Lighting circuits guide

Simple solutions for control and protection of lighting circuits
General Content

Energy efficiency challenge  p. 4

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Energy, what is in our future?

50% The required emissions reduction of GHG (Greenhouse Gas) to stabilise the greenhouse effect by 2050.

30% Possible savings with today’s technology which could reduce emissions or electrify the rest of the non-electrified world.
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 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.
- Increased resources, competition 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 pressure on reducing emissions and sustain the need for global climate change actions.
- 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 pollutants.”
Prepare and understand

30%
Energy savings in 2020 could avoid the construction of 1000 new power plants
Challenges

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 demand reduction

Buildings and Industry offer the largest and most accessible opportunities for savings.

Industry

- Over 30% of consumed energy
- Motors account for 60% of the electricity usage
- Average facility can reduce its energy consumption by 10 to 20%

Buildings

- Over 20% of consumed energy and goring (EU & US)
- 3 key areas: HVAC, lighting and integrated building solutions
- Technical projects can yield up to 30% of energy savings

Residential

- Over 20% of consumed energy (EU & US)
- Using energy efficient products may save 10% to 40% electricity

“ Schneider Electric has made this commitment and we can help you. ”
Enabling energy saving

30% Energy savings are feasible now with today’s technologies.
Challenges

Solutions which enable and sustain Energy efficiency

Our products and solutions are at every link in the energy chain enabling 10 to 30% or more in energy savings.

- Technology is crucial to achieving Energy efficiency. Energy smart innovations will continue to have 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 actions facilitate the ability initiate and to sustain all savings.

“ Schneider Electric enables customers to make a difference ”

Solutions & knowledge
- HVAC, ventilation, fan control, Lighting control & management
- Pump, compressor control, motor control & management
- Power management, critical power solutions
- Facility management, process optimisation
- Energy information services, audits & assessments
- Energy services...

Enabling technology
- Metering, monitoring & control, automation & sensors
- Drives & motor control, Lighting control systems
- Building automation systems, electrical distribution
- Power Factor Correction, power filtering
- Uninterruptible Power Systems
- SCADA, information systems
- Management tools...

Help customers make the right decisions to manage energy.
Provide information which evokes confidence in decision making.
Technology and solutions to enable sustainable savings.
Lighting accounts for a considerable proportion of electricity consumption, whatever the field of activity:

- **Industry**: 10%
- **Residential**: 40%
- **Tertiary**: 25% to 50%
- **Public lighting**: 100%

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

Project specifications and financial constraints
- page 13

The lighting design depends on:
- the application
- the initial investment
- operation and maintenance

Lamps
- pages 14 to 17
- General characteristics
- Electrical constraints

Energy savings and user comfort

Switching capacity

Continuity of service

Management
- page 36
Choice of devices for energy savings and improved comfort.

Control
- page 26
- Impulse relay or modular contactor
- Reflex ic60
- RCA

Wiring diagram

Electrical distribution
- page 18
- Cable cross-section dimensioning factors
- Canalis type

Fast dimensioning
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Protection
- page 20
- Circuit breaker for the protection of electrical conductors, control devices and loads
- Earth leakage protection function for the complementary protection of people and goods

Auxiliaries
- page 34
Choice of auxiliaries or control devices with built-in auxiliary.

Emergency lighting
- page 37

Fast dimensioning
- pages 22 to 25

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

**Illumination level and quality**

- **Lamp power output**
  Varies according to the chosen technology and is influenced by the colour 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 $1/d^2$.

- **Light fitting**
  The shape and efficiency of the reflector create a more or less focused light beam. Eg. a spot lamp has a small angle which generates a stronger but more localised 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 distribution, the control and protection devices and the associated lighting components (transformer, ballasts, possible reactive compensation, etc.).

- **Cost of the lamps**
  The cost varies according to the technology chosen. Generally, lamps with high lighting efficiency and long-life lamps are expensive and conversely.

- **Cost of the light fittings**
  The light fitting 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 input power, type and number of lamps used;
  - optimisation of lighting 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 continuity of service required and exploitation environment (traffic, crowded and opening hours, etc.).
### The various types of lamp
#### General characteristics

<table>
<thead>
<tr>
<th>Types of lamp</th>
<th>Incandescent lamps</th>
<th>Fluorescent lamps</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Basic lamps</td>
<td>Compact fluorescent lamps</td>
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<tr>
<td></td>
<td>LV halogen lamps</td>
<td>Fluorescent tubes</td>
</tr>
<tr>
<td></td>
<td>ELV halogen lamps</td>
<td></td>
</tr>
</tbody>
</table>

### Associated component
- Required for operation
  - Electromagnetic or electronic transformer
  - Integral or external electronic ballast (same as for fluorescent tube)
  - Ferromagnetic ballast + starter + optional 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 to 26 W)
    - 850 to 3500 lm (14 to 58 W)
- **Lighting efficiency (Lm/W)***
  - 5 to 15
  - 12 to 25
  - 45 to 90

### Lighting spectrum
- It determines the quality of the light (the fuller the spectrum, the closer it is to sunlight)

### Colour rendering
- **Incandescent lamps**: ★★★★★
- **Fluorescent lamps**: ★ or ★★★ according to the price and type of lamp

### Ambiences
- **Incandescent lamps**: Warm
- **Fluorescent lamps**: Variable from cold to rather warm

### Installation
- **Height**
  - 2 to 3 m
  - Average: 2 to 3 m
  - 3 to 12 m

### Number of switching operations (On/Off)
- **Incandescent lamps**: ★★★★ (high)
- **Fluorescent lamps**: ★ (several times each hour)

### Ignition time
- **Incandescent lamps**: Instantaneous
- **Fluorescent lamps**: 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
  - Humid locations: bathroom, swimming pool
- **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 $ or ferromagnetic: 7 to 20 $
  - Electronic ballast: from 15 to 200 $
  - Ferromagnetic ballast: from 7 to 20 $
  - + starter: from 0.5 to 15 $

### The light fitting
- **Price range**
  - 10 to 30 $
  - 15 to 50 $

### 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
  - 1.7 kWh

### Analysis
- **Strengths ★**
  - 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
- **Weaknesses ★**
  - Low operating cost: little maintenance
  - Energy savings
  - Does not withstand frequent switching
  - Single-tube versions with magnetic ballast and bottom-of-the-range compact lamps generate visible flicker
  - Useful replacement for basic incandescent lamps
  - Requires numerous lights, dimensions
  - Unattractive basic version

### Notes
- Declining technology. As part of their energy saving programmes, some countries (Australia, California, Canada, Cuba, UK, 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.
### LEDs lamps

<table>
<thead>
<tr>
<th>High-intensity discharge lamps</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="Image" alt="Light-emitting diode lamps and tubes" /></td>
</tr>
</tbody>
</table>

| Electronic driver (integrated or non-integrated) | Ferromagnetic ballast without igniter | Ferromagnetic ballast + igniter + optional capacitor or electronic ballast for lamp up to 150 W |

| Low-power LED network or power LEDs (1 to 3 Watts) | 3200 to 10,000 lm (80 to 250 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) |

| 50 to 120 (constantly improving) | 30 to 65 | 110 to 200 | 40 to 140 | 70 to 120 |

| Lighting spectrum defined by the manufacture |

| Numerous colour rendering and ambience possibilities | ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ | ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ | ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ | ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ |

| Many different scenarios | > 3m | > 3m | > 3m |

| At a height or on the ground |

| Instantaneous | Several minutes to reach the nominal illumination level. |

| Already in the standards: | Industry, warehouses | For white sodium only; shopping centres, warehouses, showrooms | Shopping centres, showrooms, gyms, castles |

| Road lights, traffic signs, routing | Electronic ballast: from 80 to 400 $ |

| Battery-operated handheld or isolated lighting | Ferromagnetic ballast + starter: from 15 to 100 $ |

| Substitution solution under development: most conventional lamps (incandescent, halogen, fluorescent tubes, high-intensity discharge lamps) | Ferromagnetic ballast: from 20 to 200 $ (high power: from 80 to 600 $) |

| Public lighting | Public lighting |

| Docks | Tunnels, motorways |

| Safety lighting | Runway lighting |

| Public lighting | Public lighting |

| Roads, monuments | Tunnels, airports, docks, car parks, parks |

| Tunnels, airports, docks, car parks, parks | Public lighting |

| Pedestrian streets, stadiums | Safety lighting |

| Worksite lighting | Airports |

| Airports |

| 10 to 20 $ for incandescent lamp replacement lamps | 8 to 30 $ (80 to 250 W) | 40 to 150 $ (26 to 135 W) | 20 to 90 $ (70 to 250 W) | 30 to 150 $ (70 to 400 W) |

| 200 $ (1000 W) | 170 $ (180 W) | 290 $ (1 000 W) | 500 to 1000 $ (2 000 W) |

| Electronic driver, if external: 15 to 200 $ | Electronic ballast: from 80 to 400 $ |

| Ferromagnetic ballast: from 20 to 200 $ (high power: from 80 to 600 $) + starter: from 15 to 100 $ |

| 10 to 200 $ |

| > 50,000 h | 8,000 to 20,000 h | 12,000 to 24,000 h | 10,000 to 22,000 h | 5,000 to 20,000 h |

| Independent of the switching frequency | The quality of the driver influences the overall service life |

| 50% longer with external electronic ballasts by comparison with ferromagnetic ballasts |

| 1 kWh | 2.5 kWh | 0.7 kWh | 1 kWh | 1 kWh |

| ★ Very long service life of the LED | ★ Low operating cost: little maintenance |

| ★ Insensitive to impacts and vibrations | ★ Energy savings |

| ★ Unlimited number of switching operations | ★ Very powerful lighting |

| ★ Instant ignition | ★ High investment cost |

| ★ No ultraviolet emissions | ★ Long or very long ignition time (2 to 10 minutes) |

| ★ Dimensions of the driver and heat sink for power LEDs | ★ Operate down to -25°C emitting very little heat |

| ★ Generation of significant harmonics of the 3rd and 7th orders |

| Technology seeing significant expansion: increased performance fall in prices | Becoming obsolete: replaced with high-pressure sodium vapour or metal iodide lamps |

| Becoming obsolete | Most frequently used technology for outdoor public lighting |

| The trend is to use them as a useful replacement for high-pressure sodium vapour lamps |
## The various types of lamp

Impacts of selected lamps on the choice of components

<table>
<thead>
<tr>
<th>Lamp selected</th>
<th>Induced electrical constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current profile of a lamp in its various phases over time</strong></td>
<td><strong>Start of life</strong></td>
</tr>
<tr>
<td><strong>Power up</strong></td>
<td><strong>Preheating</strong></td>
</tr>
<tr>
<td></td>
<td>0.3 to 100 ms</td>
</tr>
<tr>
<td><strong>Inrush current at power up</strong></td>
<td><strong>Preheating current</strong></td>
</tr>
<tr>
<td>Very low resistance of the filament when cold</td>
<td>All discharge lamps (fluorescent and high intensity) require a phase of gas ionisation before ignition which results in over-consumption</td>
</tr>
<tr>
<td>Initial saturation of ferromagnetic</td>
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<tr>
<td>Initial charging of circuit capacitors</td>
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<td></td>
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<tr>
<td><strong>Incandescent lamps</strong></td>
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<td></td>
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<tr>
<td>Basic and LV halogen</td>
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<tr>
<td>ELV halogen lamps + ferromagnetic transformer</td>
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<tr>
<td>ELV halogen lamps + electronic transformer</td>
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<tr>
<td><strong>Fluorescent lamps with</strong></td>
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<td></td>
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<tr>
<td>Non-compensated ferromagnetic balast</td>
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<tr>
<td>Compensated ferromagnetic balast</td>
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<tr>
<td>Electronic balast</td>
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<tr>
<td><strong>LEDs lamps</strong></td>
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<td></td>
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<tr>
<td>Drivers for LED lighting</td>
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<tr>
<td><strong>High-intensity discharge lamps with</strong></td>
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<td>Compensated ferromagnetic balast</td>
<td></td>
</tr>
<tr>
<td>Electronic balast</td>
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</tbody>
</table>

(1) LED lamps: the disturbance levels (current peaks at power up, harmonics) are highly variable from one manufacturer to another and from one type of LED lamp to another.
<table>
<thead>
<tr>
<th>Electrical connection</th>
<th>Circuit breaker</th>
<th>Earth leakage protection function</th>
<th>Control device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power factor</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- Power consumed (W)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>- Apparent power (VA)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- Harmonic leakage currents</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- Series compensation</td>
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<td></td>
<td></td>
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<tr>
<td>- Parallel compensation</td>
<td></td>
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</tr>
</tbody>
</table>

**Recommandation to be taken according to type of lamp**

### Electrical connection
- **Power factor**
  - Power consumed (W)/
  - Apparent power (VA),
  - < 1 in the presence of non-compensated reactive circuits (dominant inductance or capacitance)
  - Determines the nominal current of the circuit according to the lamps’ power output and losses.

### Circuit breaker
- The circuit breaker rating should be dimensioned to protect the conductors without tripping:
  - At power up:
  - During the lamp preheating and end-of-life phases.
  - The choice of its tripping curve and the number of downstream lamps can optimise continuity of service.

### Earth leakage protection function
- 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

### Control device
- 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.

### Selection guide
- The choice of product depends on:
  - The load type and power
  - The number of operations per day
  - The control application (push-button, PLC, etc.)

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<table>
<thead>
<tr>
<th>Power factor</th>
<th>Risk of conductor overheating</th>
<th>Risk of nuisance tripping</th>
<th>Risk of overload</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>★ During the nominal service life. At end of life</td>
<td>★ Harmonic leakage currents</td>
<td>★</td>
</tr>
<tr>
<td>Close to 1 at full load</td>
<td>★ Harmonic leakage currents</td>
<td>★ High-frequency leakage currents generated by the electronic circuits</td>
<td>★</td>
</tr>
<tr>
<td>&gt; 0.92</td>
<td>★ Harmonic leakage currents</td>
<td>★ Series compensation</td>
<td>★</td>
</tr>
<tr>
<td>0.5</td>
<td>★ Harmonic leakage currents</td>
<td>★ Series compensation: Parallel compensation</td>
<td>★</td>
</tr>
<tr>
<td>&gt; 0.92</td>
<td>★ High-frequency leakage currents generated by the electronic circuits</td>
<td>★ Parallel compensation</td>
<td>★</td>
</tr>
<tr>
<td>&gt; 0.92 with external ballast 0.5 with integral ballast</td>
<td>★ Harmonics of the 3rd and 7th orders</td>
<td>★ High-frequency leakage currents generated by the electronic circuits</td>
<td>★</td>
</tr>
<tr>
<td>&gt; 0.92</td>
<td>★ Harmonic leakage currents</td>
<td>★ Harmonic leakage currents</td>
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<td>★ High-frequency leakage currents generated by the electronic circuits</td>
<td>★ Harmonic leakage currents</td>
<td>★</td>
</tr>
</tbody>
</table>

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**Notes:**
- ★: low
- ☆: medium
- ★★: high
- ★★★: recommendation
**Electrical distribution selection**

**Cable and prefabricated busbar trunking selection principles**

**Power distribution**
- The electrical conductors have to transport energy from the electrical switchboard to the lighting loads.
- They can be cables or prefabricated busbar trunking.
- Where large areas have to be lit, they comprise a main circuit and branch circuits to the light fittings.
- 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

**Nominal current of circuits**
- The total circuit power must be analysed 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 sizing electrical distribution, one should allow for the fact that the lamps consume 1.5 to 2 times their nominal current.
- at end of life for all lamps
- during the long preheating phase for high-intensity discharge lamps

**Length of electrical distribution**
- The cable resistance induces 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.

**Cable cross-section dimensioning factors**

**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 admissible voltage drop (>U) in steady state:
    - 3% for circuits less than 100 m
    - 3.5% permissible above 200 m
  - Cable cross-section:
    - most commonly (< 20 m): 1.5 or 2.5 mm²
    - very long (> 50 m) high-power circuit, to limit voltage drops: 4 to 6 mm², or even 10 mm² (> 100 m)
Canalis prefabricated busbar trunking

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

Advantages in every stage in the life of a building

**Design**
- Simplified electrical circuit diagram.
- Direct choice of model, depending on the type and number of lamps
- Direct correspondence between the circuit breaker rating and that of the trunking (example at 35°C; KDP 20 A -> 20 A circuit breaker)
- Guaranteed performance irrespective of the installation (in accordance with the IEC 60439-2 standard)
- Suitable for all environments: IP 55 as standard, in conformity with sprinkler tests
- Protects the environment: RoHS

**Implementation**
- No halogen: releases no toxic fumes in case of fire.
- Ease of installation: no risk of wiring error.
- Can be installed by unskilled personnel (connection by connectors, polarising, 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.

<table>
<thead>
<tr>
<th>Type of electrical distribution</th>
<th>Cables</th>
<th>Canalis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria to be taken into account for selection</td>
<td>Installation procedure (generating possible overheating)</td>
<td>■</td>
</tr>
<tr>
<td></td>
<td>Mutual interference in the case of adjacent circuits</td>
<td>■</td>
</tr>
<tr>
<td></td>
<td>Ambient temperature</td>
<td>■</td>
</tr>
<tr>
<td></td>
<td>Type of electric insulating material</td>
<td>■</td>
</tr>
<tr>
<td></td>
<td>Loaded neutral correction factor (three-phase circuit with high harmonic distortion factor)</td>
<td>■</td>
</tr>
<tr>
<td></td>
<td>Conductive material</td>
<td>■</td>
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<tr>
<td></td>
<td>Length of electrical distribution</td>
<td>■</td>
</tr>
<tr>
<td></td>
<td>Nominal current of circuits</td>
<td>■</td>
</tr>
<tr>
<td></td>
<td>Use for Halogen free material</td>
<td>■</td>
</tr>
</tbody>
</table>

Canalis: Fast dimensioning
- Page 24
- Optimised calculation
- CanBrass software

Canalis prefabricated busbar trunking

<table>
<thead>
<tr>
<th>Installation Type</th>
<th>Flexible</th>
<th>Rigid</th>
<th>Very rigid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation procedure</td>
<td>■ Installed in a suspended ceiling or false floor</td>
<td>■ Suspended (installation spacing up to 3 m)</td>
<td>■ Suspended (installation spacing up to 5 m)</td>
</tr>
<tr>
<td>Light fitting attachment to the trunking</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Prewired light fitting offering</td>
<td>-</td>
<td>Canalis KBL</td>
<td>Canalis KBL</td>
</tr>
<tr>
<td>Power circuits Type</td>
<td>Quantity 1</td>
<td>1</td>
<td>1 or 2</td>
</tr>
<tr>
<td>Single-phase: 2 conductors + PE</td>
<td>Three-phase</td>
<td>Single-phase</td>
<td>Three-phase</td>
</tr>
<tr>
<td>Three-phase: 4 conductors + PE</td>
<td>Three-phase</td>
<td>Single-phase</td>
<td>Three-phase</td>
</tr>
<tr>
<td>Lighting control circuit (0-10 V, Dali)</td>
<td>-</td>
<td>Optional</td>
<td>Optional</td>
</tr>
<tr>
<td>Rating</td>
<td>20 A</td>
<td>25 or 40 A</td>
<td>25 or 40 A</td>
</tr>
<tr>
<td>Tap-off spacing</td>
<td>1.2 - 1.35 - 1.5 - 2.4 - 2.7 - 3 m</td>
<td>No tap-off or 0.5 - 1 - 1.5 m</td>
<td>No tap-off or 0.5 - 1 - 1.5 m</td>
</tr>
</tbody>
</table>
Protection selection
Circuit breaker selection principles

Circuit breakers
- Protective devices 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 protective devices must be optimised to provide absolute protection while ensuring continuity of service.
- Although the protective devices are sometimes used as lighting circuit control units, it is recommended to install:
  - separate control devices (switch, contactor, impulse relay page 26).
  - or an integrated control circuit breaker designed for lighting applications (Reflex iC60 page 27) which withstands a larger number of switching operations.

Protection of electrical distribution against short-circuits and overloads

Protection of loads against overloads

Protection of control devices

Choice of breaking capacity
- The breaking capacity must be greater than or equal to the prospective short-circuit current upstream of the circuit breaker.
- 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 conductors:
  - 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.
- Generally, the rating should be greater than the nominal current of the circuits. However, in the case of lighting circuits, to ensure excellent continuity of service, it is recommended that this rating be approximately twice the rated current of the circuit (see the paragraph opposite) 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 (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 according to habits.
- However, to prevent nuisance tripping, it may be advisable to choose a less sensitive curve (e.g. go from B to C).

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 preheating phase.

Continuity of service

Safety measures to guard against nuisance tripping
- Nuisance tripping can be generated by:
  - the inrush current at circuit closure.
  - the overload current during the lamp preheating 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 curve B to curve C or from curve C to curve D (2).
- Reduce the number of lamps per circuit.
- Start up the circuits successively, using time delay auxiliaries on the control relays (see page 34 and example on page 35).

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

Reflex iC60

The Reflex iC60 (see page 34) devices 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).

Usual values
- Circuit breaker rating: value equal to twice the rated current of the circuit (6, 10, 13, 16 or 20 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. The neutral cable must be sized to prevent it from overheating. However, the current flowing through the neutral cable may be greater than the current in each phase and can 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 an earth leakage protection device to protect human life.
Earth leakage protection devices

- 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 optimised to provide absolute protection while ensuring continuity of service.
- The implementation of earth leakage protection on lighting circuits varies according to standards, neutral system and installation habits.

 Protection selection

**Earth leakage protection device selection principles**

**Protection selection**

Earth leakage protection devices

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

Choice of sensitivity

- 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 preheating 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 residual current circuit breaker) should always be greater than or equal to the rating of the upstream circuit breaker.

Continuity of service

Safety measures to guard against nuisance tripping

**Choice of time delay**

**Discrimination**

- For a two-level earth leakage protection system, the following are recommended:
  - upstream time-delayed earth leakage protection device with sensitivity greater than or equal to three times the downstream protection device (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 to 50/60 Hz.
- Green curve: the "Si" “Super immune” protections are less sensitive to high-frequency disturbances, whilst at the same time ensuring personal safety.

Tripping curve of a 30 mA earth leakage protection function

![Tripping Curve Diagram]
Electrical distribution and protection fast dimensioning
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 supply line for a voltage drop less than 3% at the lamps, whatever the installation method and insulating material used for the conductors,
- the circuit breaker rating for protection and continuity of service with a safety margin, whatever the type of lamps.

**230 V AC single-phase copper cable**

<table>
<thead>
<tr>
<th>Infrequently used</th>
<th>Recommended</th>
<th>Acceptable</th>
<th>Not recommended/high inrush currents</th>
<th>Risk of overheating/overloading the cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example described at the bottom of the page</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Cos ϕ</th>
<th>Multiplier coefficient to be applied for</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.85</td>
<td>0.895</td>
</tr>
<tr>
<td>0.5</td>
<td>0.526</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Lighting power (kW) including any ballast losses</th>
<th>Rated current (A)</th>
<th>Maximum cable length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>1</td>
<td>294 489 783</td>
</tr>
<tr>
<td>0.4</td>
<td>2</td>
<td>147 245 391 587</td>
</tr>
<tr>
<td>0.7</td>
<td>3</td>
<td>98 163 261 391 652</td>
</tr>
<tr>
<td>1.3</td>
<td>6</td>
<td>49 82 130 196 326 522</td>
</tr>
<tr>
<td>2.2</td>
<td>10</td>
<td>29 49 78 117 196 313 489</td>
</tr>
<tr>
<td>3.5</td>
<td>16</td>
<td>18 31 49 73 122 196 306</td>
</tr>
<tr>
<td>4.4</td>
<td>20</td>
<td>24 39 59 98 157 245</td>
</tr>
<tr>
<td>5.5</td>
<td>25</td>
<td>24 31 47 78 125 196</td>
</tr>
<tr>
<td>7.0</td>
<td>32</td>
<td>24 37 61 98 153</td>
</tr>
<tr>
<td>8.7</td>
<td>40</td>
<td>29 49 78 122</td>
</tr>
<tr>
<td>10.9</td>
<td>50</td>
<td>39 63 98</td>
</tr>
<tr>
<td>13.8</td>
<td>63</td>
<td>50 78</td>
</tr>
</tbody>
</table>

**Cable**

<table>
<thead>
<tr>
<th>Cross-section of each conductor (mm²)</th>
<th>1.5</th>
<th>2.5</th>
<th>4</th>
<th>6</th>
<th>10</th>
<th>16</th>
<th>25</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Circuit breaker Rating (A)</th>
<th>Recommended</th>
<th>Twice the rated current of the lighting circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 x 6 A = 13 or 16 A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maximum (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable with PVC insulation</td>
</tr>
<tr>
<td>Other insulating material more efficient at high temperature</td>
</tr>
</tbody>
</table>

**Example of an open-plan office**

**Characteristics of the installation**
- 30 light fittings 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 rated 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 lamp distance: 60 m the next highest value in the table, i.e. 82 m is selected.

**Cable and protection values selected**
- The cable cross-section recommended 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 standard value of 13 A or 16 A.
- This rating is in fact less than or equal to the maximum authorised rating (16 or 20 A) to ensure that the cable is protected.
Three-phase copper cable
230 V AC between phase and neutral or
400 V AC between phases

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

Example described at the bottom of the page
(with table value correction allowing for 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
rated current 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:

<table>
<thead>
<tr>
<th>Cos φ</th>
<th>Multiplier coefficient to be applied for</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.85</td>
<td></td>
</tr>
<tr>
<td>0.5</td>
<td>0.526</td>
</tr>
</tbody>
</table>

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

Example of a warehouse

Characteristics of the installation
■ 39 x 70 W 230 V sodium vapour 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 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 the
  power factor into consideration:
□ 98 x 1.118 = 110 m;
□ 163 x 1.118 = 182 m the corrected value immediately above 120 m in the table,
i.e. 182 m is selected.

Cable and protection values selected
■ The cable cross-section per phase recommended 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 the
  standard value.
  This rating is in fact less than or equal to the maximum authorised rating (16 or 20
  A) to ensure that the cable is protected.

<table>
<thead>
<tr>
<th>Characteristics of the installation</th>
</tr>
</thead>
<tbody>
<tr>
<td>three-phase balanced circuit, at 40°C, Cos φ = 0.95</td>
</tr>
<tr>
<td>230 V AC between phase and neutral or 400 V AC between phases (1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lighting power per phase (kW)</th>
<th>Rated current per phase (A)</th>
<th>Maximum cable length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>including any ballast losses</td>
<td>(the value shown is the average distance between the electrical switchboard and the lamps)</td>
<td></td>
</tr>
<tr>
<td>0.2</td>
<td>1</td>
<td>587</td>
</tr>
<tr>
<td>0.4</td>
<td>2</td>
<td>294</td>
</tr>
<tr>
<td>0.7</td>
<td>3</td>
<td>196</td>
</tr>
<tr>
<td>1.2</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>2.2</td>
<td>10</td>
<td>99</td>
</tr>
<tr>
<td>3.5</td>
<td>16</td>
<td>37</td>
</tr>
<tr>
<td>4.4</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>5.5</td>
<td>25</td>
<td>32</td>
</tr>
<tr>
<td>7.0</td>
<td>32</td>
<td>40</td>
</tr>
<tr>
<td>8.7</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>10.9</td>
<td>50</td>
<td>63</td>
</tr>
<tr>
<td>13.8</td>
<td>63</td>
<td>80</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cross-section of each conductor (mm²)</th>
<th>1.5</th>
<th>2.5</th>
<th>4</th>
<th>6</th>
<th>10</th>
<th>16</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circuit breaker Rating (A)</td>
<td>Recommended Twice the rated current of the lighting circuit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable with PVC insulation</td>
<td>13</td>
<td>16</td>
<td>25</td>
<td>32</td>
<td>40</td>
<td>50</td>
<td>63</td>
</tr>
<tr>
<td>Other insulating material more efficient at high temperature</td>
<td>16</td>
<td>20</td>
<td>32</td>
<td>40</td>
<td>50</td>
<td>63</td>
<td>80</td>
</tr>
</tbody>
</table>
Electrical distribution and protection fast dimensioning
Type of Canalis, circuit breaker rating

These tables are used to determine from the main characteristics of the installation (type of flexible or rigid busbar trunking, type of lamp, lighting power, distance from the electrical switchboard):
- the busbar trunking rating (20, 25 or 40 A) for a voltage drop less than 3% at the lamps,
- the circuit breaker rating for protection and continuity of service with a safety margin, whatever the type of lamps.

Step 1: Select the busbar trunking rating according to the number and type of lamps

The example described at the bottom of the page.

Example of a factory

Characteristics of a light line
- 30 light fittings with 2 x 58 W 230 V fluorescent lamps, evenly spaced along 75 m and suspended from a rigid KBA type busbar trunking.
- Single-phase or three-phase power supply: under consideration.
- Power factor: 0.95.
- Operating temperature: < 35°C.

Calculations
- Power of the lamps: 30 x 2 x 58 = 3480 W.
- Ballast losses, estimated at 10% of the lamp power: 348 W.
- Lighting power: 3480 + 348 = 3828 W = 3.83 kW, i.e. 1.28 kW per phase for a three-phase supply.
- Corresponding rated current (I = P/U Cos φ): single-phase: 3828 W/(230 V x 0.95) = 17.5 A; three-phase (230 V between phase and neutral): 17.5/3 = 5.85 A per phase.

Step 1: select the busbar trunking rating according to the number and type of lamps (see table above)

Find the example in the table:
- line: fluorescent tube with power factor correction, type 2 x 58 W,
- column:
  - if single-phase circuit: KBA 25 A seems sufficient as 30 light fittings < 32;
  - if three-phase circuit: KBA 25 A seems sufficient as 30 light fittings < 96.

Step 2: confirm the busbar trunking rating according to the length of the circuit (tables on next page)

Find the example in the table:
- single-phase:
  - 16 A < 17.5 A < 20 A;
  - the max. corresponding lengths for KBA 25 A (70 and 56 m) are less than the 75 m of the installation;
  - this requires changing to KBA 40 A to ensure a voltage drop < 3%. This busbar trunking overdimensioning leads us to consider a three-phase solution.
- three-phase:
  - 5.85 A is almost 6 A;
  - the max. corresponding length for KBA 25 A (375 m) is far longer than 75 m;
  - therefore a three-phase KBA 25 A solution guarantees a voltage drop that is far less than 3% at the end of the busbar trunking.

Select the circuit breaker rating

Minimum value: twice 6 A = 12 A, i.e. 13 or 16 A as the nearest standard value. Note: a higher rating (up to 25 A) is possible and guarantees that the busbar trunking is protected. However, it is important to check that this rating is also compatible with the busbar trunking supply cable protection.
Step 2: confirm the busbar trunking rating according to the length of the circuit and select the circuit breaker rating

### Single-phase Canalis 230 V AC busbar trunking

**Characteristics of the installation**

<table>
<thead>
<tr>
<th>Lighting power (kW) including any ballast losses</th>
<th>Rated current (A)</th>
<th>Maximum length of the busbar trunking (m) for a voltage drop &lt; 3% at the end of the busbar trunking</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>1</td>
<td>330 375</td>
</tr>
<tr>
<td>0.4</td>
<td>2</td>
<td>165 188 231</td>
</tr>
<tr>
<td>0.7</td>
<td>3</td>
<td>62 70 144</td>
</tr>
<tr>
<td>1.3</td>
<td>6</td>
<td>99 113 231</td>
</tr>
<tr>
<td>2.2</td>
<td>10</td>
<td>16 49 56 115</td>
</tr>
<tr>
<td>3.5</td>
<td>16</td>
<td>20 49 56 115</td>
</tr>
<tr>
<td>4.4</td>
<td>20</td>
<td>45 92</td>
</tr>
<tr>
<td>5.5</td>
<td>25</td>
<td>70</td>
</tr>
<tr>
<td>7.0</td>
<td>32</td>
<td>165 188 231</td>
</tr>
<tr>
<td>8.7</td>
<td>40</td>
<td>90</td>
</tr>
<tr>
<td>10.9</td>
<td>50</td>
<td>Overloaded</td>
</tr>
<tr>
<td>13.8</td>
<td>63</td>
<td>Overloaded</td>
</tr>
</tbody>
</table>

**Busbar trunking system**

<table>
<thead>
<tr>
<th>Type of busbar trunking</th>
<th>Rating (A)</th>
<th>Circuit breaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible (KDP)</td>
<td>20</td>
<td>Maxi 20</td>
</tr>
<tr>
<td>Rigid (KBA or KBB)</td>
<td>25</td>
<td>Maxi 25</td>
</tr>
<tr>
<td>40</td>
<td>40</td>
<td>Maxi 40</td>
</tr>
</tbody>
</table>

**Recommended**

- Twice the rated current of the lighting circuit

**Example described on page 20**

---

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

**Characteristics of the installation**

<table>
<thead>
<tr>
<th>Lighting power per phase (kW) including any ballast losses</th>
<th>Rated current per phase (A)</th>
<th>Maximum length of the busbar trunking (m) for a voltage drop &lt; 3% at the end of the busbar trunking</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>1</td>
<td>361 375</td>
</tr>
<tr>
<td>0.4</td>
<td>2</td>
<td>198 225 461</td>
</tr>
<tr>
<td>0.7</td>
<td>3</td>
<td>62 70 144</td>
</tr>
<tr>
<td>1.3</td>
<td>6</td>
<td>99 113 231</td>
</tr>
<tr>
<td>2.2</td>
<td>10</td>
<td>16 49 56 115</td>
</tr>
<tr>
<td>3.5</td>
<td>16</td>
<td>20 49 56 115</td>
</tr>
<tr>
<td>4.4</td>
<td>20</td>
<td>45 92</td>
</tr>
<tr>
<td>5.5</td>
<td>25</td>
<td>70</td>
</tr>
<tr>
<td>7.0</td>
<td>32</td>
<td>165 188 231</td>
</tr>
<tr>
<td>8.7</td>
<td>40</td>
<td>Overloaded</td>
</tr>
<tr>
<td>10.9</td>
<td>50</td>
<td>Overloaded</td>
</tr>
<tr>
<td>13.8</td>
<td>63</td>
<td>Overloaded</td>
</tr>
</tbody>
</table>

**Busbar trunking system**

<table>
<thead>
<tr>
<th>Type of busbar trunking</th>
<th>Rating (A)</th>
<th>Circuit breaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible (KDP)</td>
<td>20</td>
<td>Maxi 20</td>
</tr>
<tr>
<td>Rigid (KBA or KBB)</td>
<td>25</td>
<td>Maxi 25</td>
</tr>
<tr>
<td>40</td>
<td>40</td>
<td>Maxi 40</td>
</tr>
</tbody>
</table>

**Recommended**

- Twice the rated current of the lighting circuit

**Example described on page 20**

---

(1) If the voltage or power factor is different, some values in the table must be recalculated (the value of the rated current does not change):
- for a voltage of 110-115 V: divide the values by 2,
- for a different power factor, see the table below:

<table>
<thead>
<tr>
<th>Cos φ</th>
<th>Multiplier coefficient to be applied for Power</th>
<th>Length of the busbar trunking</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.85</td>
<td>0.895</td>
<td>1:18</td>
</tr>
<tr>
<td>0.5</td>
<td>0.526</td>
<td>1:9</td>
</tr>
</tbody>
</table>

(2) If the voltage or power factor is different, the lighting power and the length of the busbar trunking must be recalculated (the value of the rated current 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:

<table>
<thead>
<tr>
<th>Cos φ</th>
<th>Multiplier coefficient to be applied for Power</th>
<th>Length of the busbar trunking</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.85</td>
<td>0.895</td>
<td>1:18</td>
</tr>
<tr>
<td>0.5</td>
<td>0.526</td>
<td>1:9</td>
</tr>
</tbody>
</table>
## Control devices

**Control devices**

- Their role is to control light fitting switching On and Off by switching the conductor(s).
- Their technology allows a very large number of switching operations (approximately 100,000) 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;
  - sophisticated functions (central control, timer, programming, etc.).
- Control of a three-phase circuit.

### Choice of control device

<table>
<thead>
<tr>
<th>Impulse relay</th>
<th>Modular contactor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of power circuit architecture (modular/monobloc)</td>
<td><strong>TL</strong></td>
</tr>
<tr>
<td>Installation options</td>
<td>In enclosure and panel</td>
</tr>
<tr>
<td>Control</td>
<td>Number of points</td>
</tr>
<tr>
<td></td>
<td>Multiple</td>
</tr>
<tr>
<td>Complexity of control</td>
<td>★ By combining auxiliaries</td>
</tr>
<tr>
<td>Installation</td>
<td>Many possible functions by using auxiliaries:</td>
</tr>
<tr>
<td></td>
<td>- time delay</td>
</tr>
<tr>
<td></td>
<td>- illuminated push-button control</td>
</tr>
<tr>
<td></td>
<td>- step-by-step control</td>
</tr>
<tr>
<td></td>
<td>- signalling</td>
</tr>
<tr>
<td></td>
<td>- latched-type control</td>
</tr>
<tr>
<td></td>
<td>- centralised multi-level control</td>
</tr>
<tr>
<td>Type of circuit controlled</td>
<td>Single-phase (1 or 2 P) or three-phase (3 or 4 P) monobloc or in conjunction with ETL extension</td>
</tr>
<tr>
<td>Number of lamps controlled</td>
<td>★ pages 30 to 32</td>
</tr>
<tr>
<td>Remote status indication</td>
<td>Protection</td>
</tr>
<tr>
<td></td>
<td>Control</td>
</tr>
<tr>
<td></td>
<td>PLC</td>
</tr>
<tr>
<td></td>
<td>Push-buttons, linear switches</td>
</tr>
<tr>
<td></td>
<td>6 to 130 V DC</td>
</tr>
<tr>
<td>Favourite applications</td>
<td>★ Residential</td>
</tr>
</tbody>
</table>

- ★ : low
- ★ : medium
- ★ : high

---

**Notes:**

- Circuit protection is provided by a separate circuit breaker.
- The control and power circuits are separate. They can also relay the management devices (page 36), which often have a limited switching capacity and do not allow multi-polar switching (phase/neutral or three-phase).
- Number of switching cycles per day (on average):
  - < 100
  - < 1000
  - < 1000
- Complexity of control:
  - ★ By combining auxiliaries
  - ★ With relay circuitry
  - ★ By combining auxiliaries
  - ★ With relay circuitry
- Remote reclosing of the protective device:
  - –

---

For further details and technical specifications, please refer to the manufacturer's documentation.
### Reflex iC60 integrated control circuit breakers

#### Monobloc
- The circuit protection and power switching functions are incorporated in a single device.
- In enclosure and panel.
- Multiple.
- Pulse or latched.
- Very low, except for control.

#### RCA iC60 remote control
- The circuit breaker combined with the RCA performs the circuit protection and power switching functions.
- In enclosure and panel.
- Multiple.
- Pulse or latched.
- Very low, except for control.

### RCA iC60 remote control

<table>
<thead>
<tr>
<th>Function</th>
<th>Reflex iC60</th>
<th>RCA iC60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating (most common values in bold)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of lamps controlled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of circuit controlled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated power single-phase (1 or 2 P) or three-phase (3 or 4 P)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controlled power</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installation options</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remote reclosing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remote status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of switching cycles per day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of power circuit architecture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumption</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impulse-type by push-button</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Latched-type by switch (as standard) or Impulse relay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modular contactor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auxiliary on circuit breaker</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLC</td>
<td>6 to 130 V DC – 24 V AC – 24/48 V AC/DC with auxiliary iMDU</td>
<td></td>
</tr>
<tr>
<td>Consumption</td>
<td>None except when controlled</td>
<td>When it is in operation (1 to 2 W)</td>
</tr>
<tr>
<td>Type</td>
<td>Impulse-type</td>
<td>Latched-type</td>
</tr>
<tr>
<td>Impulse relay</td>
<td>Modular</td>
<td>contactor</td>
</tr>
<tr>
<td>Impulse-type by push-button</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Latched-type by switch (as standard) or Impulse relay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modular contactor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection</td>
<td>Auxiliary on circuit breaker</td>
<td>Yes</td>
</tr>
<tr>
<td>Circuit protection and power switching functions</td>
<td>The circuit protection and power switching functions are incorporated in a single device.</td>
<td>Incorporated</td>
</tr>
<tr>
<td>In enclosure and panel</td>
<td>In enclosure and panel</td>
<td>Incorporated</td>
</tr>
<tr>
<td>Multiple</td>
<td>Multiple</td>
<td>Incorporated</td>
</tr>
<tr>
<td>Pulse or latched</td>
<td>Pulse or latched</td>
<td>Incorporated</td>
</tr>
<tr>
<td>Very low, except for control</td>
<td>Very low, except for control</td>
<td>Yes</td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>1 to 2 on average</td>
</tr>
<tr>
<td>&lt; 10</td>
<td>–</td>
<td>1 to 2 on average</td>
</tr>
<tr>
<td>≥ 20</td>
<td>≥ 20</td>
<td>1 to 2 on average</td>
</tr>
<tr>
<td>≤ 30</td>
<td>≤ 30</td>
<td>1 to 2 on average</td>
</tr>
<tr>
<td>≤ 40</td>
<td>≤ 40</td>
<td>1 to 2 on average</td>
</tr>
<tr>
<td>≤ 63</td>
<td>≤ 63</td>
<td>1 to 2 on average</td>
</tr>
</tbody>
</table>

#### Reflex iC60

- 10, 16, 25, 40, 63 A
- Numerous functionalities incorporated:
  - choice of control order interpretation mode
  - control and indication interface compatible with 24 Vdc programmable logic controller standards
  - compatibility with Vigi iC60 earth leakage protection auxiliaries
  - control orders time delayed by time delay relays or PLCs

- Several kW
- Single-phase (2P) or three-phase (3 or 4P)
- Several kW
- Single-phase (1 or 2P) or three-phase (3 or 4P)

#### RCA iC60

- 10, 16, 25, 40, 63 A
- Numerous functionalities incorporated:
  - choice of control order interpretation mode
  - control and indication interface compatible with 24 Vdc programmable logic controller standards
  - compatibility with the auxiliaries of the iC60 and Vigi protection product offering (iOF, iSD indication auxiliaries and iMN, iMX tripping auxiliaries, etc.)

- Several kW
- Single-phase (2P) or three-phase (3 or 4P)
- Several kW
- Single-phase (1 or 2P) or three-phase (3 or 4P)

### Applications

- Residential (houses, shops, workshops, etc.)
- Infrastructure (tunnels, outdoor car parks, public lighting, etc.)
- Service sector and industrial buildings (offices, open-space offices, warehouses, supermarkets, indoor car parks, etc.)
- Service sector and industrial buildings (offices, open-space offices, warehouses, supermarkets, indoor car parks, etc.)

#### Electronics

- The best all-in-one 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 a Acti 9 Smartlink or a PLC.
Control devices
Example

Simplification of cabling through the use of controls

Controlled by switches without relay
- Conventional cabling with two-way switches and four-way switch(es).

Controlled by power relays (contactor, impulse relay, 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, centralised multi-level control, etc. page 34) 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, light sensitive switch, etc. page 35).
Choice of rating
- The rating printed on the front of the products never corresponds to the rated current of the lighting circuit.
- The standards that determine the relay 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, preheating 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 relay 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
- 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 contactors, due to their operating principle, constantly dissipate heat (several watts) due to:
  - coil consumption,
  - 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 1 or 2 contactors). 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.
### Control devices

**Ratings and performance to type and number of lamps**

#### Relay rating
- The table below shows the maximum number of light fittings for each relay, according to the type, power, and configuration of a given lamp. As an indication, the total acceptable power is also mentioned.
- These values are given for a 230 V circuit with 2 active conductors (single-phase phase/neutral or two-phase phase/phase). For 110 V circuits, divide the values in the table by 2.
- To obtain the equivalent values for the entire 230 V three-phase circuit, multiply the number of lamps and the maximum power output:
  - by $\sqrt{3}$ (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 power ratings of the lamps most commonly used are shown in bold. For powers not mentioned, use a proportional rule with the nearest values.

#### Type of lamp

<table>
<thead>
<tr>
<th>Type of lamp</th>
<th>Unit power and capacitance of power factor correction capacitor</th>
<th>Maximum number of light fittings for a single-phase circuit and maximum power output per circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic incandescent lamps - LV halogen lamps - Replacement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40 W</td>
<td>16 A to 1500 W</td>
<td>16 A to 4000 W</td>
</tr>
<tr>
<td>60 W</td>
<td>25 A to 1600 W</td>
<td>25 A to 4200 W</td>
</tr>
<tr>
<td>75 W</td>
<td>20 A to 53</td>
<td>25 A to 38</td>
</tr>
<tr>
<td>100 W</td>
<td>16 A to 42</td>
<td>19 A to 28</td>
</tr>
<tr>
<td>150 W</td>
<td>10 A to 28</td>
<td>12 A to 35</td>
</tr>
<tr>
<td>200 W</td>
<td>8 A to 21</td>
<td>10 A to 26</td>
</tr>
<tr>
<td>300 W</td>
<td>5 A to 1500 W</td>
<td>7 A to 2100 W</td>
</tr>
<tr>
<td>500 W</td>
<td>3 A to 8</td>
<td>4 A to 6</td>
</tr>
<tr>
<td>1000 W</td>
<td>1 A to 4</td>
<td>2 A to 3</td>
</tr>
<tr>
<td>1500 W</td>
<td>1 A to 2</td>
<td>1 A to 2</td>
</tr>
</tbody>
</table>

#### ELV 12 or 24 V halogen lamps

<table>
<thead>
<tr>
<th>Transformer type</th>
<th>Power ratings</th>
<th>Relay rating</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>With ferromagnetic transformer</td>
<td>2 x 65 W</td>
<td>11 220 W</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>23 828 W</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>24 360 W</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>67 1290 W</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>111 2760 W</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>146 4550 W</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>171 6860 W</td>
<td></td>
</tr>
</tbody>
</table>

#### Fluorescent tubes with starter and ferromagnetic ballast

<table>
<thead>
<tr>
<th>Type of lamp</th>
<th>Unit power and capacitance of power factor correction capacitor</th>
<th>Maximum number of light fittings for a single-phase circuit and maximum power output per circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 tube without compensation (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 W</td>
<td>83 A to 1250 W</td>
<td>16 A to 3200 W</td>
</tr>
<tr>
<td>18 W</td>
<td>70 A to 1300 W</td>
<td>16 A to 3350 W</td>
</tr>
<tr>
<td>20 W</td>
<td>62 A to 160 W</td>
<td>15 A to 22</td>
</tr>
<tr>
<td>36 W</td>
<td>35 A to 100</td>
<td>20 A to 28</td>
</tr>
<tr>
<td>40 W</td>
<td>37 A to 81</td>
<td>20 A to 28</td>
</tr>
<tr>
<td>58 W</td>
<td>21 A to 55</td>
<td>13 A to 17</td>
</tr>
<tr>
<td>65 W</td>
<td>20 A to 50</td>
<td>13 A to 17</td>
</tr>
<tr>
<td>80 W</td>
<td>16 A to 41</td>
<td>10 A to 15</td>
</tr>
<tr>
<td>115 W</td>
<td>11 A to 29</td>
<td>7 A to 10</td>
</tr>
</tbody>
</table>

| 1 tube with parallel compensation (2) | | |
| 15 W | 53 F µ 53 | 60 A to 2400 W |
| 18 W | 53 F µ 53 | 60 A to 2400 W |
| 20 W | 53 F µ 53 | 60 A to 2400 W |
| 36 W | 53 F µ 53 | 60 A to 2400 W |
| 40 W | 53 F µ 53 | 60 A to 2400 W |
| 58 W | 53 F µ 53 | 60 A to 2400 W |
| 65 W | 53 F µ 53 | 60 A to 2400 W |
| 80 W | 53 F µ 53 | 60 A to 2400 W |
| 115 W | 53 F µ 53 | 60 A to 2400 W |

### Footnote
- Modular contactors, impulse relays or Reflex iC60 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 (except for iTL+ and iTL+). For example, for a given rating, an impulse relay is more efficient than a modular contactor for the control of light fittings with a strong brush current, or with a low power factor (non-compensated inductive circuit).
Reflex iC60
The best all-in-one 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 a Acti 9 Smartlink or a PLC.

| Integrated control circuit breakers Reflex iC60 |
|----------------|----------------|----------------|----------------|----------------|
| 10 A           | 16 A           | 25 A           | 40 A           | 63 A           |
| 28 1120 W      | 23 2175 W      | 36 1840 W      | 46 2600 W      | 402 7236 W     |
| 23 2000 W      | 29 3100 W      | 39 2800 W      | 55 3600 W      | 85 103 W       |
| 29 2850 W      | 15 3600 W      | 46 2800 W      | 60 3600 W      | 100 W          |
| 15 1050 W      | 23 3600 W      | 33 2800 W      | 80 3600 W      | 115 W          |
| 23 3400 W      | 22 4500 W      | 22 3400 W      | 88 3400 W      | 130 W          |
| 22 3400 W      | 22 4500 W      | 22 3400 W      | 88 3400 W      | 130 W          |
| 22 3400 W      | 22 4500 W      | 22 3400 W      | 88 3400 W      | 130 W          |
| 22 3400 W      | 22 4500 W      | 22 3400 W      | 88 3400 W      | 130 W          |
| 22 3400 W      | 22 4500 W      | 22 3400 W      | 88 3400 W      | 130 W          |
| 22 3400 W      | 22 4500 W      | 22 3400 W      | 88 3400 W      | 130 W          |
### Control devices

Rating performance according to the type and number of lamps (cont.)

<table>
<thead>
<tr>
<th>Type of lamp</th>
<th>Unit power and capacitance of power factor correction capacitor</th>
<th>Maximum number of light fittings for a single-phase circuit and maximum power output per circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compact fluorescent lamps</strong></td>
<td></td>
<td><strong>iCT impulse relay</strong></td>
</tr>
<tr>
<td>With external electronic ballast</td>
<td></td>
<td>16 A</td>
</tr>
<tr>
<td>5 W</td>
<td>240 to 1200 W</td>
<td>630 to 3150 W</td>
</tr>
<tr>
<td>7 W</td>
<td>177 to 457 W</td>
<td>850 to 1800 W</td>
</tr>
<tr>
<td>9 W</td>
<td>138 to 366 W</td>
<td>114 to 122 W</td>
</tr>
<tr>
<td>11 W</td>
<td>118 to 318 W</td>
<td>104 to 105 W</td>
</tr>
<tr>
<td>18 W</td>
<td>77 to 202 W</td>
<td>66 to 105 W</td>
</tr>
<tr>
<td>26 W</td>
<td>55 to 146 W</td>
<td>50 to 76 W</td>
</tr>
<tr>
<td>With integral electronic ballast (replacement for incandescent lamps)</td>
<td></td>
<td>16 A</td>
</tr>
<tr>
<td>5 W</td>
<td>170 to 390 W</td>
<td>160 to 230 W</td>
</tr>
<tr>
<td>7 W</td>
<td>121 to 285 W</td>
<td>114 to 164 W</td>
</tr>
<tr>
<td>9 W</td>
<td>100 to 233 W</td>
<td>94 to 133 W</td>
</tr>
<tr>
<td>11 W</td>
<td>86 to 200 W</td>
<td>78 to 109 W</td>
</tr>
<tr>
<td>18 W</td>
<td>55 to 127 W</td>
<td>48 to 69 W</td>
</tr>
<tr>
<td>26 W</td>
<td>40 to 92 W</td>
<td>34 to 50 W</td>
</tr>
<tr>
<td><strong>High-pressure sodium vapour lamps with ferromagnetic ballast without ignitor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without compensation (1)</td>
<td>50 W</td>
<td>Infrequent use</td>
</tr>
<tr>
<td>80 W</td>
<td></td>
<td>10 W to 1000 W</td>
</tr>
<tr>
<td>125/110 W (3)</td>
<td></td>
<td>6 W to 1400 W</td>
</tr>
<tr>
<td>250/220 W (3)</td>
<td></td>
<td>9 W to 1600 W</td>
</tr>
<tr>
<td>400/350 W (3)</td>
<td></td>
<td>9 W to 1600 W</td>
</tr>
<tr>
<td>700 W</td>
<td></td>
<td>4 W to 6 W</td>
</tr>
<tr>
<td>With parallel compensation (2)</td>
<td>50 W</td>
<td>10 W to 500 W</td>
</tr>
<tr>
<td>80 W</td>
<td>25 W</td>
<td>4 W to 4 W</td>
</tr>
<tr>
<td>125/110 W (3)</td>
<td>10 µF</td>
<td>20 W to 20 W</td>
</tr>
<tr>
<td>250/220 W (3)</td>
<td>18 µF</td>
<td>11 W to 11 W</td>
</tr>
<tr>
<td>400/350 W (3)</td>
<td>25 µF</td>
<td>12 W to 12 W</td>
</tr>
<tr>
<td>700 W</td>
<td>40 µF</td>
<td>5 W to 5 W</td>
</tr>
<tr>
<td>1000 W</td>
<td>60 µF</td>
<td>3 W to 3 W</td>
</tr>
<tr>
<td><strong>Low-pressure sodium vapour lamps with ferromagnetic ballast with external ignitor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without compensation (1)</td>
<td>35 W</td>
<td>Infrequent use</td>
</tr>
<tr>
<td>55 W</td>
<td>3 W to 9 W</td>
<td>3 W to 9 W</td>
</tr>
<tr>
<td>90 W</td>
<td>2 W to 6 W</td>
<td>2 W to 6 W</td>
</tr>
<tr>
<td>135 W</td>
<td></td>
<td>2 W to 6 W</td>
</tr>
<tr>
<td>180 W</td>
<td></td>
<td>2 W to 6 W</td>
</tr>
<tr>
<td>With parallel compensation (2)</td>
<td>35 W</td>
<td>8 W to 10 W</td>
</tr>
<tr>
<td>55 W</td>
<td>24 W</td>
<td>1 W to 4 W</td>
</tr>
<tr>
<td>90 W</td>
<td>15 W</td>
<td>4 W to 4 W</td>
</tr>
<tr>
<td>135 W</td>
<td>10 W</td>
<td>2 W to 2 W</td>
</tr>
<tr>
<td>180 W</td>
<td>5 W</td>
<td>1 W to 2 W</td>
</tr>
<tr>
<td><strong>High-pressure sodium vapour lamps - Metal-iodide lamps - Metal halide lamps</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With ferromagnetic ballast with external ignitor, without compensation (1)</td>
<td>35 W</td>
<td>Infrequent use</td>
</tr>
<tr>
<td>70 W</td>
<td>8 W to 12 W</td>
<td>13 W to 13 W</td>
</tr>
<tr>
<td>150 W</td>
<td>4 W to 7 W</td>
<td>13 W to 17 W</td>
</tr>
<tr>
<td>250 W</td>
<td>2 W to 4 W</td>
<td>11 W to 11 W</td>
</tr>
<tr>
<td>400 W</td>
<td>1 W to 3 W</td>
<td>8 W to 8 W</td>
</tr>
<tr>
<td>1000 W</td>
<td>0 W to 0 W</td>
<td>2 W to 2 W</td>
</tr>
<tr>
<td>With ferromagnetic ballast with external ignitor and parallel compensation (2)</td>
<td>35 W</td>
<td>34 W to 1200 W</td>
</tr>
<tr>
<td>55 W</td>
<td>17 W to 34 W</td>
<td>6 W to 12 W</td>
</tr>
<tr>
<td>90 W</td>
<td>15 W to 24 W</td>
<td>6 W to 12 W</td>
</tr>
<tr>
<td>135 W</td>
<td>10 W to 20 W</td>
<td>6 W to 12 W</td>
</tr>
<tr>
<td>180 W</td>
<td>5 W to 10 W</td>
<td>6 W to 12 W</td>
</tr>
<tr>
<td>With electronic ballast</td>
<td>35 W</td>
<td>38 W to 1350 W</td>
</tr>
<tr>
<td>70 W</td>
<td>29 W to 2200 W</td>
<td>18 W to 29 W</td>
</tr>
<tr>
<td>150 W</td>
<td>14 W to 33 W</td>
<td>9 W to 14 W</td>
</tr>
</tbody>
</table>

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

(2) The total capacitance of the power factor correction capacitors in parallel in 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.

(3) High-pressure mercury vapour lamps without ignitor, of power 125, 250 and 400 W, are gradually being replaced by high-pressure sodium vapour lamps with integral ignitor and respective power of 110, 220 and 350 W.

**Note:** Reflex iC60

High-pressure sodium vapour lamp with electronic ballast

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

LV halogen incandescent lamp, 1500 W

For the 10 A B-curve rating, the number of lamps should be reduced by 10% to limit unwanted magnetic tripping.
For the 10 A B-curve rating, the number of lamps should be reduced by 10% to limit unwanted magnetic tripping.

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

High-pressure sodium vapour lamp with electronic ballast

Note:

(3) High-pressure mercury vapour lamps without ignitor, of power 125, 250 and 400 W, are gradually being replaced by high-pressure sodium vapour lamps with

(2) The total capacitance of the power factor correction capacitors in parallel in a circuit limits the number of lamps that can be controlled by a contactor.

(1) With ferromagnetic ballast

parallel compensation

With parallel compensation

35 W

With integral electronic ballast

ballast

With external electronic ballast


<table>
<thead>
<tr>
<th>Type</th>
<th>14 W</th>
<th>33 W</th>
<th>9 W</th>
<th>14 W</th>
<th>26 W</th>
<th>40 W</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 W</td>
<td>2000 W</td>
<td>85 µF</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2000 W</td>
<td>1000 W</td>
<td>60 µF</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>400 W</td>
<td>250 W</td>
<td>45 µF</td>
<td>3</td>
<td>8</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>250 W</td>
<td>125 W</td>
<td>20 µF</td>
<td>8</td>
<td>22</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>125 W</td>
<td>80 W</td>
<td>12 µF</td>
<td>17</td>
<td>45</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>80 W</td>
<td>50 W</td>
<td>70 µF</td>
<td>6</td>
<td>38</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>50 W</td>
<td>25 W</td>
<td>38 µF</td>
<td>24</td>
<td>85</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>25 W</td>
<td>10 W</td>
<td>26 µF</td>
<td>15</td>
<td>40</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>10 W</td>
<td>5 W</td>
<td>24 µF</td>
<td>14</td>
<td>46</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>5 W</td>
<td>3.5 W</td>
<td>22 µF</td>
<td>13</td>
<td>48</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

In the case 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 in fact especially appropriate for lamps with a high initial current consuming up to 16 A (ITL+) or 20 A (ICT+) in steady state (for example: lamps with ferro-magnetic ballast or transformer). The following table shows the controllable power \( P_c \) according to the power factor. For high intensity discharge lamps divide the power by 2 (long preheating current).

Example: How many compensated 58 W fluorescent tubes (power factor of 0.85) with ferro-magnetic ballast (10% loss) can be controlled with a 20 A ICT+?

Number of lamps \( N \) = controllable power \( P_c \) (power output of each lamp + loss of ballast), i.e. in this case \( N = 3900 / (58 \times 10%) = 61 \).

In 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

These auxiliaries can perform a great variety of functions:
- from the simplest (signalling, timer, illumination delay, etc.);
- to the most sophisticated (centralised 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 connections.

Choice of auxiliaries
or control devices with built-in auxiliary

<table>
<thead>
<tr>
<th>Function</th>
<th>Pre-auxiliary impulse relay or impulse relay + auxiliary</th>
<th>Modular contactor + auxiliary</th>
<th>Integrated control circuit breakers Reflex iC60</th>
<th>RCA iC60 remote control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centralised control</td>
<td>iTLc or iTL + auxiliary iATLc</td>
<td>-</td>
<td>Integrated</td>
<td>Integrated</td>
</tr>
<tr>
<td>Centralised control (1 level)</td>
<td>iTL + auxiliary iATLc+s</td>
<td>-</td>
<td>Integrated</td>
<td>Integrated</td>
</tr>
<tr>
<td>Centralised control (2 levels)</td>
<td>iTL + auxiliary iATLc+c</td>
<td>-</td>
<td>Via PLC</td>
<td>Via PLC</td>
</tr>
<tr>
<td>Impulse-type local control</td>
<td>-</td>
<td>ICT + auxiliary iACTc</td>
<td>Integrated</td>
<td>Integrated</td>
</tr>
<tr>
<td>Interface with PLC</td>
<td>Auxiliary iATL24</td>
<td>Auxiliary iATL24</td>
<td>Reflex iC60 Ti24 version</td>
<td>RCA iC60 Ti24 version</td>
</tr>
<tr>
<td>Signalling</td>
<td>iTLs or iTL + auxiliary iATLs</td>
<td>ICT + auxiliary iACTs</td>
<td>Integrated</td>
<td>Integrated</td>
</tr>
<tr>
<td>Timer</td>
<td>iATEt or iATLc</td>
<td>Auxiliary iATE1 + iTL</td>
<td>iTime delay relays (iRT) + Reflex iC60</td>
<td>iTime delay relays (iRT) + RCA iC60</td>
</tr>
<tr>
<td>Step-by-step control</td>
<td>Auxiliary iATL4 + 2 impulse relays iTL</td>
<td>Via PLC</td>
<td>Max. current: 1.35 mA on Y2 input</td>
<td>Max. current: 1.35 mA on Y2 input</td>
</tr>
<tr>
<td>Illuminated push-buttons</td>
<td>1 or more auxiliaries iATLz for each iTL</td>
<td>-</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Compensation</td>
<td>iTLm or iTL + auxiliary iATLm</td>
<td>Standard operation without auxiliary</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Change in type of control</td>
<td>iATLm or iTL + auxiliary iATLm</td>
<td>Auxiliary iACTc + iCT</td>
<td>Integrated</td>
<td>Integrated</td>
</tr>
<tr>
<td>Time delay</td>
<td>iATEt or iATLc</td>
<td>Auxiliary iATE1 + iTL</td>
<td>iTime delay relays (iRT) + Reflex iC60</td>
<td>iTime delay relays (iRT) + RCA iC60</td>
</tr>
<tr>
<td>Disturbance suppressor</td>
<td>NA</td>
<td>1 auxiliary iACTp par iCT</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Voltage adaptation for control</td>
<td>Possible in V AC and V DC</td>
<td>Possible in V AC</td>
<td>Possible with an auxiliary iMDU in V DC</td>
<td></td>
</tr>
</tbody>
</table>

Overview

- iATE1
- iACT24
- iRTA
- iATLc+s
- Mounting clips

iATLm
### Example
#### Dimensioning an installation

### Supermarket: main lighting circuits
- **Supply voltage:** 230 V.
- **Single-phase distribution.**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>General lighting</th>
<th>Product enhancement</th>
<th>Car park lighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of lines</td>
<td>18 (1 per department)</td>
<td>3 (1 per display)</td>
<td>10</td>
</tr>
<tr>
<td>Number of lamps per line</td>
<td>20 light fittings with two 58 W fluorescent tubes with electronic ballast</td>
<td>Four 150 W metal-iodide lamps with ferromagnetic ballast and parallel compensation</td>
<td>Nine 70 W high-pressure sodium vapour lamps with ferromagnetic ballast and parallel compensation</td>
</tr>
</tbody>
</table>

#### Electrical distribution
- **Main lines:** Eighteen 60-m lines with Canalis KBA 25 A (2 conductors + PE)
- **Branch to each light fitting:** 1 m of cables of 1.5 mm²
- **Branch to each light fitting:** 5 m of cables of 1.5 mm²

#### Monitoring/Control

<table>
<thead>
<tr>
<th>Requirement</th>
<th>General lighting</th>
<th>Product enhancement</th>
<th>Car park lighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residual current circuit breaker</td>
<td>2P - 63 A - 300 mA - Si type 1 per group of 3 lines</td>
<td>2P - 63 A - 300 mA 1 for all the 3 lines</td>
<td>2P - 40 A - 300 mA 1 per group of 2 lines</td>
</tr>
<tr>
<td>Control devices</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impulse relay, contactor or Integrated control circuit breakers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control auxiliaries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signaling in the control panel</td>
<td>1 iATLs per impulse relay 1 iACTs per contactor</td>
<td>1 iATLc+s per impulse relay 1 iACTc per contactor</td>
<td>1 iATLc+s per impulse relay 1 iACTc per contactor</td>
</tr>
<tr>
<td>Centralised control</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

#### Management devices
- **Automated control by outside luminosity, timetable and calendar:** -
- **via PLC:** -
- **1 light sensitive switch IC2000P+**

#### Successive illumination of 6 zones
Use of one iATEt per group of lines to limit the inrush current.

![Diagram showing successive illumination of 6 zones]

#### Canalis KBB with DALI system
The winning solution for controlling and supplying power to supermarket lighting.
Management devices

These devices chiefly make it possible to optimise 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 savings and improved comfort

<table>
<thead>
<tr>
<th>Products</th>
<th>Functions</th>
<th>Compatibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>IH</td>
<td>Hourly, daily or weekly</td>
<td>Incandescent lamps, Fluorescent lamps, High-intensity discharge lamps</td>
</tr>
<tr>
<td>Electromechanical time switches</td>
<td>50%</td>
<td>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:</td>
</tr>
<tr>
<td></td>
<td>1 or 2 circuits</td>
<td>– a contactor</td>
</tr>
<tr>
<td></td>
<td>With or without power reserve (operation in the event of mains failure)</td>
<td>– an impulse relay with its latched-type control auxiliary</td>
</tr>
<tr>
<td>IHP</td>
<td>Daily, weekly or annual</td>
<td>– a Reflex IC60</td>
</tr>
<tr>
<td>Digital programmable time switches</td>
<td>50%</td>
<td>or</td>
</tr>
<tr>
<td></td>
<td>1 or 2 circuits</td>
<td>– a RCA IC60 (low rate of switching)</td>
</tr>
<tr>
<td></td>
<td>With or without conditional input</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Switching interval: at least 1 min</td>
<td></td>
</tr>
<tr>
<td>IC</td>
<td>Controlled by:</td>
<td></td>
</tr>
<tr>
<td>Ligh sensitive switch</td>
<td>30%</td>
<td>– astronomical clock (automatic sunrise and sunset calculation)</td>
</tr>
<tr>
<td></td>
<td>– luminosity detection (adjustable from 2 to 2000 lux)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>– With or without programmable clock function</td>
<td></td>
</tr>
<tr>
<td>MIN</td>
<td>30 s to 1 h</td>
<td>2300 to 3600 W</td>
</tr>
<tr>
<td>Timer</td>
<td>30%</td>
<td>100 to 3300 W not recommended for time delays of less than a few minutes</td>
</tr>
<tr>
<td></td>
<td>50% reduction of luminosity before extinction of incandescent lamps with PRE auxiliary</td>
<td>Not recommended for time delays of less than an hour</td>
</tr>
<tr>
<td>Argus</td>
<td>260°</td>
<td>1000 or 2300 W</td>
</tr>
<tr>
<td>Presence detectors</td>
<td>50%</td>
<td>1000 W not recommended for time delays of less than a few minutes</td>
</tr>
<tr>
<td></td>
<td>IP 23</td>
<td>Not appropriate</td>
</tr>
<tr>
<td></td>
<td>Detection distance: presence 4 or 12 m, movement 4 or 14 m</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Luminosity threshold: 10 to 1000 lux</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time delay of 10 s to 120 minutes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>With or without remote control</td>
<td></td>
</tr>
<tr>
<td>Argus</td>
<td>110, 180, 220, 300 or 360°</td>
<td>1000, 2000 or 3000 W</td>
</tr>
<tr>
<td>Movement detectors</td>
<td>50%</td>
<td>400 or 1200 W not recommended for time delays of less than a few minutes</td>
</tr>
<tr>
<td></td>
<td>IP 44 or IP 55</td>
<td>Not appropriate</td>
</tr>
<tr>
<td></td>
<td>Detection distance: up to 12 or 16 m</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Luminosity threshold: 2 to 1000 lux</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time delay of 1 s to 8 min or 5 s to 12 min</td>
<td></td>
</tr>
<tr>
<td>STD400, STD1000, SCU10 Remote control dimmers</td>
<td>30%</td>
<td>40 to 1000 W</td>
</tr>
<tr>
<td></td>
<td>Control of circuits from 40 to 1500 W</td>
<td>1500 W</td>
</tr>
<tr>
<td></td>
<td>30%</td>
<td>Not compatible</td>
</tr>
</tbody>
</table>
Emergency lighting

- Emergency lighting is designed to eliminate or minimise public panic in the event of a serious problem such as a fire or an earthquake and even a simple power cut.
- Suitable for all types and sizes of buildings (schools, hotels, shopping centres, hospitals, offices, shops, museums, etc.), Schneider Electric emergency lighting is essential to the safety of the occupants.
- The anti-panic devices give out a light that enables people to see where they are and to avoid obstacles, whilst the signage units clearly show the way out of the premises. These products are mainly installed at a certain height.

Different technologies and characteristics

- These light units have a light source consisting mainly of fluorescent lamps and LEDs, a battery to supply power in the event of a mains failure and an electronic circuit board. These products are selected according to their luminous flux, IP, IK, autonomy, illuminated continuously or only in the event of a power cut.
- They are also chosen for their maintainability:
  - standard units: tests are carried out manually or via a remote control,
  - Activa/self-test units: they are tested automatically and indicate their operating state by means of coloured LEDs,
  - Dardo/addressable units: they self-test and send the result over a pair of wires to a centralising control device.

Deactivating the light units

- To prevent the batteries discharging when the installation is not used or in the event of mains failure, the light units can be deactivated via a remote control.
- The standard and self-test units are deactivated via a remote control.
- Addressable units are deactivated via the Dardo Plus control unit.

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

Installation of evacuation BAES (signage)

- Install 1 unit at each exit and at each emergency exit, at each obstacle and change of direction to make it easier to evacuate the buildings safely.
- Maximum spacing between the units on each route according to the size of the evacuation pictogram.
- At a minimum height (out of reach of the public; generally 2 m).
- Affix warning signs to the units.
- Minimum luminous flux requirement.
- Autonomy requirement in the event of mains failure (generally 1 hour).
- Required on all public premises.

Installation of anti-panic/ambiance BAES

- Minimum lighting density (in lumens) by m².
- Even distribution throughout the premises. Often with a minimum number of units per room.
- Autonomy required in the event of mains failure (generally 1 hour).
- Required on all public premises.
Appendix
Practical recommendations for the protection and control of lighting systems

Basic rules
- The cross-section and length of the cables must be suitable for limiting the voltage drop to less than 3% at the end of the line in steady state (see table on pages 22 to 25).
- 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 startup current which is broken down as follows:
  - an inrush current: a surge of 10 to 100 times the rated current (In) at power up,
  - followed by the preheating current (for the fluorescent or discharge lamps): possible overloading to 2 In for several seconds or minutes, depending on the type of lamp.
- This therefore gives rise to the following risks:
  - conductor overheating,
  - nuisance circuit-breaker tripping,
  - control device overloading.

Recommendation no.1
- Limit the load on each circuit of 300 to 800 W per 2-wire circuit for standard 10/16 A 230 V AC switchgear.
- Multiply the number of circuits to limit the number of lamps per circuit.

Recommendation no.2
- Use the Canalis prefabricated busbar trunking systems for large tertiary or industrial buildings.

Recommendation no.3
- Switch on the circuits successively using time delay auxiliaries such as iATEt, or a PLC.

Recommendation no.4
- To control lamps with ferromagnetic ballast or transformer, high-performance control devices (iCT+ contactor or iTL+ impulse relay) should be used in preference to conventional relays to optimise the control of circuits of several kW up to 16 A.

Recommendation no.5
- Curve C or D circuit breakers should be preferred to curve B circuit breakers.

Manage electronic ballast lamps carefully

Problems
- The electronic ballast lamps require particular 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 no.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 no.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 no.3
- In the case of three-phase circuits + neutral with third-order and multiple harmonic rates > 33%:
  - oversize the cross-section of the neutral cable with respect to 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.
Appendix
Practical recommendations for the protection and control of lighting systems

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 preheating 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 no.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 no.2
- To limit the ageing of fluorescent lamps:
  - Set the timers or presence detectors to a minimum value of 5 to 10 minutes,
  - Or dim the light level rather than switch the lamps On and Off completely (lamps with external dimmable ballast).

Recommendation no.3
- Use incandescent or LEDs lamps for switching every minute.

Recommendation no.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 no.5
- Periodically, at the end of the average life time of the lamps, replace all the lamps and their ignitor in one area to reduce maintenance costs.

Recommendation no.6
- Use impulse relay or the Reflex iC60 rather than contactor to avoid loss of energy 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 $1.46 \times 10^{-3}$ 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 the incandescent lamps despite the halogen technology,
- the obsolescence of the mercury technology usefully replaced by sodium or metal iodide,
- the high performance of the fluorescent lamps,
- 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.
How to realise smart Lighting control and energy saving?

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.
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Emergency lighting

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⚠️ Check that the types of protection (1P, 1P+N, 2P, etc and earth leakage
protection) conform to the installation regulations in force in the country concerned
User/customer benefits

Ease of use: the zone’s lighting circuit can be operated from several locations. It is well appreciated in corridors, staircases and large rooms.

Comfort: the impulse relay offers silent continuous operation compared to same application using contactors. The distribution board can be installed in quiet rooms (bedrooms, offices) without disturbing users.

Energy savings: when remote control is needed, the impulse relay is the equipment with the lowest self-consumption. This is due to the fact that energy is only needed to change its state from ON to OFF, OFF to ON. No energy is needed to maintain the ON state. An employee can check the condition of the lighting from a central location (e.g. the reception desk) by means of the status indicator and switch the light On or Off to prevent any waste of power if users have forgotten to switch off the light.

Functions - Installer advantages

- The iTL impulse relay closes or opens its contact every time a mains voltage pulse is applied to its coil terminals. The pulse is generated by depressing one of the push-buttons. All the push-buttons are connected in parallel.
- Maintenance operations are facilitated by the On/Off toggle with locking system on the front face of the impulse relay (the remote controls are inoperative).
- Space saving: the iTLs impulse relay saves space due to integration of the auxiliary contact. The total width is still 18 mm.

Zoom on

iTL
Impulse relay

Favourite applications
- residential
- hotel
- office
- etc.

For more details see catalogue.
Savings enabler
> Coil consumption of an impulse relay can be 50% lower than a contactor solution.

Solution diagram

Private area lighting

Public area lighting

Variant with remote reporting (circuit status)

Text for specifications
- The zone lighting shall be activated by several wall push-buttons. On or Off override control of lighting must be able to be performed easily from the distribution board.
- On option, it must be possible to remotely indicate the circuit status.

Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>iC60H</td>
<td>MCB C16 A</td>
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</tr>
<tr>
<td>iTL</td>
<td>Impulse relay 16 A</td>
<td>1</td>
</tr>
<tr>
<td>iTLs</td>
<td>Impulse relay 16 A with remote indication</td>
<td>1</td>
</tr>
<tr>
<td>iPB</td>
<td>Push-button with indicator light</td>
<td>1</td>
</tr>
<tr>
<td>PB</td>
<td>Push-button</td>
<td>3</td>
</tr>
</tbody>
</table>
User/customer benefits

Ease of use: the status of the lighting circuit is indicated by the position of the two-way switch. The switch can be remote from the illuminated room.

Comfort: the impulse relay offers silent continuous operation. The distribution board can be installed in quiet rooms (bedrooms, offices) without disturbing users.

Energy savings: when remote control is needed, the impulse relay is the equipment with the lowest self-consumption. This is due to the fact that energy is only needed to change its state ON to OFF, OFF to ON. No energy is needed to maintain the final state.

Functions - Installer advantages

- The iTLm impulse relay is quite similar to a standard impulse relay, except that it is actioned not by an impulse push-button but by a changeover switch. The iTLm closes or opens its contact every time a mains voltage is applied to its On or Off terminal. The voltage can be applied via an two-way switch or any contacts from a time switch or other device.

- Facilitates maintenance operations: the coil can be manually disconnected by a switch on the front face of the impulse relay.
> **Savings enabler**

> Coil consumption of an impulse relay can be 50% lower than a contactor solution.

### Solution diagram

![Schematic diagram of lighting control system]

### Text for specifications

- The lighting in the zone shall be activated by an impulse relay controlled by a two-position switch. The OFF and ON states shall be indicated above the switch. The control of the impulse relay can be mechanically disabled for easy maintenance.

### Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>iC60H</td>
<td>MCB C16 A</td>
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<tr>
<td>iTLm</td>
<td>Impulse relay</td>
<td>1</td>
</tr>
<tr>
<td>l</td>
<td>two-way switch</td>
<td>1</td>
</tr>
</tbody>
</table>
Lighting for a humid room

User/customer benefits
Being able to control lighting in a humid room, while ensuring personnel safety, taking into account sanitary requirements and the floor and wall cleaning operations performed each day.

All guarantees must be taken (sealed push-button, use of SELV, earth leakage protection) to ensure personnel safety and protect it from electrical hazards.

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

Zoom on

**iTL Impulse relay**

Favourite applications
- humid rooms
- outdoors
- industry.

For more details see catalogue.
> Lighting control in complete safety

Solution diagram

Text for specifications
- The installation must meet the requirements of the safety rules for use of Safety Extra Low Voltage (SELV).

Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>iC60H</td>
<td>MCB C2 A</td>
<td>1</td>
</tr>
<tr>
<td>iC60H + Vigi iC60</td>
<td>MCB C16 A + Vigi earth leakage module</td>
<td>1</td>
</tr>
<tr>
<td>iTL</td>
<td>Impulse relay 2P, 25 A, 24 AC</td>
<td>1</td>
</tr>
<tr>
<td>iTTR</td>
<td>Safety transformer 16 VA, 12-24 V AC</td>
<td>1</td>
</tr>
<tr>
<td>PB</td>
<td>Sealed push-button</td>
<td>2</td>
</tr>
</tbody>
</table>
Manage lighting in a hotel corridor

Customer’s needs
The hotel manager wants to increase user comfort and save on lighting-related energy costs.

Recommendation
- Set lighting times to a minimum in passageways using a timer to:
  - switch on one or more lights from one or more control points; keep lighting on for a pre-set time
  - switch it off automatically.
- Override function for permanent lighting.
- Use Switch-off Warning in MINp timer to improve user safety.

Customer advantages
- Provides significant energy savings.
- Provides greater comfort with silent electronic timers.
- Implementation is extremely simple using standard existing control push-buttons.
- User safety is increased using Switch-off Warning function
- Different override modes (permanent, long duration) cover the various hotels operation needs (cleaning, maintenance, etc).

Product advantages
- An time delay can be set:
  - up to 20 min.
  - up to 30 luminous control push-buttons can be installed in parallel.
- Automatic selection of the control push-buttons connection facilitates installation.
- Mechanical compatibility with the distribution comb busbar makes the product easy to install on symmetrical rail.
- The Switch-off warning function is integrated in MINp timer, it warns that the lighting is about to be switched off by flickering of the lamplight.

MIN
Just enough light

Zoom on

MINs
MINp

Favourite applications
- office
- education
- hotel
- industry
- residential
- etc.

For more details see catalogue.
Energy efficiency benefits
> Automation provides significant energy savings and greater comfort with silent electronic timers.
> Different override modes (permanent, long duration) cover the hotel's various operation needs (cleaning, maintenance, etc).

Solution diagram

Text for specifications
- MINs and MINp switch-off time delay can be set between 0.5 and 20 min.
- For MINp, 1h fixed time delay is started by pressing the control push-button for more than 2 s.
- For higher powers (2.5 kW for MINs and 3.6 kW for MINp), relay with iC60H contactor and its protective circuit-breaker: their ratings depend on installed power and load type.

Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINs</td>
<td>Electronic timer</td>
<td>1</td>
</tr>
<tr>
<td>MINp</td>
<td>Electronic timer with integrated switch-off warning</td>
<td>1</td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB 1 pole</td>
<td>2</td>
</tr>
<tr>
<td>PB</td>
<td>NO push-button</td>
<td>4</td>
</tr>
</tbody>
</table>
Manage lighting in a garage

Customer’s needs
The private home-owner wants to increase comfort without increasing his/her energy bill.

Recommendation
- Set lighting times to a minimum in passageways using a timer to:
  - switch off one or more lights without using two-way push-button cabling (Impulse Relay function); keep lighting on for a pre-set time,
  - switch it off automatically.
- Override function for permanent lighting.
- Use Switch-off Warning to improve safety.

Customer advantages
- Provides significant energy savings.
- Provides greater comfort with silent electronic timers.
- Energy saving can be improved using MINt Impulse Relay function to further reduce the time the load is switched on.
- Implementation is extremely simple using standard existing control push-buttons.
- User safety is increased using Switch-off Warning function.
- Different override modes (permanent, long duration) cover the various operation needs in the garage (long time repair, etc).

Product advantages
- The Impulse Relay function integrated in MINt, allows the lighting to be switched Off or On by pressing a short time on the control push-buttons.
- 30 luminous control push-buttons can be installed in parallel.
- Automatic selection of the control push-buttons connection facilitates installation.
- Mechanical compatibility with the distribution comb busbar makes MINt easy to install on symmetrical rail.
- The Switch-off Warning function is integrated in MINt timer, it warns that the lighting is about to be switched off by flickering of the lamplight.

MIN
Just enough light

Favourite applications
- office
- education
- hotel
- industry
- residential
- etc.

For more details see catalogue.
> **Energy efficiency benefits**

- Automation ensures more energy savings and comfort with silent electronic timers.
- The impulse relay reduces the time the load is switched on.
- Different override modes (permanent, long duration) cover the various operation needs in the garage (long time repair, etc).
- User safety is increased using integrated Switch-off Warning function.

---

### Solution diagram

![Solution diagram](image)

---

### Text for specifications

- MINt switch-off time delay can be set between 0.5 and 20 min.
- 1 h fixed time delay can be started by pressing the control push-button for more than 2 s.
- For higher powers (3.6 kW), relay with a iCT contactor and its protective circuit-breaker: their ratings depend on installed power and load type.

---

### Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINt</td>
<td>Electronic timer with integrated switch-off warning</td>
<td>1</td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB 1 pole</td>
<td>1</td>
</tr>
<tr>
<td>PB</td>
<td>NO push-button</td>
<td>1</td>
</tr>
</tbody>
</table>
Ensure effective lighting of the entrance of a block of flats

Customer’s needs
Shared building premises (entrance halls, cellars, garages, etc) have the specific feature of episodic and irregular use. Moreover, they are normally located in dark places requiring lighting at all times of the day and night. Permanent lighting of these places is incompatible with the notion of energy savings.

Recommendation
By using MINp timer, it is easy to efficiently manage temporary lighting of shared building premises.

The switch-off warning function built into MINp warns by flickering of the lamplight just before the end of the period, thus enabling the restart a new lighting period in complete safety without reaching total darkness.

If permanent lighting is needed (servicing, maintenance, etc), the On override function will ensure continuous operation of lights.

Customer advantages
- Automation provides:
  - significant energy savings,
  - greater comfort,
  - better security.
- The Override function on the front face enables permanent lighting for cleaning and maintenance services.

Product advantages
- An up to 20 min. time delay can be set.
- Automatic selection of the control push-buttons connection facilitates installation.
- 30 luminous control push-buttons can be installed in parallel.
- Mechanical compatibility with distribution comb busbar makes MINp easy to install on symmetrical rail.

MIN
Just enough light

For more details see catalogue.
> **Energy efficiency benefits**
> - Energy saving by automatically extinguishing lighting when it is not necessary.
> - Comfort and safety increased with the associated early switch-off warning.

---

**Solution diagram**

![solution_diagram]

---

**Text for specifications**

- The switch-off time delay can be set between 0.5 and 20 min.
- 1 h fixed time delay is started by pressing the control push-button for more than 2 s.
- The MINp timer requires connection of push-buttons in the installation phase.
- For higher powers (3.6 kW), relay with an ICT contactor and its protective circuit-breaker: their ratings depend on installed power and load type.

---

**Products used**

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINp</td>
<td>Electronic timer with integrated switch-off warning</td>
<td>1</td>
</tr>
<tr>
<td>iO60H</td>
<td>MCB 1 pole</td>
<td>1</td>
</tr>
<tr>
<td>PB</td>
<td>NO push-button</td>
<td>1</td>
</tr>
</tbody>
</table>
Lighting control

Manage lighting in a stairway, corridor or hall

Customer’s needs
The building manager wants to increase user comfort and save on lighting-related energy spendings.

Recommendation
- Set lighting times to a minimum in passageways using a timer to:
  - switch on one or more lights from one or more control points,
  - keep lighting on for a pre-set time,
  - switch it off automatically.
- Override function for permanent lighting.

Customer advantages
- Automation provides:
  - significant energy savings,
  - greater comfort,
  - better security.
- The Override function on the front face enables permanent lighting for cleaning and maintenance services.

Product advantages
- An up to 7 min. time delay can be set.
- 30 luminous control push-buttons can be installed in parallel.

Zoom on

MIN
Just enough light

Favourite applications
- office
- education
- hotel
- industry
- residential
- etc.

For more details see catalogue.
> Energy efficiency benefits
> Automation provides significant energy savings and greater comfort.
> Different override modes (permanent, long duration) cover various operation needs (cleaning, maintenance, etc).

Solution diagram

Text for specifications
- The switch-off time delay can be set between 1 and 7 min. in steps of 15 s.
- For higher powers (2.5 kW), relay with a iCT contactor and its protective circuit-breaker: their ratings depend on installed power and load type.

Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
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</tr>
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<tbody>
<tr>
<td>MIN</td>
<td>Electromechanical timer</td>
<td>1</td>
<td>15363</td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB 1 pole</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>PB</td>
<td>NO push-button</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Automatic switching off of the lighting after a long period

Customer’s needs
Ensuring that the lighting will be systematically switched off following a more or less long period of activity.

Recommendation
- Allow the user full independence for switching the lighting On or Off:
  - one or more push-button control points;
  - no unintentional switching off during activity.
- Timer setting beyond the foreseeable period of activity (3 or 4 hours, for example).

Customer advantages
- Unlike with a timer, it is possible to switch off the lighting at any time. No minimum duration of lighting.
- Assurance that the lighting will be switched off even if forgotten.

Product advantages
- The time delay can be up to 10 hours.
- Direct connection to the contactor by clips.
- Several types of time delay possible.

Zoom on

iATEt
Multi-function auxiliary timer

Favourite applications
- hotel
- office
- etc.

For more details see catalogue.
Savings enabler
Allows an energy saving of up to 10% on lighting circuit electricity consumption, depending on user’s discipline.

Text for specifications
- The lighting shall be operated manually ON from several push-buttons. A long-delay timer will turn it off after a programmable delay of up to 10 hours. Each press of a push-button will reset the timer.

Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>iC60H</td>
<td>MCB C25 A</td>
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<tr>
<td>iATEt</td>
<td>Multifunction time delay auxiliary</td>
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<tr>
<td>ICT</td>
<td>Contactor 1P 25 A</td>
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</tr>
<tr>
<td>PB</td>
<td>Push-button</td>
<td>3</td>
</tr>
</tbody>
</table>
Lighting control

On/Off according daylight - sensor-free

User/customer benefits
Energy savings, safety: outside lighting is automatically activated and deactivated according to the position of the sun. The sun position is detected by means of an astronomical time switch that takes the seasons into account. As a result, outside lighting is only used to ensure safety around the building, without wasting energy. Extra savings can be achieved by providing lighting only on working days.

Functions - Installer advantages
- Maintenance free: the IC Astro offers similar functionality to a twilight switch but does not require a light sensor. Therefore, no cleaning and no replacement due to vandalism are required.
- Easier installation: than for a twilight switch since wiring for a light sensor is no longer required.
- Geographical optimisation: sunrise and sunset times can be adjusted to take into account the local longitude, shading from higher buildings, nearby cliffs, etc.
- Extension: an override 230 V AC input is provided in the IC Astro. An external switch will provide ON override for testing during maintenance operations.

Zoom on

IC Astro
Programmable astronomical twilight switch

For more details see catalogue.
> Savings enabler
> Up to 25% energy saving can be expected, depending on settings.

Solution diagram

Text for specifications
- Outside lighting shall be controlled by a time switch taking into account local sunrise and sunset hours.

Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>iC60H</td>
<td>MCB C16 A</td>
<td>1</td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB C25 A</td>
<td>1</td>
</tr>
<tr>
<td>IC Astro</td>
<td>Programmable astronomical twilight switch</td>
<td>1</td>
</tr>
<tr>
<td>ICT</td>
<td>Modular contactor 3P+N 25 A</td>
<td>1</td>
</tr>
</tbody>
</table>
Lighting control

On/Off according daylight and presence with override

User/customer benefits
Energy savings, safety: people movements are detected and if light is required it will come on automatically and turn off after a while when they have left. This saves unnecessary lighting and improves safety, since there is no wall switch to look for in the darkness.

Flexibility: a two-way switch at the reception desk (for example) provides a continuous ON override option for special occasions

Sensitivity: a presence detector is much more sensitive than a movement detector (PIR). It will detect the slightest movement.

Functions - Installer advantages
- The PIR activates a relay for higher power handling. Sensitivity is adjustable for taking into account the natural light, as is the timer for the ON state delay after the last movement is detected.
- The two-way switch provides the option of continuous supply of the relay.

Zoom on

Argus Presence
Presence detector

Favourite applications
- hotel
- office

For more details see catalogue.
> **Savings enabler**  
> PIR enables 20 to 80% savings on lighting circuit electricity consumption, depending on adjustment and flow of persons.

**Solution diagram**

**Text for specifications**
- The zone lighting shall be activated by movement detection, taking into account the natural light.
- The lighting can be set continuously ON from a remote switch.

**Products used**

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>iC60H</td>
<td>MCB C2 A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB C32 A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Argus Presence</td>
<td>Presence detector</td>
<td>1</td>
<td>MTN 550590</td>
</tr>
<tr>
<td>ICT</td>
<td>Contactor 1P+N 25 A</td>
<td>1</td>
<td>A9C20732</td>
</tr>
<tr>
<td>Two-way switch</td>
<td></td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Optimise hotel car park lighting

Customer’s needs
The hotel manager wishes to optimise car park lighting operation and control energy costs. He wants to increase the hotel guests’ comfort and safety.

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.

Customer advantages
- A heightened feeling of safety is provided at minimum cost as the lighting is always On when it is dark.
- The settings are easily accessible on the twilight switch located in the electrical distribution panelboard.

Product advantages
Adjustable brightness threshold from 2 to 2000 Lux.
- Screwless terminals for easy and fast connection.
- Simple push-button on front face for test the cabling.
Delivered rotating wall-mounted cell for easier installation.

Favourite applications
- office
- education
- hotel
- industry
- etc.

For more details see catalogue.
> **Energy efficiency benefits**
> - Power saving by automatically extinguishing lighting when it is not necessary.
> - Avoiding relying upon uncertain human action secures savings.
> - A heightened feeling of safety is provided at minimum cost as the lighting is always On when it is dark.

---

**Solution diagram**

![Solution Diagram]

---

**Text for specifications**

The solution is to set the lighting operation threshold on the IC2000 twilight switch according to the external brightness measured by the wall-mounted cell:

- The characteristics of protection circuit-breakers and iCT contactor depend on the installed power and type of load.
- iCT contactor, if power consumption exceeds 2300 W.

---

**Products used**

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC2000</td>
<td>Twilight switch (delivered with wall-mounted cell)</td>
<td>1</td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB 1 pole</td>
<td>1</td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB 3 poles</td>
<td>1</td>
</tr>
<tr>
<td>ICT</td>
<td>Modular contactor 3 poles</td>
<td>1</td>
</tr>
</tbody>
</table>
Lighting control

Optimise shop-window lighting

Customer’s needs
The shop owner wants to light up the shop window at nightfall and save energy by automatically switching off the lighting late at night when the streets are empty.
He wants to prevent the lighting from switching on, on shop closure days.

Recommendation
Use a programmable twilight switch to automatically control shop-window lighting according to brightness and/or the time of the day.

Customer advantages
- A heightened feeling of safety is provided at minimum cost as the lighting is always on when it is dark.
- The settings are easily accessible on the twilight switch located in the electrical distribution panelboard.

Product advantages
- Compact 45 mm product.
- Intuitive text guidance for easy programming.
- External input to override operation using a standard switch.
- Adjustable light level from 2 to 2100 lux.
- Adjustable time delay to prevent unwanted operation in case of short variance of light.
- Automatic winter/summer time change.

Favourite applications
- office + education
- hotel
- industry
- etc.

With darkness comes light

For more details see catalogue.
> **Energy efficiency benefits**
> Power saving by automatically extinguishing lighting when it is not necessary and when there are fewer passers-by.
> The change to summer/winter time is automatic.
> Excellent shop-window lighting as soon as night starts to fall.

**Solution diagram**

![Solution diagram](image)

**Text for specifications**
- IC2000 P+ twilight switch associated with a wall-mounted cell:
  - program on the IC2000P+, the period when you might need light (example: from 9 p.m. to 6 a.m. except Sunday),
  - set the lighting operation threshold on the IC2000P+ according to the external brightness (example: 20 lux).
- Switching the external input on with the standard switch SW, turns on the light permanently.
- Circuit-breakers to protect the devices and the lighting circuits.
- iCT contactor, if power consumption exceeds 2300 W.

**Products used**

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC2000P+</td>
<td>Programmable twilight switch (delivered with a wall-mounted cell)</td>
<td>1</td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB 1 pole</td>
<td>1</td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB 1 pole</td>
<td>1</td>
</tr>
<tr>
<td>SW</td>
<td>One-way switch</td>
<td>1</td>
</tr>
</tbody>
</table>
Automate public lighting according to sunrise and sunset with reduced light feature

Customer’s needs
The local authority wants to improve the reliability of public lighting operation to increase the comfort and safety of its residents. But in the meantime the authority wants to monitor lighting operation time to make energy savings and to further reduce the light level by 50% to save more energy in the off-peak period in the evenings.

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.

Customer 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 software.

Product advantages
- Intuitive text guidance for easy programming.
- Program saved up to 12 years if mains failure.
- Use of memory key and programming via PC with LTS kit for saving and duplicating settings and programs.
- External On override control by switch or push-button.
- Mechanical compatibility with distribution comb busbar for easier installation on symmetrical rail.
- Screwless terminals for easy and fast connection.

Favourite applications
- office
- hotel
- industry

For more details see catalogue.
**Text for specifications**

- IC Astro 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.
- A difference in sunrise and sunset times is adjustable separately by ± 120 min.
- PB push-buttons (or switches) are connected to external inputs 1 and 2 for manual override operation of lighting.
- Circuit breakers to protect the devices and the lighting circuits.
- Maximum admissible power of the IC Astro output contacts depends on the load type.
- The rating of the ICT contactors protection circuit-breaker depends on installed power and load type.

---

### Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC Astro 2C</td>
<td>Programmable astronomical twilight switch, 2 channels (delivered with a memory key)</td>
<td>1</td>
</tr>
<tr>
<td>PB</td>
<td>1 module NO push-buttons or one-way switch</td>
<td>2</td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB 1 pole</td>
<td>1</td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB 3 poles</td>
<td>2</td>
</tr>
<tr>
<td>ICT</td>
<td>Modular contactor 3 poles</td>
<td>2</td>
</tr>
</tbody>
</table>
Automate lighting of surroundings of a building

Customer’s needs
When a public or tertiary building requires illumination of its surroundings at night, simple time programming is not sufficient to ensure safety and energy saving at the same time as the brightness threshold varies according to season and climate. The site manager wishes to light up the surroundings when the natural brightness threshold becomes insufficient and switch off automatically when daylight is sufficient again.

Recommendation
The IC 100 twilight switch is the ideal product for problem-free management of these needs. Once installed and its threshold set, it will automatically switch on and turn off the lighting at the right time. A built-in time delay avoids untimely closing or tripping during undesired transient brightness conditions.

Customer advantages
- Simplicity.
- Energy savings.
- Comfort.
- Safety.

Product advantages
- Simplicity of installation.
- Economic solution.
- Robustness.
- Indication of front panel brightness threshold (LED).
- Setting the tripping threshold from 2 to 100 lux.

Zoom on
IC
With darkness comes light

IC 100

Favourite applications
- office
- education
- hotel
- industry

For more details see catalogue.
Solution diagram

Text for specifications
The solution is to set the lighting operation threshold on the IC 100 twilight switch according to the external brightness measured by the wall-mounted cell:
- The photoelectric cell detects low brightness, causes closure of IC 100 contact and ensures lighting.
- The IC 100 monitoring light comes on when brightness threshold is reached and switches off lighting.
- Time delay on closing and breaking of contact: 10 s.
- For higher powers, relay using a iCT contactor and its protective circuit-breaker: their ratings depend on installed power and load type.

Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC 100</td>
<td>Twilight switch (delivered with wall-mounted cell)</td>
<td>1</td>
</tr>
<tr>
<td>iO60H</td>
<td>MCB 1 pole</td>
<td>1</td>
</tr>
</tbody>
</table>
Optimise hotel car park lighting in accordance with sunrise and sunset times

Customer’s needs
The hotel manager wishes to optimise car park lighting operation. The comfort and security of hotel guests are paramount. The manager also wishes to control energy costs.

Recommendation
Use a programmable astronomical twilight switch allowing automatic switch-on and switch-off of lighting according to sunrise and sunset times.

Customer benefits
- A heightened feeling of security is provided at minimum cost as the lighting is always on when required.
- 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.

Product advantages
- Intuitive text guidance for easy programming.
- Program saved up to 12 years if mains failure.
- Use of memory key and programming via PC with LTS kit for saving and duplicating settings and programs.
- External On override control by switch or push-button.
- Mechanical compatibility with distribution comb busbar for easier installation on symmetrical rail.
- Screwless terminals for easy and fast connection.

Zoom on

IC
With darkness comes light

IC Astro 1C

Favourite applications
- office
- hotel
- industry
- etc.

For more details see catalogue.
Energy efficiency benefits
- Power saving by automatically extinguishing lighting when it is not necessary.
- The change to summer/winter time is automatic.
- Manual override of temporary or permanent On and Off status is possible.

Solution diagram

Text for specifications
- The IC Astro 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.
- A difference in sunrise and sunset times is adjustable separately by $\pm 120$ min.
- PB push-button (or switch) is connected to external input 1 for manual override operation of lighting.
- Circuit-breakers to protect the devices and the lighting circuits.
- Maximum admissible power of the IC Astro output contact depends on the load type.
- The rating of the ICT contactor protection circuit-breaker depends on installed power and load type.

Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC Astro 1C</td>
<td>Programmable astronomic twilight switch, 1 channel</td>
<td>1</td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB 1 pole</td>
<td>1</td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB 3 poles</td>
<td>1</td>
</tr>
<tr>
<td>ICT</td>
<td>Modular contactor 3 poles</td>
<td>1</td>
</tr>
<tr>
<td>PB</td>
<td>NO push-button</td>
<td>1</td>
</tr>
</tbody>
</table>
Centralised push-buttons with local On/Off

User/customer benefits

Energy savings, safety: the lighting for each zone can be activated and deactivated locally by users. At a central point (for example reception desk) the attendant can turn off all the lighting zones in one action to avoid wasting energy in case some users forget to switch off.

For safety reasons all the lighting zones can also be turned on in one action.

Functions - Installer advantages

- Local push-buttons activate impulse relays, individually, for each lighting circuit.
- One central On and one central Off push-button are connected to every iTLc impulse relay. So all the impulse relays can react simultaneously to common commands.
- The iTLc impulse relay saves wiring and space as the central command interface is integrated. The overall width is still 18 mm.

Zoom on

iTLc
Impulse relay

Favourite applications
- hotel
- office
- etc.

For more details see catalogue.
> Savings enabler
> Central On/Off push-buttons allow an energy saving of up to 15% on lighting circuit electricity consumption, depending on user’s discipline.

**Solution diagram**

```
+----------------+-------------------+
|                |                   |
| S1             | A1 iTLc           |
| 1              | 1                 |
| on             | on off            |
| 2              | A2                |
| on             | off               |
| iC60H          | iTLc              |
| L N            |                   |
```

**Text for specifications**
- Each lighting circuit shall be activated by local push-buttons and from general On and Off push-buttons from the reception desk.

**Products used**

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>iC60H</td>
<td>MCB C16 A</td>
<td>1</td>
</tr>
<tr>
<td>iTLc</td>
<td>Impulse relay 16 A with centralised control</td>
<td>2</td>
</tr>
<tr>
<td>PB</td>
<td>Push-button</td>
<td>4</td>
</tr>
</tbody>
</table>
Centralised On+Off push-buttons with status indicator, local On/Off

User/customer benefits

Energy savings, safety: the lighting for each zone can be activated and deactivated locally by users. At a central point (for example reception desk) the attendant can turn On or Off all the lighting zones in one action to avoid wasting energy in case some users forget to switch off.

A lighting status indicator gives visual feedback of the action.

Functions - Installer advantages

- iTL impulse relays: each one drives a single lighting circuit in a conventional way with local push-buttons.
- iATLc+s auxiliary module: provides iTL status changeover contacts and collects common ON and OFF command. It is compatible with standard iTL impulse relay for new or upgrading existing installations.
- Common remote On and Off push-buttons are connected to every iATLc+s on the related On inputs and Off inputs. All impulse relays will react simultaneously to common commands.

Favourite applications

- office
- education
- hotel
- industry
- retail

For more details see catalogue.
Savings enabler
Central On/Off push-buttons allow energy saving of up to 10-15% on lighting circuit electricity consumption, depending on user’s discipline.

Text for specifications
- Each lighting circuit shall be activated by local push-buttons and by common On and Off push-buttons at the reception desk where a summary status indicator will be provided.

Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>iC60H</td>
<td>MCB C2 A</td>
<td>1</td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB C10 A</td>
<td>2</td>
</tr>
<tr>
<td>iTL</td>
<td>Impulse relay</td>
<td>2</td>
</tr>
<tr>
<td>iATLC+s</td>
<td>Central command</td>
<td>2</td>
</tr>
<tr>
<td>iIL</td>
<td>Indicator light</td>
<td>1</td>
</tr>
<tr>
<td>PB</td>
<td>Push-button</td>
<td>4</td>
</tr>
</tbody>
</table>
Centralised On overriding with local On/Off

User/customer benefits
Energy savings and safety: the lighting for each zone can be activated and deactivated locally by users. At a central point (for example reception desk) the attendant can turn off all the lighting zones in one action to avoid wasting energy in case some users forget to switch off.

Functions - Installer advantages
- Local push-buttons activate impulse relays, individually, for each lighting circuit.
- One central Off push-button is connected to every iATLc auxiliary module for iTL or directly to every iTLc impulse relay. As a result, all the impulse relays can react simultaneously to common commands.
- The iTLc impulse relay saves wiring and space as the central command interface is integrated; overall width is still 18 mm.
- The iATLc central command interface is compatible with the standard iTL impulse relay for upgrading existing installations, iATLc+iTL is equivalent to iTLc.

Zoom on

iTLc
Impulse relay

Favourite applications
- Office
- Education
- Hotel
- Industry
- Retail
- Infrastructure

For more details see catalogue.
> **Savings enabler**

> Central Off push-button allows an energy saving of up to 10-15% on lighting circuit electricity consumption, depending on user’s discipline.

---

**Text for specifications**

- Each lighting circuit shall be activated by local push-buttons and from a general Off push-button at the reception desk.

---

**Products used**

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>iC60H</td>
<td>MCB C2 A</td>
<td>1</td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB C16 A</td>
<td>2</td>
</tr>
<tr>
<td>iTLc or iTL+iATLc</td>
<td>Impulse relay with centralised control</td>
<td>2</td>
</tr>
<tr>
<td>PB</td>
<td>Push-button</td>
<td>6</td>
</tr>
<tr>
<td>Two-way switch</td>
<td>Changeover switch</td>
<td>1</td>
</tr>
</tbody>
</table>
Centralised On+Off overriding with local On/Off

User/customer benefits
Energy savings, safety: the lighting for each zone can be activated and deactivated locally by users. At a central point (for example reception desk) the attendant can turn off by overriding all the lighting zones in one action to avoid wasting energy in case some users forget to switch off.
For safety reasons all the lighting zones can be turned ON in one action.
Local actions are permitted only when central overriding is deactivated.

Functions - Installer advantages
- Local push-buttons activate impulse relays, individually, for each lighting circuit.
- One central ON switch and one central OFF switch are connected to every iTLc impulse relay.
- Savings: the iTLc impulse relay saves wiring and space as the central command interface is integrated; overall width is still 18 mm.
- Extension: by adding one MCB and iTLc per extra lighting zone. The connection method is similar.

Zoom on
iTLc
Impulse relays

Favourite applications
- office
- education
- hotel
- industry
- retail
- infrastructure

For more details see catalogue.
> Savings enabler

> Central push-buttons allow an energy saving of up to 10-15% on lighting circuit electricity consumption, depending on user’s discipline.

Solution diagram

Text for specifications
- Each lighting circuit shall be activated by local push-buttons and from general On and Off push-buttons at the reception desk.

Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>iC60H</td>
<td>MCB C2 A</td>
<td>1</td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB C16 A</td>
<td>2</td>
</tr>
<tr>
<td>iTLc</td>
<td>Impulse relay with centralised control</td>
<td>2</td>
</tr>
<tr>
<td>PB</td>
<td>Push-button</td>
<td>6</td>
</tr>
<tr>
<td>Two-way switches</td>
<td>Changeover switch</td>
<td>2</td>
</tr>
</tbody>
</table>
Retro-fit with wireless lighting

User/customer benefits
Office implantation will move with tenant’s configuration that the flexibility of Canalis allows.
Evolutivity thanks to a number of tap-off outlets available for new loads and extension.

Functions - Installer advantages
- Quickness of installation with 2 in 1: 1 circuit for lighting and 1 circuit for emergency lighting.
- Lighting devices will be fed by Canalis KDP meanwhile the push-button will follow the new wall structure.
- Intuitive mounting of Canalis elements and simple programming of RF push-button. This push-button can be removed for new configuration without light modification.

Zoom on

KDP
Flexible busbar

Favourite applications
- office
- hall buildings
- schools.

For more details see catalogue.
Text for specifications

- The electrical power shall be distributed by a flexible busbar trunking system, with plug-in openings factory fitted, at regular intervals for radio frequency connectors.

Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canalis KDP</td>
<td>20 A 3P</td>
<td>1</td>
</tr>
<tr>
<td>Feed units</td>
<td>MCB C32 A</td>
<td>1</td>
</tr>
<tr>
<td>Connectors</td>
<td>RF 6 A</td>
<td>1</td>
</tr>
<tr>
<td>Concrete fixing plug</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Pragma</td>
<td>48 modules</td>
<td>1</td>
</tr>
<tr>
<td>Push-button</td>
<td>Alvais RF</td>
<td>1</td>
</tr>
<tr>
<td>Fastening support &amp; plate</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>
Lighting control

Control office lighting locally

Customer’s needs
The facility manager wants to optimise his/hers operating cost by saving lighting energy in the offices.

Recommendation
Use IHP+2c and iTL to control office lighting locally by push-buttons and centrally by a programmable time switch.

Customer advantages

Product advantages
- Display on backlit LCD screen of the hour and minutes, the day of the week, the current operating mode and the day schedule.
- Use the kit LTS programming tool for easy programmation with a PC.
- 84 switching operations to offer large programming capacities.
- Mechanical compatibility with distribution comb busbar for easier installation on symmetrical rail.
- Screwless terminals for easy and fast connection.

Zoom on

IHP
Efficiency at your fingertips

For more details see catalogue.
**Lighting Control**

**Products used**

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>IHP+2c</td>
<td>Programmable time switch, 2 channels (C1&amp;C2)</td>
<td>1</td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB 2 poles</td>
<td>2</td>
</tr>
<tr>
<td>iTL</td>
<td>Impulse switch</td>
<td>2</td>
</tr>
<tr>
<td>iATLc+s</td>
<td>Impulse relay</td>
<td>2</td>
</tr>
<tr>
<td>PB</td>
<td>NO push-button</td>
<td>2</td>
</tr>
</tbody>
</table>

* French, English, Swedish, Dutch, Finnish, Norwegian/Danish languages. Others languages are available with other references.

---

**Solution diagram**

![Solution diagram](image)

---

**Energy efficiency benefits**

- Energy saving by automatically extinguishing lighting when it is not necessary.
- Easy modification of time switch program for special events and vacation avoiding useless energy spending.

---

**Text for specifications**

Control the lighting of the building:

- By a centralised order transmitted by an impulse type IHP+ 2c to the iATLc+s impulse relay auxiliary. IHP+ 2c functions provide the benefit of centralised:
  - time programming,
  - manual override operation.
- Locally by means of push-buttons and benefit from iTL functions: manual operation using the iTL toggle.
Optimising the lighting of open plan offices

Customer needs
On average, over one-third of the total energy consumed in office buildings is used for lighting.
In this type of building, occupied mainly during the daytime, undeniable energy savings can be achieved by optimising luminaire lighting times.
This installation can manage switching off of the lighting at the desired times, while allowing users to control the luminaires outside of the programmed period.

Proposed solution
- Lighting circuits are switched On and Off by office users by means of room-mounted push-buttons located in each space.
- An IHP time switch sends to the Reflex iC60 circuit protection and control device orders for switching off according to the building’s operating requirements.
- The Reflex integrated control circuit breaker is configured in mode 1 to allow local restarting of the lighting.
- The light switching On/Off data and electrical faults are transmitted to the building’s monitoring room.

Benefits for users/customers
- **Energy efficiency**: optimisation of lighting times allows energy savings of up to 30%.
- **Simplicity**:
  - automated and secure lighting management solution,
  - indications on the front panel of the product and remote signalling.
- **Safety**: padlocking possible without any additional accessory.
- **Continuity of service**: the Reflex iC60 is a bistable actuator which does not change state in the event of a power outage.

Zoom on

**Reflex iC60**
Integrated control circuit breaker

For more details see catalogue.
> Energy savings
> The Reflex iC60 integrated control circuit breaker makes it possible to save up to 30% of electricity consumption while ensuring user safety and comfort.

---

**Technical specifications of the solution**
- The lighting loads must be powered by an integrated control circuit breaker.
- Lighting circuits are switched On and Off by the users of the premises by means of room-mounted push buttons.
- Centrally controlled switching off of the 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**

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>iC60H</td>
<td>Miniature circuit breaker 10 A</td>
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</tr>
<tr>
<td>Reflex iC60H</td>
<td>2P integrated control circuit breaker, C curve, 25 A, 230 V, 50 Hz</td>
<td>2</td>
</tr>
<tr>
<td>PB</td>
<td>N/O room-mounted push-button</td>
<td>2</td>
</tr>
<tr>
<td>IHP</td>
<td>Weekly programmable time switch</td>
<td>1</td>
</tr>
</tbody>
</table>
Lighting control

Local push-buttons enabled by a keycard

User/customer benefits

Energy savings: the user enables the room lighting by inserting the keycard into its support. Local push-buttons will be active.

The lighting is turned off when the card is removed.

Functions - Installer advantages

- Keycard switch: the changeover contact energises the push-buttons when the card is inserted and the Off inputs of the impulse relays when it is removed.
- iTLc impulse relay: drives a single lighting circuit in a conventional way with local push-buttons. Independent On and Off inputs are provided for centralised control.

Favourite applications
- office + education
- hotel
- industry
- retail
- infrastructure

For more details see catalogue.
Savings enabler
Keycard control allows an energy saving of up to 10-15% on lighting circuit electricity consumption, depending on user’s discipline.

Solution diagram

Text for specifications
Use of the lighting is enabled by keycard detection. When the card is in its base, pressing a push-button turns it On and pressing again or removing the card will turn it Off.

Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>iC60H</td>
<td>MCB C2 A</td>
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</tr>
<tr>
<td>iC60H</td>
<td>MCB C10 A</td>
<td>1</td>
</tr>
<tr>
<td>Keycard switch</td>
<td>Changeover contact type</td>
<td>1</td>
</tr>
<tr>
<td>iTLc</td>
<td>Impulse relay with centralised control</td>
<td>1</td>
</tr>
<tr>
<td>PB</td>
<td>Push-button</td>
<td>3</td>
</tr>
</tbody>
</table>
Centralised On+Off overriding and local push-buttons enabled by a keycard

User/customer benefits

Energy savings: use of the room’s lighting circuits is enabled while the keycard is inserted into its base.

Convenience: since a push-button is provided for each lighting circuit, Room On and Room Off push-buttons are provided for faster use.

Functions - Installer advantages

- **Keycard switch**: when the card is inserted the No changeover contact is closed, energizing the push-button line and making the Room On and Room Off push-buttons operational. When the card is removed, the NC contact feeds the Off input of the iTLc relay.

- **iTLc impulse relay**: drives a single lighting circuit in a conventional way with local push-buttons.

A 230 V signal on the Off input from the Room Off push-button or from the keycard’s NC contact will reset the relay. The room On signal sent to the On inputs activates the relays.

Zoom on

**iTLc**

Impulse relays

For more details see catalogue.
> Savings enabler
> Keycard control allows an energy saving of up to 10-15% on lighting circuit electricity consumption, depending on user’s discipline.

Text for specifications
- Use of the lighting is enabled by keycard detection. Each circuit can be controlled separately by a separate push-button and collectively by Room On and Room Off push-buttons.

Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>iC60H</td>
<td>MCB C2 A</td>
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</tr>
<tr>
<td>iC60H</td>
<td>MCB C10 A</td>
<td>1</td>
</tr>
<tr>
<td>Keycard switch</td>
<td>Changeover contact type</td>
<td>1</td>
</tr>
<tr>
<td>iTLc</td>
<td>Impulse relay with centralised control</td>
<td>1</td>
</tr>
<tr>
<td>PB</td>
<td>Push-button</td>
<td>5</td>
</tr>
</tbody>
</table>
User/customer benefits

Energy savings: use of the room’s lighting circuits is enabled when the keycard is inserted into its base.

Convenience: push-buttons are provided for each lighting circuit. Room On and Room Off push-buttons are provided for faster use (action on several circuits).

Safety: the lighting stays On for the preset time once the card has been removed.

Functions - Installer advantages

- Keycard switch: when the card is inserted the No changeover contact is closed, so the push-button line is energised, Room On and Room Off push-buttons are operational. When the card is removed, the NC contact feeds the Off input of the iTLc impulse relay.

- iRTC time delay relay: its changeover contact energises the push-button line as soon as the Y1 input is high. The adjustable time delay starts when the keycard switch contact opens, then the changeover contact energises the Off inputs of the iTLc impulse relays.

- iTLc impulse relay: drives a single lighting circuit in a conventional way with local push-buttons.
  A 230 V signal on the Off input from the Room Off push-button or NC contact of the iRTC will reset the relay. The Room On signal sent to the On input activates the relay.

Favourite applications

- office
- education
- hotel
- industry
- retail
- infrastructure.

For more details see catalogue.
> Savings enabler

> Keycard control allows an energy saving of up to 10-15% on lighting circuit electricity consumption, depending on user’s discipline.

---

Solution diagram

![Diagram showing keycard switch, time delay relay, impulse relay, and push-buttons with connections labeled as follows:

- L: Lighting
- N: Neutral
- Room ON: Active when card is inserted
- Room OFF: Active when card is removed
- Local: Manual control
- OFF: Automatic Room Off after time delay
- 1 minute time delay after the card is removed

---

Text for specifications

- Use of the lighting is enabled by keycard detection. Each circuit can be controlled separately by a separate push-button and collectively by Room On and Room Off push-buttons. Automatic Room Off comes after the preset time delay once the card has been removed.

---

Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
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<tbody>
<tr>
<td>iC60H</td>
<td>MCB C2 A</td>
<td>1</td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB C10 A</td>
<td>1</td>
</tr>
<tr>
<td>Keycard switch</td>
<td>Changeover or Normal Open contact type</td>
<td>1</td>
</tr>
<tr>
<td>iRTC</td>
<td>Time delay relay</td>
<td>1</td>
</tr>
<tr>
<td>iTLc</td>
<td>Impulse relay with centralised control</td>
<td>1</td>
</tr>
<tr>
<td>PB</td>
<td>Push-button</td>
<td>5</td>
</tr>
</tbody>
</table>
Lighting control

Lighting and wall socket circuits enabled by a keycard with delayed disabling

User/customer benefits

Energy savings: use of electrical appliances in the room is enabled when the keycard is inserted into its base.

Safety, comfort: electrical appliances are turned off after a time delay starting when the card is removed, making it easier to have a last look before leaving.

Functions - Installer advantages

- Keycard switch: the No contact is closed when the card is inserted; it energises the Y1 time delay input.
- iRTC time delay relay: its changeover contact energises the push-button line as soon as the Y1 input is high. The adjustable time delay starts when the keycard switch contact opens, then the changeover contact energises the Off inputs of the iTLc impulse relays.
- iTLc impulse relay: drives a single lighting circuit in a conventional way with local push-buttons. A 230 V signal on the Off input will reset the relay.
- iCT relay: the power relay is directly fed by the iRTC time delay relay when the card is inserted. The iCT relays control the switched lighting circuit and the wall socket circuit.

Zoom on

iRTC
Time delay relay

For more details see catalogue.
> **Savings enabler**  
> Keycard control allows an energy saving of up to 10-15% on lighting circuit electricity consumption, depending on user’s discipline.

## Text for specifications
- Use of the room’s lighting and wall sockets is enabled by keycard detection. The end of enablement comes after a presetable time delay starting when the card is removed.

## Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>iC60H (Q1)</td>
<td>MCB C2 A</td>
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</tr>
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<td>iC60H (Q2, Q3)</td>
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</tr>
<tr>
<td>iC60H (Q4)</td>
<td>MCB C16 A</td>
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</tr>
<tr>
<td>Keycard switch</td>
<td>NO contact type</td>
<td></td>
</tr>
<tr>
<td>iTLC</td>
<td>Impulse relay with centralised control</td>
<td></td>
</tr>
<tr>
<td>iRTC</td>
<td>Time delay relay</td>
<td>1</td>
</tr>
<tr>
<td>ICT</td>
<td>Contactor 1P+N 16 A</td>
<td>1</td>
</tr>
<tr>
<td>PB</td>
<td>Push-button</td>
<td>8</td>
</tr>
<tr>
<td>Wall socket</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>
Controlling power off for a hotel room by keycard

Customer needs
A hotel room is a private space yet remains under the responsibility of the operator. Ensuring customer safety and comfort whilst optimising profitability are the main concerns of a hotel manager.

To limit electrical risks during periods of non-occupancy of the room and reduce electricity consumption, the proposed system allows all the electrical circuits used by the customer (power sockets, lighting) to be powered off except for the facilities that must be left powered up for reasons of comfort (refrigerator, air conditioning).

Proposed solution
- 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 has been 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.

Benefits for users/customers
- Safety: 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: Simplicity of the control circuit thanks to the Ti24 interface, which provides a direct link with the room’s PLC.

Zoom on

Reflex iC60
Integrated control circuit breaker

With Ti24 interface

Applications:
- hotel
- supermarket
- factory
- university
- offices.

For more details see catalogue.
> **Energy savings**

- The Reflex iC60 integrated control circuit breaker makes it possible to save up to 30% of electricity consumption while ensuring user safety and comfort.

---

**Solution diagram**

---

**Technical specifications of the solution**

- The non-priority loads must be powered by an integrated control circuit breaker, which should be able to operate in all positions to allow installation in a false ceiling.
- The integrated control circuit breaker can 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 must generate no noise or unwanted temperature rise.

---

**Products used**

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reflex iC60H</td>
<td>2P integrated control circuit breaker, C curve, 25 A 230 V 50 Hz, with Ti24 interface</td>
<td>1</td>
</tr>
<tr>
<td>iC60H</td>
<td>10 A 2P circuit breaker, C curve</td>
<td>5</td>
</tr>
<tr>
<td>iC60H</td>
<td>16 A 2P circuit breaker, C curve</td>
<td>1</td>
</tr>
</tbody>
</table>
Lighting control

Time scheduled Off and local push-buttons

User/customer benefits

Ease of use: zone lighting is activated with local push-buttons.
Energy savings: the lighting is automatically deactivated at the programmed closing time and then periodically.

Flexibility of use: light can still be switched On after switch-off time. It will be deactivated after the next programmed interval if no manual Off comes earlier.
Global building energy performance: this application can be selected as C-class energy performance.

Functions - Installer advantages

- On/Off control of lighting circuits (unlimited number of circuits): with iTLc impulse relays.
- Time scheduling: an IHP+ time switch sends periodic Off pulses starting at closing time. The interval is programmable. Pulses are collected by the iTLc.
- Savings: minimum wiring and maximum space saving as the iTLc does not need any auxiliary override module.
- Extension: by adding one MCB and iTLc per extra lighting zone. The connection method is similar.

Zoom on

iTLc
Impulse relay

Favourite applications
- office
- education
- industry
- retail
- infrastructure

For more details see catalogue.
> Savings enabler
> Up to 15% energy saving can be expected, depending on user’s discipline.

Solution diagram

Text for specifications
- The zone’s lighting circuits shall be manually operated by local push-buttons. At the preset closing time the lighting shall be automatically switched off, periodic off shall occur at programmable intervals during closing time, whilst reactivation with push-buttons will remain available.

Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>iC60H</td>
<td>MCB C2 A</td>
<td>1</td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB C16 A</td>
<td>2</td>
</tr>
<tr>
<td>iTLc</td>
<td>Impulse relay 16 A with centralised control</td>
<td>2</td>
</tr>
<tr>
<td>IHP+ 1C</td>
<td>Programmable time switch</td>
<td>1</td>
</tr>
<tr>
<td>PB</td>
<td>Push-button</td>
<td>6</td>
</tr>
</tbody>
</table>
User/customer benefits

Energy savings: the lighting for all zones is automatically activated at the beginning of the programmed occupancy hours and deactivated at the end. Lights can be switched off for the midday break.

Flexibility: from every zone users can activate and deactivate the local lighting from a single push-button. The automatic On and Off will still be active.

Functions - Installer advantages

- Manual On/Off control of each lighting circuit (unlimited number): with iTLc impulse relays.
- Time scheduling: an IHP+ 2-channel time switch sends On and Off pulses at opening and closing times. Pulses are collected by the iTLcs on their On/Off override inputs. It is suggested that several Off pulses are programmed overnight to prevent misuse of manual activation.
- Extension: more iTLc can be added and connected in parallel on the On/Off pulse lines.

Zoom on

iTLc
Impulse relay

Favourite applications
- office
- education
- industry
- retail
- infrastructure

For more details see catalogue.
Savings enabler

Depending on user’s discipline, savings of 10 to 20% can be expected.

Solution diagram

Text for specifications

- The zone’s lighting circuits shall be manually operated by local push-buttons. At the preset opening time the lighting for all zones shall be automatically switched on and then switched off at the closing time and periodically during the closing time. The local push-buttons will still be active.

Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>iC60H</td>
<td>MCB C2 A</td>
<td>1</td>
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<tr>
<td>iC60H</td>
<td>MCB C16 A</td>
<td>2</td>
</tr>
<tr>
<td>iTLc</td>
<td>Impulse relay 16 A with centralised control</td>
<td>2</td>
</tr>
<tr>
<td>IHP+ 2C</td>
<td>Programmable time switch</td>
<td>1</td>
</tr>
<tr>
<td>PB</td>
<td>Push-button</td>
<td>6</td>
</tr>
</tbody>
</table>
Building vacancy program with zone Off push-buttons and local push-buttons

User/customer benefits

Energy savings: the lighting of rooms on different floors is automatically turned OFF at a defined preset time (closing time of the building). Each floor can be turned off manually with a dedicated push-button. Each room can be turned On and Off locally.

Convenience: Outside the closing period the lighting can be switched ON locally; it will stay ON until the next periodic stop sent by the time switch.

Functions - Installer advantages

- Hard-wired solution: for lighting applications, group control and time scheduling. Provided with conventional electrotechnical equipment. Testing is simple, extension is by addition of iTLC impulse relay.
- iTLC impulse relay: controls one lighting circuit with a dedicated push-button. Its On and Off inputs get the common Floor Off order from a push-button and building Off from the building time switch.
- iATLC+c: there is one auxiliary module per floor. This module isolates the common OFF order of its floor, preventing it from turning Off the other floors.
- IHP+ 1C: this impulse 1 channel time switch defines the closing time of the building. A 1 second impulse must be programmed at the closing time and later, every X hours during the closing period, depending on the desired frequency of the periodic stops.
- Option: common On order can be provided by cabling the On inputs of iTLCs the same way as the Off inputs. For an automatic ON impulse at the beginning of a working day, replace the IHP+ 1C with an IHP+ 2C connected to every iATLC+s (second diode) and every On input.

Zoom on

iATLC+c
Central control for impulse relays

For more details see catalogue.
Solution diagram

Text for specifications
- Each lighting circuit shall be activated individually by local push-buttons. A lighting de-activation push-button shall be provided on each floor, with action on the defined lighting zone. A zone is a group of circuits. All floors shall be de-activated at the closing time defined in a time switch and then periodically until the building is opened again. Manual action is possible between periodical stops.

Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>iP60H</td>
<td>MCB C2 A</td>
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</tr>
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<td>iP60H</td>
<td>MCB C10 A</td>
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</tr>
<tr>
<td>iATLC+c</td>
<td>Central command</td>
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</tr>
<tr>
<td>iTLc</td>
<td>Impulse relay 16 A with centralised control</td>
<td>4</td>
</tr>
<tr>
<td>IHP+ 1C</td>
<td>Programmable time switch</td>
<td>1</td>
</tr>
<tr>
<td>PB</td>
<td>Push-button NO</td>
<td>14</td>
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</tbody>
</table>
Centralised On+Off and local push-buttons, 1 circuit enabled by daylight condition

User/customer benefits

Energy savings: once the lighting circuit closest to the windows is defined, this circuit is automatically turned off when there is sufficient natural light and action on its push-button is cancelled. The other lighting circuits in the room remain independent from this automatic control.

Efficient use: users can activate and de-activate each lighting circuit from a single push-button. Room On and Off push-buttons are provided for efficient use on all of the room’s circuits.

Functions - Installer advantages

- Circuit manual On/Off: control of each lighting circuit (unlimited number) with push-buttons coupled to iTLc impulse relays.
- Room manual push-buttons activate and de-activate all iTLc impulse relays simultaneously, from their On/Off inputs.
- Twilight switch + outdoor sensor: an IC2000 delivers the supply to the push-buttons on the window circuit only when the natural light level is low. When the light is sufficient or by actioning the general Off push-button a general Off signal is sent to all iTLc.
- Extension: more iTLc can be added and connected in parallel on the On/Off lines.

Zoom on

IC2000
Light sensitive switch

IC2000 + Cell

Favourite applications

- office
- education
- industry
- retail
- infrastructure

For more details see catalogue.
> **Savings enabler**  
> Depending on the user’s discipline, a saving of 20% can be expected.

**Solution diagram**

- **Lighting Control**
- **Products used**
- **Solution diagram**

**Text for specifications**

- The room’s lighting circuits shall be individually operated by dedicated push-buttons and simultaneously by Room On and Room Off push-buttons. Manually actioning the lighting circuit closest to the windows will only be possible when the natural light level is insufficient; it will be automatically turned Off when sufficient light is detected.

**Products used**

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>iC60H</td>
<td>MCB C2 A</td>
<td>1</td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB C10 A</td>
<td>2</td>
</tr>
<tr>
<td>IC2000</td>
<td>Twilight switch + outdoor sensor (cell)</td>
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</tr>
<tr>
<td>iATLc+c</td>
<td>Central command</td>
<td>1</td>
</tr>
<tr>
<td>iTLc</td>
<td>Impulse relay 16 A with centralised control</td>
<td>2</td>
</tr>
<tr>
<td>PB</td>
<td>Push-button</td>
<td>8</td>
</tr>
</tbody>
</table>
Monitor lighting time and manage the bells in a school

Customer’s needs
The school director wants to optimise his operating costs by saving lighting energy and to automatically start school bells at the right time.

Recommendation
Limit the amount of lighting used to the number of hours required for school activities by programming the times during which classrooms and common areas need to be lit. Monitor how long the lighting is used and be informed when the time is exceeded (for maintenance purposes). Program bell operating times and durations.

Customer advantages
- Automatic management of school bells and lighting.
- Easy modification of time switch program for special events and vacation.
- Easy copying of the program from one time switch to another with the memory key.
- Possibility of temporary or continuous override operation with standard switch or push-button installed away from the panelboard to allow cleaning and maintenance persons to work outside school hours.
- Automatic summer/winter time change.

Product advantages
- Display on backlit LCD screen of the hour and minutes, the day of the week, the current operating mode and the day schedule.
- Use the kit LTS programming tool for easy programmation with a PC.
- 84 switching operations to offer large programming capacities.
- Mechanical compatibility with electrical distribution comb busbar for easier installation on symmetrical rail.
- Screwless terminals for easy and fast connection.

IHP
Efficiency at your fingertips

For more details see catalogue.
> **Energy efficiency benefits**
> Energy saving by automatically extinguishing lighting when it is not necessary.
> Easy modification of time switch program for special events and vacation, avoiding useless energy spending.
> The change to summer/winter time is automatic.

### Text for specifications

IHP+2c programmable time switch to program:
- on IHP+2c output 1; the days and times when the lighting should be switched on (example: Monday to Friday 8 h 15 to 9 h 30 and 15 h 30 to 18 h 30).
- on IHP+2c output 2; the day, time and duration of school bell operation using the pulse function (example: Monday to Friday every hour from 8 h 30 to 16 h 30, the bells operate 20 s).

- Standard switch or push-button connected to the external input 1 for off-hours timer operations.
- Circuit-breakers to protect the devices and lighting circuits.
- ICT contactor, to manage the school lighting.
- The characteristics of protection circuit-breakers and ICT contactor depend on the installed power and type of load.

### Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>IHP+2c</td>
<td>Programmable time switch, 2 channels</td>
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</tr>
<tr>
<td>iC60H</td>
<td>MCB 1 pole</td>
<td>2</td>
</tr>
<tr>
<td>ICT</td>
<td>Modular contactor 2 poles</td>
<td>1</td>
</tr>
<tr>
<td>PB</td>
<td>NO push-button</td>
<td>1</td>
</tr>
</tbody>
</table>
Manage lighting in various parts of a shop

Customer’s needs
The shop manager wants to control the energy consumption while maintaining an appropriate lighting level in the different parts of his shop.

Recommendation
- A time switch ITM offers all the necessary features in a single product:
  - Shop and window lighting limited to opening times,
  - Time delay of storeroom lighting,
  - Flashing of the illuminated shop sign in association with a twilight switch when night falls.

Customer advantages
- Automation ensures better control of energy expenses.
- The shop window and sign are valorised.
- The range of features reduces installation volume.

Product advantages
- Easy copying of the program from one time switch to another with the memory cartridge.
- Multifunctional, compact, modular and economical.
- Simple accessible configuration on the front face.
- Possibility to control up to 4 separate outputs.

Zoom on

ITM & IC
Program, time delay and count. Let yourself be guided.

Favourite applications
- Office
- Education
- Hotel
- Industry

For more details see catalogue.
> Energy efficiency benefits
> Automation ensures better control of energy expenses by automatically extinguishing lighting when it is not necessary.
> Energy saving while emphasising the shop window and lighted signs.

Solution diagram

The ITM is used to control 4 output channels (C1 to C4) according to the status of 3 inputs (E1 to E3). The E3 input is conditioned by the level of external brightness controlled by IC2000.

<table>
<thead>
<tr>
<th>Output</th>
<th>Use</th>
<th>Type of function used (programming)</th>
<th>Input</th>
<th>Type of input used</th>
<th>Connected components</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Window lighting</td>
<td>Weekly time programming</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>C2</td>
<td>Stock room lighting</td>
<td>Timer</td>
<td>E1</td>
<td>Control input</td>
<td>PB push-button</td>
</tr>
<tr>
<td>C3</td>
<td>Sales area lighting</td>
<td>Weekly time</td>
<td>E2</td>
<td>Override input programming</td>
<td>SW switch</td>
</tr>
<tr>
<td>C4</td>
<td>Neon sign</td>
<td>Flashing</td>
<td>E3</td>
<td>Condition input</td>
<td>Twilight switch</td>
</tr>
</tbody>
</table>

Output C1 allows lighting of the shop window at the required times and days.
Output C2, programmed in timer function, receives the operating authorisation from PB push-button connected to input E1.
Output C3 authorises lighting of the sales area at the required times and days. It can be forced by the SW switch cabled to the input E2.
Output C4 makes the shop sign flash when the twilight switch connected to E3 enables it to do so.

Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITM 4c-6E</td>
<td>Multifunctional switch</td>
<td>1</td>
</tr>
<tr>
<td>IC 2000</td>
<td>Twilight switch (delivered with a wall-mounted cell)</td>
<td>1</td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB 1 pole</td>
<td>1</td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB 1 pole</td>
<td>5</td>
</tr>
<tr>
<td>ICT</td>
<td>Modular contactor 2 poles</td>
<td>4</td>
</tr>
<tr>
<td>PB &amp; SW</td>
<td>NO push-button &amp; one-way switch</td>
<td>1</td>
</tr>
</tbody>
</table>
Monitor lighting time and manage the bells in a school

Customer’s needs
The school director wants to optimise his operating costs by saving lighting energy and to automatically start school bells at the right time.

Recommendation
Limit the amount of lighting used to the number of hours required for school activities by programming the times during which classrooms and common areas need to be lit. Monitor how long the lighting is used and be informed when the length of time is exceeded. Program bell operating times and durations.

Customer advantages
- All the necessary features in a single product. Control up to 4 separate outputs:  
  - general management output,  
  - lighting output,  
  - bell output,  
  - preventive maintenance output.  
- The range of features reduces installation volume.

Product advantages
- Easy copying of the program from one time switch to another with the memory cartridge.  
- Multifunctional, compact, modular and economical.  
- Simple accessible configuration on the front face.

Zoom on

ITM
Program, time delay, count. Let yourself be guided

ITM4c - 6E

Favourite applications
- office  
- education  
- hotel  
- industry

For more details see catalogue.
> Energy efficiency benefits
> Energy saving by automatically extinguishing lighting when it is not needed.
> Easy modification of time switch program for special events and holidays, avoiding useless energy spending.
> The change to summer/winter time is automatic.

Solution diagram

The ITM multifunctional time switch controls 4 output channels (C1 to C4) according to the status of 2 inputs (E1 and E2).

<table>
<thead>
<tr>
<th>Output</th>
<th>Use</th>
<th>Type of function used (Programming)</th>
<th>Input</th>
<th>Type of input used (Functions)</th>
<th>Connected components</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>General management</td>
<td>Annual schedule programming: school opening dates</td>
<td>E1</td>
<td>Metering input: counts the number of hours the lighting operates in the building (C3 output)</td>
<td>C3 output</td>
</tr>
<tr>
<td>C2</td>
<td>Inter-classroom bells</td>
<td>Impulse programming: times days and operating duration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>Building lighting</td>
<td>Weekly schedule programming: operating times and days</td>
<td>E2</td>
<td>Reset input: the counters is reset manually via the push-button</td>
<td>Push-button contact</td>
</tr>
<tr>
<td>C4</td>
<td>Duration exceeded</td>
<td>Hour counter programming: maximum usage time of C3 output</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

C1 output, wired in series with C2 output, prevents the bells ringing on days when the school is not open.
*CBuilding lighting* C3 output is connected to metering E1 input to which it transmits the number of hours during which it operated.
*C4 output switches on the green indicator light on the push-button when the maximum usage time of C3 output is exceeded. The push-button is used to reset the number of operating hours indicated by reset E2 input.

Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITM4c-6E</td>
<td>Multifunctional time switch</td>
<td>1</td>
</tr>
<tr>
<td>iC60H</td>
<td>MCB 1 pole</td>
<td>3</td>
</tr>
<tr>
<td>iCT</td>
<td>Modular contactor 2 poles</td>
<td>1</td>
</tr>
<tr>
<td>iPB</td>
<td>Modular NC push-button with indicator light</td>
<td>1</td>
</tr>
</tbody>
</table>
Improving management of a public lighting system in a town

Customer needs
The quality of lighting is of prime importance for a town. This 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;
- Switching the power socket circuit On and Off;
- Information on equipment operating states, so as to plan repair operations;
- Remote restarting following an electrical fault.

In the event of a remote management failure, a function designed to ensure improved dependability of service is performed by a local PLC for switching the public lighting On and Off.

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

Benefits for users/customers
- Simplicity:
  - automated, secure solution for switching the power supply On and Off;
  - indications on the front panel of the product and remote indication.
- Safety: 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.

Zoom on

RCA ic60
Remote control

With Ti24 interface

For more details see catalogue.
> Improving lighting management
> Optimisation of lighting time while ensuring improved quality of service.

Solution diagram

Technical specifications of the solution

- 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

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCA iC60</td>
<td>230 V AC 50 Hz remote control with Ti24 4P interface</td>
<td>2</td>
</tr>
<tr>
<td>iO60H</td>
<td>20 A 4P circuit breaker, B curve</td>
<td>2</td>
</tr>
<tr>
<td>Vigi iO60</td>
<td>300 mA 4P earth leakage module</td>
<td>2</td>
</tr>
<tr>
<td>RCA iC60</td>
<td>230 V AC 50 Hz remote control with Ti24 2P interface</td>
<td>1</td>
</tr>
<tr>
<td>iO60H</td>
<td>16 A 2P circuit breaker, C curve</td>
<td>1</td>
</tr>
<tr>
<td>Vigi iO60</td>
<td>30 mA 2P earth leakage module</td>
<td>1</td>
</tr>
</tbody>
</table>
Automating the lighting for an industrial workshop

Customer needs
The lighting of an industrial workshop is of prime importance to ensure employee safety and good productivity at work stations. To optimise consumption, it is advantageous to automate lighting times according to work periods. For safety reasons, employees must not be able to switch off the lights. However, it is necessary to allow local override control in order to perform maintenance operations (change of lamps or night work in the workshop, for example).

This installation allows the operator to choose an automated or manual mode for the control of each lighting circuit.

Proposed solution
- The lighting loads are powered by a Reflex iC60 integrated control protective device.
- The Building Management System (BMS) sends to the Reflex orders for switching On and Off according to the building’s operating requirements.
- The Reflex integrated control circuit breaker is configured in mode 3 to allow override control of the lighting or switching off of the lighting by the operator.
- The light switching On/Off data and electrical faults are transmitted to the facility’s monitoring room.

Benefits for users/customers
- Simplicity:
  - no weak current interface between the Reflex and the Building Management System (BMS),
  - lower cabling costs, up to 50% fewer connections,
  - indications on the front panel of the product and remote signalling.
- Flexibility: possibility of manual override control.
- Safety: padlocking possible without any additional accessory.
- Continuity of service: the Reflex iC60 is a bistable actuator which does not change state in the event of a power outage.

Zoom on

Reflex iC60
Integrated control circuit breaker

Reflex iC60H with Ti24 interface

Favourite applications:
- industrial workshop
- conference room
- station platform
- airport hall
- supermarket.

For more details see catalogue.
> Energy savings

The Reflex iC60 integrated control circuit breaker makes it possible to save up to 30% of electricity consumption while ensuring user safety and comfort.

Solution diagram

Technical specifications of the solution

- The lighting loads must be powered by an integrated control circuit breaker.
- On/Off control of lighting circuits must be supervised by a management PLC connected to a BMS.
- Manual override setting of the lighting On or Off can be performed by a selector switch on the front of the electrical distribution switchboards.
- The light switching On/Off data and electrical faults are transmitted to the supervision system, without any additional weak current interfaces.

Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>iC60H</td>
<td>Miniature circuit breaker C 10 A</td>
<td>1</td>
</tr>
<tr>
<td>Reflex iC60H</td>
<td>4P integrated control circuit breaker, C curve, 25 A, Ti24 (mode 3 setting)</td>
<td>2</td>
</tr>
<tr>
<td>Harmony serie K</td>
<td>3-position selector switch, dia. 22 mm</td>
<td>2</td>
</tr>
</tbody>
</table>
Managing the lighting of an outdoor car park with two levels of intensity

Customer needs
Lighting for an outdoor car park is provided by high-power lights. However, depending on the level of luminosity and the occupancy of the car parks, lighting at maximum power is not always necessary. Accordingly, managing lighting according to the various levels of intensity makes it possible to optimise energy and bulb replacement costs.

This installation can manage lighting automatically by measuring the luminosity. The power is adapted according to the periods of use of the car park.

Proposed solution
- A Multifunction Time Switch sends to the Reflex iC60 circuit protection and control device orders for switching On and Off according to the building’s operating requirements.
- A light sensitive switch can adapt the light intensity of each zone.
- The Reflex iC60 integrated control circuit breaker is configured in mode 1 to allow override control of the lighting by the operator.
- The light switching On/Off data and electrical faults are transmitted to the facility’s monitoring room.

Benefits for users/customers
- Energy efficiency:
  - optimisation of lighting times and power allows energy savings of up to 30%,
  - increase in luminaire service life.
- Simplicity:
  - reduction in wiring time,
  - indications on the front panel of the product and remote signalling.
- Safety: padlocking possible without any additional accessory.
- Continuity of service: the Reflex iC60 is a bistable actuator which does not change state in the event of a power outage.

Reflex iC60
Integrated control circuit breaker

For more details see catalogue.
> Energy savings

> The Reflex iC60 integrated control circuit breaker makes it possible to save up to 30% of electricity consumption while ensuring user safety and comfort.

Solution diagram

Technical specifications of the solution
- The lighting loads must be powered by an integrated control circuit breaker.
- On/Off control of the lighting circuits is performed by a time switch connected to a photocell which can adjust lighting power depending on the light intensity.
- Manual override control of the lighting by push buttons must be possible.
- The light switching On/Off data and electrical faults are transmitted to the monitoring room.

Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>iC60H</td>
<td>Miniature circuit breaker C 10 A</td>
<td>1</td>
</tr>
<tr>
<td>Reflex iC60H</td>
<td>2P integrated control circuit breaker, C curve, 25 A, 230 V, 50 Hz</td>
<td>2</td>
</tr>
<tr>
<td>ITM</td>
<td>Multifunction time switch</td>
<td>1</td>
</tr>
<tr>
<td>IC100</td>
<td>Light sensitive switch and photocell</td>
<td>1</td>
</tr>
<tr>
<td>iPB</td>
<td>Grey N/O push-button</td>
<td>2</td>
</tr>
<tr>
<td>iIL</td>
<td>230 V red indicator lamp</td>
<td>2</td>
</tr>
</tbody>
</table>
Customer needs
In an underground car park, ventilation and lighting play a major part in personal safety.

1. Any malfunction must immediately alert the supervision staff.
2. The supervision staff must be able to diagnose the malfunction and put the equipment back into service very quickly: remotely, where possible, or on site.
3. If the automated control device fails, these loads must remain operational without interruption.

Proposed solution
• The Acti 9 Smartlink enables all the terminal switchboards to be directly connected to the site monitoring network.
• The circuit breaker auxiliaries iOF+SD24 indicate any tripping or deliberate opening.
• The contactors and impulse relays receive the On/Off switching orders and indicate their state.
• Switches on the front panel of the switchboards allow the maintenance personnel to activate the automated device to control the contactors and impulse relays via push-buttons. In this case, the position of the inhibitor switch is sent over the Modbus network by the Acti 9 Smartlink interface.

Benefits for customers
• The devices are connected to the Modbus network via the Acti 9 Smartlink communication interfaces and fully prefabricated connectors:
  - cabling is quickly installed, without risk of error (cable inversion, etc.).
  - during maintenance operations, the “fine wire” links inside the switchboard can immediately be identified. No handling tool is required, thanks to the plug-in connectors.
• A single RS485 link connects the various switchboards to the PLCs and to the monitoring system.
• Reliability of data and indications:
  - IEC 60947-5-4 compliant low-level signalling contacts iOF+SD24
  - high level of electromagnetic compatibility of Acti 9 Smartlink modules.
• Integrated into Acti 9 Smartlink, protection device trip and luminary operating time metering makes it possible to plan preventive maintenance.

Zoom on
Acti 9 Communication System
Acti 9 Smartlink
iOF+SD24
iACT24

Prefabricated cables
iOF+SD24
iACT24

• iOF+SD24 compatible with all Acti 9 circuit breakers and residual current devices
• Flexible contactor control management
• Conformity with IEC 60 947-5-4, IEC 60 947-5-1 and IEC 61131-2
• Prefabricated 5-point connectors.
> Improved device availability
> Less downtime due to efficient, reliable remote management.

**Solution diagram**

**Products used**

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acti 9 Smartlink</td>
<td>Communication interface</td>
<td></td>
</tr>
<tr>
<td>iOF+SD24</td>
<td>24 V DC circuit breaker auxiliaries</td>
<td></td>
</tr>
<tr>
<td>iACT24</td>
<td>24 V DC contactor auxiliaries</td>
<td></td>
</tr>
<tr>
<td>iATL24</td>
<td>24 V DC impulse relay auxiliaries</td>
<td></td>
</tr>
<tr>
<td>Prefabricated cables</td>
<td>Short: 100 mm Average: 160 mm Long: 870 mm Long, semi-prefabricated: 870 mm</td>
<td></td>
</tr>
<tr>
<td>Ti24 connectors</td>
<td>Pack of 12</td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>24 V DC</td>
<td></td>
</tr>
<tr>
<td>Premium</td>
<td>PLC</td>
<td></td>
</tr>
</tbody>
</table>
Dali installation in Canalis

User/customer benefits
In shopping mall, Canalis enables distribution of electricity and data to all building with possibility to have different zones.

Centralised installation: availability of power for replacement and modifications.
Lighting management linked to existing BMS.

Energy saving by adding dimming ballasts enable user to reduce by 35% the consumption of electricity: the ballasts will regulate the power of lighting according either with configuration or with presence sensor.

Functions - Installer advantages
- Easy of installation with Plug&Play system, type tested in factory.
- The KBC connector allows zoning just by phase selection.
- Easiness of installation with 1 installation time for 3 types of load: lighting, heaters and emergency lighting.
- Same concept for power distribution with KS and KN to feed KBB lines.
- The connection to BMS is done with same busbar trunking thanks to T option of KBB.

Zoom on

KBB
Rigid busbar trunking

Favourite applications
- office
- retail.

For more details see catalogue.
Savings enabler
- Can reduce up to 1/3 the lighting exploitation with zoning.
- And up to 35% with dimming command.
- Time: installation for safety circuit and for ambiance light circuit carried out in one action

Solution diagram

Text for specifications
- The tap-off units can be connected and disconnected under energised conditions without risk to the operator.
- Lighting distribution circuit shall allow Dali management.

Products used

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
<th>Unit</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canalis KBB</td>
<td>40 A in T version: straight length, flexible elbow, fixing brackets, hooks and feed units</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Canalis KBC</td>
<td>16 A, with protection</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Canalis KNA</td>
<td>100 A, straight length</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Canalis KNB</td>
<td>Plastic Tap-off for protection devices</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
As the global specialist in energy management with operations in more than 100 countries, Schneider Electric offers integrated solutions across multiple market segments, including leadership positions in energy and infrastructure, industrial processes, building automation and data centres/networks, as well as a broad presence in residential applications.

Schneider Electric is dedicated to making individuals’ and organisations’ energy safe, reliable, efficient, productive and green from Power Plant to Plug™.

We are changing our brand names and becoming one Schneider Electric. You’ll get the same great quality products, but from one name you can remember and trust. This provides you and your customers with the reassurance associated with Schneider Electric.

Some of our market leading brands have already become Schneider Electric including Merlin Gerin, Telemecanique, Square D, GET, Mita, Sarel, Himel, Thorsman, Tower and TAC.

Working as one Schneider Electric makes it clearer that our ranges are highly compatible for integrated solutions.