Canalis® busbar trunking

Technical Guide

Automotive industry

Schneider Electric

Contents

Floor plan of a car plant

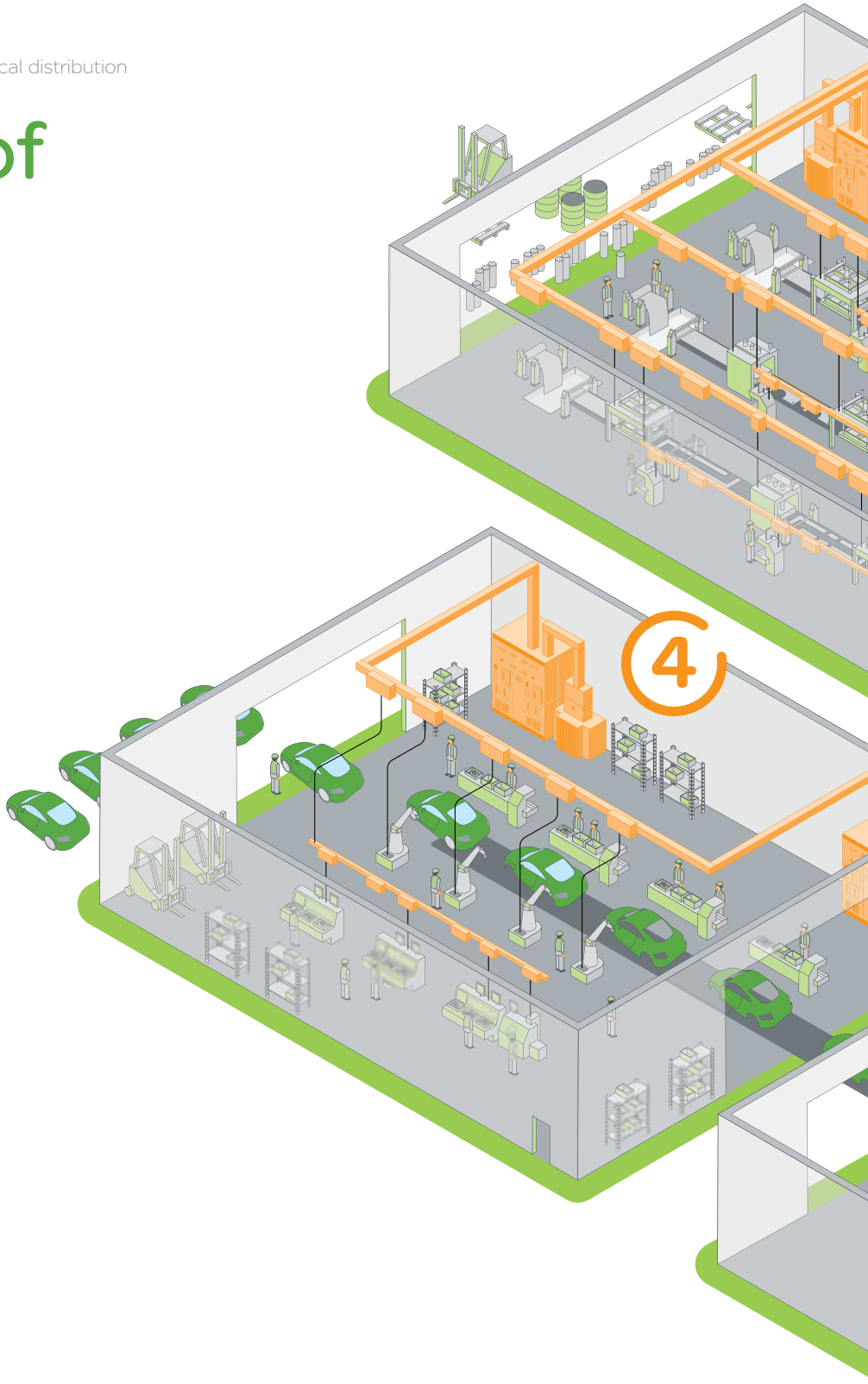
Vehicle manufacturing process in a car plant

A car plant is usually split according to two different types of process:

> **Mechanical processing plant:**
Comprising the processing line for the mechanical parts, such as the engine and the gearbox.

> **Vehicle assembly plant:**
Comprising the car assembly line which is divided into five main processes:

1. Pressing
2. Bodywork
3. Paintwork
4. Assembly
5. Testing



A car assembly plant features 4 key areas:

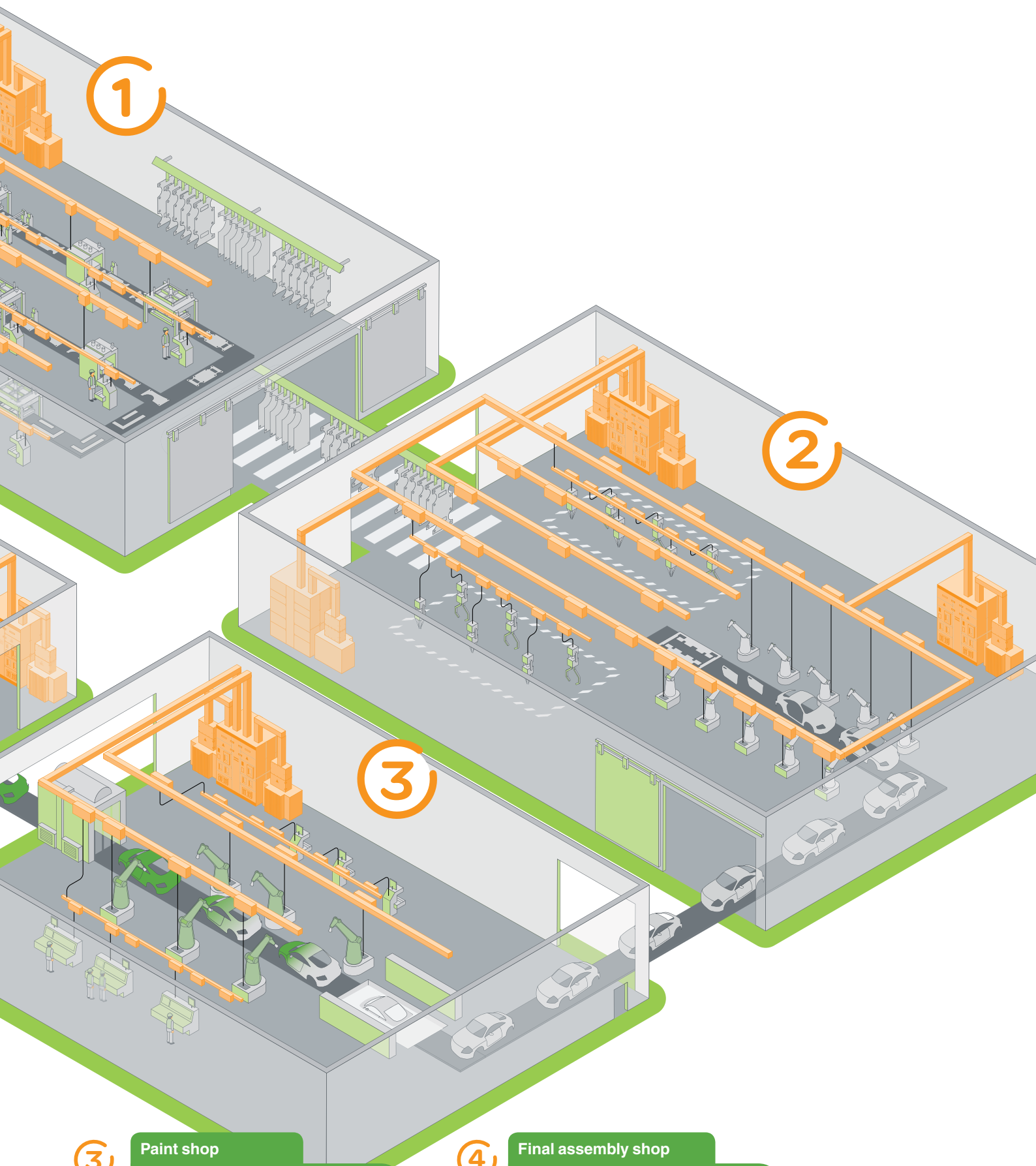
1 Press shop

Pressing is the first stage in the car manufacturing process. The raw material arrives in the form of steel coils. These pass through a line of presses to be drawn, trimmed, punched and profiled ready for use in the body shop as components for the body shell.

2 Body shop

The body shop is where the car body shell is built. The various parts are assembled to form the car body.

Robots are used for the welding operations, which makes this step in the process 98% automated.



3 Paint shop

The paint work starts with an electrophoretic coating anti-corrosion surface treatment, followed by the application of sealants and an anti-chip coating.

The top coats of paint, lacquer and varnish are then applied to the body shell.

4 Final assembly shop

Final assembly is the last stage of the manufacturing process, consisting of assembling the mechanical parts, the driver's compartment, the mirrors and the internal trim.

Car manufacturing requirements

To cut production costs

Faced with the challenges of globalisation, cost control has become even more critical for car manufacturers to be able to remain competitive on the global market.

The main objective is to drive down the cost of building vehicles by optimising investment and operating costs simultaneously.
Actions undertaken by manufacturers include:

Reducing non-production investment costs

By cutting CAPEX (capital expenditure) and OPEX (operational expenditure).

Breakdown of infrastructure investment costs in a car plant	
Construction (civil engineering)	50%
Electricity	25%
Mechanical (structure)	25%

Improving the rate of production

By cutting the number of production stoppages. A 1-hour stoppage in a 60-hectare facility with a production capacity of 800 units/day would cause considerable losses to the business.
Any downtime has a direct impact on product costs, and consequently on competitiveness.

Optimising energy bills

Reducing energy consumption is one of the major challenges faced by manufacturers, not only to cut electricity bills but also to meet sustainable development commitments.
Finding solutions to improve energy efficiency requires an in-depth knowledge of the consumption levels in each area of the plant.
This can be achieved by installing metering systems to measure the various branches from the power grid.

To respond quickly

Adapting to vehicle model and strategy changes

"Just in time" manufacturing is used in the automotive sector to minimise inventory, improve productivity and meet consumer demand in terms of price, quality and, above all, lead time. This model demands a high level of responsiveness and agility while maintaining service continuity.
Car manufacturers tend to change their range of vehicles every four years or so to keep up with market trends. This requires significant modifications to the manufacturing process, which can have subsequent consequences for the electrical distribution system.

As part of the measures to increase productivity, it is important for manufacturers to implement relocation strategies to improve physical and data flows, which means electrical installations need to be scalable.

The detailed arrangement of process machinery is often not yet known at the preliminary design stage, hence the need for a flexible installation.

Relying on tried and tested solutions

In their desire to cut development and installation costs manufacturers prefer to choose modular, standardised architectures which provide tried-and-tested, scalable solutions without affecting operation of other elements in the system, thus ensuring better service continuity.

Reducing design time and development costs

Shortening the time to market of a new vehicle range is particularly important.
Shorter design and installation stages of a workshop can therefore have a considerable impact on the overall time to market.

To produce high quality output

The quality of the power supplying the process affects product quality

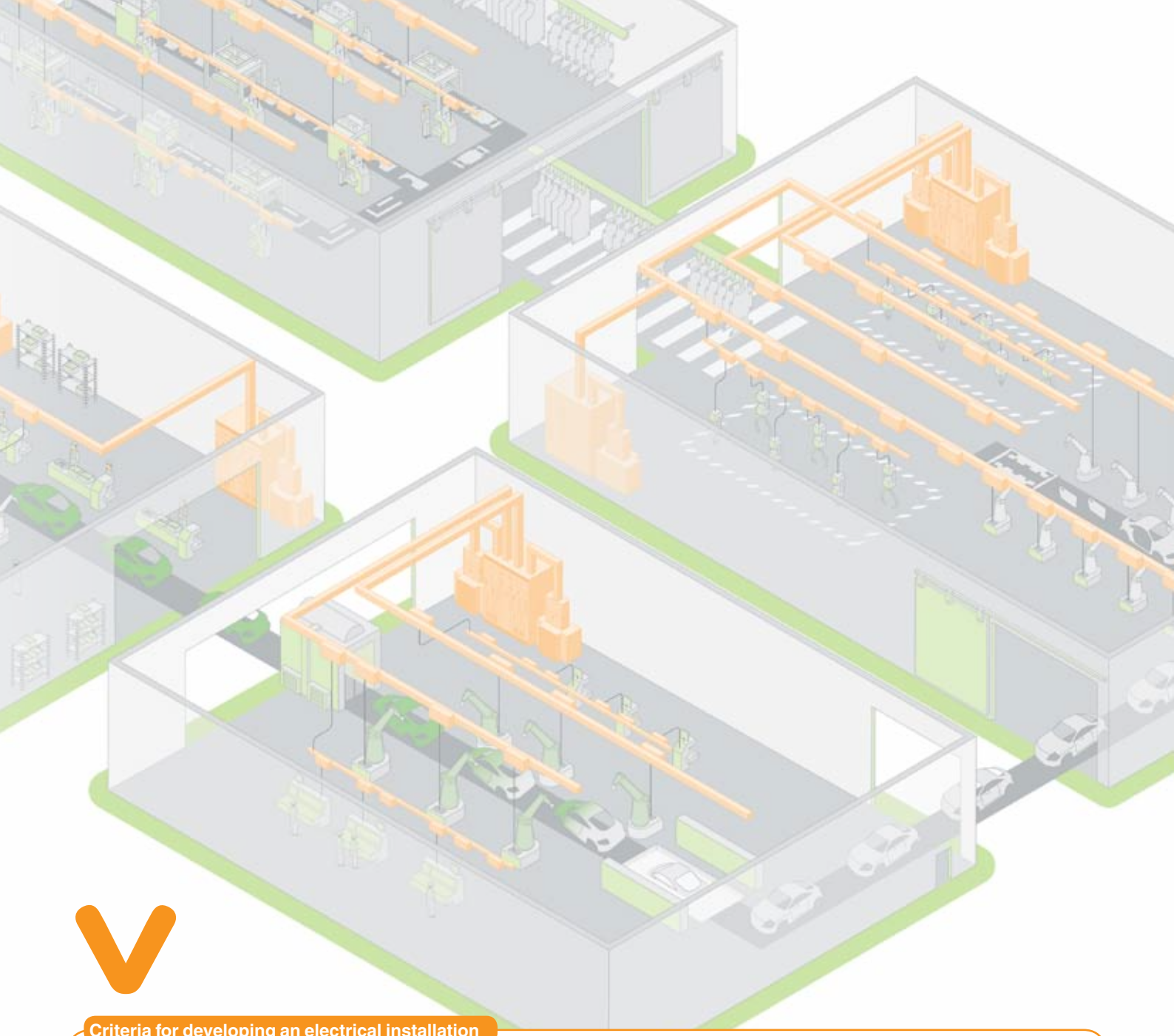
Voltage drops can have a direct effect on the quality of the paintwork, which would be one of the first things a customer would notice.
Ensuring the short-circuit power is particularly important in the welding process to guarantee weld quality.

Reliability

Electrical equipment reliability is important not only in terms of service continuity but also to ensure a high quality end product.
Production stoppages in welding workshops have a direct impact on weld quality.

To ensure the safety of personnel

In spite of the high level of automation in the car manufacturing process, there is still a high concentration of human activity and a high flow of traffic (of raw materials or body parts for assembly). This type of environment demands an extremely high level of safety and reliability.



Criteria for developing an electrical installation

Service continuity and vehicle quality

> Well-designed electrical distribution architectures

> Reliable products which significantly increase continuity of service and minimise maintenance requirements.

Safety of personnel

> Products which conform to operator safety standards

> Products which require less maintenance

> Products which are simple to install and use

> Products which prevent connection and operating errors.

Lower investment costs

> Simplified electrical distribution architectures

> Standardised architectures

> Lower installation costs

> Less floor space occupied by electrical equipment.

Shorter site construction times

> Prefabricated, standardised solutions

> Simplified assembly and installation on-site.

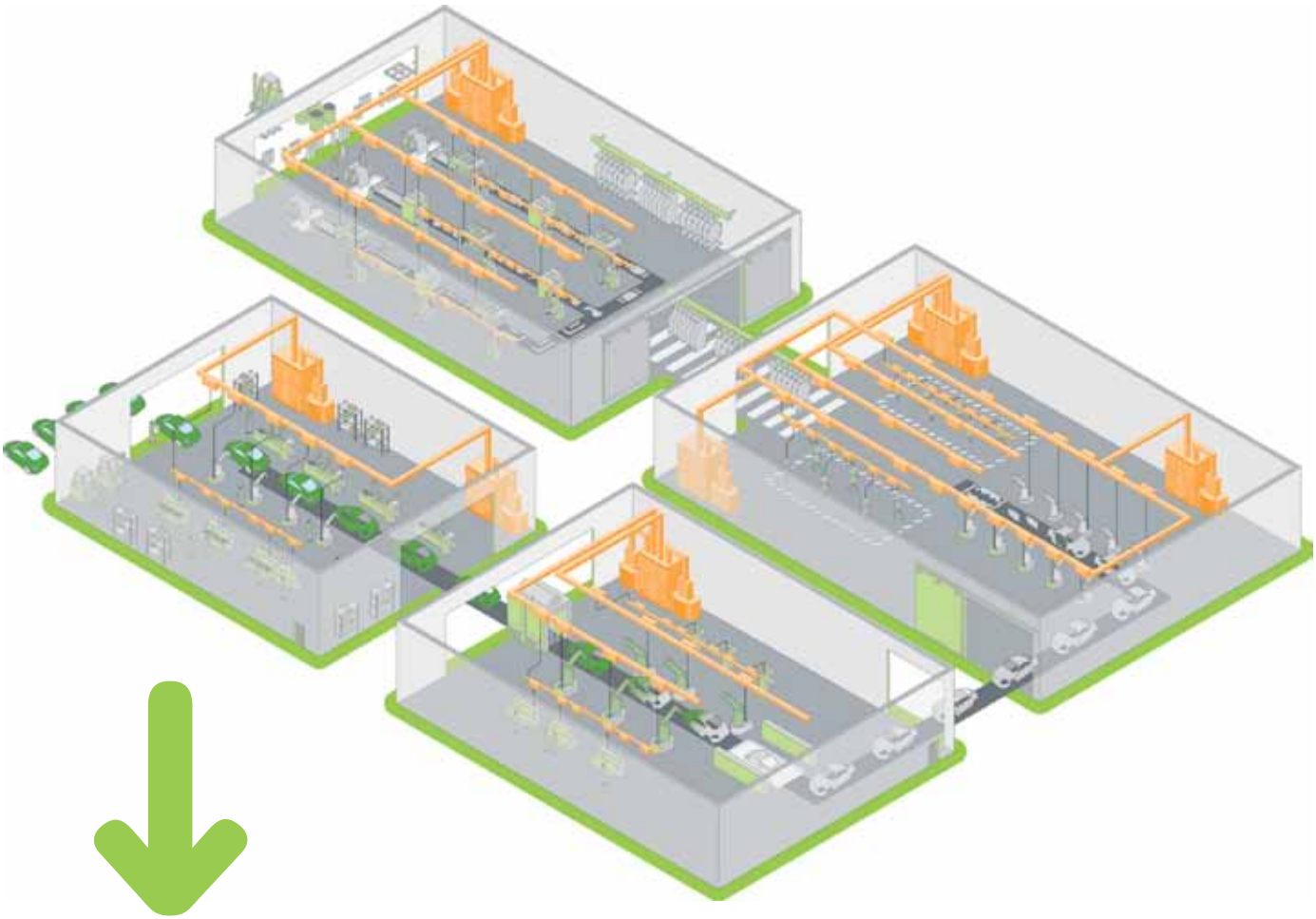
Lower operating costs

> Energy savings (lighting, HVAC, processes)

> Energy management.

Electrical distribution architectures

1 Characteristics of electrical distribution systems in a car plant



An electrical distribution system has to satisfy multiple objectives:

- Correct operation of the process
- Safety of personnel
- Prevention of damage to equipment
- Continuity of service and quality of the power supply.

Distribution architecture needs differ from one workshop to another.
It depends on the power quality and availability requirements of each workshop, as well as the level of power required.

The economic cost depends on the degree of complexity of the selected system to meet the needs of the process.
The choice of architecture is therefore a compromise between technical and financial considerations.

1 Characteristics of electrical distribution systems in a car plant (continued)

> System criteria

Industrial transformers

Two types of transformer are used in the distribution system:

1. Specialty low-impedance transformers
Low-impedance leakage transformers are used to limit voltage drops in the transformers. This is particularly important in welding applications (where welding equipment is highly sensitive to voltage at the welding terminals) to facilitate arcing and ensure stability of the electric arc.

The use of these transformers has a significant impact on the sizing of the other components in the system, namely the circuit breakers, which have to break very high short-circuit currents, and the downstream trunking, which also has to withstand very high short-circuit currents generated by this type of transformer in the event of a fault, and therefore requires sufficient electrodynamic withstand.

$$Isc = \frac{In \times 100}{Ucc}$$

2. Normal transformers
The transformer power varies between 630 and 2500 kVA. It makes more sense from a cost, technical and redundancy perspective to connect several identical transformers in parallel to provide the required power than to use a single high-power transformer.

Backup power

Given the power required by the installation, car plants do not usually have a need for special equipment such as UPSs or generators. Continuity of service is normally assured by the network architectures, the level of reliability of the equipment, the discrimination of the protective devices and the maintenance policy.

Earthing systems

The following considerations must be taken into account in the choice of neutral earthing system:
> Electric shock protection
> Protection against electrical fires
> Service continuity
> Overvoltage protection
> Protection against electromagnetic interference.

1. Protection against electrical fires
In TT and IT systems, if an insulation fault occurs, the intensity of the current generated by this fault is low or extra low respectively, which produces a potential fire hazard.

In the case of a dead short fault in a TN system, the intensity of the current generated by the insulation fault is high, and can cause significant damage.

In the event of an impedance-based fault, TN systems without an RCD do not offer sufficient protection.
A TN-S system used in combination with RCDs is recommended.

During normal operation the TN-C system presents the highest fire risk. The unbalanced load current runs continuously not only in the PEN conductor, but also in any components connected to it, such as the metal framework, machine ground, shielding, etc.

When a short circuit occurs, the power dissipated in these extra, unaccounted paths increases considerably. For this reason TN-C systems are prohibited in areas where there is a risk of explosion or fire.

2. Service continuity

The core feature of an IT earthing system is that even after an initial insulation fault the electrical installation can continue to operate normally without interruption. This system provides the best continuity of service in an electrical installation and is generally used in critical applications such as welding where an interruption to the power supply can have an adverse effect on weld quality.
Another benefit of the IT system is that any repairs required following an initial fault can be scheduled for a time when operation of the electrical installation is not critical.

3. Overvoltage protection

TT systems often require the use of surge arresters.
In an IT system, protection against overvoltages caused by MV faults is provided by a surge limiter.

4. Protection against electromagnetic interference

TT, TN-S and IT systems can meet all the requirements in terms of electromagnetic compatibility.

However, it should be noted that the TN-S system generates more interference for the duration of the insulation fault due to the higher fault current.

TN-C and TN-C-S systems are not recommended; in these systems a continuous unbalanced load current flows through the PEN conductor, the exposed conductive parts of the equipment and the cable shielding.

This continuous current generates disturbing voltage drops between the exposed conductive parts connected to the PEN. The presence of third-order harmonics and their multiples has significantly amplified this current in modern installations.

Summary

Type of earthing system	TT	TN-C	TN-S	IT
Safety of personnel	●●●	●●●	●●●	●●●
Safety of equipment:				
against fire hazards	●●●	●	●●	●●●
equipment protection (1)	●●●	●	●	●●●
Power supply availability	●●	●●	●●	●●●●
Effect of electromagnetic interference (2)	●●	●	●●	●●

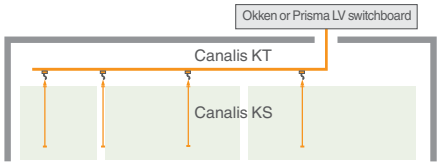
●●●● = *excellent*
●●● = *good*
●● = *average*
● = *poor*

(1) In the event of an insulation fault
(2) Types of electromagnetic interference:
- External: HV grid fault, switching overvoltages, overvoltages caused by atmospheric phenomena, etc.
- Internal: ground fault currents, harmonics on the LV network

> Electrical distribution concepts

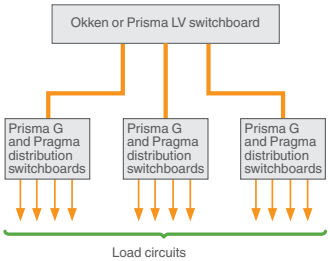
There are three electrical distribution concepts:

1 Decentralised distribution



The distribution system comprises busbar trunking runs.

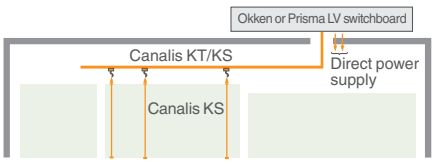
2 Centralised distribution



The main LV switchboard provides the power supply for the distribution switchboards only.

The protection devices for the runs are located in the main LV switchboard.

3 Mixed distribution

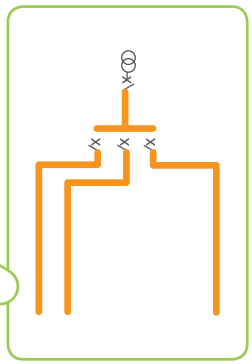


This is a combination of the two previous solutions.

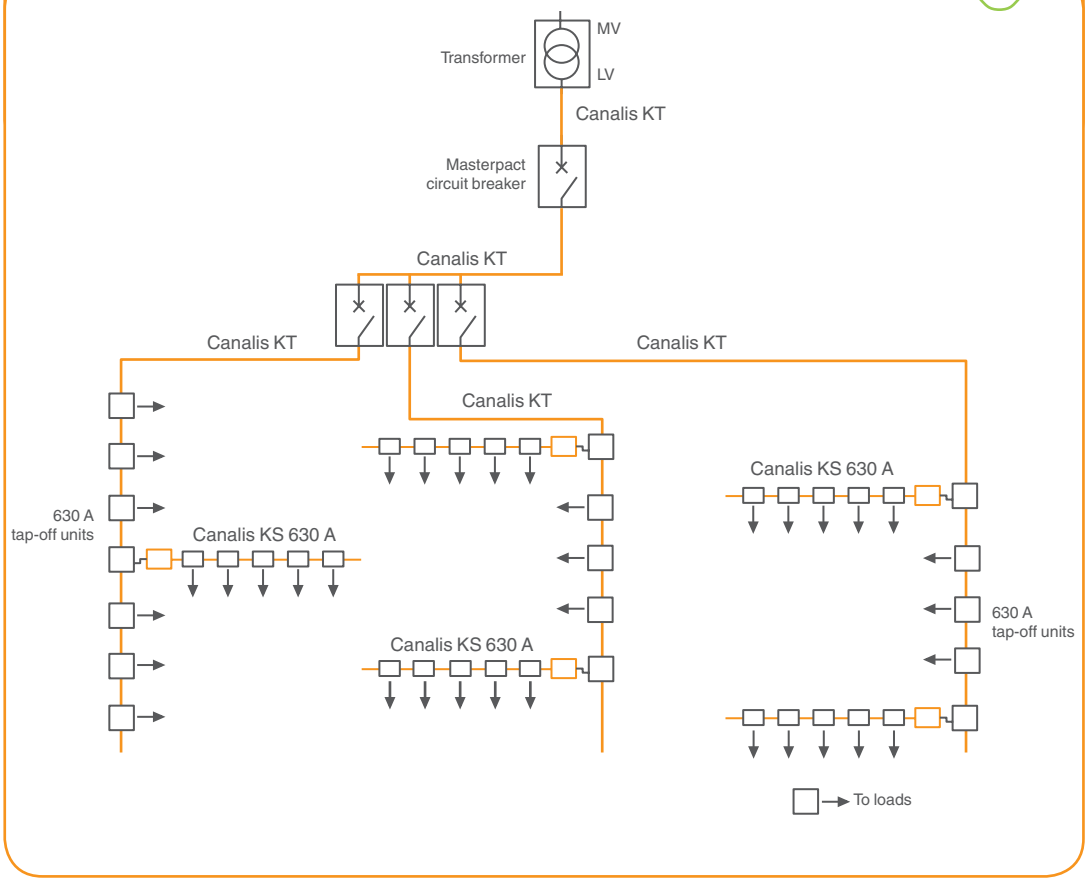
2 High power circuit configurations

Radial antenna configuration

This is the standard configuration. One busbar trunking system is connected to a single power source. This configuration provides the minimum level of reliability, with no redundancy capability in the event of a power failure.
Given that the transformers are not conencted in parallel, the Isc is low, which means that the switchboard, breaking devices and trunking are more cost-effective.
This configuration is installed in processes requiring a level of reliability **< 95%, such as foundries and forges.**

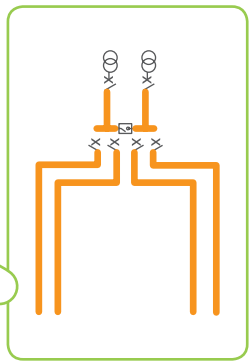


Radial antenna configuration

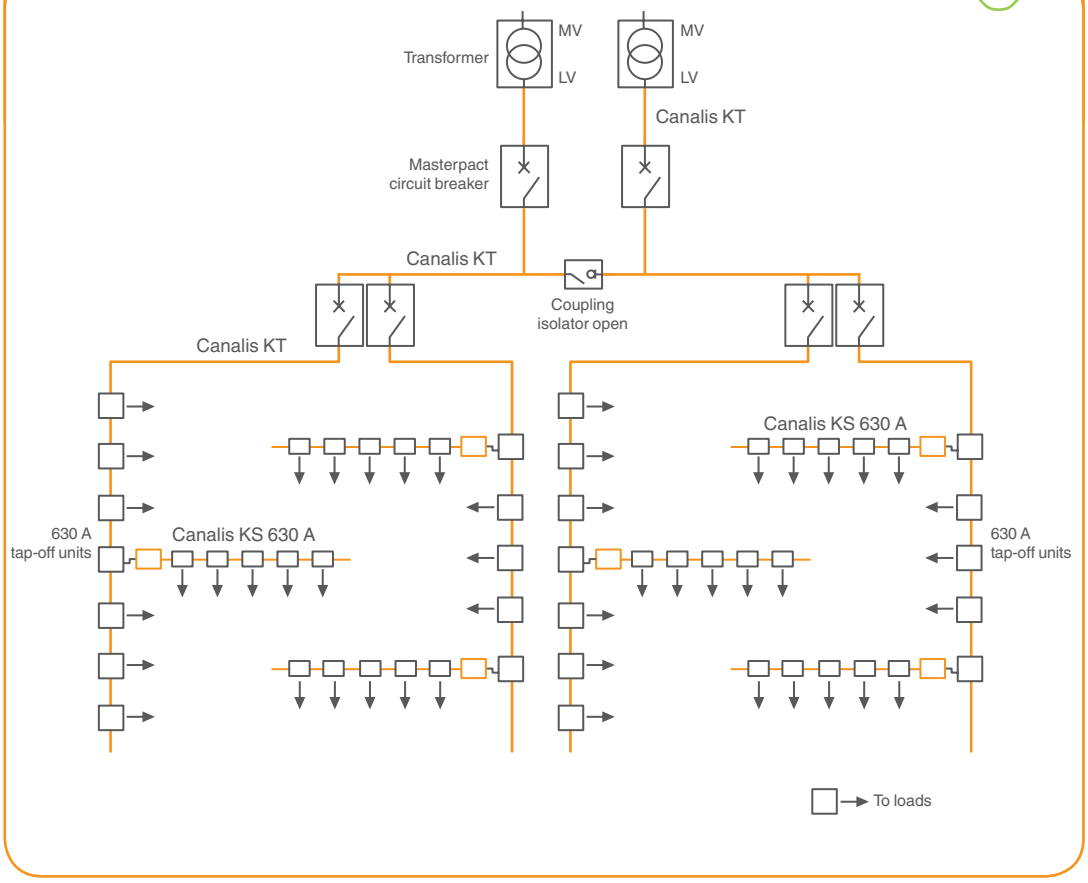


Dipole configuration

The busbar trunking power supply is provided by 2 transformers. These transformers are located close to each other and are connected in parallel to the same LV siwtchboard. To improve availability in the event of a fault on the busbars or to allow maintenance on one of the transformers, it is possible to divide the LV switchboard into 2 parts with a normally open connection.
In view of the service continuity offered by this type of configuration, it is generally installed in processes where a high level of reliability is required **> 95% such as in the press shop.**



Dipole configuration



2 High power circuit configurations (continued)

Interconnected configuration

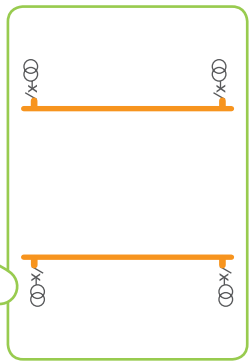
In this type of configuration, the transformers are physically located some distance from each other and power each side of the busbar trunking. A load can be powered by either transformer. This improves power availability since the load can always be powered if one of the sources fails.

Redundancy can be:

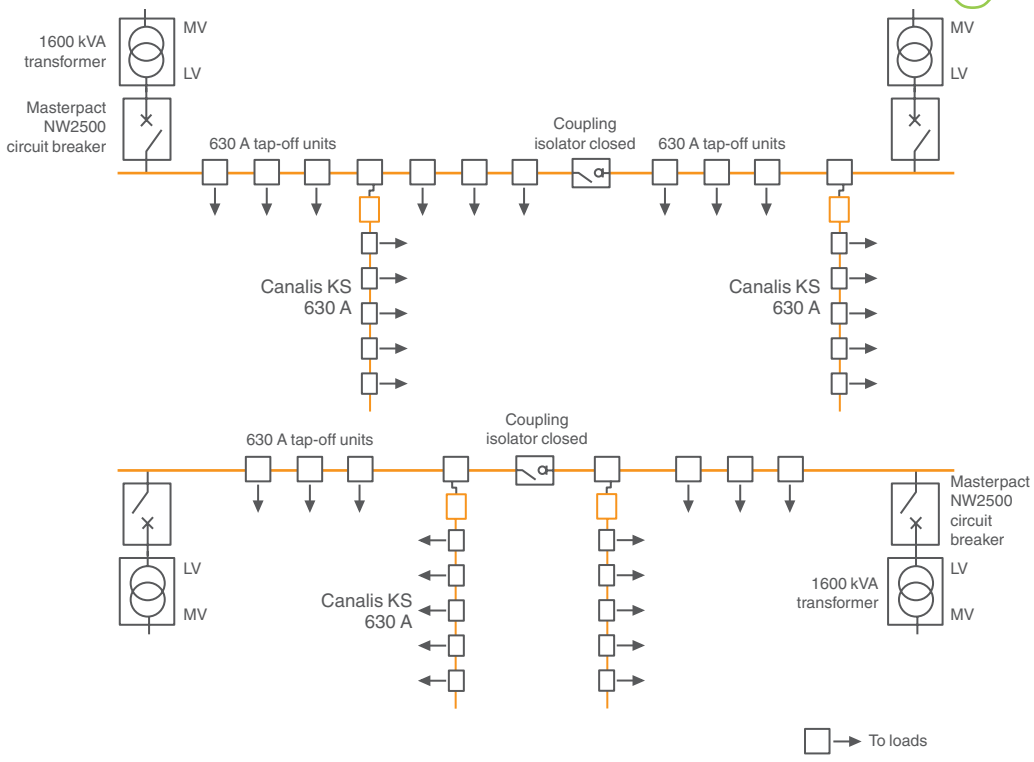
> **Full:** Each transformer is capable of powering the entire installation.

> **Partial:** Each transformer can only power part of the installation; if one of the transformers should fail, load shedding is usually required.

This type of configuration helps reduce voltage drops and the overall size of the trunking installation.

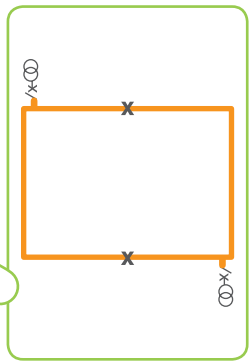


Interconnected configuration

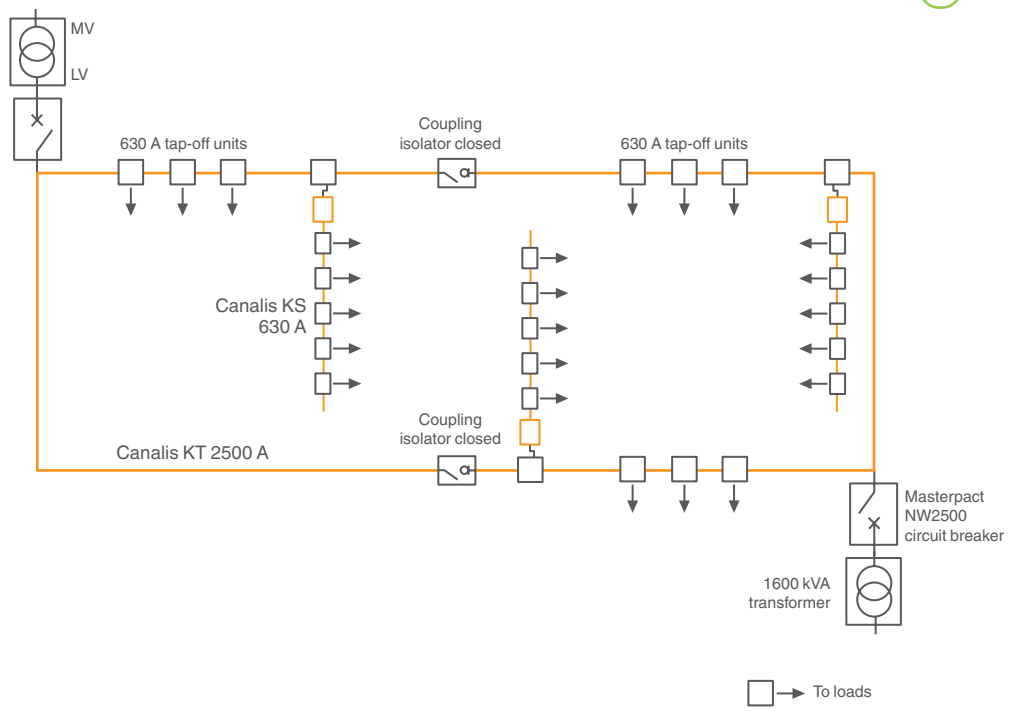


Loop configuration

This configuration is an extension of the interconnected configuration. It generally consists of 4 transformers which are connected by the same MV run to power a loop configured using busbar trunking.
One trunking section is powered by several transformers connected in parallel. This type of configuration is particularly suitable for extensive installations with a high density of loads.
Full redundancy can be achieved when 3 transformers can power the entire installation.
In addition to the continuity of service provided by this configuration, it also helps reduce voltage drops. **The loop architecture is particularly common in workshops where welding takes place, such as the press shop or the body shop.**



Loop configuration



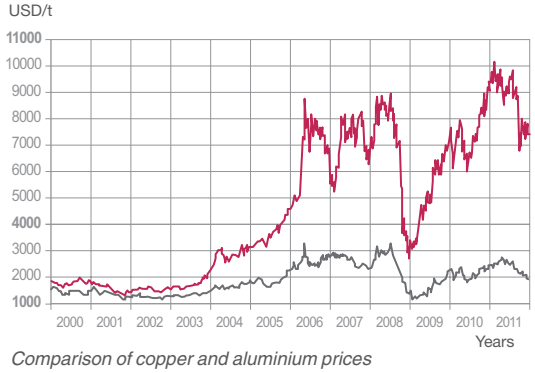
Summary

Configuration	Press shop	Body shop	Paint shop	Final assembly
Radial	●		●	
Dipole			●	
Interconnected	●	●	●	●
Loop	●	●		●

Canalis in car plants

1 Canalis helps reduce investment and operating costs

> Investment costs



Comparison of copper and aluminium prices

Low product costs

To mitigate the effects of an unstable and speculative copper market and offer competitive products with the same performance levels, Canalis aluminium busbar trunking is the ideal solution for the automotive industry from a cost perspective.

The advantages of aluminium:

Good conductivity

High quality contacts

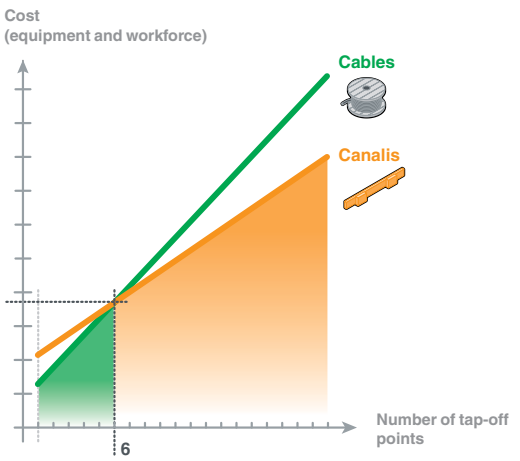
Lighter products (less weight to transport)

Recyclable

Low installation costs

The need to get a new car model to market in very short lead times often places significant pressure on installation times, which can impact heavily on costs.
Canalis helps reduce installation time.
Tap-off units can be wired at the machine builder's premises while the busbar trunking is installed on-site.

Comparative overview of investment
for a 400 A electrical distribution system



The Canalis busbar trunking system optimises installation costs:

> Only 2 or 3 people are required to install Canalis in the same time it would take to install a cabled solution.

> Connection to the MV/LV substation is via a quick jointing system.

> Tap-off units can be prepared in the workshop to reduce the amount of time spent on-site.

> Trunking runs can be installed at the same pace as the main installation is constructed to optimise the work carried out on-site and provide ample opportunity to troubleshoot any potential problems.

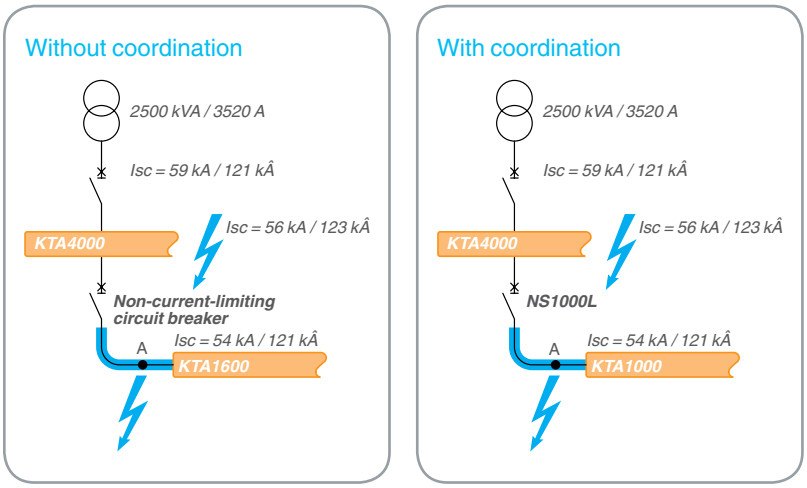
> Canalis busbar trunking solutions are factory-tested to reduce connection times.

1 Canalis helps reduce investment and operating costs (continued)

Cost-effective solutions (coordination between circuit-breaker and Canalis)

To meet the needs of automobile applications, electrical distribution architectures often comprise low-impedance transformers connected in parallel. This type of architecture imposes high short-circuit currents which the downstream installation must be able to tolerate.

To satisfy these specific requirements, manufacturers tend to derate their installations, which is costly.
Schneider Electrique has developed cost-effective solutions offering the same overall performance.
The principle relies on the use of Compact NS and NSX circuit breakers with high current-limiting capacity.
In the event of a short circuit, these circuit breakers allow only those currents which are less than the prospective short-circuit current to continue to flow, which helps to reduce the electrodynamic and thermal stress on the downstream installation.



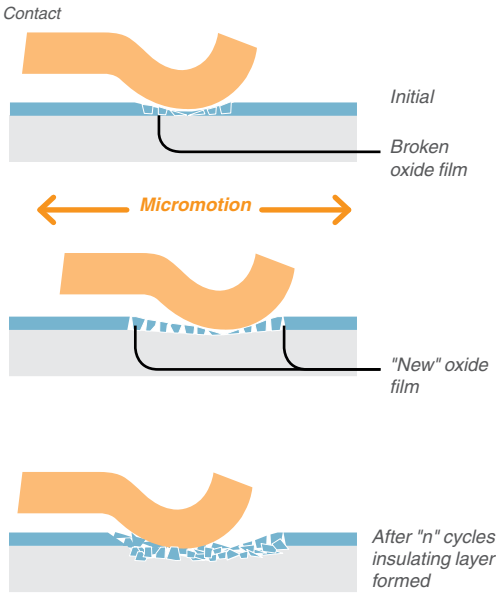
> Operating costs

Maintenance costs

The quality of the electrical contacts in Canalis busbar trunking assured by the use of bimetal technology provides operational continuity without the need for any maintenance.
This contact quality is not guaranteed if the conductors are made of tin-plated aluminium.

Fretting corrosion caused by the micromotion of contacts is a well-known phenomenon in many industries, particularly the automotive industry, where sources of such movement are common and include the expansion and contraction of conductors caused by high inrush currents (in a welding application, for example) and contact vibration, as well as other forms of electrodynamic stress.

Explanation of fretting corrosion

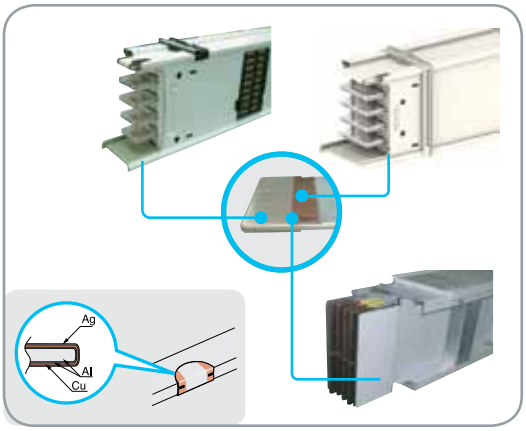


Movement of the intermetallic contacts causes mechanical wear and weakens the tin-plating, which in turn causes delamination: the mode of failure is therefore the production of an oxidised layer on the surface of the contact which acts as an electrical insulator and causes a heat rise at the point of contact.

Canalis overcomes this problem through the use of bimetallic contact technology.

Bimetallic contacts are used at each connection point (junctions and tap-off units). They have an external surface of silver-plated copper and and internal surface of aluminium which is welded to the aluminium conductors on the trunking.

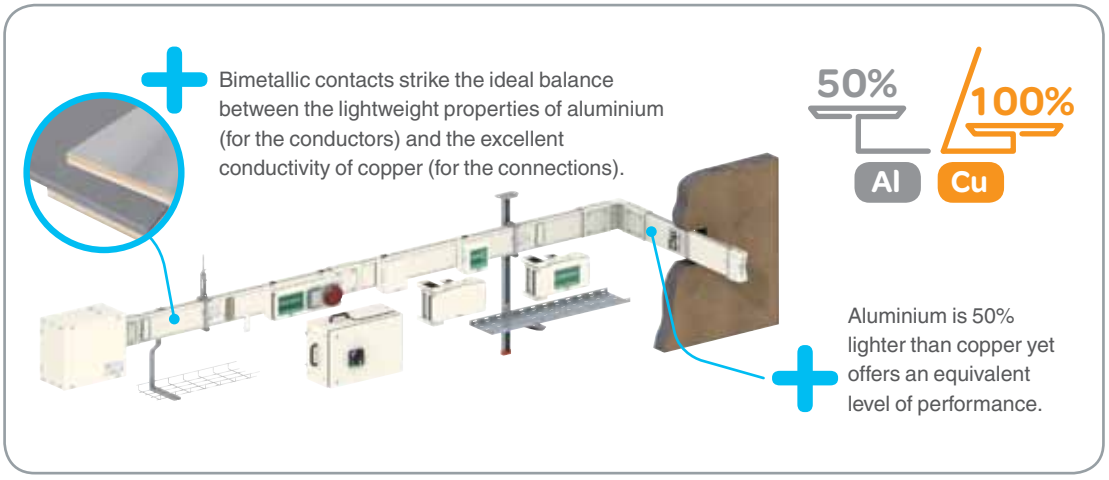
Silver-plated copper prevents fretting corrosion and has excellent conductivity properties.



With Canalis, Schneider Electric combines the respective advantages of copper and aluminium to construct better busbar trunking systems:

Excellent electrical contact provided by silver-plated aluminum/ copper contacts

The all-aluminium structure is lightweight and cost-effective.



Cost of decommissioning

Canalis busbar trunking is reusable.
The principle of a prefabricated solution and the lifetime of Canalis products means that they can simply be dismantled, cleaned and reused.

At the end of their life, Canalis products can either be dismantled or crushed to extract the various constituent materials for reuse.
The recycling potential is greater than 95%.
This includes ferrous metals, copper, aluminium and thermoplastic resins.

With Canalis, more than

95%

of materials can be recycled

2 Canalis helps improve service continuity and flexibility

> Service continuity

Improving the continuity of service of an electrical installation hinges on two main criteria:

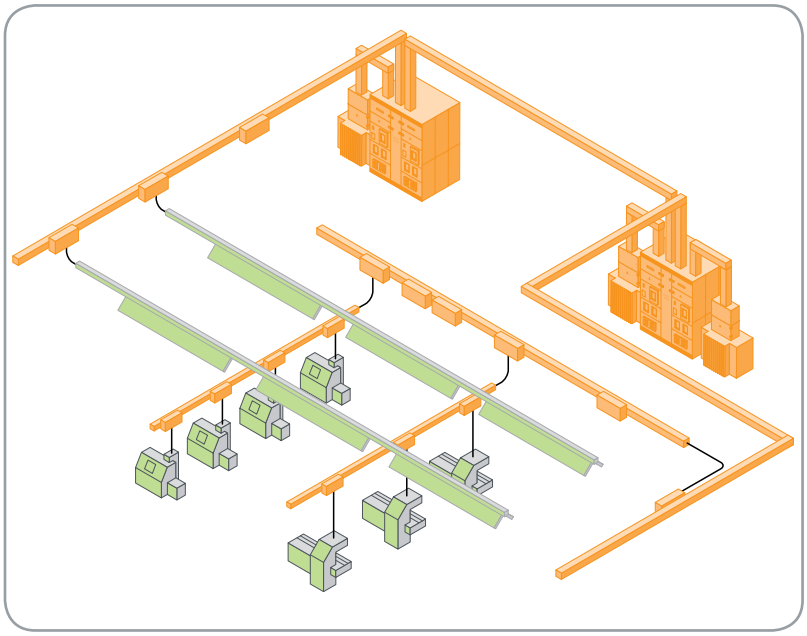
> **immunity to power outages** through the use of reliable products and well-designed architectures,
> **reduction of intervention and restart times** following maintenance and repair work.

Canalis's concept of decentralised distribution means that the electrical circuit is immediately visible and legible if any intervention is required on the installation, thus speeding up maintenance.

Canalis plug-in tap-off units allow machines to be connected or disconnected while the system is energised, which provides better continuity of service.

If the transformer should fail, car manufacturers usually have a replacement transformer in their equipment stores.
Canalis's quick jointing system means that connection to the MV/LV substation can be done very quickly, thus reducing the outage time.

Canalis products are "zero maintenance" thanks to the quality of their electrical contacts.

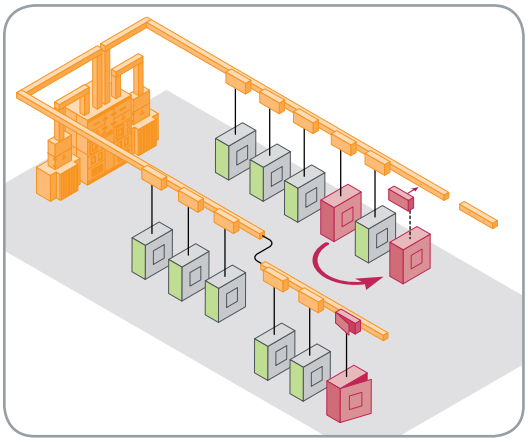


Decentralised distribution

> Flexibility

The Canalis installation is independent from the detailed layout of the loads which offers greater flexibility at the preliminary design stage.

As part of the continuous efforts to increase productivity, the automotive industry implements relocation strategies to improve physical and data flows.
Canalis meets this need for flexibility, since products can be added or removed when the system is energised without affecting service continuity.



3 Canalis helps conserve natural resources

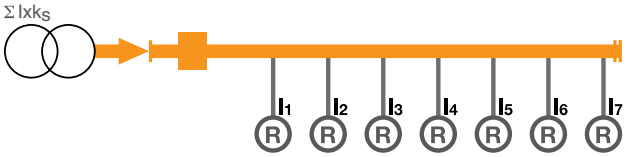
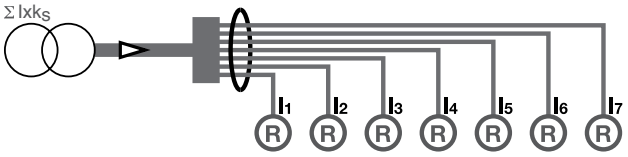
> Environment

Canalis helps reduce line losses by 20% and uses 75% less plastic

The cost of an electrical installation includes the initial investment for the equipment and its installation, the cost of maintenance and the cost of the energy losses during operation.

The concept of decentralised distribution is a way of merging all the circuits into one, thus minimising the number of small cross-section lengths and the weight of insulating materials.

*Example: 34 m of **Canalis KS 250 A** trunking equipped with fourteen 4-pole 25 A feeders*

Distribution type	Insulation	Consumption
Distributed		
		
K_S: stacking factor = 0.6	23 kg	1600 joules
Centralised		
		
K_S: stacking factor = 0.6	90 kg	2000 joules

-20%
line losses

<75%
consumption of plastics

4 Canalis offers energy management solutions

> The merits of energy efficiency

Canalis tap-off units with communication capability are used to measure electrical parameters in real time (current, energy, power factor, total harmonic distortion).
These parameters can be analysed to identify potential cost saving and optimisation opportunities.

Cutting energy bills

Controlling consumption helps to:

> Make users more aware of consumption and spread the cost

> Manage the capacity of the electricity supply

> Improve the power factor and avoid penalties

> Avoid exceeding the subscribed power demand by means of a load shedding procedure.

Improving power quality

Measuring total harmonic distortion and analysing the harmonic currents of each order helps to:

> Identify sources of pollution for the purposes of separating sensitive loads

> Derate the power devices (transformers, busbar trunking)

> Select filtering solutions

Detecting and capturing waveforms and sags helps locate the source of losses and production downtime. Detecting and capturing transient phenomona helps pinpoint the source of faults.

Improving power quality

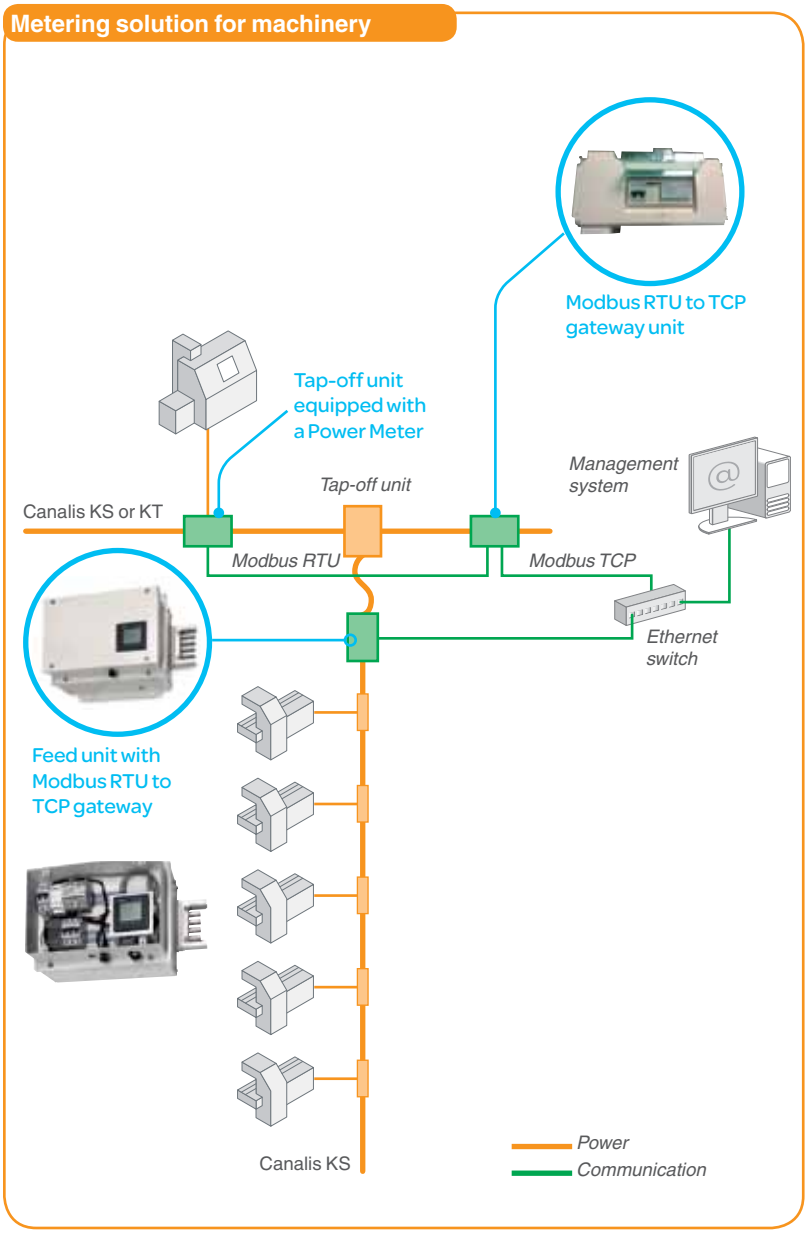
Continuity of service is improved by:

> Verifying that equipment is operating correctly using local metering devices

> Analysing protection settings remotely or locally

> Remote control and monitoring

> Using Web technologies to access data.



5 Software tools

Schneider Electric offers many tools to help customers optimise the design of their electrical installations. Our teams are on hand to guide you through the entire process, from the preliminary design stage right through to commissioning and maintenance solutions.
There are several powerful design and costing tools available to help optimise solutions, save time and cut development costs. **These tools include:**

IDspec

IDspec software helps you design electrical installations at the preliminary design stage and simulate the various options to arrive at the optimum solution.

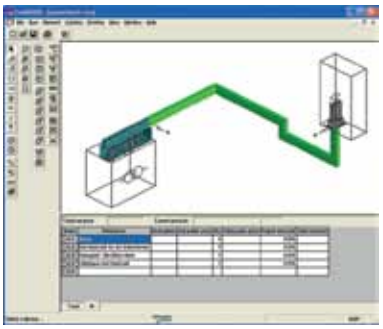
Ecodial

Ecodial design software helps you calculate the size of your electrical installations and optimises your choice of equipment.

CanCad

CanCad allows you to design the layout of your trunking system using an Autocad 3D library for use in any CAD system.

CanBrass

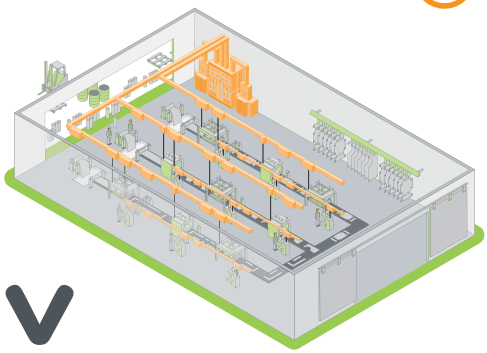


CanBrass software helps you design and cost Canalis busbar trunking runs.

Technical solutions

The key workshops in a car plant

Press shop 1



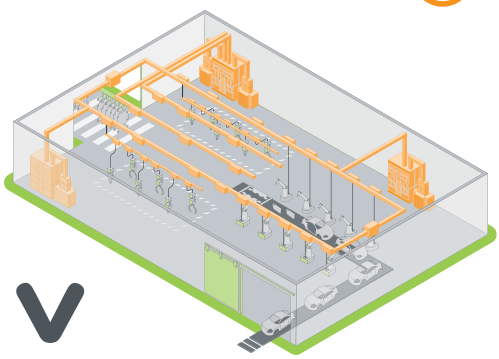
Environment

- Area of building: 20,000 to 50,000 m²
- Degree of protection: IP55
- Average power per m²: 200 VA

Application

- 200 to 300 kVA presses (7 to 8 presses per workshop)
- A large number of small machines
- Stacking factor: 0.1 to 0.2
- The presses are connected to Canalis KTA 2500 A runs (tap-off unit with Compact NS or NSX circuit breaker)
- Small-scale consumers are connected to Canalis KS 250 A runs.

Body shop 2



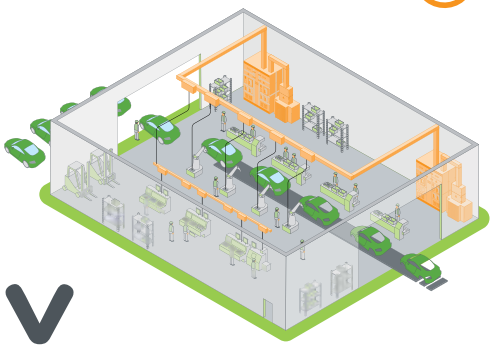
Environment

- Area of building: 30,000 to 50,000 m²
- Degree of protection: IP55
- Polarity:
  - motor power supply: 3P+N+PE
  - welding: 3P+PE
- Average power per m²
  - motive power 60/100 VA
  - welding 150/200 VA

Application

- Motive power:
  - recycling station (630 kVA)
  - refrigeration unit
  - compressor (300 kVA)
- Welding machines Irms = 300 A connected to Canalis 630 A
- Welding robots connected to Canalis KTA 2500 A
- Stacking factor: 0.1 to 0.2
- The presses are connected to Canalis KTA 2500 A runs (tap-off unit with Compact NS or NSX circuit breaker)
- Small-scale consumers are connected to Canalis KS 250 or 630 A runs.

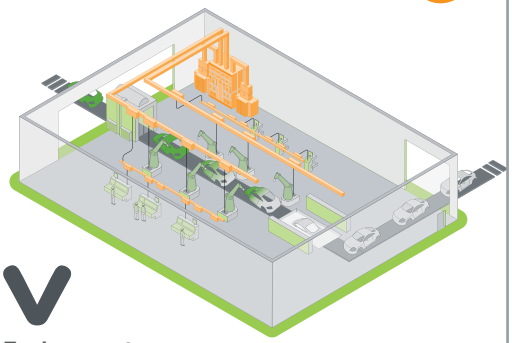
Assembly 4



Environment

- Area of building: 50,000 to 100,000 m²
- Degree of protection: IP55
- Polarity: Motive power: 3P+N+PE
- Average power per m²: 80 to 130 VA
- Application: assembly machines, robots, cranes, conveyors
- Power: 80% of loads where P < 50 kVA, 20% from 50 to 80 kVA
- Canalis KTA 2500 A, Canalis KS.

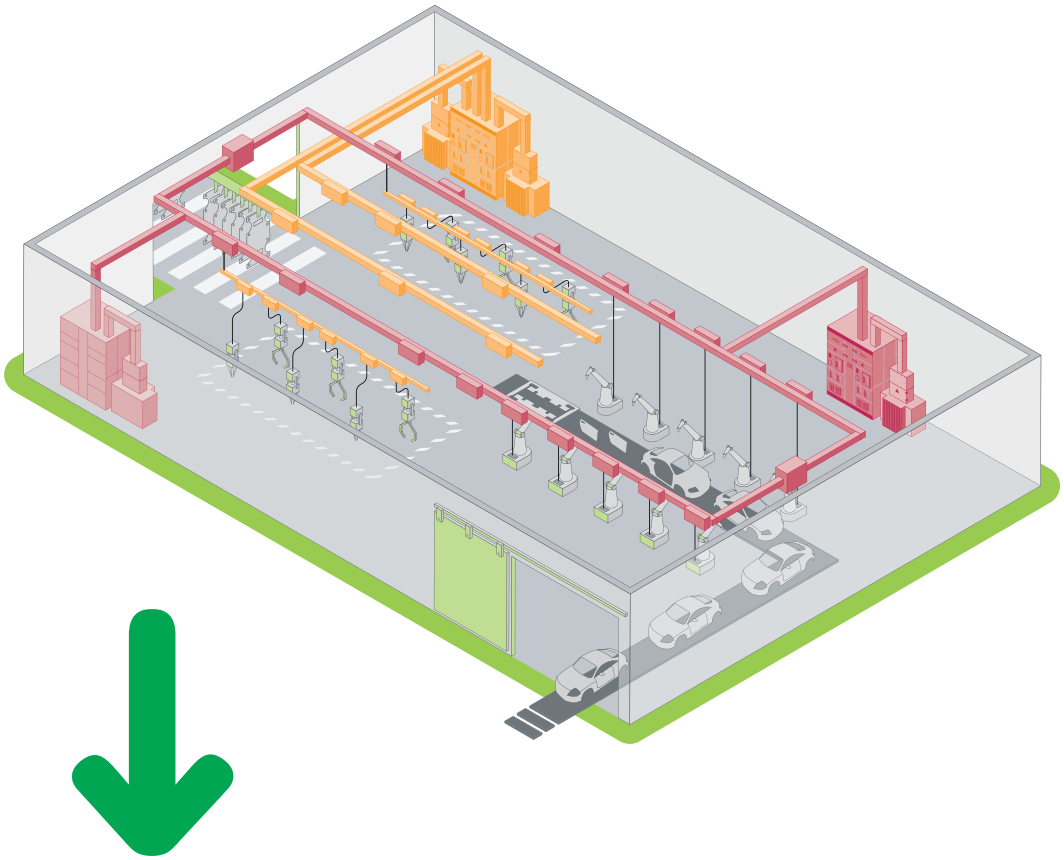
Paint shop 3



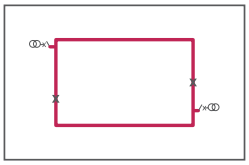
Environment

- Area of building: 25,000 to 35,000 m²
- Degree of protection: IP55
- Temperature constraints: ambient temperature per location 50°C
- Average power per m²: 400 VA
- Machines connected to Canalis KTA 2000 A, KTA 2500 A
- Canalis tap-off unit with circuit breaker.

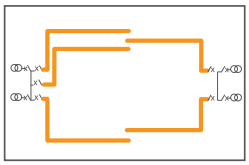
Focus on the body shop



Welding trunking circuit



Motive power trunking circuit



Welding is one of the most specialised applications in the automotive industry. The primary concern is to achieve the best weld quality at the highes output rate, without impacting installation and maintenance costs.

Constraints imposed on the electrical distribution system

Short-circuit power is required at the weld points (to ensure the lowest voltage drop)

> Use of a low-impedance transformer (Ucc ~ 1.5%)
> Use of a loop system to reduce the distance between the transformer and the loads
> Use of busbar trunking.

It must be possible to withstand the thermal stress generated by the inrush currents and the total harmonic distortion of the welding robots and equipment

> The installation should be sized to take account of current peaks, stacking, output rates and the thermal withstand of the equipment.
> Isolate the welding circuit so that it only powers the welding guns and robots; provide another power supply circuit for process machinery and services.

The installation must be protected to prevent nuisance tripping

> Set protection devices to take account of the RMS* caused by harmonic phenomena and current peaks.

**RMS: Root Mean Square*

Tap-off units adapted for different applications

Tap-off units can be equipped with a fuse or circuit breaker as required.
Tap-off units up to 630 A can be connected when the system is live.

Tap-off units for circuit-breakers

In addition to protection functions, tap-off units for Compact NSX or NS circuit breakers offer integrated energy monitoring and metering capability, coordination of all protection devices controlled for an entire run, compact dimensions and ease of use.

> 25 to 630 A plug-in units (can be plugged in when the run is energised)
> 400 to 1250 A bolt-on units.

Energy metering and monitoring

> Energy meter for optimum cost allocation
> Total harmonic distortion for power quality monitoring
> Alarm notification for operation management and preventive maintenance
> Continuous activation of event logs and tables for monitoring operation of the installed base and maximising energy efficiency.

Coordination

System performance is ensured by coordination between the protection provided by the Schneider Electric circuit breaker and the distribution over the Canalis busbar trunking system.

Compact NS circuit breakers have a high current-limiting capacity. A circuit breaker's current-limiting capacity concerns its ability in the event of a short circuit to permit only a limited current IL to flow which is less than the maximum asymmetrical prospective short-circuit current Isc.
This significantly reduces both electrodynamic and thermal stresses on the installation. (Refer to the coordination tables in the Canalis KS and Canalis KT catalogues).

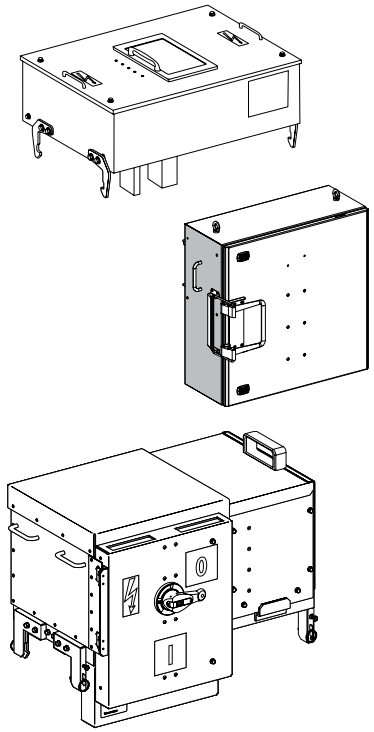
Compact size and use

Circuit breakers have a low dissipation factor which means they can be integrated into compact metal tap-off units. The rotary handle cover locking system facilitates installation and maintenance tasks.

Tap-of units for fuses

Canalis offers a wide range of tap-off units for fuses:

> 25 to 630 A plug-in units (can be plugged in when the run is energised)
> 400 to 1000 A bolt-on units
> For NF, BS or DIN fuse, size 00 to 3
> Load breaking via switch-disconnector or disconnection by opening the cover
> Versions available with partition between upstream and downstream compartments with locking capability and internal arc resistance.



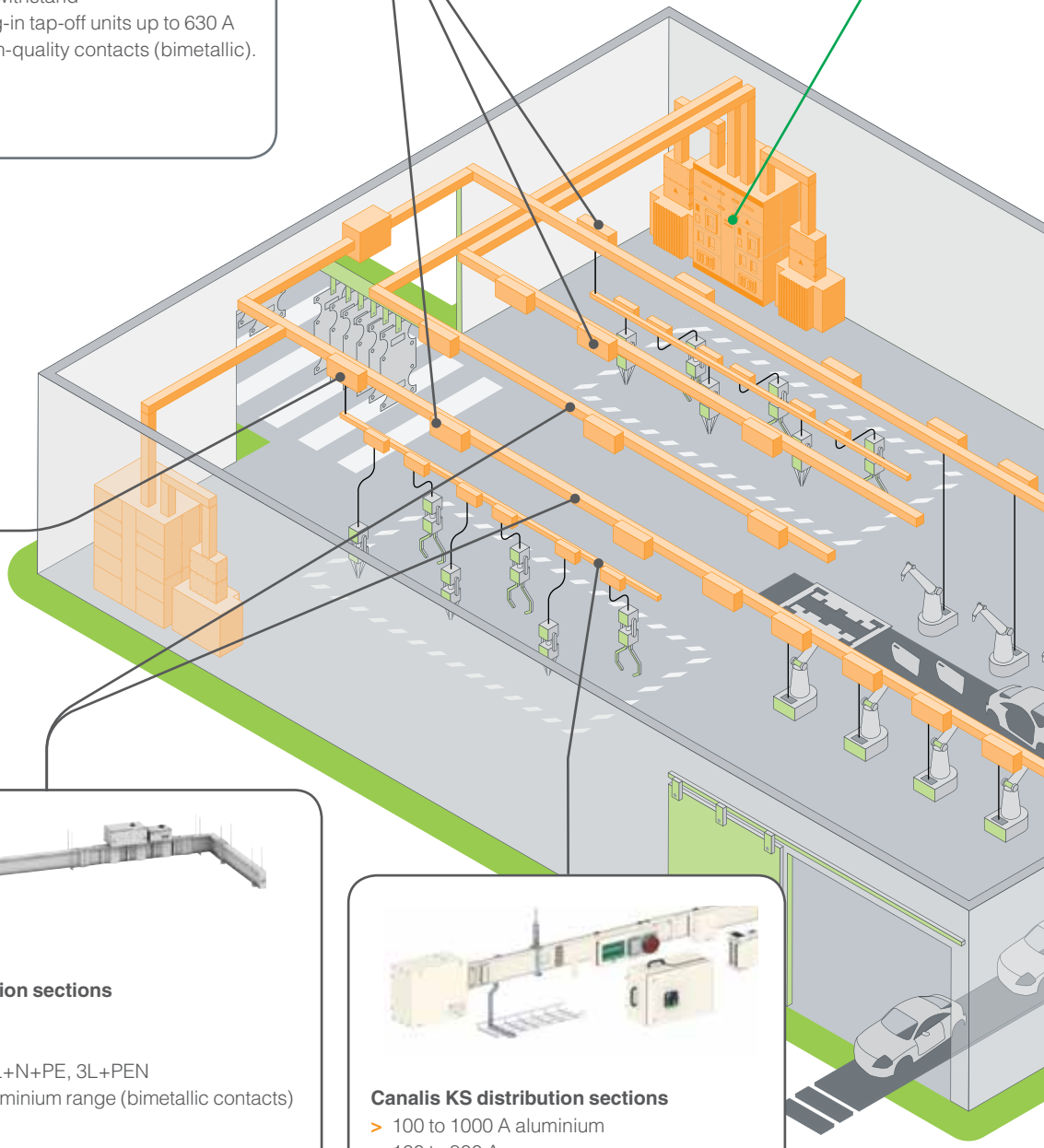
Body shop solutions

Canalis tap-off units

KS/ KT tap-off units
- 25 A to 1250 A ratings
- Protection via fuse or circuit breaker
- Communication capability (for metering and monitoring)
- Cable size
- Safety of personnel
- Isc withstand
- Plug-in tap-off units up to 630 A
- High-quality contacts (bimetallic).

Compact NS/NSX

Compact NS/NSX
- Protection function (long and short time)
- Micrologic S/A/E/P
- Remote indication
- Time-stamped event log and tables
- Maintenance indicator
- Communication.



Canalis KT transport and distribution sections
- 800 to 4000 A aluminium
- 1000 to 5000 A copper
- Number of conductors: 3L+PE, 3L+N+PE, 3L+PEN
- Excellent contact quality on the aluminium range (bimetallic contacts)
- Silicone-free
- IP55, sprinkler-resistant
- Conforming to standard IEC 61439 1 and 6
- Transport sections
- 2 and 4 m fixed lengths
- Made-to-measure lengths from 0.5 to 3 m
- Distribution sections
- 2 and 4 m fixed lengths
- Number of tap-off points: 4 max. every 4 m.

Canalis KS distribution sections
- 100 to 1000 A aluminium
- 160 to 800 A copper
- Number of conductors: 3L+PE, 3L+N+PE
- Bimetallic contact
- Silicone-free
- IP55, sprinkler-resistant
- Conforming to standard IEC 61439 1 and 6
- 3 and 5 m fixed lengths or made to measure
- Number of tap-off points: 12 max. every 3 m.

Low voltage switchboard (Okken)

Operator safety
> Internal arc (100 kA/0.4 s) IEC 61641
> In normal operation
> Integration of Schneider Electric products.

Service continuity
> Fully withdrawable in operation according to IEC 61439
> Can be upgraded when energised.

High performance
> Up to 7300 A HBB
> Horizontal busbars: Icw = 150 kA/1 s
> Vertical busbars: Icw = 100 kA/1 s
> Up to 690 V.

Flexibility and versatility
> Back-to-back, front or rear access
> PCC/MCC.

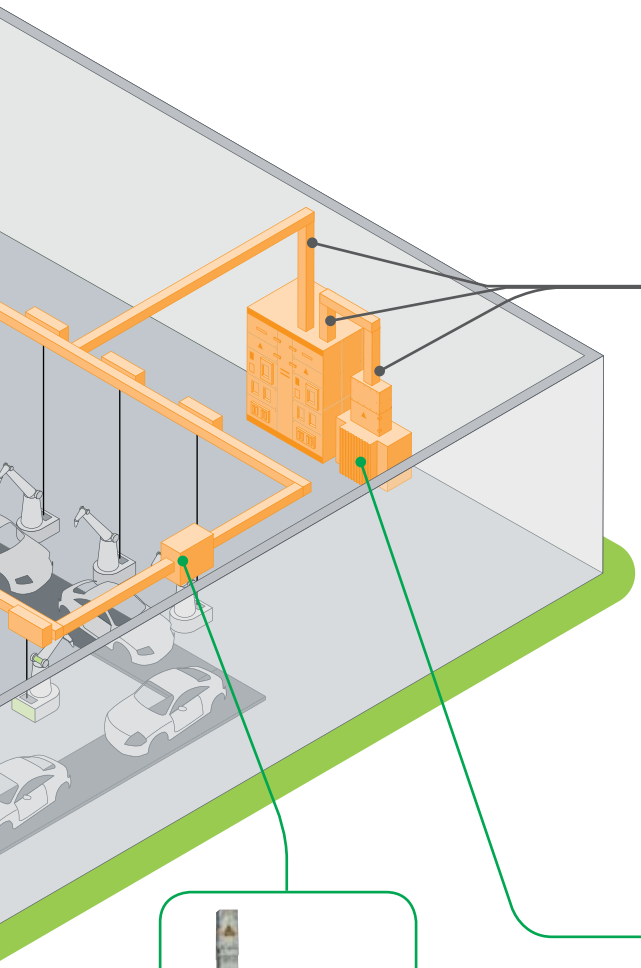
Medium voltage switchboard (MCset, Gset, PIX)

Operator safety
> Internal arc fault IEC 62271-200, 50 kA/1 s.

Service continuity
> Fully withdrawable circuit breaker (LSC2B-PM).

High performance
> Up to 4000 A
> Isc = 50 kA/3 s
> Un = 24 kV
> GIS or AIS
> breaking technology (vacuum or SF6).

Flexibility and versatility
> Incomer at the top or bottom
> Free-standing or wall-mounted installation.



Connection

Connections
> Direct connection to Trihal transformers and Prisma Plus and Okken switchboards
> Installed and tested according to IEC 61439 1 and 6
> Quick and simple connection of the busbar trunking to the interface
> Compact size
> Joint block integrated in the interface.

Change of direction

Changes of direction
> Components for changing direction can be adapted to any run
> They are available in fixed lengths or made to measure.

Coupling isolator with or without protection.

Trihal transformer

Specialty transformer: low Ucc
> Negligible voltage drop.

Oil-immersed transformers (Minera)
> 630 to 2500 kVA
> Insulation < 24 V/410 V
> PCB-free.

Dry-type transformer (Trihal)
> 630 to 2500 kVA
> Rated insulation level Insulation up to 36 kV
> Silicone-free.

Minera transformer

Lighting

A well-designed lighting installation should offer:

Financial benefits

Reducing operating and maintenance costs

> A good lighting system is one which takes account of potential building design changes. Anticipating these changes helps reduce costs.

> A lighting management system can help reduce energy consumption by up to 50%.

Productivity benefits

Improving production conditions and **quality control**

> Speed of execution of tasks.

> Optimising quality – a well-designed lighting system allows for greater precision.

Social benefits

Reducing visual discomfort and the risk of accidents

> Well-adapted lighting levels (expressed in lux) can help improve vision.

> Sharp contrasts and shapes and the absence of glare improves visibility and hence performance.

> A quality lighting installation reduces fatigue and stress.

Environmental benefits

Reducing overall energy consumption of the lighting system.

Lighting levels in car plants

The average level of lighting to be maintained corresponds to a minimum threshold above which the luminaires will function, depending on the type of lighting required:

Ambient lighting

This is the general light level in workshops which takes no account of the specific requirements in certain work areas. In workshops such as the assembly shop, the ambient lighting level is generally 150 lux.

Accent lighting

This consists of providing a much brighter level of lighting (up to 300 lux) in a specific zone, such as the production line, for example.

Task lighting

This is the use of a fluorescent light fitting to illuminate a zone more precisely, such as the use of a special lighting arrangement to illuminate a specific area in the assembly shop. The lighting level for this type of lighting can reach a maximum of 800 lux.

Configuration		Press shop	Body shop	Paint shop	Assembly	Final assembly
Installation height (m)		(12-15)	< 9	< 9	< 9	< 9
Lighting (lux)	Ambient	150	150	150	150	150
	Accent	300	300	300	300	-
	Task	-	-	2500	1000	-
Average power (VA/m²)		20	20	20	25	10

Ambient lighting solution

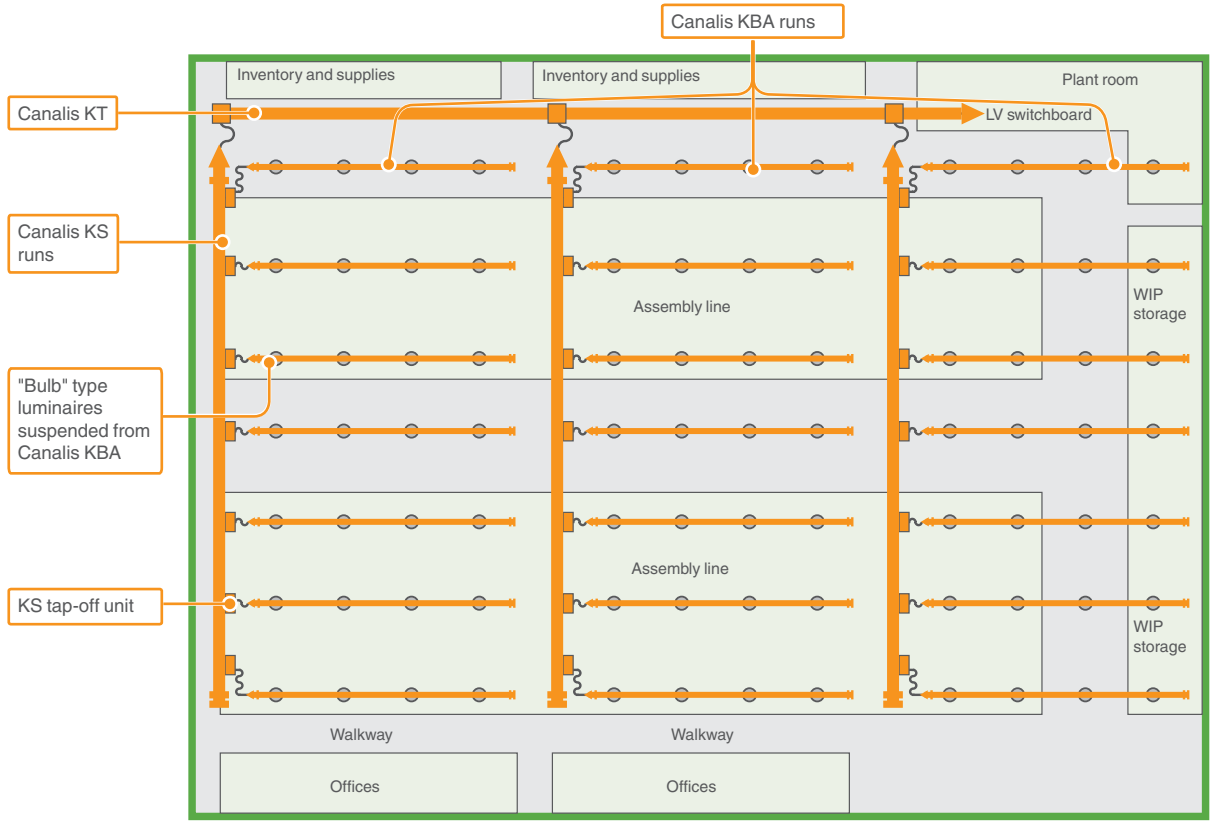
Irrespective of the type of luminaire (fluorescent tubes or bulbs), power will be supplied from the Canalis **"primary"** runs. These runs are provided in KS or KN trunking (the choice between KS and KN depends on the intensity required and hence the level of lighting).

These primary runs feed **"secondary"** runs which use Canalis KBA/KBB trunking. The luminaires are suspended from the Canalis KBA/KBB trunking.

150 lux ambient lighting

> 1200 reflectors 2 x 58 W distributed over 60 Canalis runs installed at a height of 8 m
> Power supply for 6 KBB runs via 4 KN 100 A runs
> Control and monitoring via K-system
- lighting for each zone
- timer programme
- centralised and local control.

Example of a basic solution for **ambient lighting**



The basic solution described above does not meet all the lighting needs, in particular those regarding:

1. Adapting the luminous intensity to the various zones and at different times,
2. Monitoring and using the available natural light,
3. Controlling electricity costs.

To meet all these needs, Canalis busbar trunking is used in conjunction with a DALI communication bus.

This complete lighting solution provides:

1. Distributed electrical distribution using Canalis busbar trunking,
2. Protection and control of lighting runs,
3. Interoperability with the building management system.

Overall:

Needs	Functions
Energy savings	Adaptation of the lighting level according to: - a timer programme - the amount of natural light - the ability to create different zones
Customisation, flexibility, scalability	Local or centralised controls Ability to create or modify zones according to potential changes to the system
Safety	Automatic illumination in the event of a fault Cascade illumination
Maintenance savings	Luminaire operating time counter Troubleshooting assistance
Ease of use	Time-delayed local control

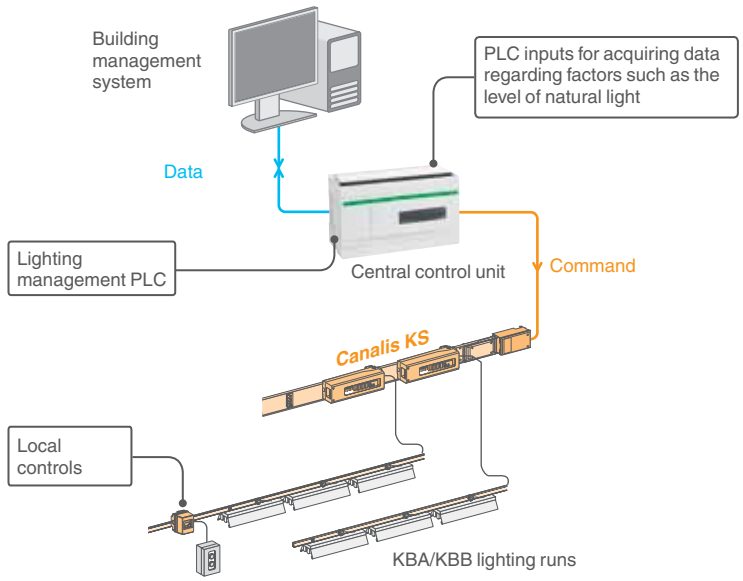
Lighting management

The concept is based on dividing the workshops into homogenous zones, taking account of the light sources available in the workshops and the requirements of each zone in terms of lighting level and control.

The zones are then divided into groups, where a group corresponds to a set of luminaires controlled simultaneously for both switching on and off.

These zones are controlled independently according to a predefined programme which can be used to control some or all of the luminaires in each zone.

Lighting management architecture



Example **of ambient lighting** for a workshop

Zone 1: Walkways

Zone 2: Offices

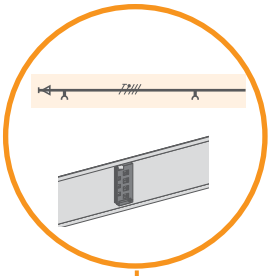
Zone 3: WIP storage

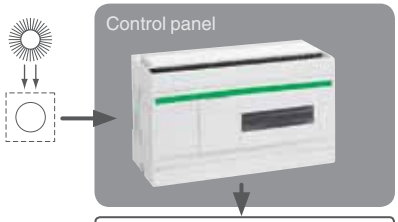
Zone 4: Plant room

Zone 5: Inventory and supplies

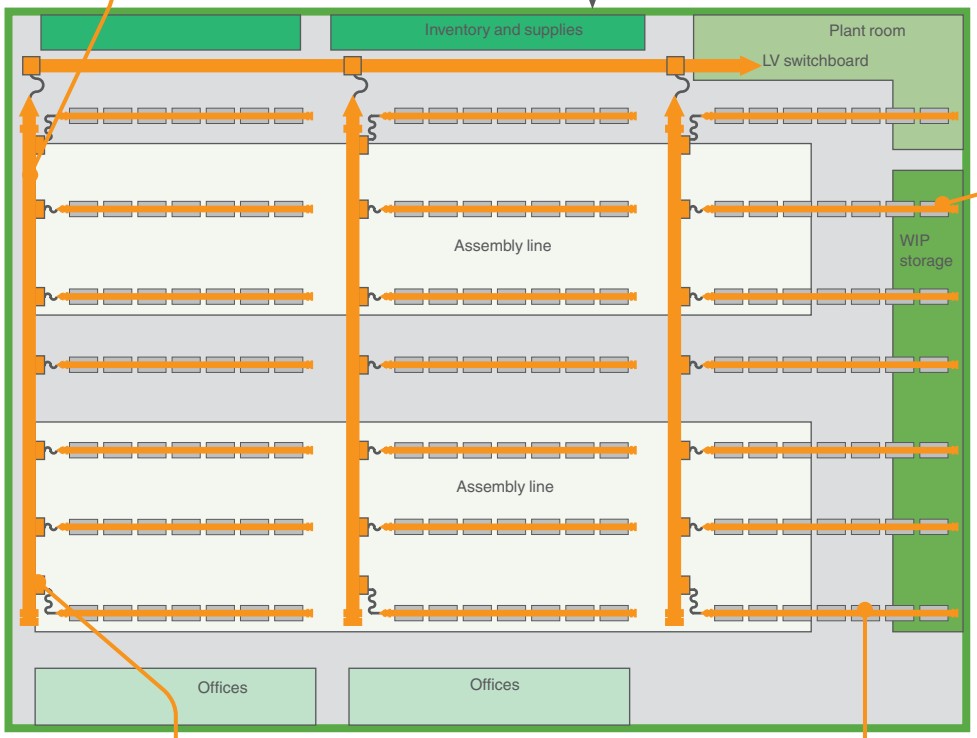
Zone 6: Assembly line

Primary run:
Canalis KN or KS

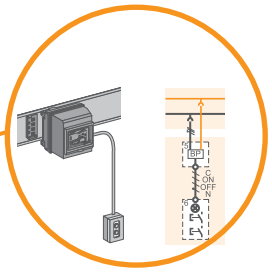


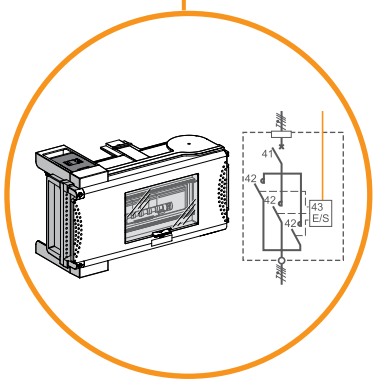


Remote control switching bus (extraction of the various groups in each zone)

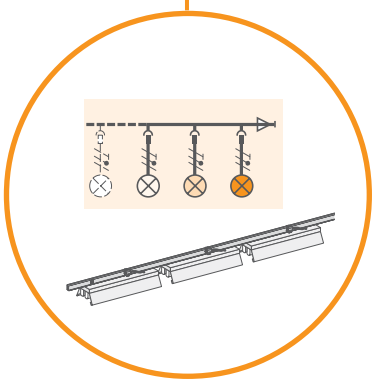


Local **control**





Tap-off unit:
Protection of the various lighting runs



Lighting run:
KBA/KBB with luminaires

Accent lighting

Operating principle

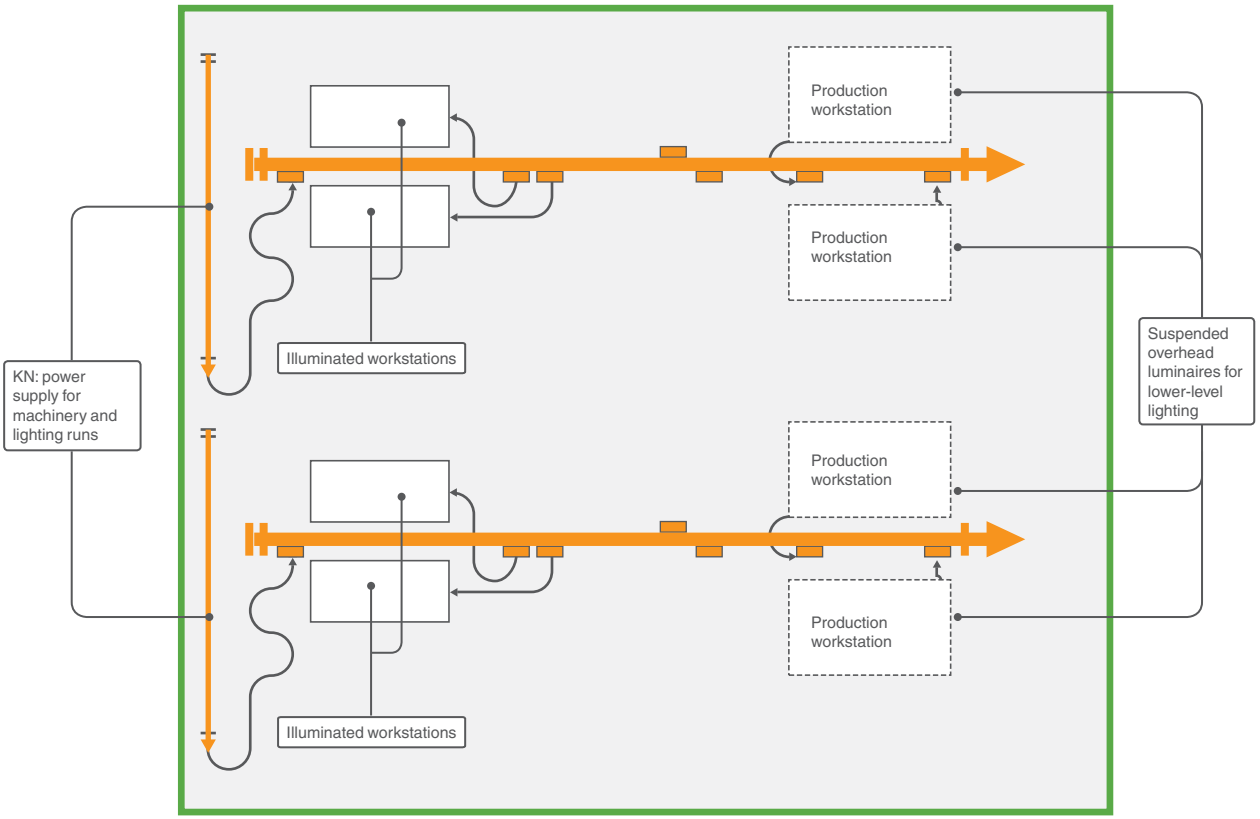
To meet the need for accent lighting, the luminaire power is supplied directly from the primary runs feeding the ambient lighting or from dedicated busbar trunking.
The advantage of using the primary ambient lighting runs is that the lighting can be controlled via the DALI. In practice, both solutions are used.

Examples of integrated lighting equipment:

> Cutting workstations with integrated lighting
> Spotlights for parts inspection
> Ceiling grids with integrated fluorescent tubes
> Suspended overhead luminaires.

Special lighting (300 lux)
Example: For an area 90 x 50 m (4500 m²), installation height 5 m:
> 225 reflectors 2 x 58 W distributed over 15 Canalis KBB 40 A runs installed at a height of 5 m
> Canalis KBB runs fed by a KN 100 A with a K-system control unit.

Accent lighting for the assembly line



Best-in-class products

Primary distribution

SM6: Modular HV switchgear

Rated voltage: 24 to 36 kV

Rated current Ics: 800 A max. for 24 kV – 630 A max. for 36 kV

Trihal: HV/LV transformers

Trihal HV/LV transformers are used in HV/LV substations and are ideally suited to locations where personal safety is paramount

Power rating: 100 kVA to 15 mVA

Rated insulation level: 36 k max.

Thermal insulation class: F

Prisma P or Okken cubicle: Main switchboard

Rated operating current I(e) at 40°C: 4000 A

Rated short-time withstand current Icw: 100 kA rms/1s

Degree of protection: IP30 to IP55

Canalis KT: high-power busbar trunking

Rated current: 800 to 5000 A

Tap-off points every 0.5 to 1 m on each side

Tap-off units: 25 to 1250 A
plug-in up to 630 A

Degree of protection: IP55

Secondary distribution

Prisma G enclosures: Distribution switchboards

Rated operating current I(e) at 40°C: 630 A

Rated short-time withstand current Icw: 25 kA rms/1s/Isc = 50 kA

Degree of protection: IP30 to IP55

Canalis KS: Busbar trunking for medium-power distribution

Rated current: 100 to 1000 A

4 live conductors

Tap-off points every metre on each side
Dimensions of trunking sections available to fit floor height

Tap-off units and connectors: 25 to 400 A

Degree of protection: IP55

Canalis KN: Busbar trunking for low-power distribution

Rated current: 40 to 160 A

4 live conductors

Tap-off points every 0.5 to 3 m

Tap-off units and connectors: 16 to 63 A

Degree of protection: IP55

Control bus

Compact NSX: Moulded case circuit breakers

Rated current Ics: 100 to 630 A

Ui: 800 V

Ue: 690 V

iC60: Modular circuit breakers

Rating: 63 A max.

Rated current: 1 to 63 A and breaking capacity 100 kA max.

Operating voltage: 440 VAC max.

Insulation voltage: 500 V

Degree of pollution: level 3

Auxiliaries: status and trip indicator, shunt trip release, undervoltage release, overvoltage release

Lighting products

Canalis KDP: Busbar trunking for lighting and low-power loads

- Rated current: 20 A
- Degree of protection: IP55
- Number of live conductors: 2 or 4
- Tap-off points every 1, 2 or 3 metres
- Tap-off connectors: 10 and 16 A
- Packaged on a reel

Canalis KBA and KBB: Busbar trunking for lighting and low-power loads

Canalis KBA with KBL

- Rated current: 25 or 40 A
- Degree of protection: IP55, halogen-free, RoHS-compliant, sprinkler test certified
- Number of live conductors: 2 to 4 for KBA and 2 to 8 for KBB
- Length of sections: 2 and 3 m
- Straight lengths RAL 9003 with tap-off points at regular intervals (every 0.5 to 1.5 m)
- Flexible lengths
- Tap-off connectors: 10 and 16 A
- Maximum distance between fixing points: 3 m for KBA, 5 m for KBB
- Cable trays and fixing accessories for low current
- Control bus

Canalis KBL industrial luminaires

- Power: 2 x 49 W, 2 x 58 W, 2 x 80 W
- Equipped with tap-off connector and fixing system
- Degree of protection: IP20 to IP55

KNX/DALI interface

- Max. number of DALI electronic ballasts: 64
- Max. number of groups: 16
- Max. number of DALI scenarios: 16
- Degree of protection: IP20

Lighting products (continued)

DALI controller

Max. number of electronic ballasts: 64

Degree of protection: IP20

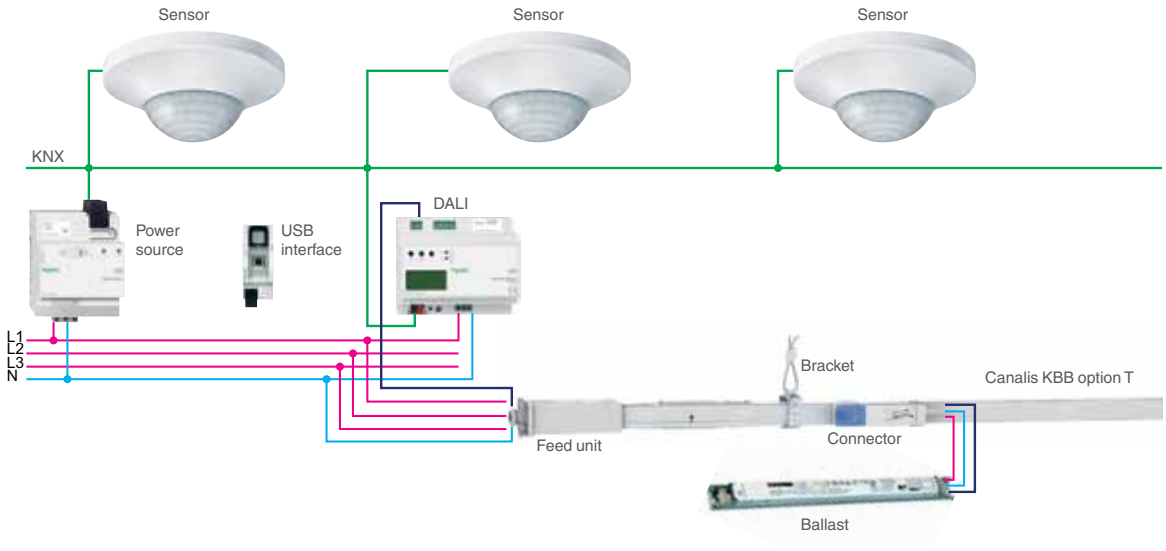
DALI multi-sensor

Combination of presence detector and brightness sensor with DALI interface

Light sensor: 10 to 1000 lux

Degree of protection: IP20

Constant brightness control with **KNX/DALI** gateway

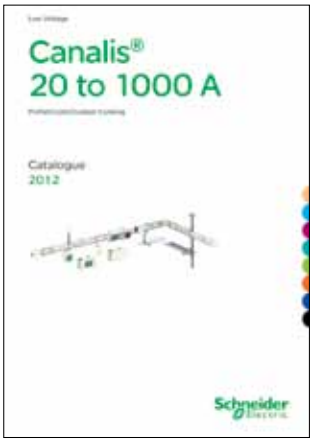


Support materials

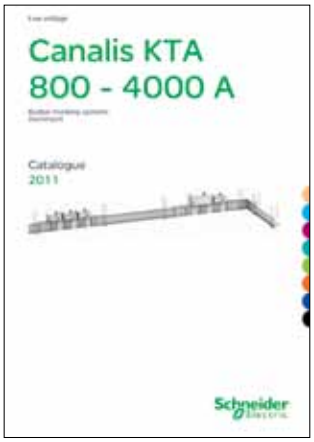
Technical publications and brochures

iBusway for Lighting Management guide – *DEBU032EN*

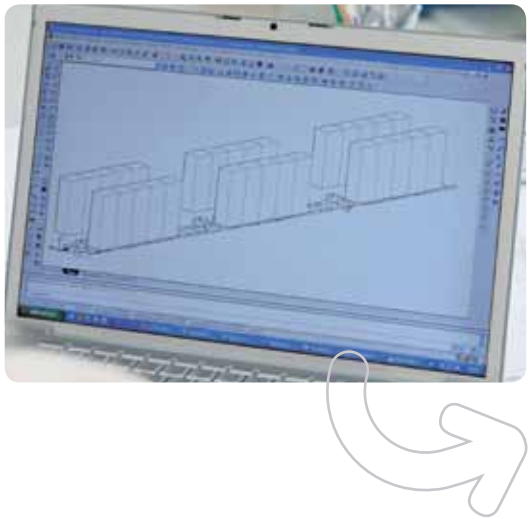
iBusway for Lighting Management brochure – *DESWED112002EN*



Canalis 20 to 1000 A catalogue – *DEBU022EN*



Canalis KTA or KTC catalogue – *DEBU021EN*



Software

CanBrass and CanCad applications

These tools, used to design the installation, provide graphic representation of the Canalis runs and tap-off units.
You can use the CanCad application to represent the layout of the Canalis runs in an AutoCad environment and thus validate project conformity.

These tools are intended for:

> Design offices
> The Schneider Electric teams guiding you through your projects.

More information about the Canalis offer can be found online at:

www.schneider-electric.com

Canalis is now available on tablets!

Download the app from the Apple Store

Download the app from the Google Play

> Learn more about Canalis KT online

Make the most of your energy™

www.schneider-electric.com

Schneider Electric Industries SAS

35, rue Joseph Monier
CS 30323
F - 92506 Rueil Malmaison Cedex
France

RCS Nanterre 954 503 439
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www.schneider-electric.com

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