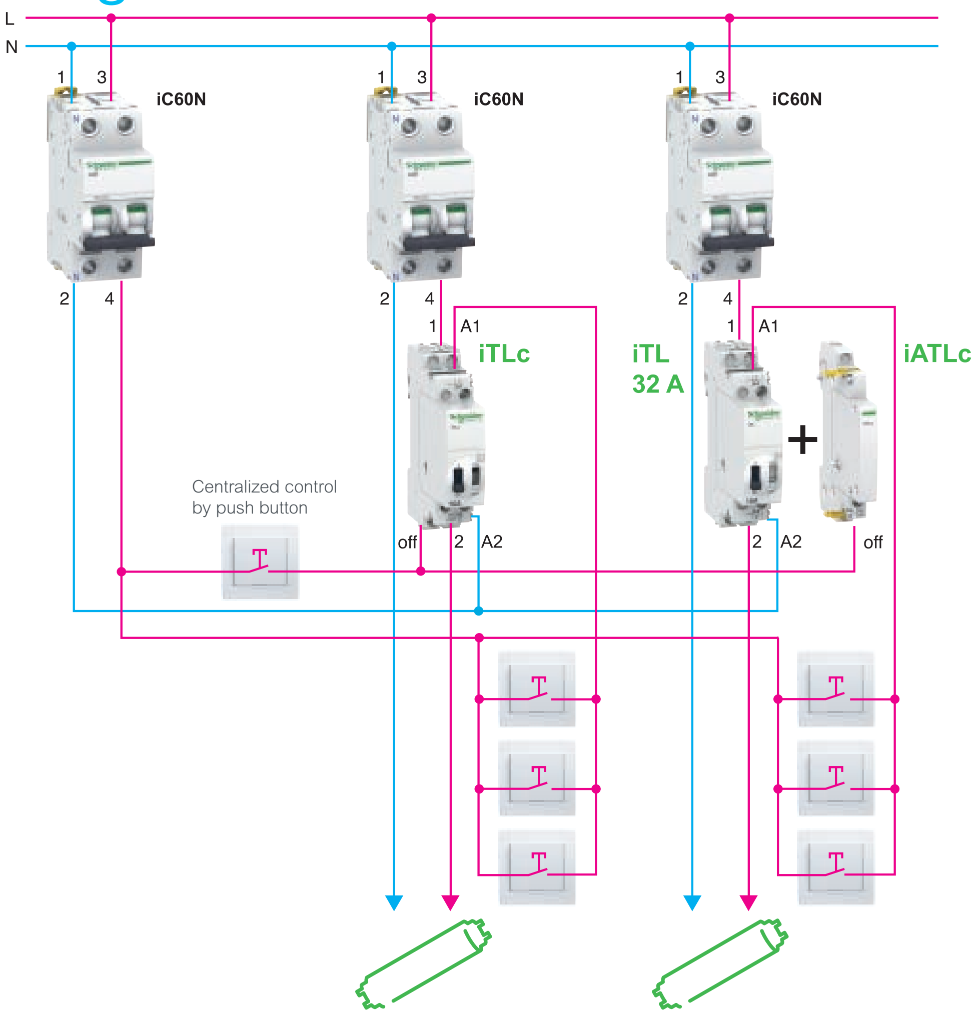
Solution

Diagram



Specifications

- A single push button must be able to extinguish all the building's lighting.
- The space for the solution including the "centralized control" function must be compatible with the available space in the existing switchboard.

Products used			
Product	**Function**	**Quantity**	**Reference**
Acti9 iC60N	MCB 1P+N	1	Depend on rating
Acti9 iC60N	MCB 1P+N	2	Depend on rating
Acti9 iTL	32 A impulse relay	1	A9C30831
Acti9 iATLc	Centralized control auxiliary	1	A9C15404
Acti9 iTLc	Centralized-control impulse relay	1	A9C33811

More about
Acti9 iATLc

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QR code

Schneider Electric Industries SAS
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Lighting management for a solicitor's office

iATLc+s

"Impulse remote control + central control = energy savings + ease of use"

Customer case

The lighting for each area can be switched on or off locally by office workers, and the receptionist can switch all the lighting areas on (or off) from a central control, to prevent any waste of energy if users have forgotten to switch off the light.

Monitoring of the lighting status is necessary for the reception desk (indicator lit if one of the offices is illuminated).

Benefits

- Energy optimization: centralized remote control allows all the office and meeting room lights to be extinguished from a single location. It prevents leaving the lighting on in rooms when closing the solicitor's office.
- Comfort: an indicator lamp can indicate that an office or meeting room is lit. Local push buttons actuate impulse relays individually for each lighting circuit.

Our recommendation

The combination of Acti9 iATLc+s auxiliaries for Acti9 iTL impulse relays allows both local control of each office, centralized control, and monitoring of the light status.
Centralized control is provided by a single push button, and the status report of the light is achieved by mounting in series the auxiliary signaling contact of each impulse relay.

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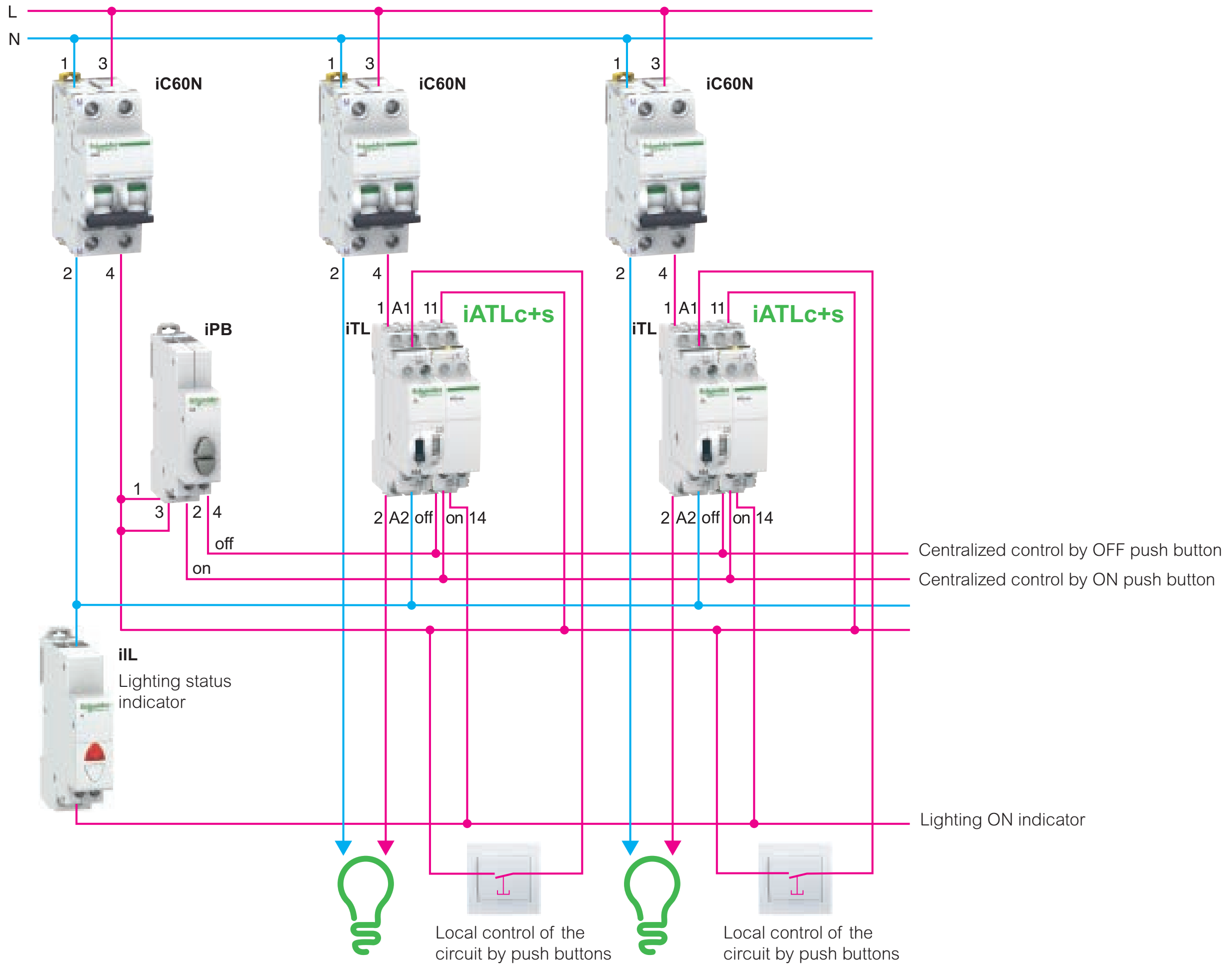
Solution

Diagram



Specifications

- Each lighting circuit is actuated by local push buttons and via common switch-on and switch-off orders by push button located at the reception level
- A review of the lighting status is provided by a light indicator.

Products used			
Product	**Function**	**Quantity**	**Reference**
Acti9 iC60N	MCB 1P+N	1	Depend on rating
Acti9 iC60N	MCB 1P+N	2	Depend on rating
Acti9 iTL	impulse relay	2	A9C30811
Acti9 iATLc+s	Centralized control + signaling	2	A9C15409
Acti9 iIL	Indicator lamp	1	A9E18320
Acti9 iPB	Double push button	1	A9E18035

More about
Acti9 iATLc+s

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Lighting management for a university

iATLc+c

Optimize energy consumption and improve operation flexibility

Customer case

The university facility manager wants to achieve savings on lighting consumption for this building of several floors.

Each room should be controlled separately. A manual control shall be also possible for each floor.

The building light should be turned off automatically when the university is closed.

The light in one room can be switched on again (for maintenance purposes, or exceptional events like late conferences or meetings) and will remain switched on until the next extinguishing order.

Benefits

- **Ease of installation:** the centralized function incorporated in the impulse relay can reduce the space requirement in the switchboard.
- **Simple automatic control solution:** the IHP+ 1c programmable time switch has a user-friendly interface, an impulse control mode and a large number of possible switching operations.

Our recommendation

The use of an iTLc impulse relay ensures the control of a lighting circuit via dedicated push buttons for each classroom. It also makes it possible to receive a lighting extinguishing control order for the complete floor.
In addition, one iATLc+c auxiliary for each floor allows extinguishing of all the building's lighting.
The IHP+ 1c ensures automatic extinguishing of the entire building by impulse control.

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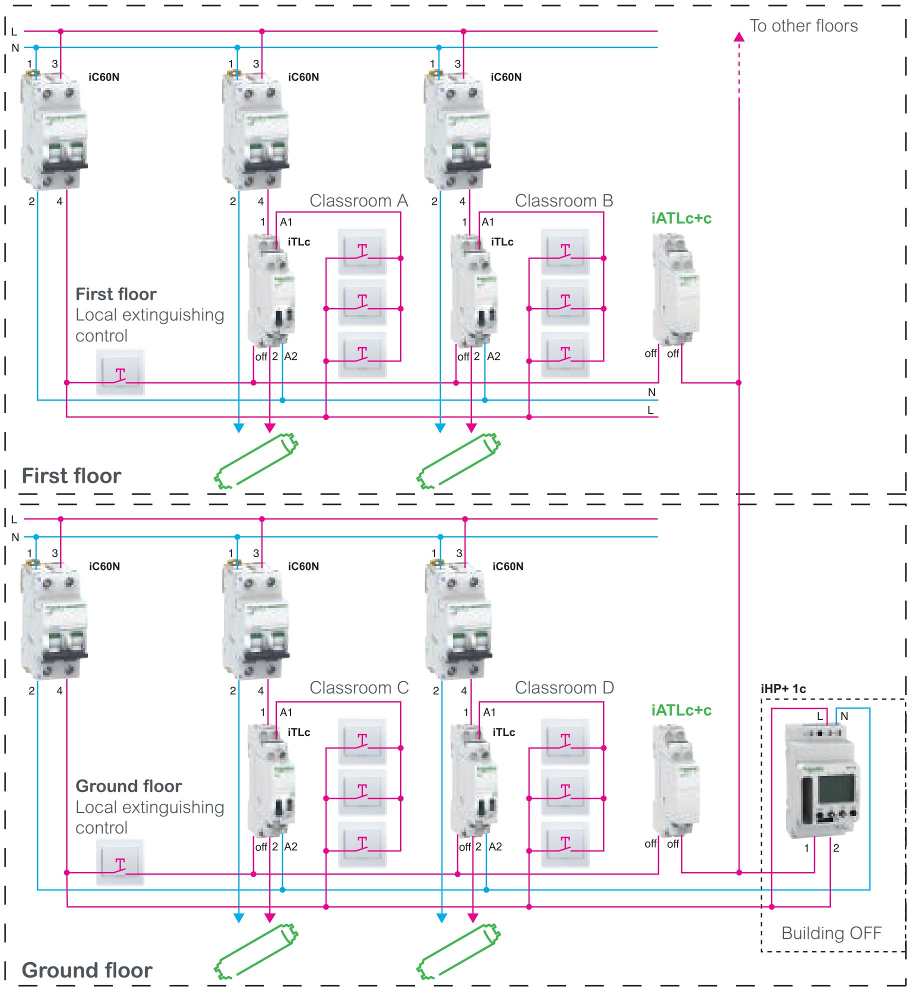
Solution

Diagram



Specifications

- The lighting solution must be optimized in terms of space requirements.
- No special skills should be required for configuration.
- The lighting control should be performed independently, per room, per floor and for the whole building.
- The general lighting switch off should be performed through an automatic impulse control order generated when the building is closed and then repeated every half-hour.

Products used			
Product	Function	Quantity	Reference
Acti9 iC60N 1P+N	MCB	6	Depend on rating
Acti9 iATLc+c	Multiple-level centralized control auxiliary	2	A9C15410
Acti9 iTLc	16 A centralized-control impulse relay	4	A9C3381
Acti9 IHP+ 1c	Programmable time switch	1	CCT15551

More about iATLc+c

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Ensuring the satisfactory functioning of loads critical for human protection

Easy operation and higher continuity of service

Customer case

In an underground car park, ventilation and lighting are essential. Any malfunction must immediately alert the surveillance personnel. They must be able to diagnose the equipment and restore it to operation very quickly, remotely when possible, or by going to the site.

Even in the event of a malfunction of the automatic control system which manages them, these loads must continue to operate without interruption.

Our recommendation

Thanks to Acti9 Smartlink, all the final distribution boards are connected directly to the site surveillance network. The circuit breaker auxiliaries iOF+SD24 report any tripping and any deliberate opening. The contactors and impulse relays receive switch-on and switch-off orders and report their status.
Selector switches on the front panel of the switchboards allow maintenance personnel to take over control of the automatic system to manage the contactors and impulse relays via push buttons.
In that case, the position of the inhibition selector switch is sent over the Modbus network via the Acti9 Smartlink interface.

Benefits

- Fast, reliable installation: the appliances are connected to the Modbus network via Acti9 Smartlink communication interfaces and entirely prefabricated connector systems:
  - wiring is performed quickly, without risk of error (inversion of cables, etc.),
  - during maintenance operations, "thin wire" connections inside the switchboard are identifiable immediately. They can be handled without any tools thanks to plug-in connectors.
- Reliability of data and indications:
  - low-level iOF+SD24 signaling contacts complying with IEC 60947-5-4,
  - high level of electromagnetic compatibility of the Acti9 Smartlink modules.
- Data ready for asset management: directly integrated in Acti9 Smartlink, the counting of protective device tripping actions and hours' operation of luminaires can be used to plan preventive maintenance.

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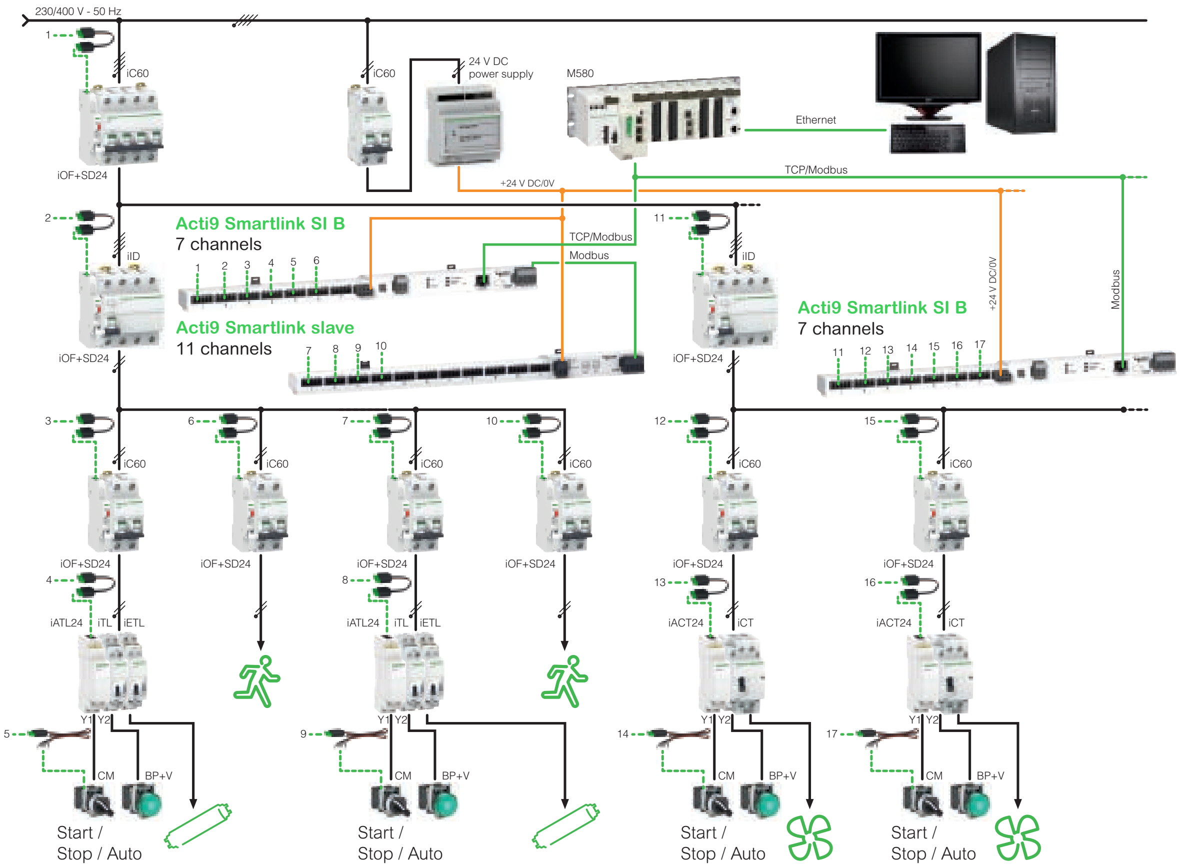
Solution

Diagram



Specifications

- The communication system should combine command, monitoring, control and protection functions designed for energy efficiency solutions in any type of environment.
- Based on the Modbus protocol, the communication system allows switchboard data to be exchanged in real time with a supervision system or a PLC.

Products used			
Product	Function	Quantity	Reference
Acti 9 Smartlink SI B	Communication interface	2	A9XMZA08
Acti 9 Smartlink Slave	Communication interface	1	A9XMSB11
iOF+SD24	24 V DC circuit breaker auxiliaries	9	A9A26897
iACT24	24 V DC contactor auxiliaries	2	A9C15924
iATL24	24 V DC impulse relay auxiliaries	2	A9C15424
Power supply	Power Supply 24 V DC	1	ABL8MEM24012
M580	Programmable logic controller	1	-

More about Acti9 Smartlink

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Lighting management for a hotel room

Monitor the presence for easier operation and savings

iRTC

Customer case

For the hotel manager, the need is to ensure customer comfort and to control the energy consumption.

The lighting and electrical equipment other than refrigerators must be switched off when there is no occupant in the room.

Benefits

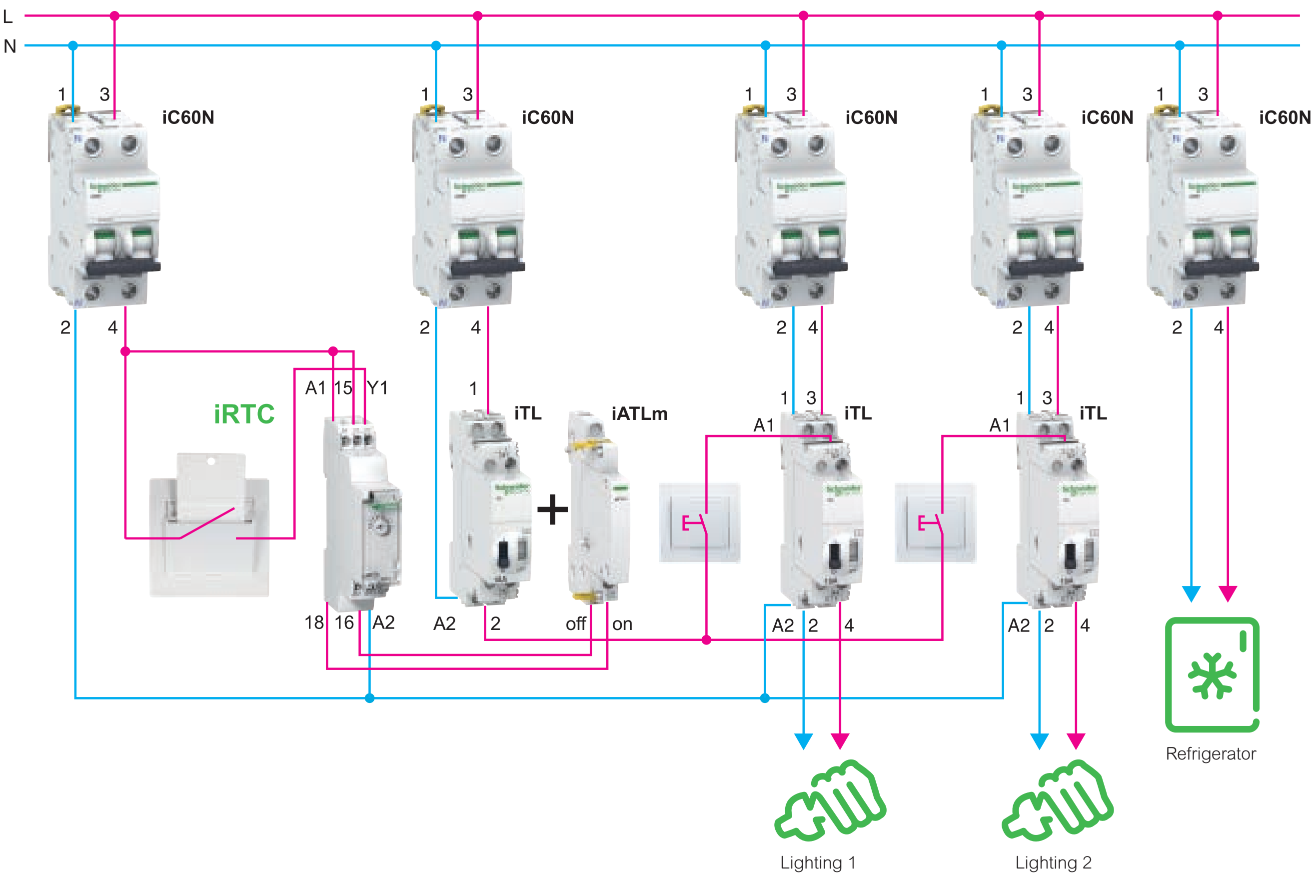
- Comfort: the electrical equipment is switched off automatically at the end of a time delay which begins when the keycard is removed from its slot. This offers the advantage of being able to cast a last glance in the room before leaving, or being able to retrieve a forgotten object.
- A simple, economical and trendy solution: automatic switching off of the room's non-priority circuits allows energy savings and contributes to the green image of the hotel.

Our recommendation

Using a keycard switch combined with an Acti9 iRTC time delay relay allows the non-indispensable electrical circuits to be switched off after a time delay when the customer leaves his room.
The Acti9 iTL 32 A impulse relay combined with the latched control function (iATLm) switches off all the room's various electrical circuits.

Solution

Diagram



Specifications

- The room's lighting and power sockets are activated when the keycard is detected. After removing the keycard, the deactivation takes place after a predetermined time delay.

Products used			
Product	Function	Quantity	Reference
Acti9 iC60N	MCB 1P+N	1	Depend on rating
Acti9 iC60N	MCB 1P+N	4	Depend on rating
Acti9 iRTC	Time delay relay	1	A9E16067
Acti9 iTL	32 A 1P impulse relay	2	A9C30831
Acti9 iTL	16 A 2P impulse relay	1	A9C30812
Acti9 iATLm	Impulse relay auxiliary for latched control	1	A9C15414

More about Acti9 iRTC

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Control the power of a hotel room with keycard

“Remote management & presence detection improve customer comfort”

Reflex iC60N

Customer case

A guest room is a private space that remains under the responsibility of the manager. Ensuring the security and comfort of the guest while optimizing profitability is the hotel manager’s main concern.
In order to limit electrical risks during periods when the room is unoccupied and to reduce electricity consumption, the requested system switch off all electrical circuits used by the customer (power outlet, lighting). Power will stay on for the other appliances which must be powered for comfort reasons (refrigerator, air conditioning).

Benefits

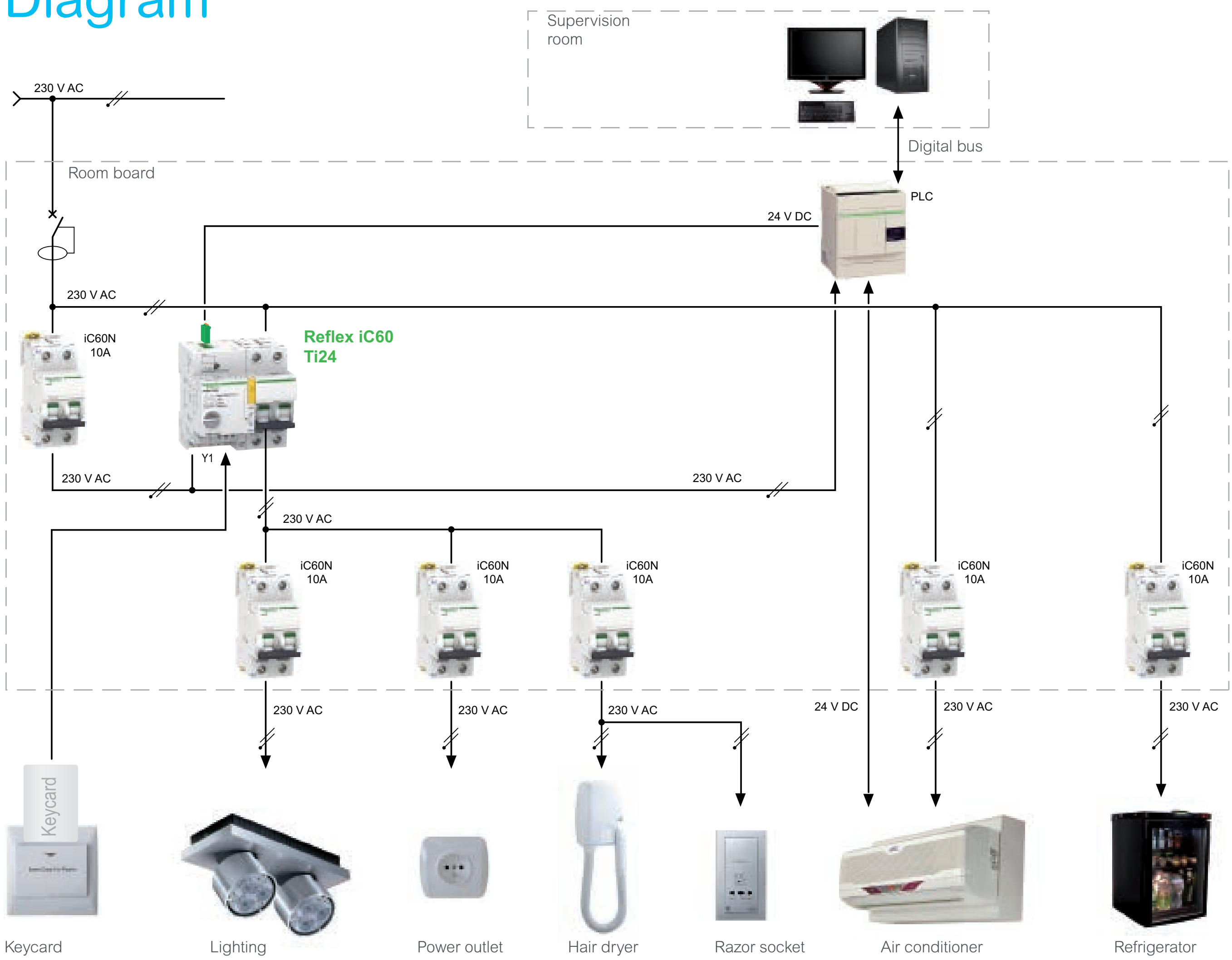
- **No unwanted temperature rise**, which allows installation in a false ceiling.
- Energy efficiency: no permanent consumption because the Reflex iC60 is a bistable product.
- **Efficiency:** no undesirable noise in steady-state conditions, unlike a contactor.
- **Simplicity:** the Ti24 interface provides a direct link between the control circuit and the room's PLC.

Our recommendation

The room's power supply is provided by a distribution board fastened horizontally in the false ceiling at the room entrance. This arrangement does not allow the use of a modular contactor.
A Reflex iC60 integrated-control circuit breaker can switch off the circuits power supply when the keycard is removed from its reader located at the entrance to the room.
Customer presence and electrical fault information is reported to the room's PLC without any additional interface. This information is then transmitted to the supervision room via a communication bus.

Solution

Diagram



Specifications

- The non-priority loads shall be powered via an integrated-control circuit breaker which shall be able to operate in all positions to allow installation in a false ceiling.
- The integrated-control circuit breaker shall be controlled by the presence of the keycard in its reader.
- The circuit breaker state (open/closed) shall be indicated at the PLC level.
- The solution shall generate no noise or unwanted temperature rise.

More about Reflex iC60N

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Products used			
Product	Function	Quantity	Reference
Acti9 iC60N 2P	MCB	6	Depend on rating
Acti9 Reflex iC60N	2P C-curve 25 A 230 V 50 Hz integrated-control circuit breaker with Ti24 interface	1	A9C62225

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Lighting management for an archive room

Manual or automatic control to ensure light shutdown

iATEt

Customer case

The customer requires assurance that the lighting will systematically switch off after a more or less long period of activity.

Staff must have the flexibility to switch off or extend the duration of the lighting from several control points.

Benefits

- Flexibility of use: the time delay can be set at up to 10 hours. Possibility of extinguishing the lighting at any time. No minimum duration of lighting.
- Ease of installation: the iCT and iATEt auxiliary combination does not require wiring as mechanical and electrical connection are done by clips.

Our recommendation

The use of an Acti9 iATEt timer combined with an Acti9 iCT contactor allows:
- setting of the lighting duration,
- extinguishing the lighting at any time (operation unauthorized on a timer),
- the possibility to restart a lighting cycle,
- moreover, the iCT contactor allows high-powered control.

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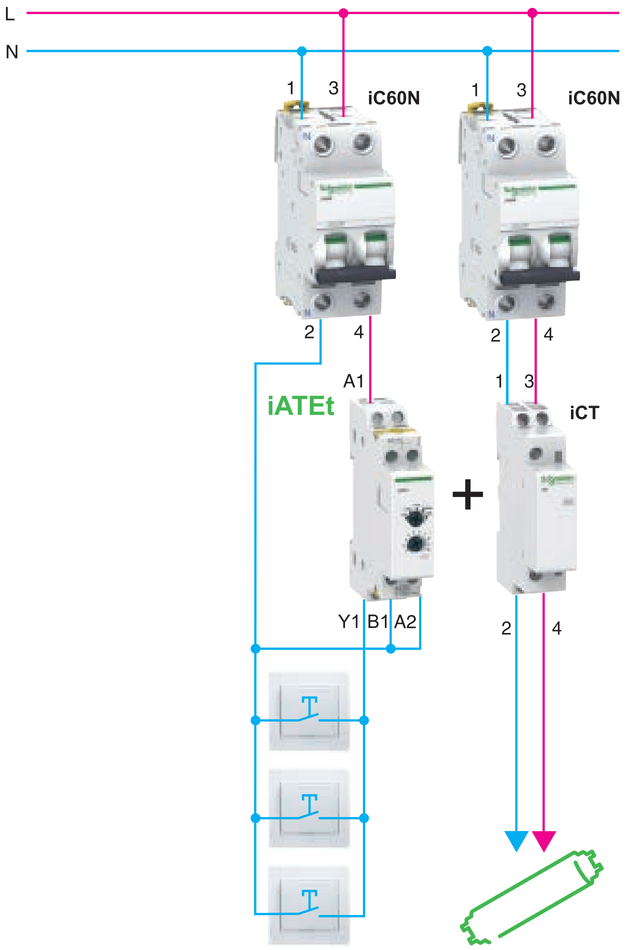
Solution

Diagram



Specifications

- The lighting is switched on manually from several push buttons and should switch off automatically after an adjustable time of maximum duration 10 hours.
- The time delay must be reset by each press on a push button, and the lighting can be extinguished at any time.

Products used			
Product	Function	Quantity	Reference
Acti9 iC60N	MCB 1P+N	1	Depend on rating
Acti9 iC60N	MCB 1P+N	1	Depend on rating
Acti9 iATEt	Multifunction time delay auxiliary	1	A9C15419
Acti9 iCT	25 A 2P contactor	1	A9C20736

More about Acti9 iATEt

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Lighting management in a stairway, a corridor or a lobby

MIN

Just enough lighting time!

Customer case

The building manager wants to achieve savings on energy expenses related to lighting, while maintaining customer comfort.

Benefits

- Energy savings: automatic management of the lighting period makes it possible to precisely optimize the “light ON” time without interfering with the user comfort.
- Easy operation: the maintenance personnel have access to permanent lighting by means of a selector switch on the front of the timer or can restart the time delay by simply pressing one of the lighting push buttons.

Our recommendation

The use of a MIN timer makes it possible to:
- adjust the lighting period very finely, from one or more control points,
- automatically extinguish the lighting,
- the timer settings if permanent lighting is required. override.

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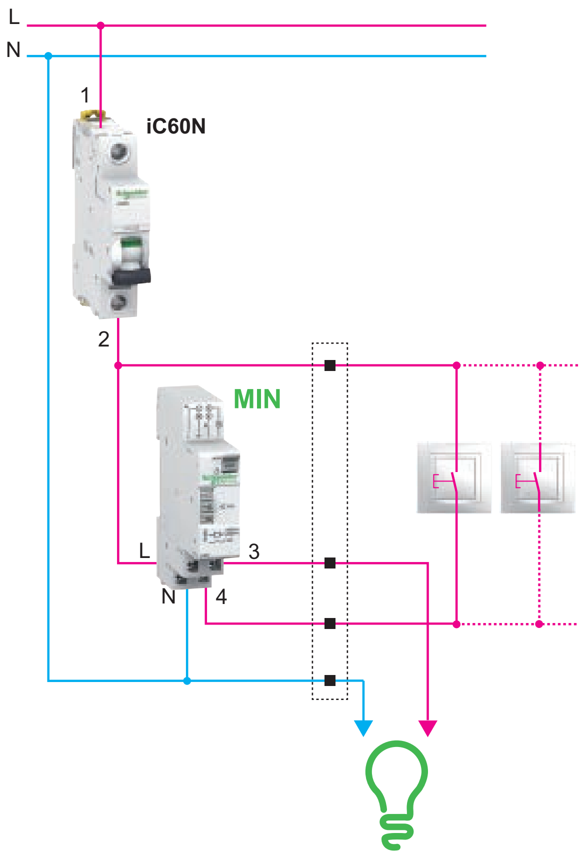
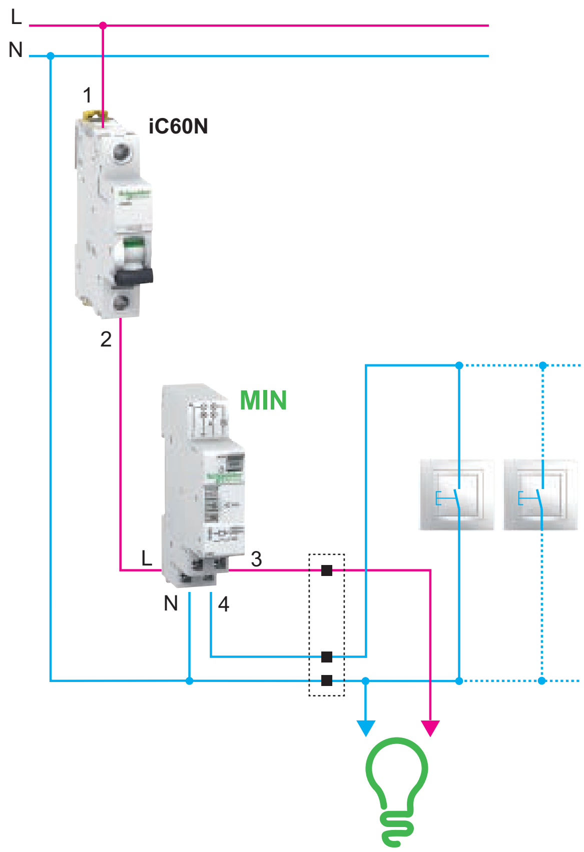
Solution

Diagram

Connection to 4-conductor riser pipe



Connection to 3-conductor riser pipe



Note: 3 or 4 wire connection to be selected using the lateral selector switch of MIN.

Specifications

- The solution should be compatible with existing 3 or 4 conductor installations without altering the installation, via a selector on the product.
- The solution should have an extinguishing time delay adjustable from 1 to 7 minutes, and be able to override the installation's settings to permanent lighting.
- A press on a control push button restarts the preset time delay.

Products used			
Product	Function	Quantity	Reference
Acti9 MIN	Electromechanical timer	1	15363
Acti9 iC60N	MCB 1P	1	Depend on rating

More about MIN

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Lighting management in a house basement

Just the light that is needed!

MINt

Customer case

The basement lighting must be controlled from several location and extinguished automatically in case someone forgets.

This lighting must also be able to be extinguished manually.

The installation must be able to have a long time delay for maintenance available from any local push buttons and a permanent lighting function for works.

Benefits

- Energy optimization: automatic switch off in case someone forgets
- Flexibility: the integral impulse relay function allows manual extinguishing of the lighting by pressing one of the installation's push buttons.
- Easier operation: two override control modes are available (permanent, long term), making it possible to cover the basement's various operating needs (cleaning, tidying, works, etc.).

Our recommendation

The use of a Acti9 MINt timer makes it possible to:
- set the lighting period to a minimum and have prior notice before extinguishing,
- switch off the lighting by pressing one of the push buttons (impulse relay function),
- have two lighting override control modes: either permanent by actuation on the front of the device, or for a period of one hour, by pressing one of the installation's push buttons for 2 seconds.

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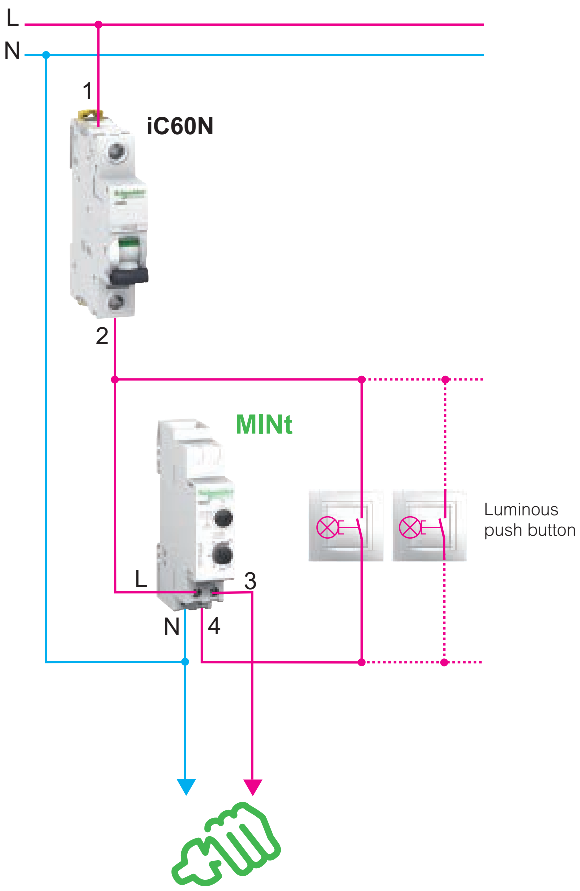
Solution

Diagram



Specifications

- The solution should have an extinguishing time delay setting of between 0.5 and 20 minutes, with prior notice of lighting extinguishing, and be able to override the installation's settings to permanent lighting.
- Switching off the lighting remains possible throughout the period of the time delay.
- Pressing a control push button for more than 2 seconds should start a fixed time delay of one hour; a second long press should allow extinguishing.

Products used			
Product	Function	Quantity	Reference
Acti9 MINt	Electronic timer with impulse relay function	1	CCT15234
Acti9 iC60N	MCB 1P	1	Depend on rating

More about MINt

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Optimize lighting in the common areas of a residential building

Lighting only for the duration needed

MINp

Customer case

In an existing installation equipped with a simple impulse relay, the association of co-owners wants to reduce the cost of lighting by preventing the lighting from being left constantly lit.

The building inhabitants agreed to automatically limit the lighting period but they would like to be notified of imminent extinguishing and press the button again if required.

The association of co-owners wants to be given remote access to a longer lighting time for a removal or for maintenance work without adding extra controls.

Our recommendation

The use of a Acti9 MINp timer makes it possible to:
- set the lighting period to a minimum in corridors, stairs, a lobby, etc. using a timer to switch on one or more lamps from one or more control points,
- warn, through flickering of the light, that the lighting will soon be extinguished,
- have two lighting override control modes, either permanent by actuation on the front of the device, or for a period of one hour, by pressing one of the installation's pushbuttons for 2 seconds.

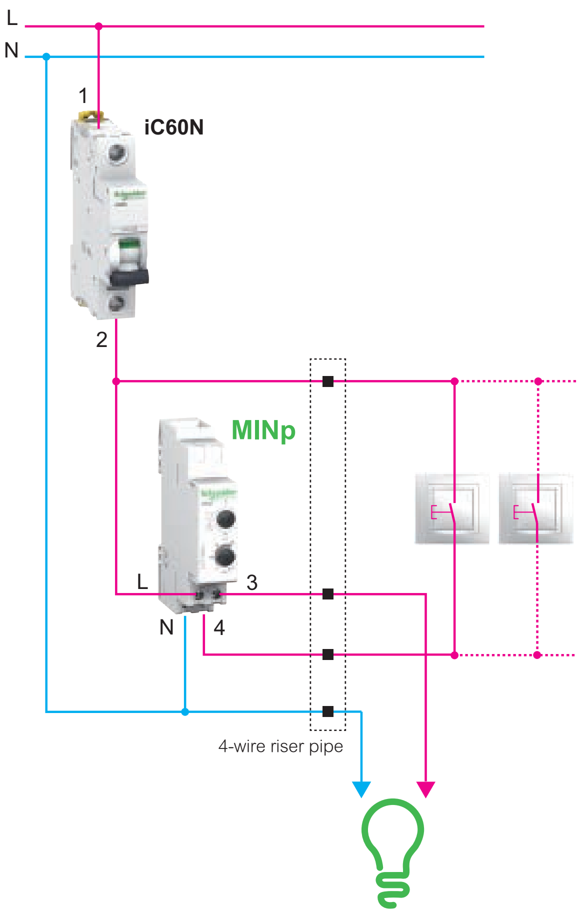
Benefits

- Energy optimization: automatic management of the lighting period optimize energy consumption.
- User comfort is improved by the warning function before light goes out (the warning consists of blinking the luminaires).
- Ease of installation: the MINp is compatible with cabling of the 3- or 4 conductor type without altering the installation.
- Easy operation: two override control modes are available (permanent, long-term). They can cover the various customary needs of the building entrance (cleaning, tidying, etc.).

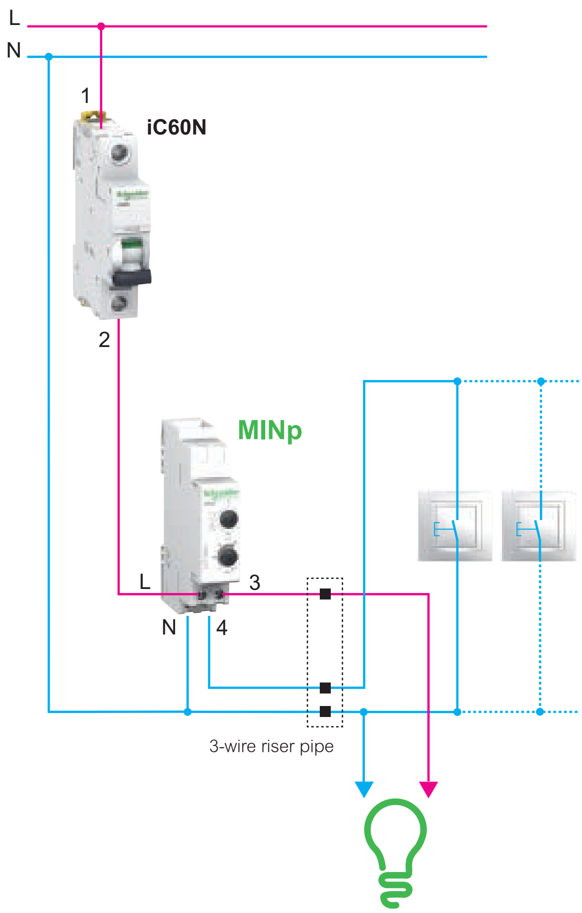
Solution

Diagram

Connection to 4-conductor riser pipe



Connection to 3-conductor riser pipe



Note: 3 or 4 wire connection to be selected using the lateral selector switch of MIN.

Specifications

- Be fully compatible with existing 3- or 4-conductor installations without altering the installation.
- Have an extinguishing time delay setting of between 0.5 and 20 minutes, with prior notice of lighting extinguishing, and be able to override the installation's settings to permanent lighting.
- Pressing a control push button for more than 2 s causes the start of a fixed time delay of one hour; a second long press allows extinguishing.

Products used			
Product	Function	Quantity	Reference
Acti9 MINp	Electronic timer with switch-off warning	1	CCT15233
Acti9 iC60N	MCB 1P	1	Depend on rating

More about MINp

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Schneider Electric Industries SAS
35, rue Joseph Monier - CS 30323
F92506 Rueil-Malmaison Cedex

Optimizing the lighting of open office spaces

Automatic switch-off for optimized consumption and local control for user comfort

Reflex iC60N

Customer case

The facility manager of an office building is aware that on average, over one-third of the total energy consumed in his facility is used for lighting. In this type of building, occupied mainly during the daytime, undeniable energy savings can be achieved by optimizing luminaire lighting times.

This installation can manage extinguishing of the lighting at the desired times, while allowing users to locally control the luminaires outside of the programmed period.

Benefits

- Energy efficiency: optimization of lighting times allows energy savings of up to 30%.
- Simplicity:
  - automated lighting management solution with local or remote indication of the status,
  - coordination between protection and control device calculated by Schneider Electric.
- Easy maintenance: padlocking possible without any additional accessory.
- Continuity of service: the Acti9 Reflex iC60 is a bistable actuator which does not change state in the event of a power outage.

Our recommendation

An Acti9 IHP time switch sends to the Acti9 Reflex iC60 integrated-control circuit breakers orders for extinguishing according to the building's operating requirements.
The Acti9 Reflex integrated-control circuit breakers are configured in mode 1 to allow local restarting of the lighting.
Lighting circuits are switched on and off by office users by means of ambience control push buttons located in each zone.

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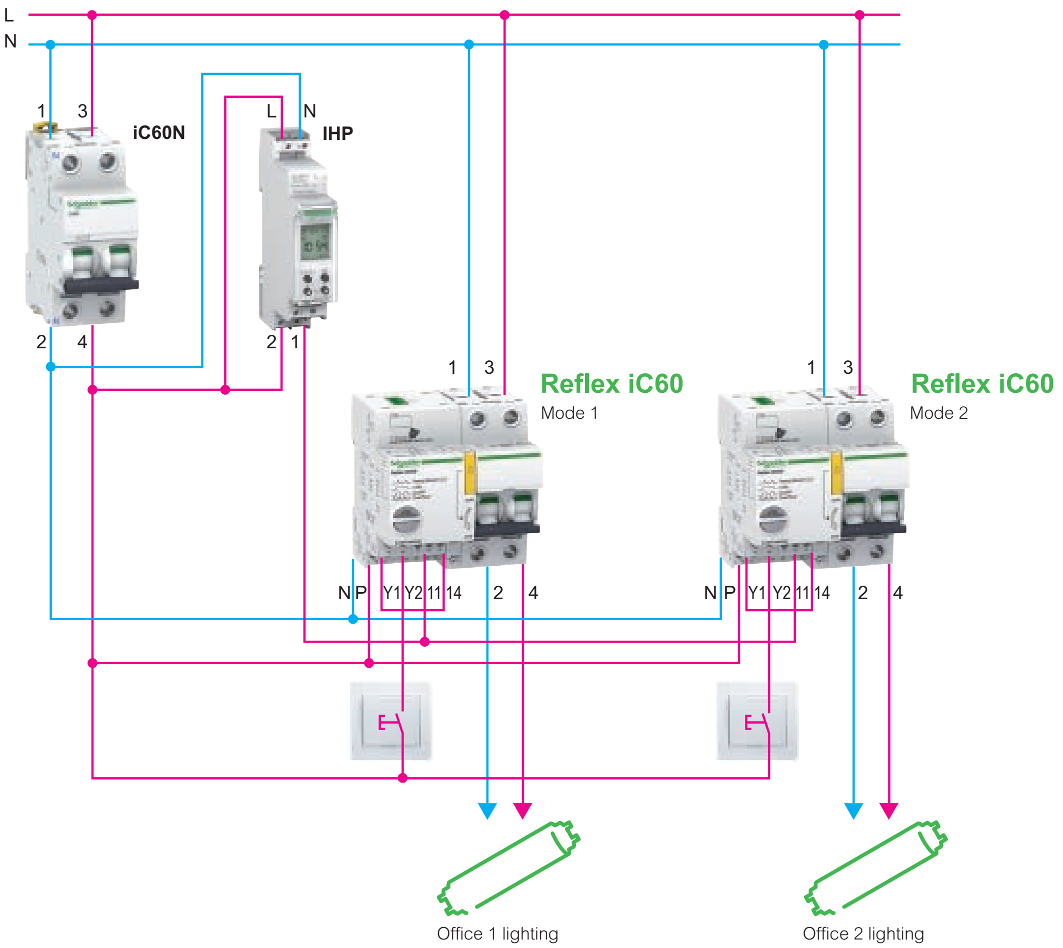
Solution

Diagram



Specifications

- The lighting loads must be powered via an integrated-control circuit breaker.
- Lighting circuits are switched on and off by the users of the premises by means of ambience control push buttons.
- Centrally controlled extinguishing of lighting circuits must be able to be programmed by means of a time switch.
- It must be possible for the occupants to restart the lighting outside of the programmed lighting times.

Products used			
Product	Function	Quantity	Reference
Acti9 Reflex iC60N	Integrated-control circuit breaker 1P+N	2	A9C62216
Acti9 iC60N	MCB 1P	1	Depend on rating
Acti9 IHP	Weekly programmable time switch	1	CCT15854

More about Reflex iC60N

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Schneider Electric Industries SAS
35, rue Joseph Monier - CS 30323
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Light management of a large office building

Control of energy consumption and easy reallocation

Customer case

The facility manager wants to automate the lighting of a large office building, while keeping the possibility of local control, energy consumption management and luminaire maintenance.

He also needs to adapt the lighting according to a timer program, the presence of people and the level of natural light based on several areas.

In addition, he wants to perform override control of lighting by area, and rapidly reallocate a work area.

Our recommendation

The choice to make is a KNX type Building Management System, connected to a "Canalis KBB" busbar trunking architecture with 1 or 2 electrical network, DALI-compatible, performing lighting management, measuring and monitoring.
KNX presence detectors located in each area maintain a constant luminosity level in the presence of employees, for optimal working conditions.
Override setting of the lighting for each area is performed by KNX switches, and fault information is sent by the ballasts via the DALI communication network.
In case of rearrangement, it is easy to allocate new monitoring points for an office or group of luminaires.

* DALI: Digital Addressable Lighting Interface.

Benefits

- Fast installation: Canalis busbar trunking, formed of prefabricated elements, can be installed rapidly and with protection. Connections require no tools and are designed to prevent any risk of incorrect connection.
- Flexibility: reallocation of the various offices is made easy.
- Simplified maintenance: no preventive maintenance campaign (renewal of the lamps according to their service life).
- Efficiency: simple lighting management and cost optimization scenarios.

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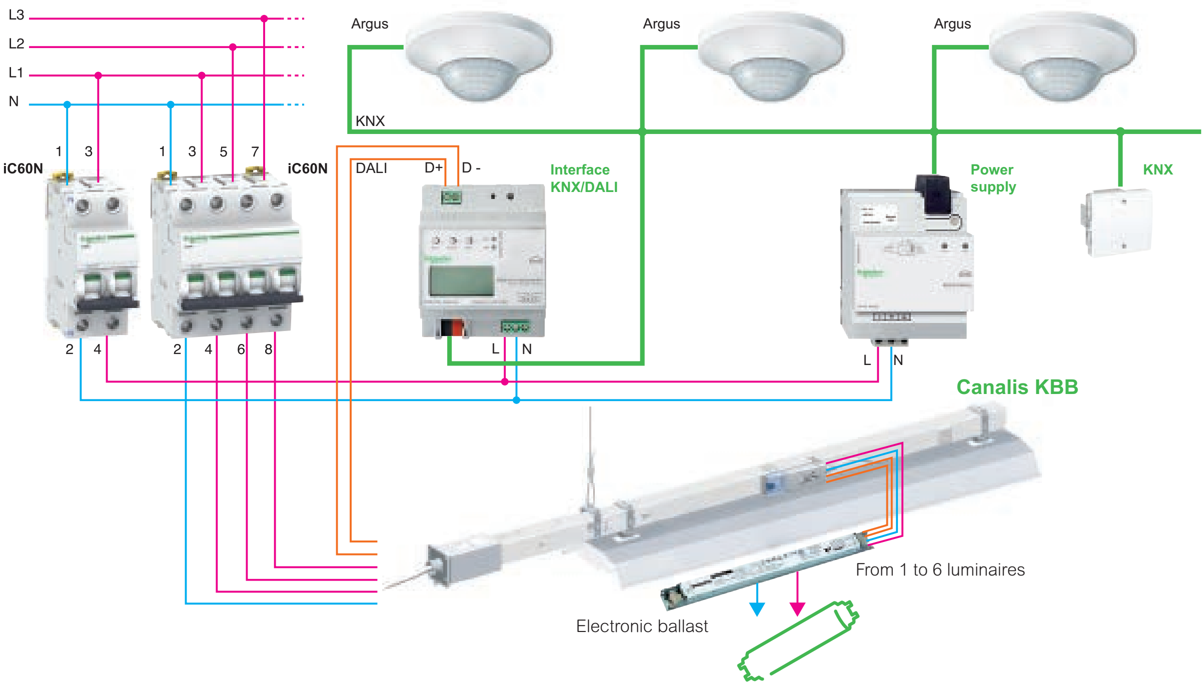
Solution

Diagram



Specifications

- The lighting management system has to be a decentralized distribution system incorporating a DALI communication bus connected to the Building Management System. It should perform control of the luminaires by area, and allow the creation of lighting scenarios according to the occupants' hours of presence and the extinguishing of unoccupied areas.
- The solution should be based on prefabricated elements with tap-offs, being completely scalable.
- The connections should be done without tools.

Products used			
Product	**Function**	**Quantity**	**Reference**
Canalis KBB	40 A straight element (with communication bus)	-	KBB40ED4303TW, KBB40ED44305TW
Canalis KBB	40 A power supply box	1	KBB40ABG4TW, KBB40ABG44TW
Canalis busbar trunking	Fasteners	-	KBA40ZFUW
Canalis busbar trunking	Tap-off connectors	-	KBC16DCB21 + KBC16ZT1
KNX Push Button	Push button	1	NU553018
KNX power supply	Power supply	1	MTN684064, MTN684032
KNX DALI-Gateway	Communication gateway	1	MTN6725-0001
KNX Argus	Presence detector	3	MTN630919
Acti9 iC60N	MCB 1P+N	1	Depend on rating
Acti9 iC60N	MCB 3P+N	1	Depend on rating

More about Canalis KBB

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Automating the lighting for an industrial workshop

Remote and manual control for better continuity of service and flexibility

Reflex iC60N

Customer case

The lighting of an industrial workshop is of prime importance to ensure the security of employees and good productivity at the workstations.

To optimize consumption, the workshop owner wants to automate the lighting time of the luminaire according to working hours.

But for protection reasons, employees must not be able to turn off the lights. However, it is necessary to allow local override switch on/off for maintenance operations (e.g. changing lamps or working at night in the workshop).

The workshop owner wants to be able to choose between automated or manual mode for the control of each lighting circuit.

Benefits

- Simplicity: no low voltage power interface between the Reflex and the Building Management System (BMS), lower cabling costs, up to 50% fewer connections, indications on the front of the product and remote indications, all in one product.
- Flexibility: possibility of manual override control.
- Padlocking possible without any additional accessory.
- Continuity of service: the Acti9 Reflex iC60 is a bistable actuator which does not change state in the event of a power outage.

Our recommendation

The lighting loads are powered by an integrated-control Acti9 Reflex iC60 protective device.
The Building Management System (BMS) sends switch-on and switch-off orders to the Reflex, according to the building's operating requirements.
The Acti9 Reflex integrated-control circuit breaker is configured in mode 3 in order to prevent local control by the workers, but also to allow local override of the BMS, while authorized by the facility supervisor. Also the light switch-on/off data and electrical faults are transmitted to the facility supervision room.

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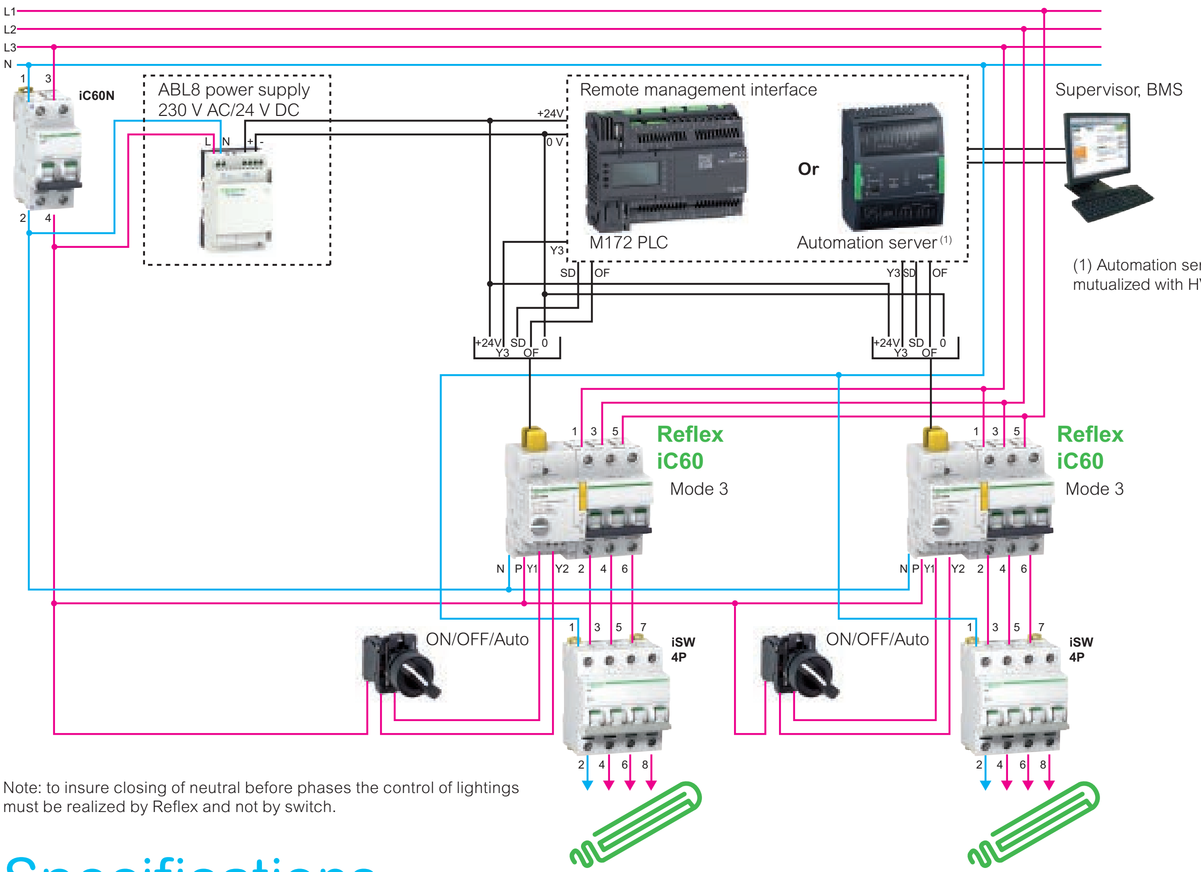
Solution

Diagram



(1) Automation server can be also mutualized with HVAC system

Note: to insure closing of neutral before phases the control of lightings must be realized by Reflex and not by switch.

Specifications

- The lighting loads must be powered via an integrated-control circuit breaker.
- ON/OFF control of lighting circuits must be supervised by a Power Logic Controller connected to a Building Management System.
- Manual override setting of the lighting to ON or OFF can be performed by a selector switch.
- The light switch-on/switch-off data and electrical faults are transmitted to the supervision system, without any additional low voltage power interfaces.

Products used

Product	Function	Quantity	Reference
Acti9 iC60N	MCB 1P+N	1	Depend on rating
Acti9 Reflex iC60N	3P C curve 25A integrated control circuit breaker with Ti24 interface (mode 3 setting)	2	A9C62325
Acti9 iSW	4P switch disconnector 40 A	2	A9S65440
Harmony K series	3-position selector switch, dia. 22 mm	2	
Modicon M172	PLC	1	TM172PDG42R
SmartX controller	Controller system	1	SXWASB24X10001
Phaseo ABL8	Power supply	1	ABL8MEM24012

More about Reflex iC60N

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Lighting for a humid room

Impulse remote centralized control
Improve energy efficiency & user comfort

iTL

Customer case

Be able to control lighting in a humid room, while ensuring personnel protection, taking into account sanitary requirements, the floor and wall cleaning operations performed each day.

Benefits

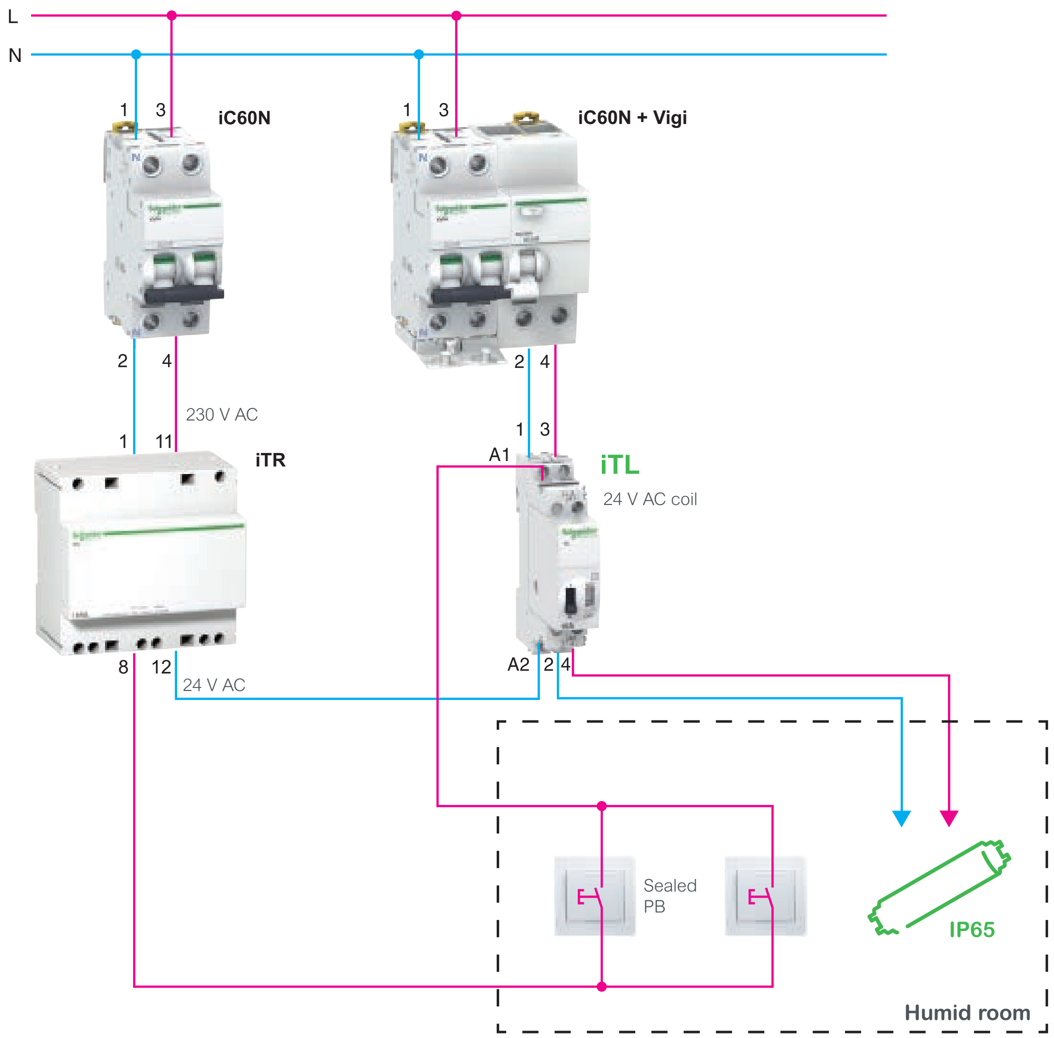
- **Ease of installation:** the control terminal connection capacity allows the use of cable of cross section up to 4 mm².
- **Protection:** the 4 kV isolation level between the coil and the power contacts can meet the requirements of a Safety Extra Low Voltage (SELV) installation according to IEC standard.

Our recommendation

The Acti9 iTL impulse relay with 24 V coil, together with a power supply via iTR safety transformer, ensures a level of isolation between the main voltage and the control voltage.
All guarantees must be taken (sealed push button, use of SELV, earth leakage protection) to ensure personnel safety and protect it from electrical hazards.

Solution

Diagram



Specifications

- The impulse relay must have a performance level in compliance with the regulatory requirements for a "Safety Extra Low Voltage" (SELV) electrical installation.

Products used			
Product	Function	Quantity	Reference
Acti9 iC60N	MCB 1P+N	1	Depend on rating
Acti9 iC60N + Vigi iC60	MCB 1P+N + 30 mA Vigi earth leakage protection module	1	Depend on rating
Acti9 iTL	16 A, 24 V AC 2P impulse relay		A9C30112
Acti9 iTR	16 VA, 12-24 V AC safety transformer		A9A15218

More about Acti9 iTL

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Emergency lighting in a public building: junior high school

"Emergency lighting unit"

Exiway Smartexit

Exiway Smartled

Customer case

The junior high school, as a public building, must have an emergency lighting system that complies with national regulations and allows the school to be evacuated even in the event of a power failure thanks to exit signs and anti-panic lighting.
The public utilities need to reduce the cost of maintenance by ensuring the availability of the emergency system in the event of a main failure.
A logbook with all the test results, status of emergency lighting luminaire and maintenance dates must be available to comply with regulation.
Emergency lighting devices must be integrated into the environment without compromising aesthetics.

Our recommendation

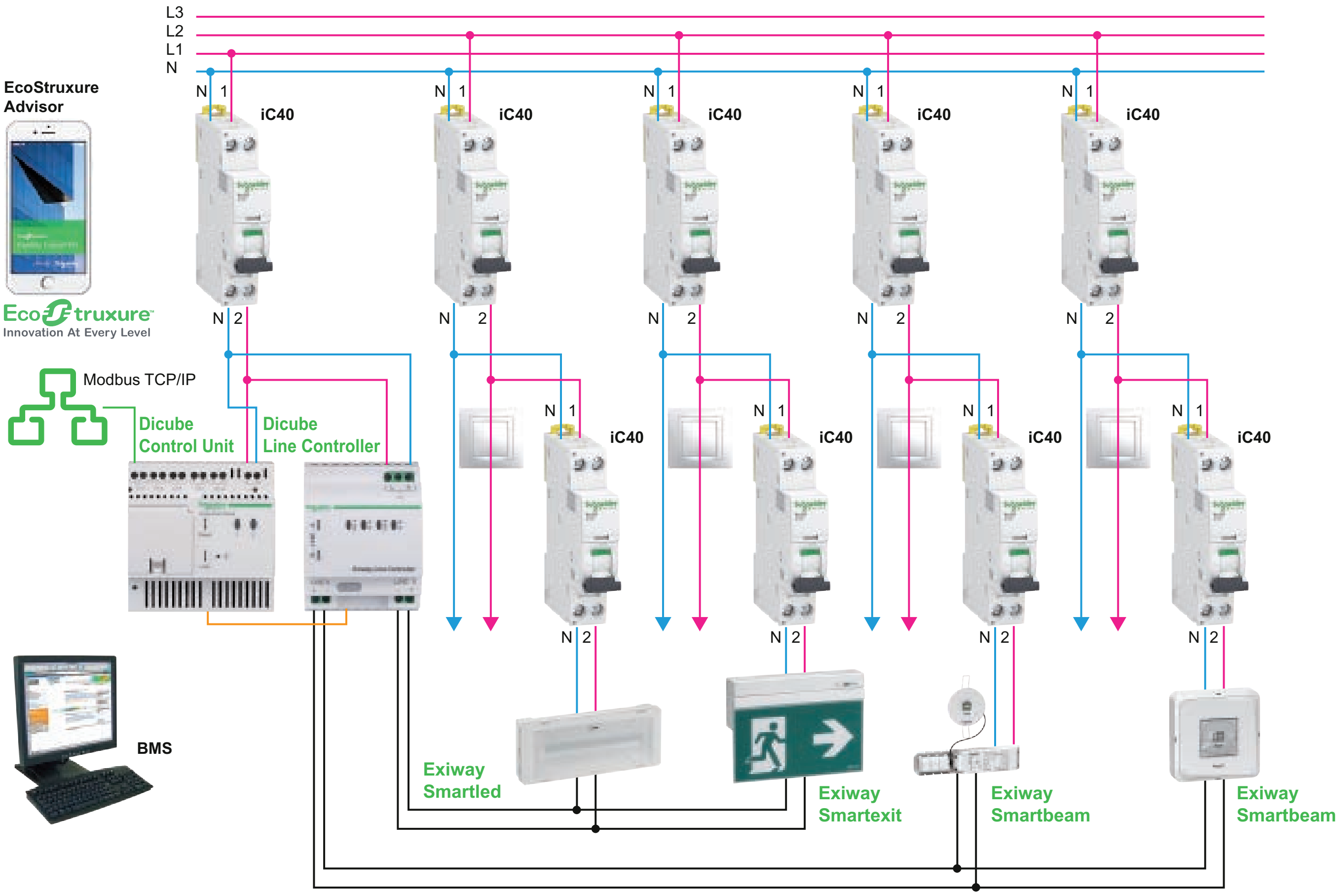
The use of anti-panic emergency lighting units and exit sign help reduce the risk of panic, making evacuation paths and obstacles visible, and allowing to follow and find easily the escape route.
Thanks to LED light source with an average lifetime of more than 100.000 hours and LiFePO4 batteries, our Emergency Lighting range can work maintenance free for more than 8 years as lifespan expectations.
The range includes auto test Emergency Lighting (able to test itself automatically). Addressable emergency lighting system can also create automatically the logbook of events.
With different aesthetical range proposal we can satisfy customer requirements with surface or flush mounted products for anti-panic and Exit sign purposes.

Benefits

- Easy, fast installation: the emergency lighting units are designed to simplify the work of the installer (numerous handling operations are performed without tools, numerous mounting possibilities, simplified markings, quick connectors, cable glands, accessories).
- Lower maintenance costs: provided with integral self-control, the emergency lighting units make periodical tests on the light source, the battery and the electronic module. The results are indicated by multicolored LEDs.
- Extended service life: the LED technology reduces power consumption and increases reliability and service life of the installation.

Solution

Diagram



Specifications

- The installation is made by antipanic emergency lighting and exit sign to indicate the escape route.
- Periodical tests, functional and duration, are automatically managed by the supervisioning system.
- The logbook of events must be created automatically registering test results and faults.

Products used			
Product	Function	Quantity	Reference
Acti9 iC40	MCB 1P+N	9	Depend on rating
Exiway Dicube	Control unit with controller module	2	OVA53167
Exiway Smartled	Emergency light fitting	1	OVA48301
Exiway Smartexit Dicube	Emergency exit sign - addressable	1	OVA48604
Exiway Smartbeam Activa	Emergency luminaire - flush	1	OVA48921
Exiway Smartbeam Activa	Emergency luminaire - surface	1	OVA48924

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Notes

Notes

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