Industrial Building Solution

If the building space is modular, eco-friendly and augmentable over time, it’s best done with ABB Building Solutions. Energy distribution and automation suiting the spaces.

Index




Building Segment Overview

Building Segment Overview
Segmentation

In a certain sense, the technology is transversal, but the solutions are effective when the technology is calibrated to the application. The best technical and economic compromise, the best design solutions are the result of experience, system choices and component choices.
The careful and detailed analysis of the needs of the case of interest defines the user case.

Building Segment Overview
Segmentation

Residential

Single Family
- Houses
- Private dwellings
- Single Apartments

Multiple Family
- Multi family dwelling
- Apartment's complex

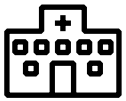
Commercial

Hospitality
- Hotels, Resorts, Motels
- Dormitories, Lodgings, Rooming
- Cruiser ships

Office
- Low/Mid/High-rise
- Multi-purpose
- Laboratories
- Call centres
- Single/Time-share property

Retail & Mall
- Stores, Hypermarkets
- Retail chains, Malls
- Restaurants, Food chains
- Showrooms

Leisure Facilities
- Casinos, Theme parks
- Sport stadiums, gym-pools
- Museum, Theatres



Institutional

Healthcare
- Hospitals
- Nursing, Retirement homes
- Elderly Care, Day Care
- Multi-centres

Educational
- Schools, Universities, Colleges
- Research facilities
- Archives, Libraries

Public
- State/city buildings, Halls
- Post-offices
- Temples, Historic
- Police, Military, Prisons

Infrastructure

Transportation
- Airports, Ports, Stations
- Bus/Truck/Train terminals
- Parking facilities
- Tunnels

Storage
- Warehouses
- Cold storage plants

Others Infrastructure
- Water/Sewage treatment

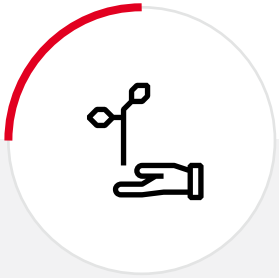
Industrial

Manufacturing
- Factory
- Manufacturing
- Transformation
- Packaging

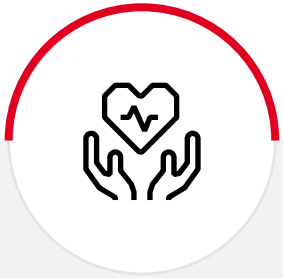
Others Industrial
- Chemical, Pharmaceutical
- Processing
- Telecom
- Power Plants
- Agricultural

Building Segment Overview
Core needs

Currently, the strategic lines that guide the definition of the characteristics of a building are aimed at satisfying 4 classes of fundamental needs:



—
Environmental footprint



—
Health & comfort

—
Life cycle cost and value

—
Future proof assets

These classes of basic needs can be translated into 7 performances that measure the quality of the building itself. Transversal aspects common to all the required performances are scalability and modularity, more important the more rapidly the market demands change.

Building Segment Overview
Building performances

Connectivity

The building enables its intelligent components to connect providing proper cyber security, preventing software vulnerabilities and minimizing risks associated with data flow and storage.

Efficiency

The building optimizes the energy consumption and supports the efficient use of resources.

Total Cost of Ownership

The building gives the transparency of the operating and maintenance costs. Warnings occur before a major fault.

Sustainability

The building aims to reduce the CO_2 footprint of its operation in accordance global standards for people and planet.

Productivity

The building increases the productivity of employees, sets the right conditions (light, air quality, temperature …) adapting to the occupancy and expected performances.

Flexibility

The building technology allows it to adapt easily to new usage requirements.

Well-being

The building technology keeps employees and visitors healthy.

Industrial Solution

Industrial Vertical Profile
Introduction

Definitions of Manufacturing Industries

The Manufacturing sector

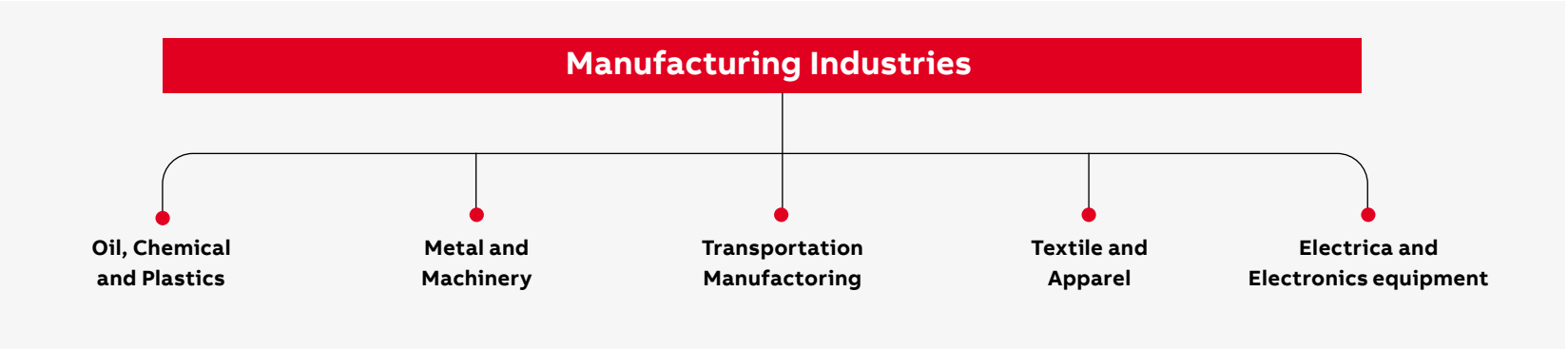
The Manufacturing sector comprises establishments engaged in the mechanical, physical, or chemical transformation of materials, substances, or components into new products.

Manufacturing is the making of goods

Manufacturing is the making of goods. The items that are manufactured may be completed products or they might consist of components that contribute to a whole that's produced in another facility. Manufacturing facilities typically feature production lines or areas that are dedicated to producing one or more items. A facility might manufacture products to stock stores or make them to order, producing items only as they're requested by a buyer. The manufacturing industry is essential to produce everything from clothing and food to tires and toothpaste.

Establishments in the Manufacturing sector are often described as plants, factories, or mills and characteristically use power-driven machines and materials-handling equipment. However, establishments that transform materials or substances into new products by hand or in the worker's home and those engaged in selling to the public products made on the same premises from which they are sold, such as bakeries, candy stores, and custom tailors, may also be included in this sector. Manufacturing establishments may process materials or may contract with other establishments to process their materials for them. Both types of establishments are included in manufacturing.

Categories of Manufacturing Industry



Industrial Vertical Profile
Trends and key challenge

Below are some of the key challenges faced by Manufacturing Industries globally and some of these challenges is likely to be continued in coming year.

Sustainability

Achieving carbon-neutrality will be necessary yet little differentiating for manufacturers of industrial products — but helping others becoming carbon neutral presents a trillion-dollar opportunity. Heat recovery, optimization of cooling, pumping systems and water consumption. Appropriate computer-based and cloud-based production processes. Implementation of LEAN and 6sigma manufacturing principles. Use of renewable sources such wind and solar. Electric motors are perhaps the biggest consumers of electrical energy. Replacing older has resulted in an efficiency increase of up to 5%. The use of variable speed drivers can achieve an economy of 20% to 50% depending on the load in question and startup condition. Non-renewable energy conservation Equipping roofs and parking spaces with power generated solar panels which may be routed to supportive assets - e.g. administrative buildings or lighting for warehouses. By substituting the utility power with a renewable one for plant infrastructure, the manufacturer replaces non-renewable energy from fossil fuels with naturally sustainable ones from the Sun, together with the constant study of technology for securing future investments Use of Factory Energy management system such as ABB OPTIMAX and ABB Microgird solution .

Global supply chain

An ever-increasing array of contradictory and dynamic parameters (such as trade barriers, political instability, epidemics, and natural disasters) will force companies to square the circle, to actively manage the risks — and to stay flexible

Cyber-attack

Control systems are based increasingly on software. Computer systems now include a very wide variety of smart devices. Control systems typically include three threat categories: hacking, general malicious software and errors committed by employees. Protect the reliability, integrity and availability of power and automation technologies against unauthorized access or attack

Industrial Vertical Profile
Trends and key challenge

Lack of talent (Cost of talent)

One way which ABB can help companies is tacking this challenge to increase the use of automation inside the factory. here are countless tasks and processes manufacturers can automate, but it often makes sense to start with the basics like data collection and reporting.

Safety

Beware of hazardous chemicals, moving and rotating mechanical parts, electric shocks, dust explosions, fires. ABB has number of system that can address the electrical safety of the worker

Digitization

Digitalization is about extracting value from data through analyses .One example is that in order to maintain the process, production lines are monitored every day and measures are taken to maintain steady performance of the line. Data is collected and categorized according to the critical factors which affect the production lines. To maintain
optimal usage of machinery, the energy control system monitors the power quality factor by gathering the data which helps to determine how power quality can be improved this is required so robot can operate for long period and minimizing breakdown.

Industrial Vertical Profile
Manufacturing industry lifecycle

Lifecycle of Manufacturing industry will consist of 6 processes

Plan

Planning stage, the Owner of the facility will need to define their project needs, identify the general budget and schedule, and potentially identify a site for the building

The final outcome of the planning phase is a 'Program', or in some countries, a 'Brief', which clearly defines the owner's needs and a plan to design and construct the facility.

Design

Within the design phase, a designer will interpret the needs of the owner into a design for the facility which is to a level of detail that it can be built.

Assessment

Building assessment phase this between design and construction phase

The Phase can consist of multiple sub phases which involve approval from government Bodies, regularity authority and environment agencies be involved in this phase can be.

Construct

Construction phase, a contractor will lead the assembly and construction of the facility.
This will include the procurement of all the elements needed to build the facility, including arranging for the elements to be transported to site.

Operate and Maintain

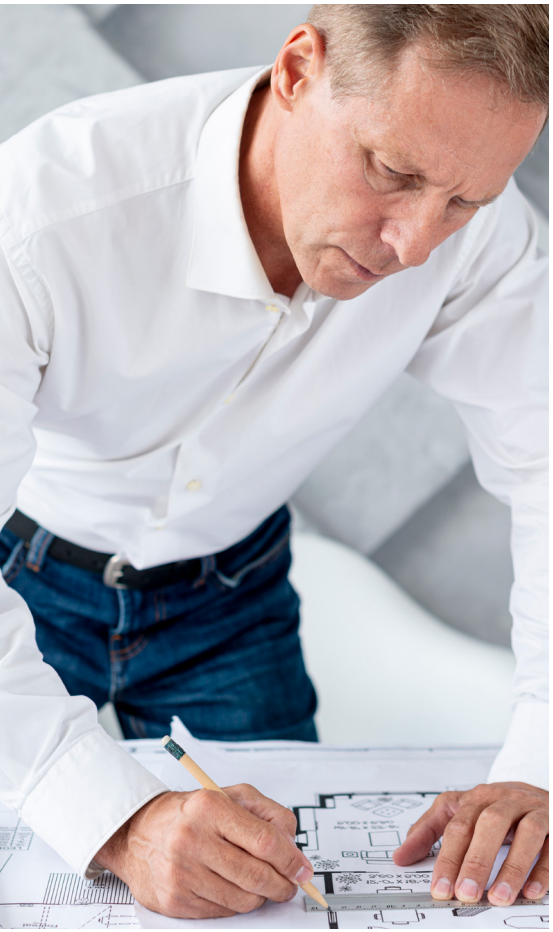
Operations & Maintenance (O&M) phase is typically the longest phase within the facility lifecycle.

In this phase, the owner will use the facility for its intended purpose, and they will need to operate and maintain the functionality of the facility.

Refurbishment

Refurbishment is the process of improvement, decorating and re-equipping. It may also include elements of retrofitting with the aim of making a building more energy efficient and sustainable.

Industrial Vertical Profile
Manufacturing industry lifecycle



Planning Phase

During the planning stage, the Owner of the facility will need to define their project needs, identify the general budget and schedule, and potentially identify a site for the building. The owner may employ the services of an architect, contract developer, or other professional to help them defined their needs, and identify the resource requirements. The final outcome of the planning phase is a ‘Program’, or in some countries, a ‘Brief’, which clearly defines the owner’s needs and a plan to design and construct the facility.
They will also need to identify, and sometimes purchase, a site for the facility.

Design Phase

Within the design phase, a designer will interpret the needs of the owner into a design for the facility which is to a level of detail that it can be built.

Building Assessment phase

There is one more phase that is between design and construction phase which is called Industrial Building Assessment phase. the Phase can consist of multiple sub phases which involve approval from government Bodies, regularity authority and environment agencies this can process can change from region to region and type of the Manufacturing industry that is being built.

Typical process that can be involved in this phase can be:

- Assessment of the environmental impact of industrial buildings carbon footprint (CF)and water footprint (WF)
- Life Cycle Assessment of Construction Materials.
- Energy consumption during construction Phase
- Energy consumption of machinery that to be deployed inside the factory
- Construction and demolition waste (CDW) Calculation
- Assessment of how to reuse the Construction waste

Industrial Vertical Profile
Manufacturing industry lifecycle

Construction Phase

Within the construction phase, a contractor will lead the assembly and construction of the facility. This will include the procurement of all the elements needed to build the facility, including arranging for the elements to be transported to site. After arrival, the building component will be assembled on-site and tested to ensure the appropriate level of quality. The constructed facility will also require any inspections by governing authorities to ensure that it is safe to use for it's intended purpose. For a building project, the primary construction phase typical ends when the contractor obtains a 'Certificate of Occupancy'. The Certificate of Occupancy is issued by the local governing authority or code office, and it certifies that the building complies with the codes and requirements and that the owner can occupy the building.

Operations & Maintenance Phase

The Operations & Maintenance (O&M) phase is typically the longest phase within the facility lifecycle. In this phase, the owner will use the facility for its intended purpose, and they will need to operate and maintain the functionality of the facility. In some research, up to 80% of the entire lifecycle cost of a facility is spent in the operations phase. This phase is also sometimes referred to as Facility Management (FM), and an owner may perform the facility management services within their own internal employees, or they may hire a 3rd party FM service provider.

Refurbish Phase

Refurbishment is often used interchangeably with renovation or restoration (which is to do with restoring a building to its former condition). In general, refurbishment can encompass such works as 'cosmetic' renovations (such as painting and decorating), upgrading, major repair work, alterations, conversions, extensions, and modernizations.
The lifecycle of a building can be significantly extended by effective refurbishment. As every building is unique, not only structurally, technically, and typologically, but also in local context, the correct approach to refurbishment should be assessed according to the particular conditions. Designers should seek to understand the actual uses of existing buildings and communicate with diverse stakeholders from the initial project phase to the end of the refurbishment.

Industrial Vertical Profile
Manufacturing industry lifecycle

Greenfield vs. Brownfield investments

Companies that want to expand their interests internationally generally make physical investments and purchases in another country. This is known as foreign direct investment (FDI). They purchase, lease, or otherwise acquire assets in their host country including facilities such as plants, office space, or other types of buildings. These acquisitions may come in the form of new or existing facilities.

GREEN FIELD INVESTMENT

In a greenfield investment, parent company opens a subsidiary in another country. Instead of buying an existing facility in that country, the company begins a new venture by constructing new facilities in that country. Construction projects may include more than just a production facility. They sometimes also entail the completion of offices, accommodations for the company's staff and management, as well as distribution center.

Investors Coonstruct New Facility

Requires more time

Doesn't require cleanup cost

BROWNFIELD INVESTMENTS

Brownfield investments, on the other hand, occur when an entity purchases or leases an existing facility to begin new production. Companies may consider this approach a great time and money saver since there is no need to go through the motions of building a brand new building.

Redevelops existing facility

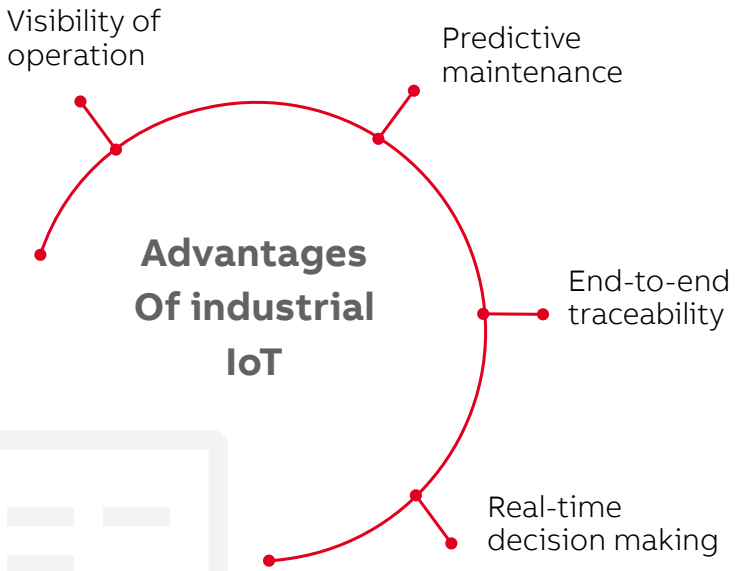
Requires less time

Cleanup costs are incurrent

Industrial Vertical Profile

Emerging trends – Industrial IoT

The Industrial Internet of Things is the use of connected smart devices in industrial applications for purposes such as automation, remote monitoring, and predictive maintenance.
The IIoT is a more robust version of the Internet of Things.



Industrial business is complex by nature

- Long life cycles to modernize machinery Isolated business processes Security and liability challenges

Integrations and platform must run for a long time

- Machines cannot easily be replaced Must run > 10 years

Must be interoperable to avoid vendor lock-in

Require ecosystem to optimize automation processes and enable new business models

Industrial Vertical Profile
Customer needs

For the manufacturing industry, our research shows 9 sub-needs to be addressed, which are anchored in the 4 customer needs categories.

Environmental Footprint

Corporate social responsibility
- Manufacturing companies are required to implement clear and auditable sustainability policies, to demonstrate their commitment to corporate social responsibility. A large part of those objectives is related to assessing and reducing the resources and emissions associated with production.

Resource efficiency
- Alongside the environmental benefits of reducing consumption of electricity, gas and water involved in the production process, additional efficiency gains can be made with a more efficient operation of the building.

Health and Comfort

Employee safety & security
- Providing a safe working environment which attempts to eliminate all risks for employees, alongside stringent incident-avoidance policies, are the highest priority concerns within manufacturing plants. Workers need to feel safe whilst operating equipment, and when using break rooms, parking and circulation spaces.

Employee satisfaction
- Comfortable modern amenities help attract and retain talent, and all employees benefit from the best environmental conditions onsite, all of which align with social sustainability goals.

Industrial Vertical Profile
Customer needs

Life Cycle Cost and Value

Utilities stability
- Having a solid strategic renewable energy production and buying program allows industries to be more resilient in the face of fluctuating energy prices market.

Production continuity
- Factory owners want to get to market in the least amount of time as possible. An uninterrupted production depends on many factors such as the availability of competitively priced energy supply, qualified staff, and sustained investments in the factory, all of which require production managers to keep an eye on several inputs.

Investment appeal
- Using components with low environmental impact to drive clean production attracts green fund investors.

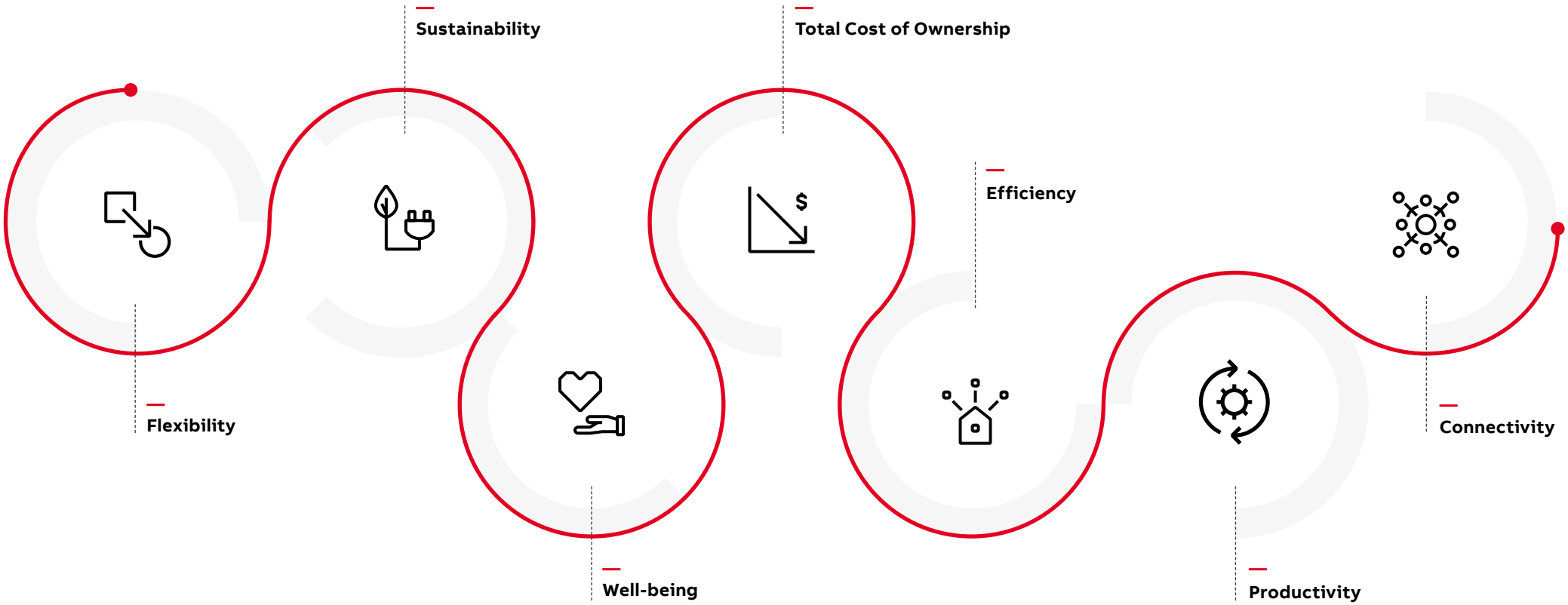
Future Proof Assets

Expansionreadiness
- Production is driven by market demand, and a modular factory with interoperable components can quickly ramp up to meet the needs of customers creates a competitive advantage.

Equipment resilience
- Factories prefer to avoid the replacement of components and parts over the lifetime of operation, which also contributes to reducing the long-term footprint of the factory. Industrial settings require swift action to preserve optimal production parameters.
- liability issues.

Building segment performance for retails and malls

The 7 building performances exist to ensure that the solutions deployed in Manufactoring is holistic and cater to the core needs of involved stakeholders. In other words, this is a people & planet first approach, and the careful selection of ABB building technology serve the purpose of enabling the performances to achieve our common goals.



Building segment performance for industrial

Flexibility

Control and reassign resources rapidly with modular building setup. Being ready to scale-up power supply and distribution to increase production.
The manufacturing industry is under constant pressure to adapt and evolve to meet consumer demand, which means successful factories are flexible and dynamic.
On the building side, sensor driven LED-lighting and intelligent building controls enable reconfiguration of floorplan services with minimal effort. Systems can be tailored to provide a variety of different operating characteristics to meet changing needs.
The use of modular construction allows quicker addition of new building sections, and up-to-date information about the existing building is needed to accelerate the issuance of reconstruction or refurbishment project permits.

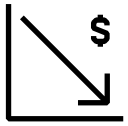
Well-being

Safety and security are first concern in industrial environment and ideal indoor conditions for healthy and comfortable office staff & production workers.
In manufacturing plant, a primary function is building ventilation to maintain acceptable indoor air quality standards and prescribes appropriate ventilation rates (ASHRAE Standard 62). Local, state, or provincial, and federal occupational health agencies also set additional strict specific standards for air contaminants, including carbon monoxide, ozone, volatile organics, formaldehyde, silicone, glues, epoxies, and other air contaminants of special concern. These tightened requirements result in enormous amounts of building air being exhausted rather than recirculated.
Pressurization schemes that either attempts to keep air out of space or keep air within a space depending upon the process are involved. Clean areas require clean supply air and typically are pressurized positively to adjacent spaces to keep the air from those spaces out of the clean area. Air movement can be critical with processes that have high latent loads. In case of emergency, an evacuation program based on reliable emergency lighting solutions help guide the employees to safety.

Building segment performance for industrial

Sustainability

CSR reporting with reliable and transparent data for reduction of scope 1, 2 and 3 emissions with extensive energy management program and sustainable power policies
Due to large roof layouts and exterior parking, many manufacturing industries maximize their onsite renewable production by installing solar panels in those areas. Combined with energy storage and distribution systems, onsite renewable production has great potential to reduce CO2 emissions. Moreover, real-time monitoring of equipment condition and energy consumption helps optimize operation, enabling peak- shaving and demand response strategies.



Total Cost of Ownership

Long lasting equipment compliant with industrial conditions and requirements avoid early replacement. Continuous and uninterrupted energy supply to achieve production objectives.
Increased production, lower prices, and improved quality and variety, all while maintaining a commitment to sustainability are challenges that affect the profitability of factories. Operational budgets are of prime importance for industries, which often operate non-stop under market pressure. Because the production process is repeated indefinitely, seemingly small energy savings end up having significant impacts on the balance sheet. The more granular an asset management system is, the more opportunities for such savings can be uncovered. Investing in components and monitoring systems allow to maintain the highest power quality and avoids damaged equipment, lost productivity, material losses or missed delivery schedules.

Efficiency

Achievement of production and environmental KPIs with integrated energy and asset management and detailed load profile analysis to enable proactive resource management and AI optimization
Resource efficiency is crucial for profitability, and when it comes to the operation of a production facility, the opportunities are varied and numerous. Integrated building controls allow to take advantage of free cooling during nighttime as a simple way to increase energy efficiency. Motion sensors combined with LED-lighting controls enable interim light reduction settings to reduce energy usage in areas with no activity for a preset time. Heat capture systems that recover heat from a process by routing hot water or steam condensate through a heat exchanger where the energy is used for other process systems, or other uses such as HVAC heating and domestic water heating. In some cases, process waste heat can also be used for space heating. The use of energy recovery products is becoming more available as a standard offering such as heat exchanger skids/packages, air-to-air and water-to-air systems.

Building segment performance for industrial

Connectivity

Connected equipment to enable optimized asset management. Production line and device level condition monitoring with consolidated data overview. Continuous equipment and power condition monitoring facilitates decision making at all levels to improve operation. Automated alarms for temperature fluctuations in the warehouse help preserve the quality of products and materials; a consistent temperature is a mission critical requirement for many industries, hence the importance of the building management being well informed with connected sensors.

Productivity

Employee performance is driven by safe and comfortable working spaces and continuous monitoring and advanced data analysis to avoid downtime related to technical faults
Process and manufacturing facilities are big electric consumers. The biggest challenges for them are availability of reliable and clean power. When power failure or quality problems occur, production is directly impacted. Such problems can be as obvious as electrical components that are damaged or fail prematurely, or as subtle as equipment that randomly malfunctions. Implementing power conditioning systems solve power quality issues, and help operators achieve increased production outputs whilst protecting crucial operations.

Testimonials from ABB technology users

Testimonials from ABB technology users

EUROPE

NORTHVOLT SWEDEN

At the forefront of electrification and sustainability

Electrification is an important part of creating a more sustainable society. For example, in the automotive industry, many manufacturers are converting to carbon-neutral vehicles. Ford has said that by 2022, electrified cars will outsell those with an internal combustion engine. Volkswagen has announced that its last generation of cars with internal combustion engines - with some exceptions - will roll out in 2026.

To succeed, high quality batteries will be required. Volkswagen collaborates with Swedish company Northvolt, whose vision is to develop the world's most environmentally friendly battery and to establish one of Europe's largest and most advanced lithium-ion battery factories.

In the summer of 2019, the first shovel was taken to Northvolt Ett, the company's so-called Giga factory in Skellefteå, which will be its primary production unit. The large-scale production will initially have a production capacity of 16 gigawatt hours (GWh) per year, which corresponds to approximately 300,000 electric car batteries. By 2024, capacity will increase to 32 GWh; with long term capacity projected at 40 GWh per year.

Sustainability permeates Northvolt's culture and the giga factory is thought to be the world's most environmentally friendly battery factory. Its production process is as sustainable as the products it makes. For the operation at Northvolt Ett, only renewable energy from hydropower will be used.

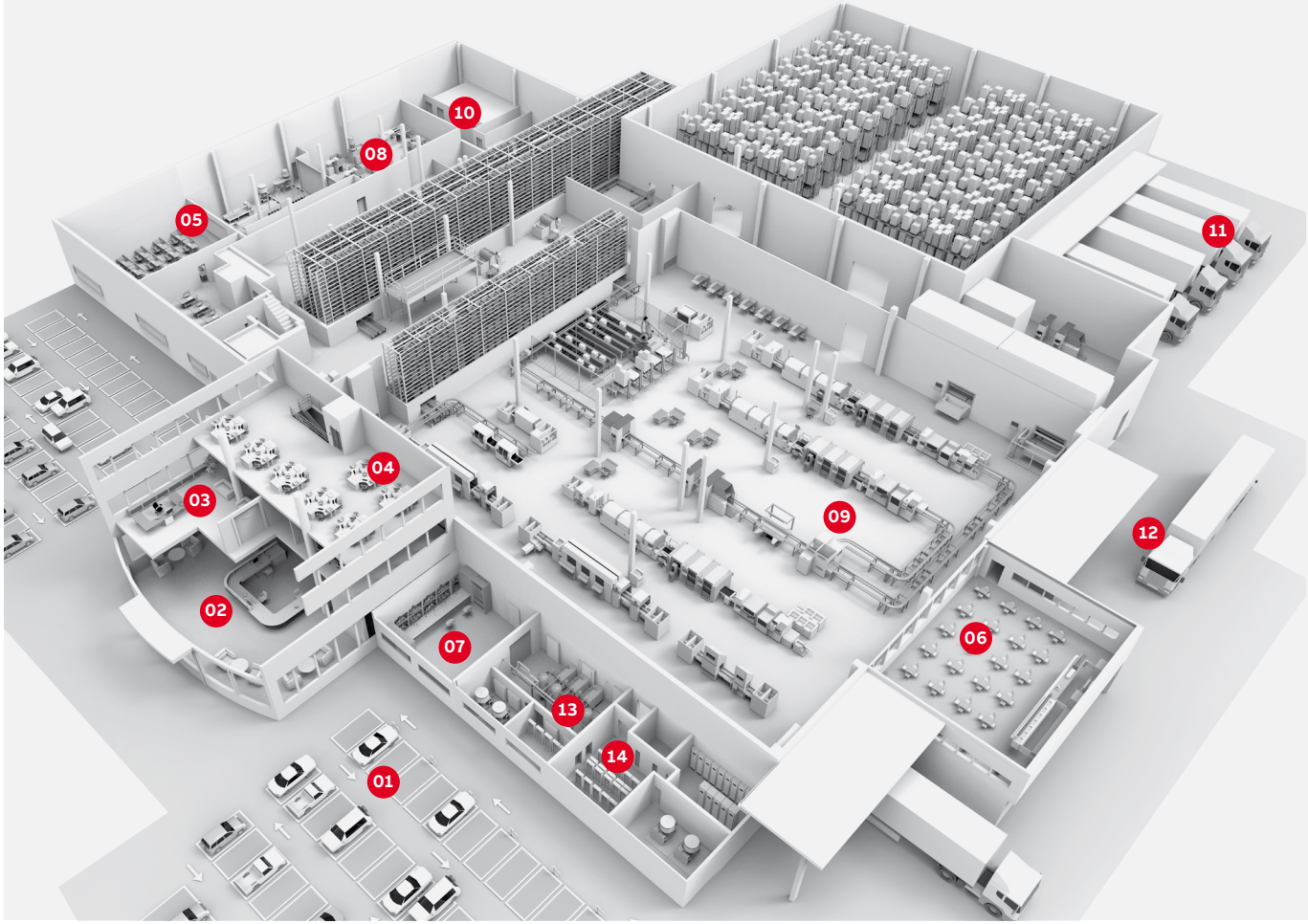
Electrification solutions:

- Power Management System control system
- 2 main transformers 145 / 33kV, 120MVA
- 33kV GIS switchgear 94 panels, total length 80 meters
- 60 distribution transformers
- Approximately 35 km of high voltage cable
- Approximately 30 km of control and fiber cable

Solution architecture

Building typology
Manufacturing enviroment

The entire Manufactoring building may or may not contain different areas dedicated to specific functions.



01. Staff parking
02. Enterance and lobby
03. Factory manager office
04. Open space
05. Training room
06. Factory canteen
07. Control room
08. Laboratory
09. Processing
10. Cold room
11. Packaging area and storage facility
12. Fleet parking
13. Mechanical/plant room
14. Electrical room

Building typology
Manufacturing enviroment

—

Staff parking

Staff parking is the space where Employees Park their car and the same area where factory employees and subcontractor arrives through factory buses or private transportation. Executive Staff come in their car and park their car as designated Areas. In these Parking Area some of the parking spots is dedicated to Electrical Vehicle cars to charge their car freely which is power through solar PV Panels.

- Lighting Control – Timers, Light Sensor Interface
- EVCI – Terra Chargers
- Power Distribution – Packaging and Solution
- Energy Management – Optimax
- Energy Management – BMS / Active Energy
- Drives and Motor –Low Voltage Motors

—

Lobby and common areas

Enterance and lobby

These are common are which staff ad factory worker used to commute to different spaces inside factory

- HVAC Control – AHU Control, Air Quality
- Lighting Control – Occupancy Control, Day Light control , On Off Control
- HVAC Control – Smoke Control system
- Power Distribution – Sub Distribution Board / Distribution Board
- Emergency lighting – Emergency Luminaries and exit sign.

Building typology
Manufacturing enviroment

—
Lobby and common areas

Factory manager office
This space is primary in use by factory manager From here he can log into different system and view different system status related production, power distribution system and Energy consumption of the factory.

- Room Wiring and control – User Interface for Lighting and FCU control
- Lighting Control – Occupancy Control, Day Light control, On Off Control
- ABB Ability – Energy and Asset Monitoring
- ower Distribution System – ABB ZEE600
- HVAC Control – Integra or ASPECT
- Emergency lighting – Emergency Luminaries and exit sign.

—
Lobby and common areas

Open space
The open space office is in use by the staff from account, finance and Factory Operation team, Automation team, HSE Team and facility staff .
It very important to provide them comfortable, secure, and convenient environment so that they work proactively and focus on their work.

- HVAC Control – AHU Control, Air Quality, VAV Control
- Lighting Control – Occupancy Control, Day Light control, On Off Control
- Emergency lighting
- Power Distribution – Distribution Board
- Emergency lighting – Emergency Luminaries and exit sign.

Building typology
Manufacturing enviroment

Training room

It’s a space where staff and worked gather for training on Health and safety, training from OEM who supplied different system inside the factory and annual gathering with staff and workers.

- HVAC Control - AHU & FAHU Control and Monitoring
- Power Distribution – Sub Distribution Board / Distribution Board
- Lighting Control – On off control, Dimming Control and Occupancy control, Daylight
- Saving, Curtain Control .
- Drives and Motor – HVAC Motors and VFD
- Drive and Motor – Smart Sensor
- Emergency lighting – Emergency Luminaries and exit sign.

Factory canteen

It’s a large space inside the factory where factoryworker during their shift take their breakfast, lunch and dinner depending on what shift they are working . it very important to maintain good quality of the air in this area because of large number of people are gathered and sitting near to each other.

- HVAC Control –FAHU Control and Monitoring, Air Quality
- HVAC Control – Exhaust Fan control
- Power Distribution – Sub Distribution Board / Distribution Board
- Lighting Control – On off control, Dimming Control and Occupancy control, Daylight Saving
- Drives and Motor – IEC Low Voltage Motors ,HVAC VFD, Smart Sensor
- Emergency lighting – Emergency Luminaries and exit sign.

Building typology
Manufacturing enviroment

Control room

The control room is some sense very different from the control rooms of the other building types. For Manufacturing industries in can be inside the factory and sometime outside the factory in separate floor. A large space of the complete floor dedicated.

- HVAC Control – VAV Control ,FCU Control , Air Quality
- Power Distribution – Sub Distribution Board / Distribution Board
- Power Distribution – UPS
- Energy Management – Optimax
- Energy Management – BMS / Active Energy
- Lighting Control – On off control, Dimming Control and Occupancy control, Daylight Saving
- Drives and Motor – IEC Low Voltage Motors , Smart Sensor
- Emergency lighting – Emergency Luminaries and exit sign.

Laboratory

The purpose of the laboratory within the laboratory is to check the incoming sample that will be sent to the processing area to ensure that it meets the required quality standards.
The sample is also brought for inspection from the processing area for quality control purposes and to verify its compliance with the different regulatory standards respected by the factory.

- HVAC Control - VAV Control , FAHU Control , Exhaust Control
- HVAC Control – Smoke Control
- Motor and driver - IEC Low Voltage Motors , Smart Sensor ,HVAC VFD
- Power Distribution – UPS
- Emergency lighting – Emergency Luminaries and exit sign.

Building typology
Manufacturing enviroment

Processing

- HVAC Control – FAHU Control
- HVAC Control – Exhaust Control
- HVAC- Industrial Dust Collector
- Lighting Control – Dimming – On Off – Lux Level Control
- Emergency Lighting
- Power Distribution – UPS
- Power Distribution – Power Conditioning
- Power Distribution - MCC
- Power Distribution – Low Voltage Switch gear
- Emergency lighting – Emergency Luminaries and exit sign.
- Drive and Motors - HVAC Drives, IEC Low Voltage Motors
- Drive and Motor – Smart Sensor

Industrial Dust Collector
An industrial dust collector is a type of air pollution control equipment used in factories, plants, warehouses and other industrial or commercial settings to meet environmental and workplace safety requirements.

HVAC Control – FAHU Control
Air treatment for mission critical facilities like food processing area and laboratorie requires special attention. It should be filtered to a certain extent so no contaminants would enter the laboratory space. Heavy filtering requires fine filters, introducing a substantial pressure drop in the system. So, when selecting a variable speed technology, it's critical to make sure the fan can overcome such a resistance. Thus, modern EC fans are often not able to overcome the resistance and create a high pressure in the system, and are being replaced with traditional motor technologies like induction, permanent magnet or SynRM offered by ABB.

ABB offers up to IE5 efficiency motors for the highest energy saving in the system. ABB HVAC drives on top increase the savings further, while maintaining the overpressure or under pressure in the laboratory and keeping the air pure

Building typology
Manufacturing enviroment

—

Cold room

Cold rooms can be also called refrigeration chambers which are designed to maintain certain conditions inside. Cold rooms are used for storing temperature-sensitive products. The design behind cold rooms that allows them to function efficiently isn't so different from any other refrigeration system. Cold rooms use compressors, condensers, fans, and evaporators to maintain temperature within the unit. After a gas refrigerant gets compressed in the compressor it expands, and the gas absorbs energy. The hot gas flowing from the compressor passes over the evaporator coils and, after liquifying under high pressure, this cools the evaporator coils and the surrounding air. To maintain temperature, cold rooms must also be well insulated.

- HVAC Control - Cold Room Monitoring
- Motion – HVAC Drives, IEC Low Voltage Motors, Smart Sensor
- Lighting Control- On Off Actuators
- Power Distribution – Main Distribution Board ,UPS
- Emergency Lighting

Building typology
Manufacturing enviroment

Packaging area and storage facility

In Packaging there are number of processes which is related to palletizing of product. The Products packed here can go to large warehouse facility or can be dispatched to the retailers.

- Power Distribution- Main Distribution Board.
- Power distribution – Power Conditioning
- Power Distribution – UPS
- HVAC Control – AHU Control
- HAVC Control – Smoke Control system
- Lighting Control – Day Light Control
- Lighting Control – DALI
- Emergency Lighting
- Drives and Motor – IEC Low Voltage Motors , Smart Sensor

Fleet parking

In this space large truck at parked inside the factory premises collect the packed material from factory and then take it to their relevant destination for warehouse or either relaiters .
At spare time these EV Truck can be powered from Electrical vehicle charging infrastructure that is being powered from renewable energy source.

- Lighting Control -Timer, outside Light Sensor Interface
- EVCI – Terra Chargers
- Power Distribution – HVC BUS & TRUCK
- Energy Management – Optimax
- Energy Management – BMS / Active Energy

Building typology
Manufacturing enviroment

Mechanical/plant room

A plant room is a room or space in a building dedicated to the mechanical equipment and its associated electrical equipment.
Depend upon factory size the number of mechanical room will change in factory .in Most cases will have mechanical room spread across the building and near to the area where they are serving.

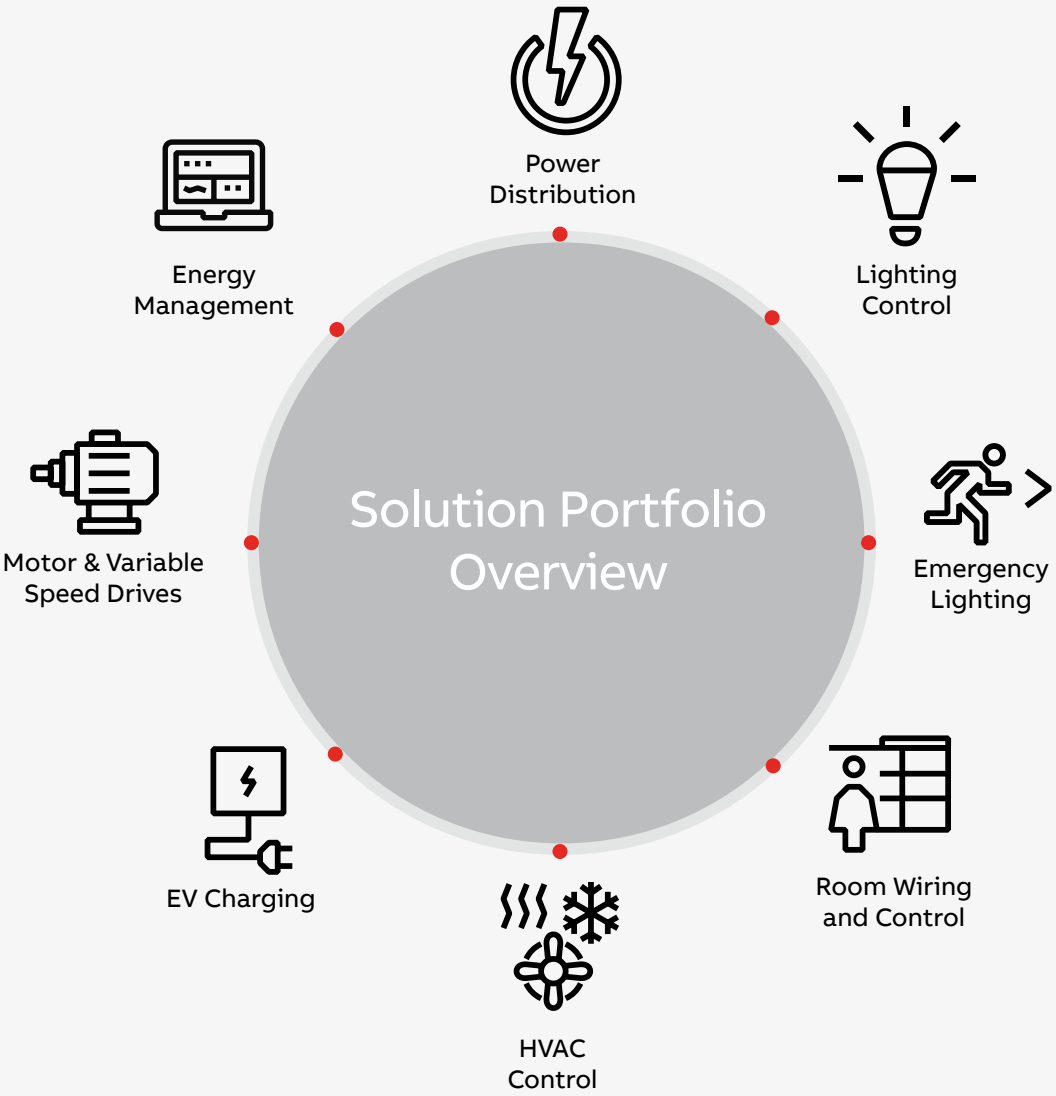
Mechanical room can have below mechanical devices
- HVAC Control - Chilled Water Circulation – Primary and Secondary
- HVAC Control - Heat Exchanger
- HVAC Control - AHU & FAHU Control and Monitoring
- HVAC Control – Boiler's control
- HVAC Control – Chiller control
- HVAC Control – Exhaust Fan control
- Lighting Control – On off control, occupancy control
- Drives and Motor – IEC Low Voltage Motors, and HAVC VFD, Smart Sensor, Industrial cooling direct drive motor and VSD packages

Electrical room

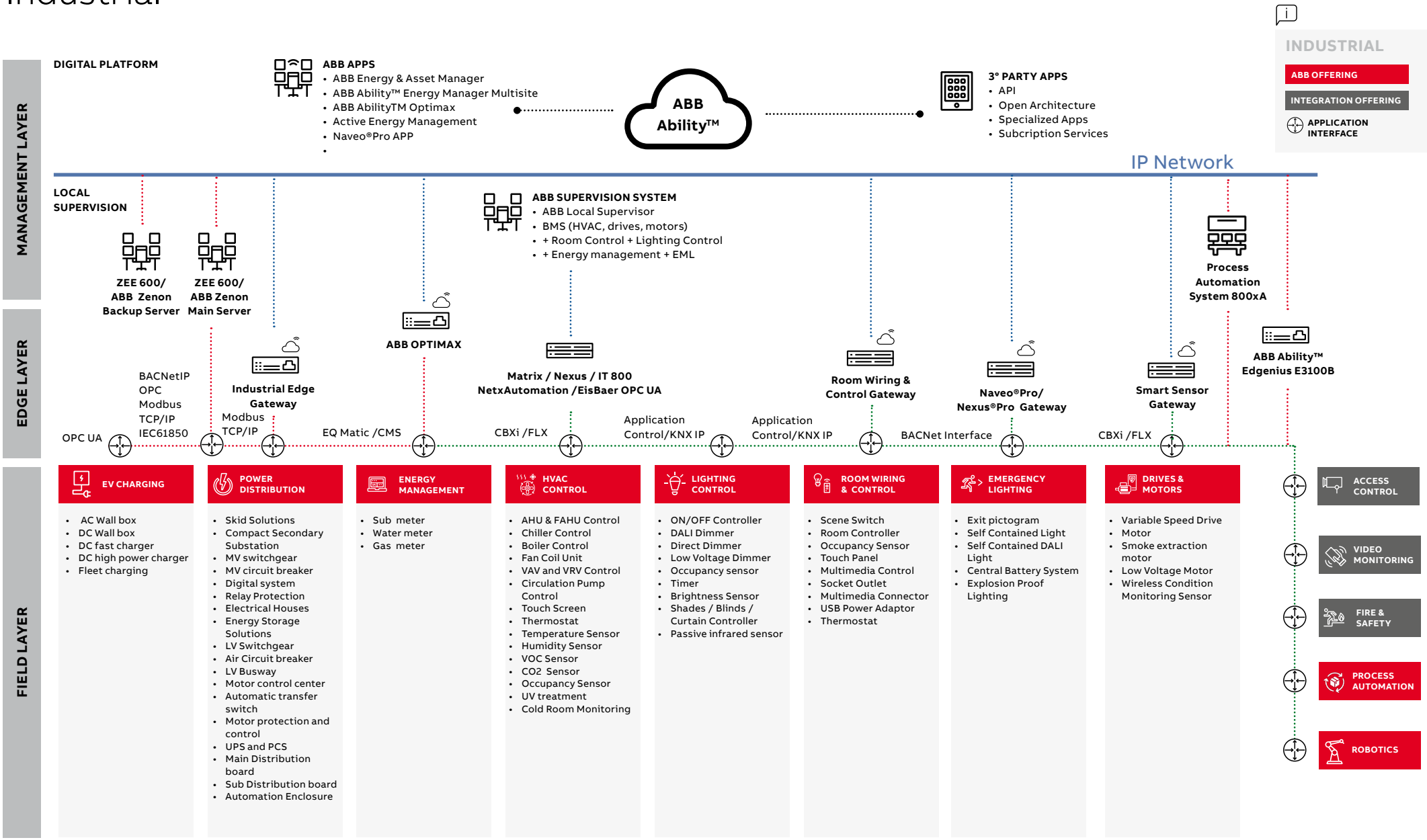
There are various electrical located inside the Factory some are near Processing Are where there is large utilization of electricity these room contain equipment sub as main distribution board, sub main distribution board. On the other hand Main Electrical room or some time outside the building where there is dedicated room or it can be inside EHouse which is located in factory premises. The EHouse can MV SWG ,transformer and Low Voltage SWG.

- Power Distribution -MV Primary Switchgear, MV Secondary Switchgear,
- Protection relay
- Power Distribution – LV SWG, MCC panel
- Power Distribution – Packaging solution, Microgrid
- Power Distribution – Battery Energy storage
- Energy Management -Ekip Up, CMS 700
- HVAC Control - AHU Control
- Emergency Lighting

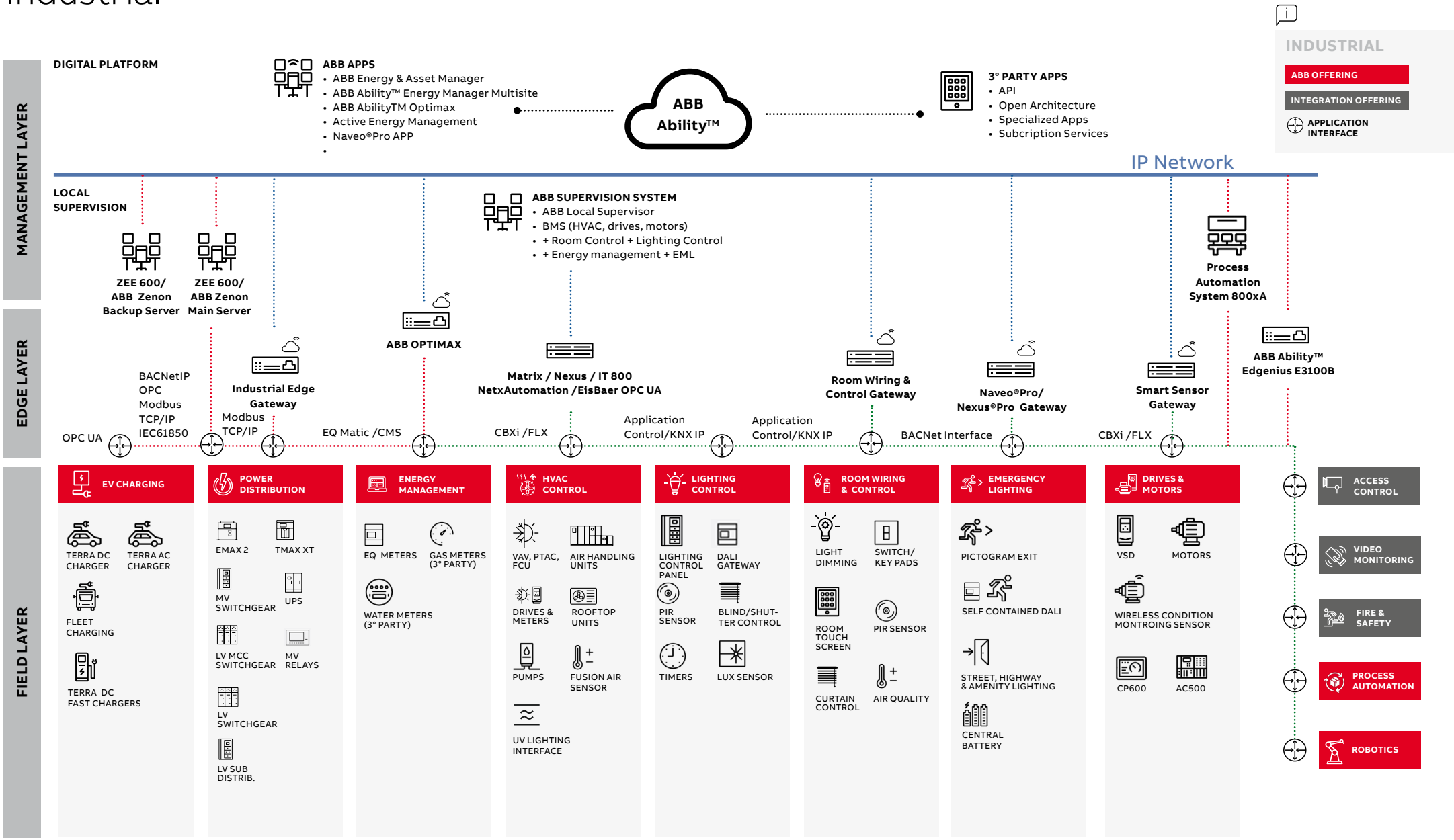
Portfolio Overview



Reference Architecture
Industrial



Reference Architecture
Industrial



Power Distribution

A reliable and energy efficient electrical distribution is needed to keep a building powered, so that computers, lights, heat, and more keep the business running smoothly. ABB offers a wide range of electrical distribution devices to protect a building from overloads, short circuits, ground or arc faults as well as meters to monitor the electricity consumption.

Power Distribution

Example of power distribution application

Electrical power distribution system might receive power at one or more sources. Power distribution and safety system generally include panel enclosure, bus bar, circuit breaker, fuse, relay, feeder, protection devices, safety devices etc.

Overview - Motivation & Key Elements
Efficiency and consumption monitoring

- Metering systems are provided for each zone and main services such as lighting, heating, air conditioning
- The ABB supervision system makes integration of water and gas meters easy and simple
- ABB Ability Energy and Asset Manager provides a common interface and can use analytics,for real-time understanding of building energy consumption and efficient identification of areas of improvement

Safety

- The office building is designed to hosts hundreds of employees for working activities and visitors, therefore special attention to people safety and protection is important
- One of the most critical exposure happening in electrical system is an electric arc inside a switchboard

Continuity of service

- Protection devices have been selected to ensure total safety
- Redundancy of UPSs for monoblock structures or redundancy at module level for modular UPSs is pro-posed to ensure high reliability

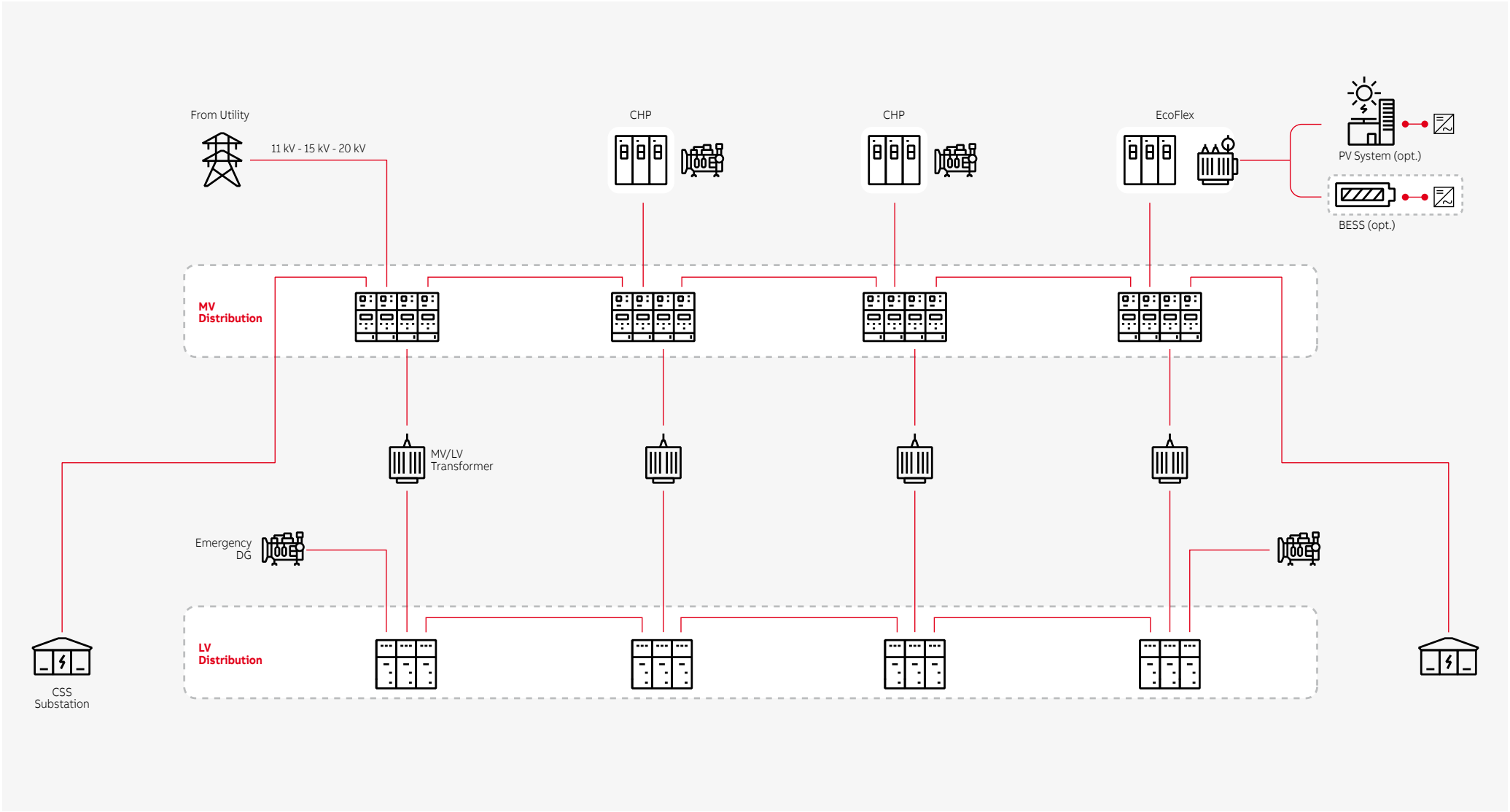
Maintainability

- Monitor performance indicators of protection devices, transformers, generator and automatic transfer switches
- To reduce maintenance cost, it is suggested the adoption of a predictive maintenance program

Power Distribution

Overall Architecture MV Distribution

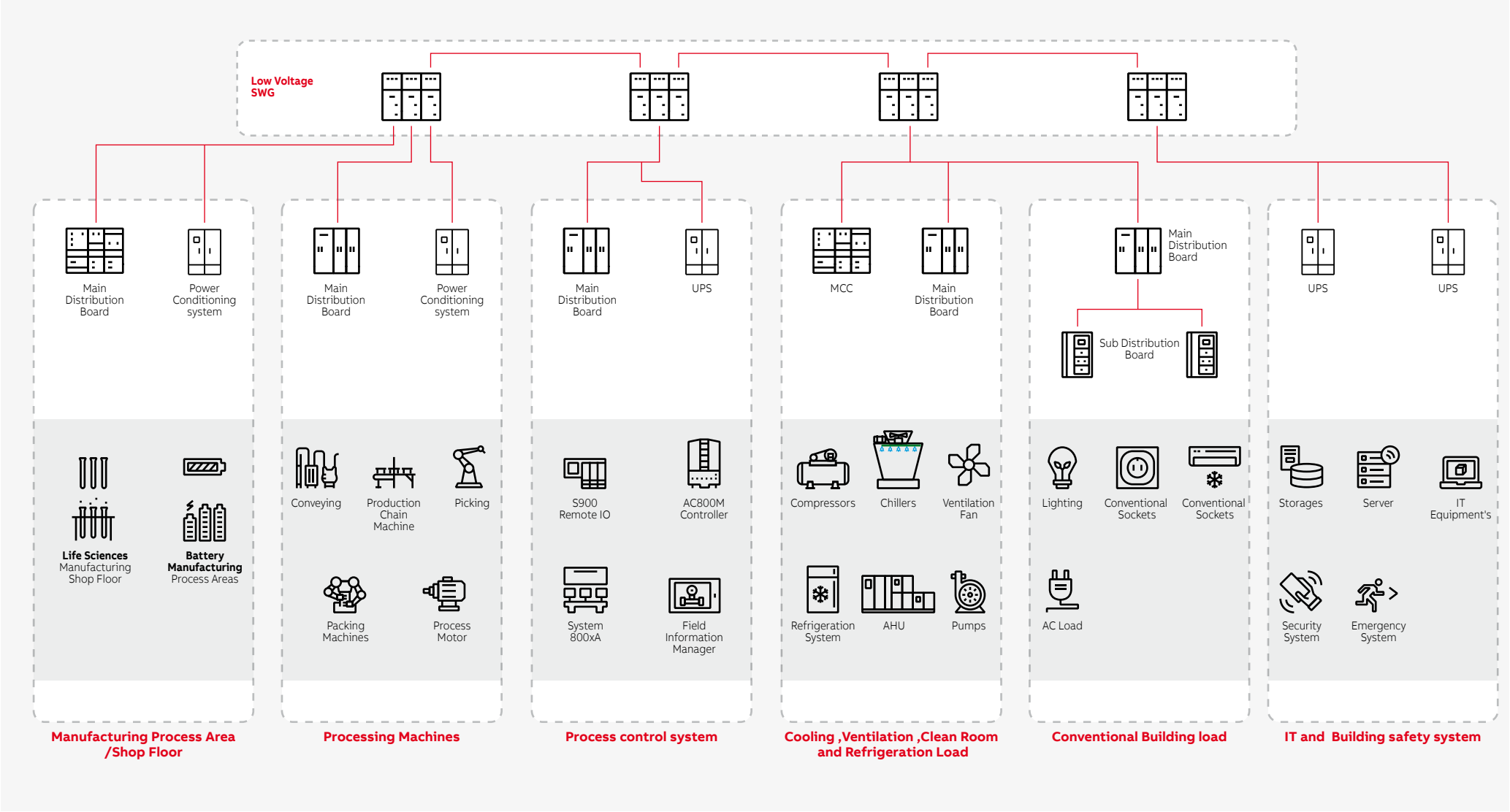
Reference Architecture



Power Distribution

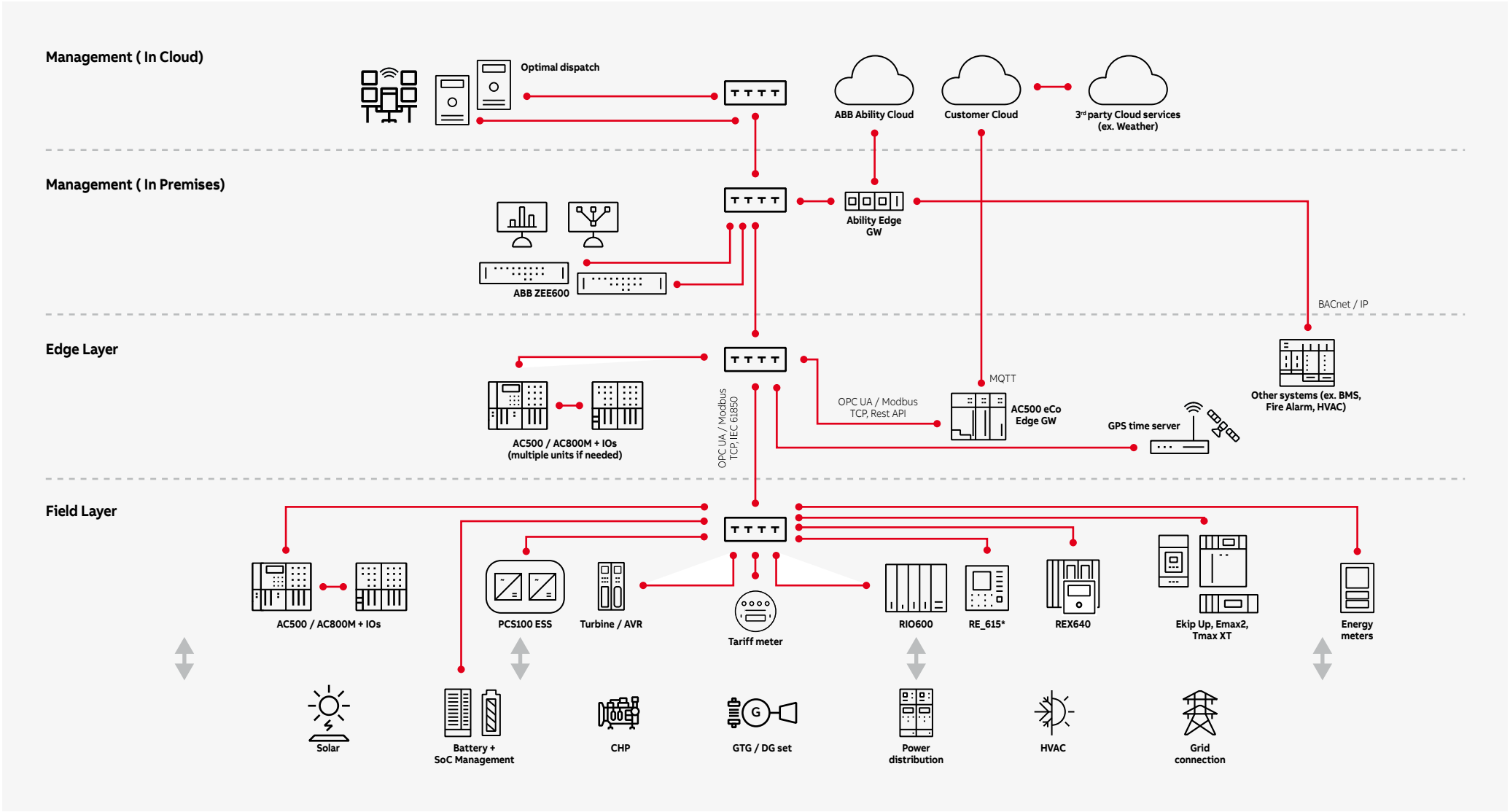
Overall Architecture LV Distribution

Reference Architecture



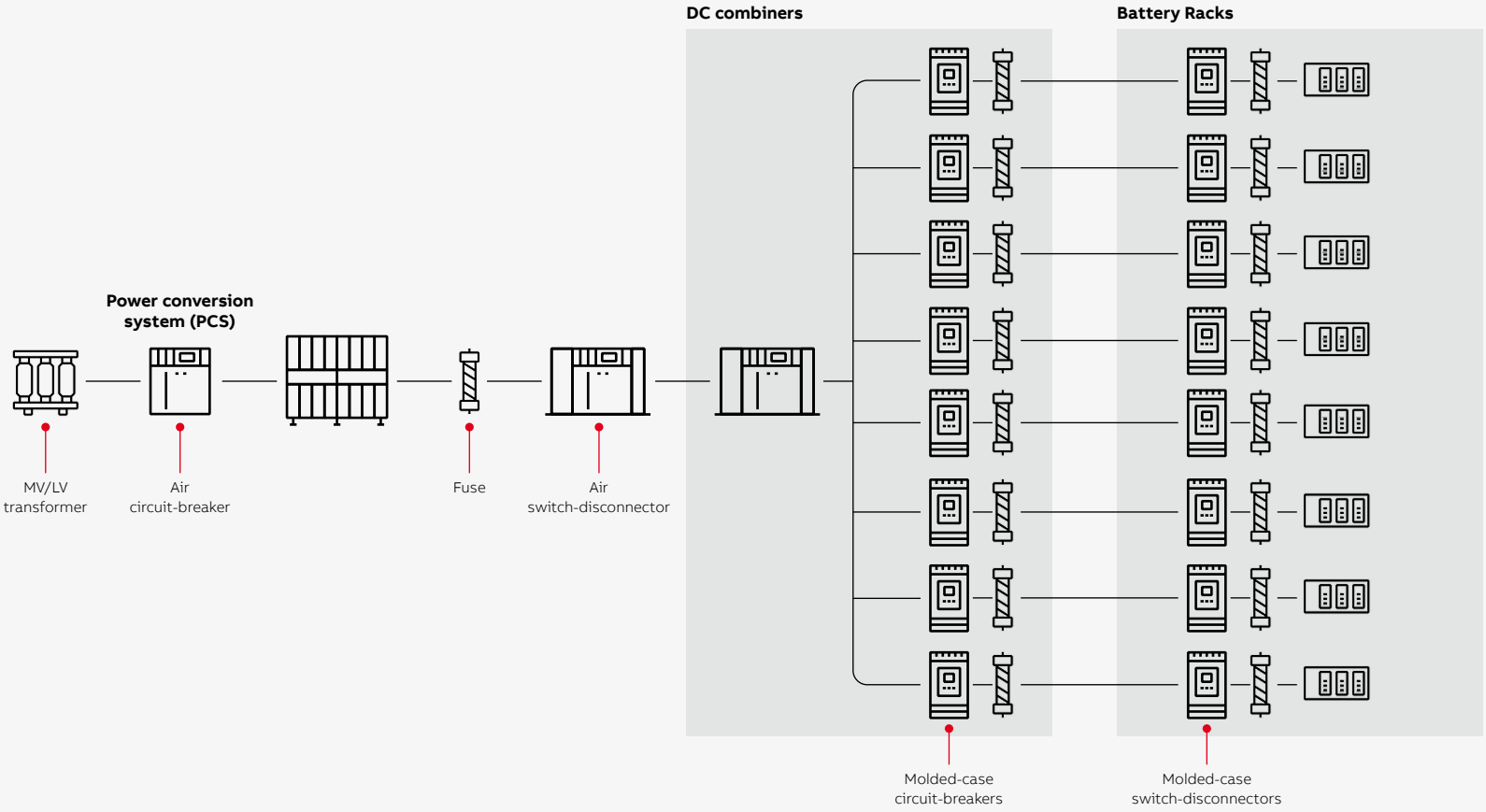
Power Distribution
Microgrids

System architecture, conceptual



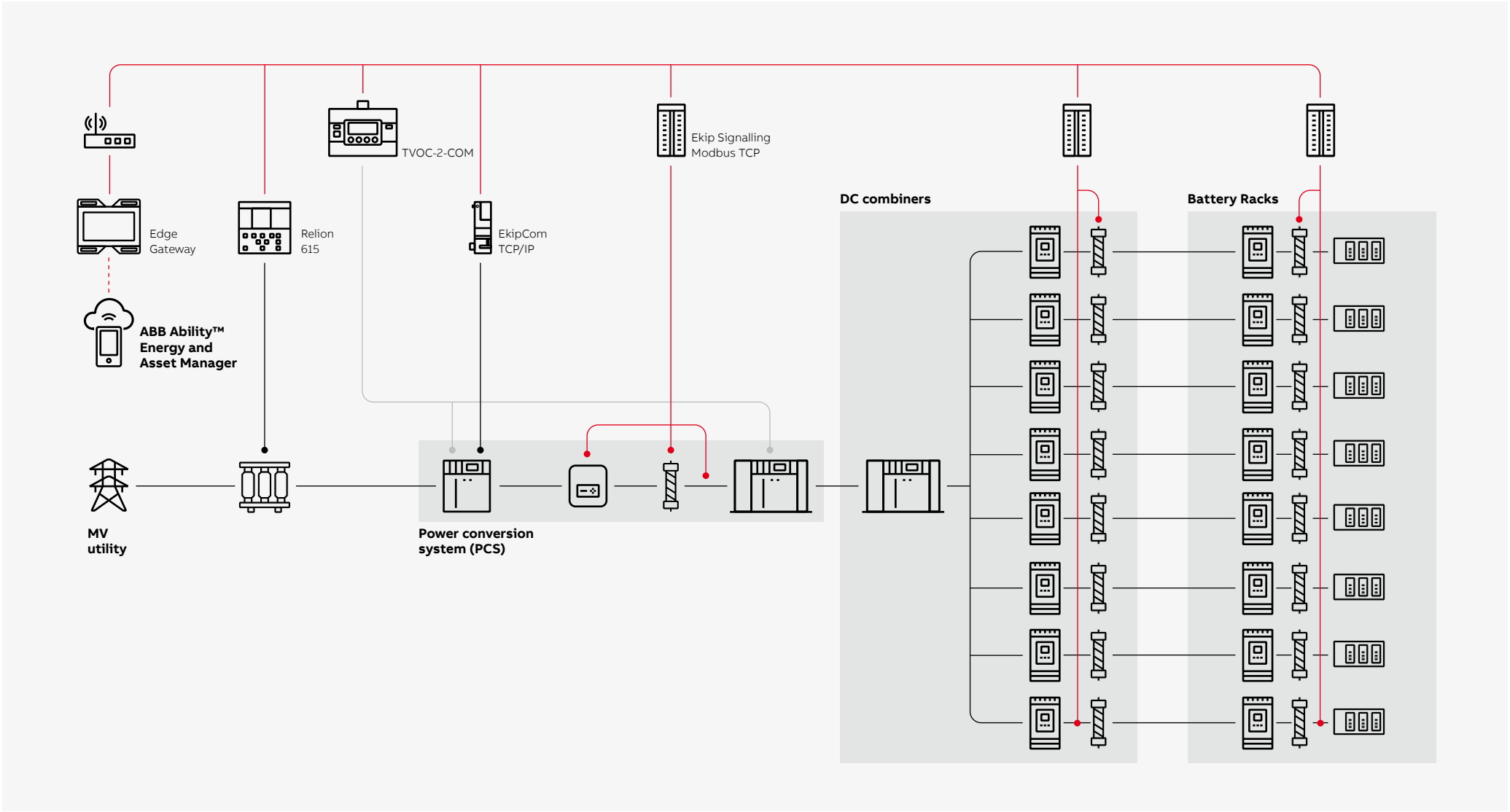
Power Distribution
Battery Energy Storage

Monitoring system



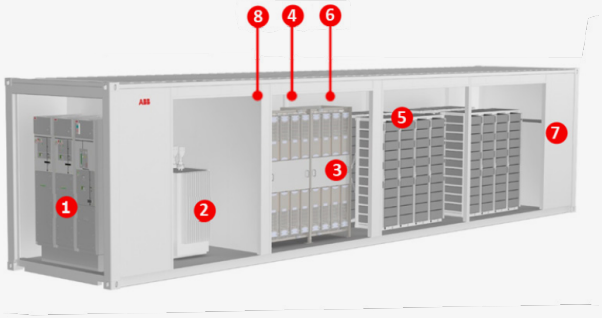
Power Distribution
Battery Energy Storage

Monitoring system

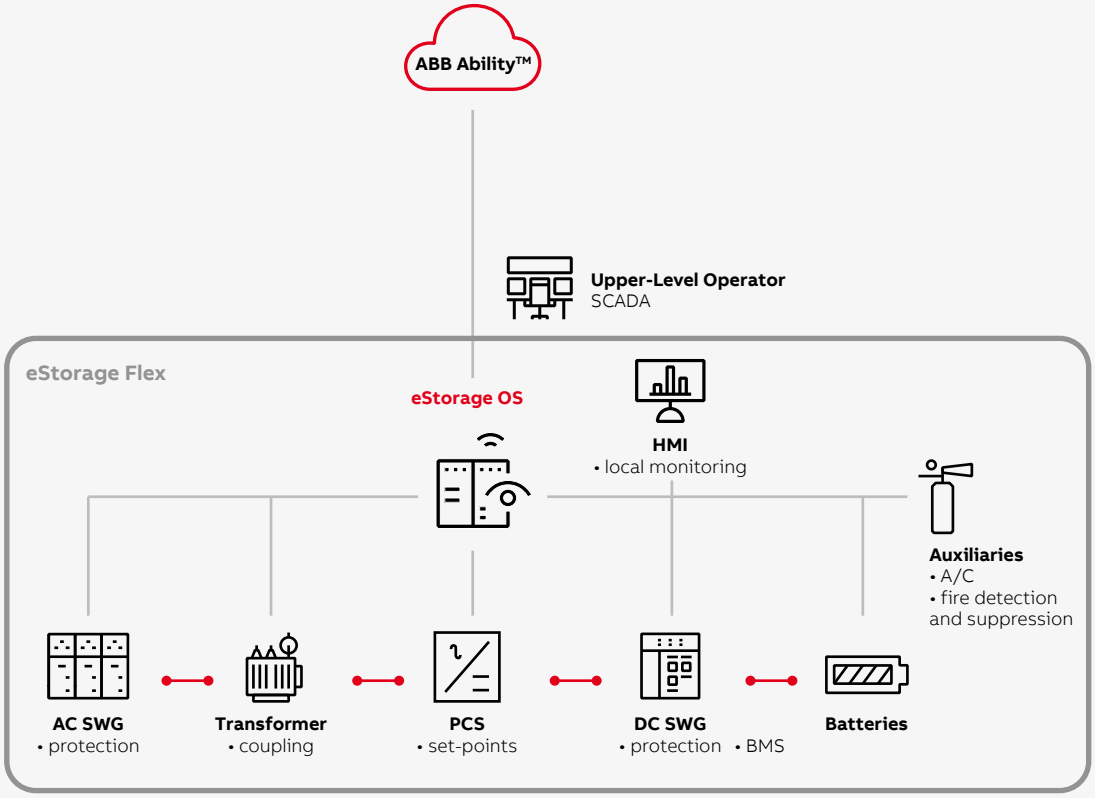


Power Distribution
Battery Energy Storage

BEES Solution

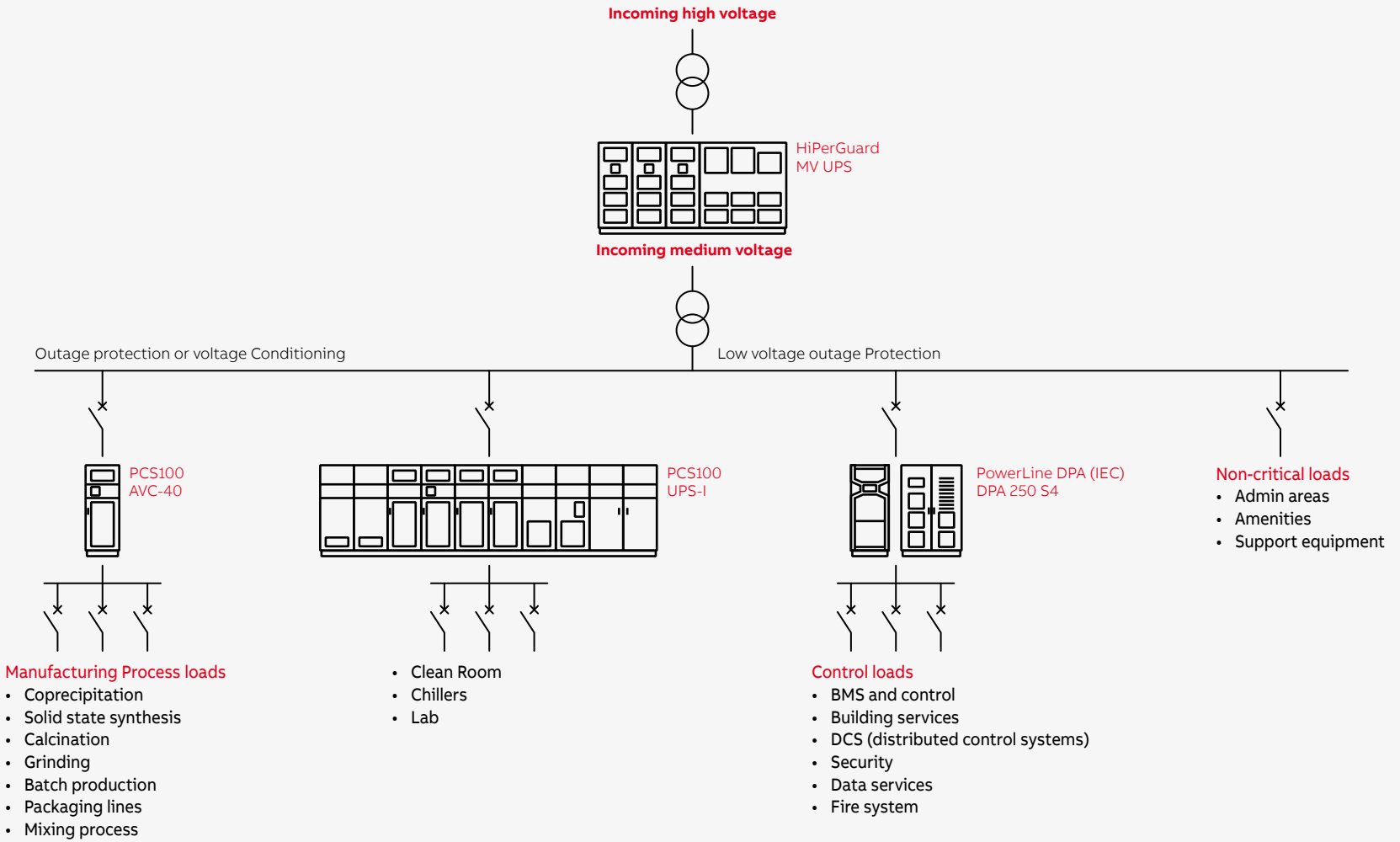


1. AC switchgear
2. Coupling Transformer
3. Inverter
4. DC Switchgear
5. Battery Modules + BMS
6. Fire suppression system
7. HVAC
8. eStorage OS



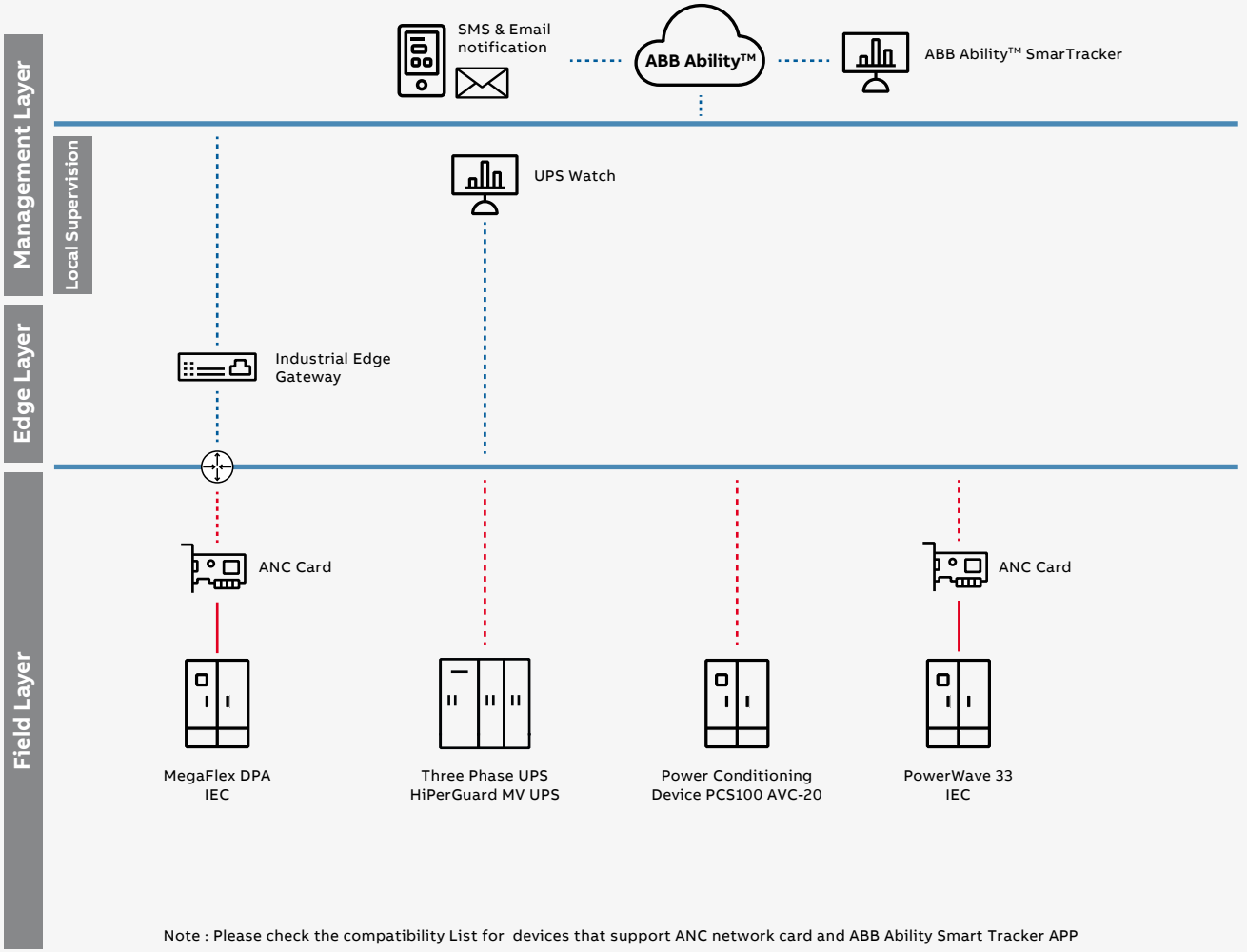
Power Distribution
UPS and PCS Application

BESS Solution



Power Distribution
UPS and PCS Application

Digital Architecture

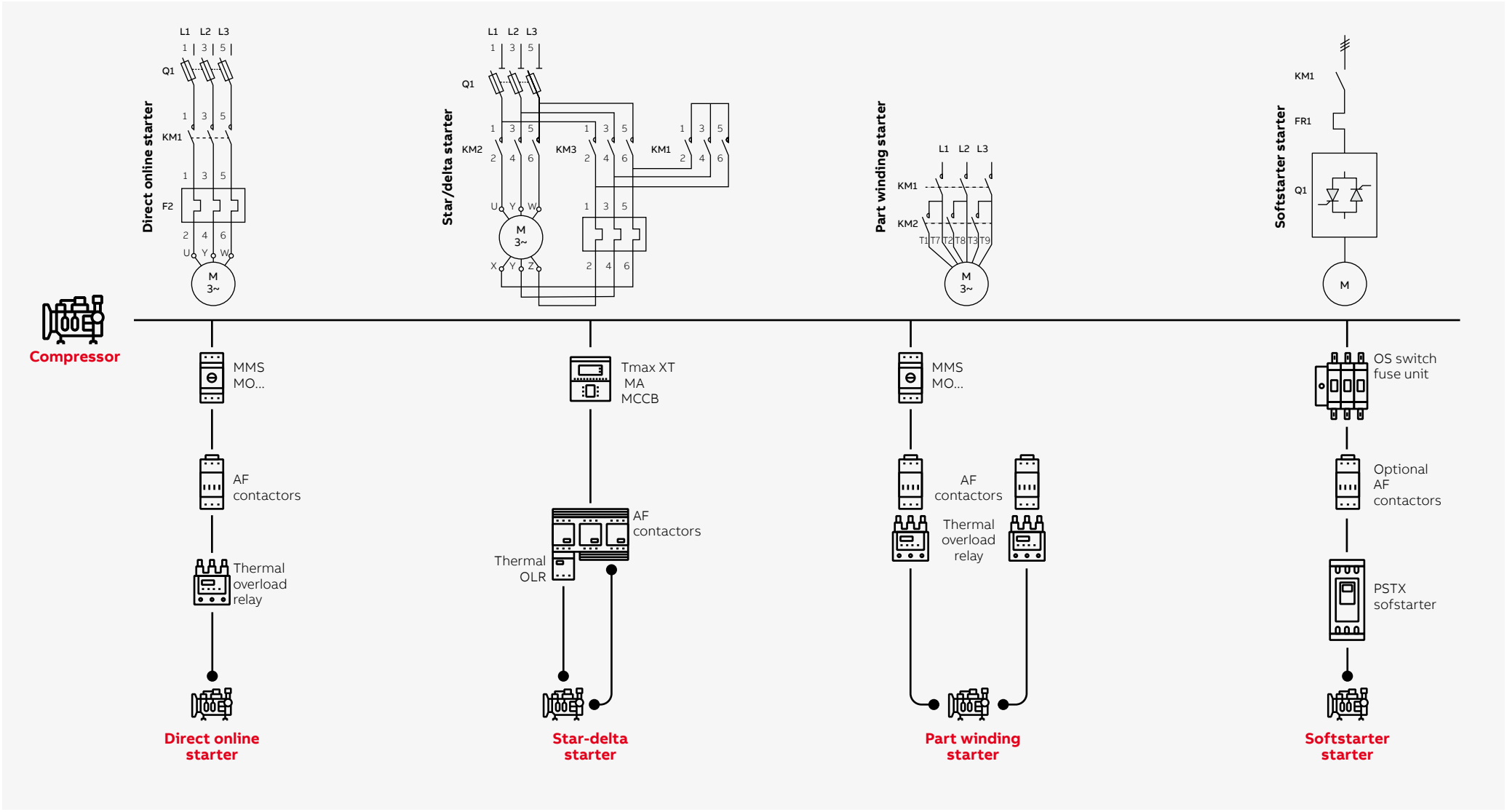


Note : Please check the compatibility List for devices that support ANC network card and ABB Ability Smart Tracker APP

Power Distribution

Motor starting and protection for HVAC Chiller

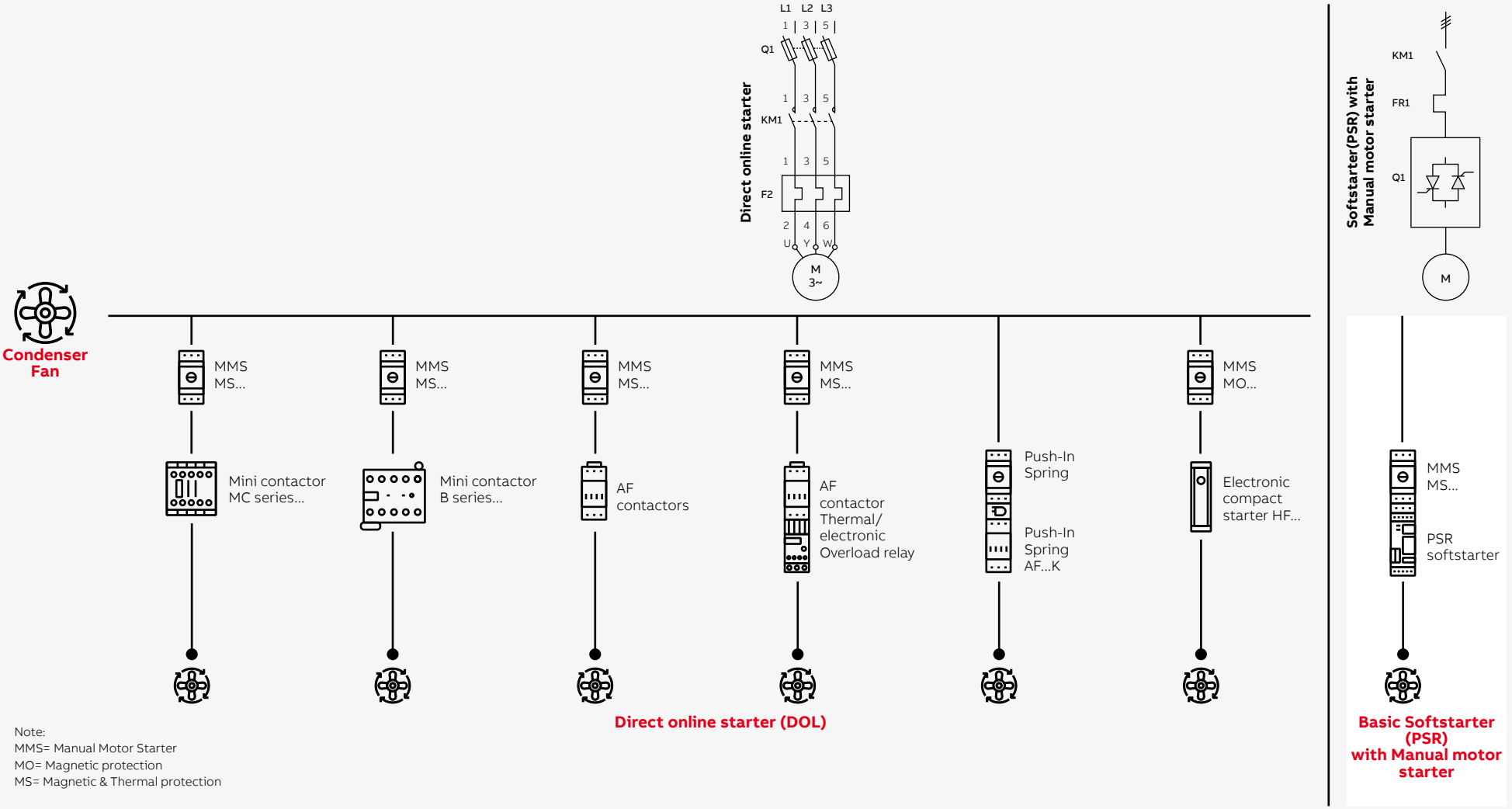
Compressor Recommended Starter for Air Cooled Chiller



Power Distribution

Motor starting and protection for HVAC Chiller

Starting and protection, recommended starter type for condenser fan

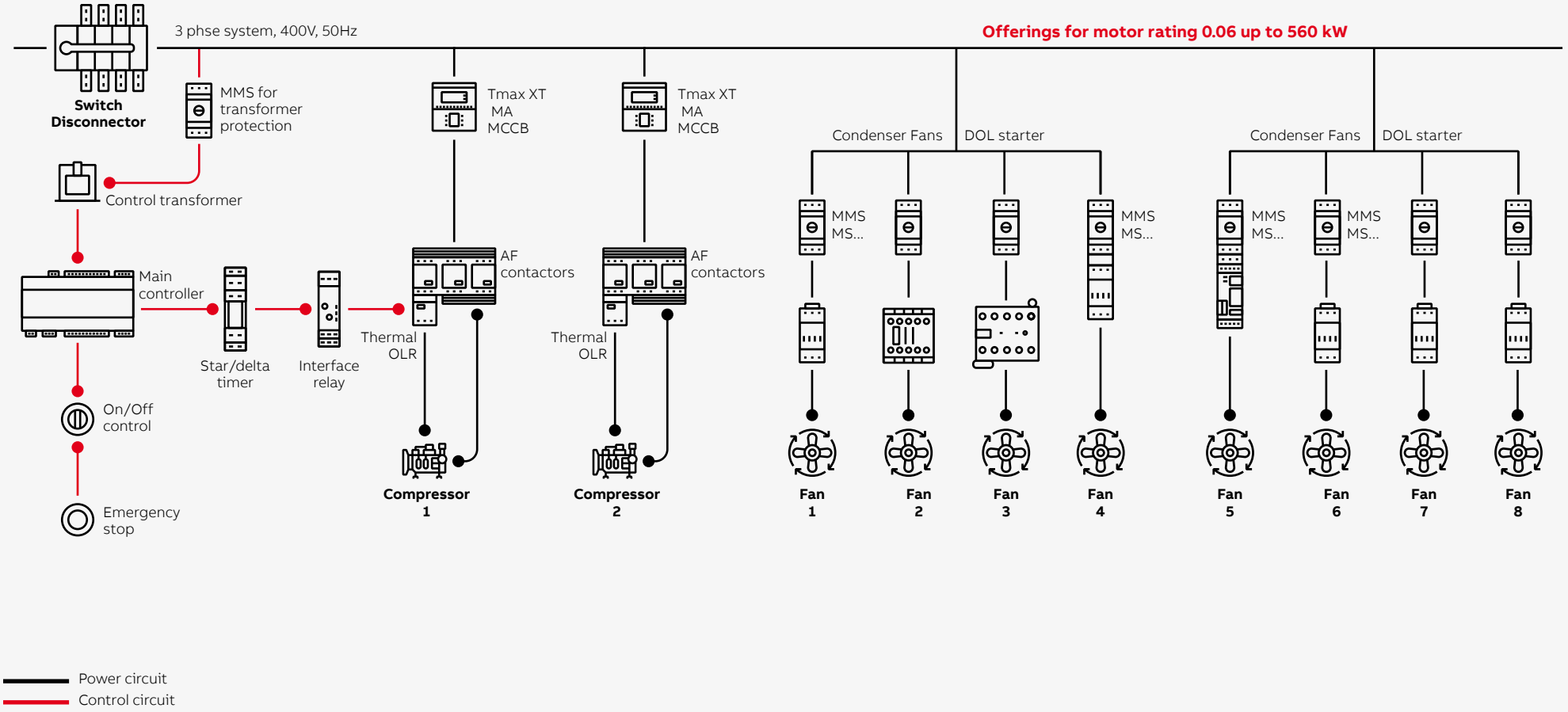


Note:
MMS= Manual Motor Starter
MO= Magnetic protection
MS= Magnetic & Thermal protection

Power Distribution

Motor starting and protection for HVAC Chiller

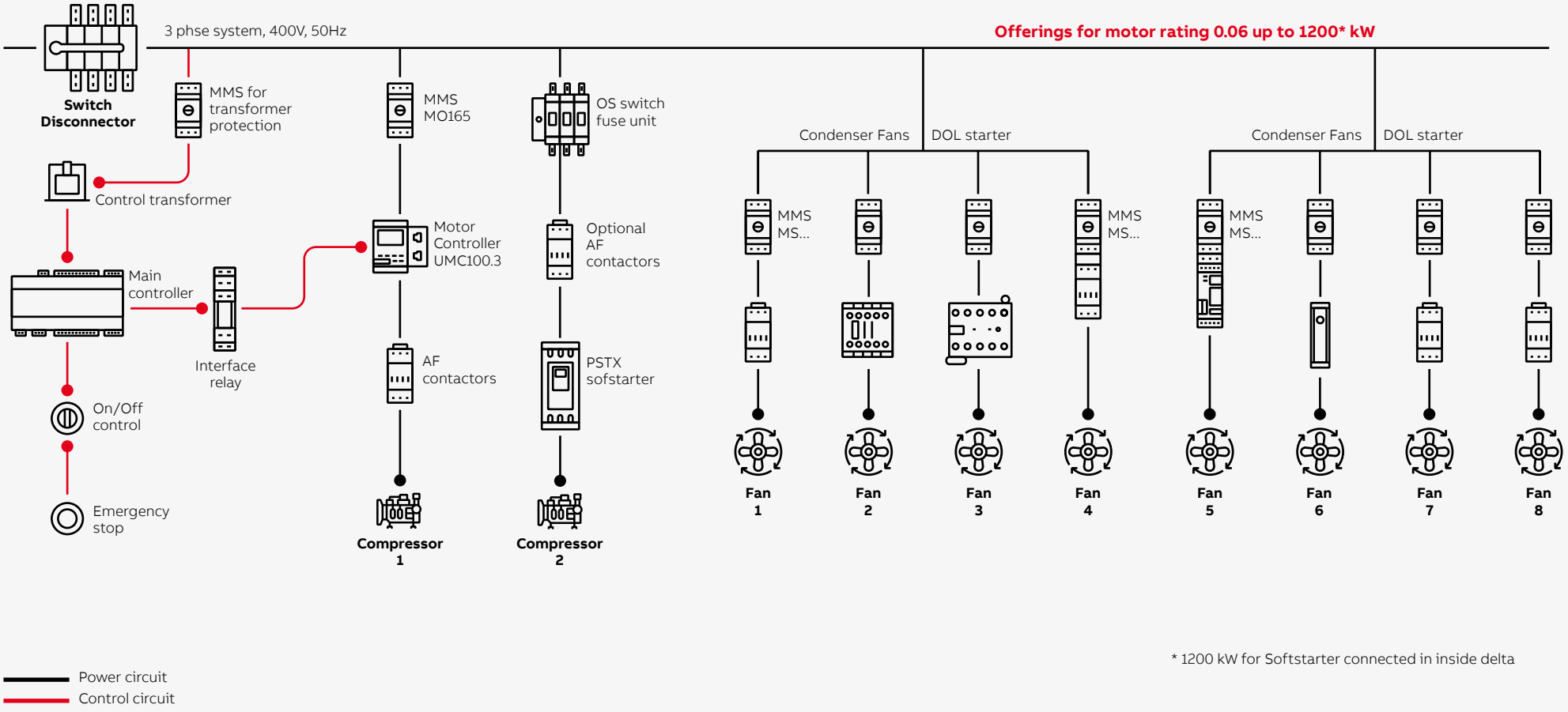
ABB's solution for motor Starting and Protection (Air Cooled Chillers)



Power Distribution

Motor starting and protection for HVAC Chiller

ABB's Advanced solution for motor starting (Air Cooled Chillers)



Power Distribution
Medium Voltage Switchgear and Components

Primary Air Insulated switchgear - UniGear ZS1

UniGear ZS1 is the ABB mainline switchgear for primary distribution up to 24 kV, 4 000 A, 63 kA. The switchgear is manufactured worldwide and there are more than 500 000 panels currently installed.
UniGear ZS1 is used to distribute electric power in a variety of demanding applications such as on off-shore platforms, in container or cruise ships, in mines as well as in utility substations, power plants or chemical plants.
Panels are available as a single busbar, double busbar, back-to-back or double level

Air-insulated secondary switchgear UniSec (up to 24 kV)

UniSec is an indoor air-insulated switchgear for medium voltage secondary distribution up to 24 kV, 1250A, 25kA.
UniSec is suitable for a wide range of applications including industry, substations, data centers, small generation systems, buildings & infrastructures and smart grids.

Power Distribution
Medium Voltage Switchgear and Components

Gas-insulated ring main unit SafeRing

Medium voltage (MV) SF6-insulated ring main unit for secondary distribution up to 40.5 kV, 630A.
SafeRing is a ring main unit (RMU) for the secondary distribution network.
It is available in 18 different configurations suitable for most switching applications within the range from 6 to 40.5 kV. The standardized RMU configurations, which are mostly required within a distribution network, can be extensible upon request.
SafeRing is a completely sealed system with a stainless steel tank containing all live parts and switching functions. A sealed steel tank with constant atmospheric conditions ensures a high level of reliability as well as personnel safety and a virtually maintenance-free system.
It offers also a compact design with small footprint and low weight.

Arc Resistant Air Insulated switchgear - SafeGear

SafeGear and SafeGear HD arc-resistant switchgear meets or exceeds the IEEE C37.20.2 standard for metal-clad switchgear and the IEEE C37.20.7 standard for arc-resistant testing guidelines, and has been seismically tested to IBC Region D. SafeGear is also qualified to Ip1.5.

SafeGear, rated up to 50kA, and SafeGear HD, rated for 63kA, not only meet the conventional standards for metal-clad switchgear, but go beyond the metal-clad standards to provide the added protection of arc-resistant construction. The arc-resistant design reduces life-cycle costs through equipment protection, and improves

Power Distribution
Medium Voltage Switchgear and Components

Gas Insulated switchgear – PrimeGearTM ZX0

PrimeGear™ ZX0 reduces the impact on global warming by 99.99 percent and supports customers to enter digitalization. It is future focused, ready to support the digitalization of your operations. Current and voltage sensors plus remote monitoring and diagnostics features provide insights at your fingertips, whether onsite, with our on-premise solution, or elsewhere, via our cloud-based solution.

ReliaGear®

ReliaGear® ND ANSI narrow design medium voltage switchgear
Indoor air-insulated metal-clad switchgear for primary distribution up to 15 kV, 2,000 A, 31.5 kA with one-high and two-high construction available. Higher kA available in Advance construction.

Measuring in at 26 inches wide, 98 inches tall and 77 inches deep (85 inches deep for two-high), ReliaGear ND is a compact solution.

The Relion® protection relay family offers the widest range of products for the protection, control, measurement and supervision of power systems for ANSI applications.

Power Distribution
Medium Voltage Switchgear and Components

Gas Insulated switchgear – ZX series

Flexible combination, reliability, availability and economy are the attributes that make it easy for our clients in industry and utilities to decide in favor of primary gas insulated switchgear products from the ZX series. Together with complete conventional solutions, the use of digital protection and control technology, sensor systems and plug-in connections make ZX systems fit for the future.

MV Circuit Breakers

Circuit breakers for indoor and outdoor applications with the world's most successfull range in medium voltage vacuum and SF6 gas.
Across every market, ABB's circuit breakers occupy a leading position thanks to their proven reputation for reliability, performance and long life. CBs from ABB are available for original equipment manufacturers (OEM) to incorporate in their own installations or for use in repair, retrofit and upgrade projects.

Power Distribution
Medium Voltage Switchgear and Components

Arc fault protection

The occurrence of an arc fault is the most serious fault within a power system. The destructive impacts of an arc flash event can lead to severe injuries of the operating personnel, to costly equipment damages and long outages.

ABB offers active arc fault protection solutions for both arc fault detection and elimination which can reduce the above-named consequences. Combined they are designed to detect an internal arc in 1.5ms and after its detection eliminate it in less than 4 ms. Due to this the safety and the availability of the power system can be improved tremendously. Operating the network with a conventional solution with an operating time of 80 – 100 milliseconds results in cable fire and copper and steel melting.

Relion® series protection relays

The Relion® product family is a range of products for the protection, control, measurement and supervision of power systems for IEC and ANSI applications. Relion products have been designed to implement the core values of the IEC 61850 Standard

Power Distribution
Medium Voltage Switchgear and Components

Instrument Transformers and Sensors

The range of electric values in power supply systems is very extensive. This is why it is necessary to match the respective currents and voltages to the values appropriate to connected measuring, protection, and control instruments.

ABB manufactures instrument transformers according to ANSI, IEC, GOST, GB, BS and DIN standards and other standards if required.

ABB Ability™
Condition Monitoring for switchgear – SWICOM

SWICOM is a monitoring and diagnostic unit which provides mechanical and electrical health status of a fleet lineup. It acquires data communicating with IEC 61850 based protection relays and via sensor bus of additional e.g temperature sensors, and converts the data to diagnostic information.

Power Distribution
Low Voltage Switchgear and Components

NeoGear™

NeoGear is a new switchgear, based on an innovative busbar concept.
Combined with the connectivity and digital smartness of the ABB Ability™ platform, it offers maximum safety, highest reliability, more flexibility, better efficiency and measurable ROI.

- NeoGearTM is safer, thanks to its revolutionary busbar system.
- NeoGearTM uses 25% less space than conventional switchgear.
- NeoGearTM saves energy thanks to its excellent thermal performance and sharply
- reduced heat losses up to 20%.
- NeoGearTM is underpinned by the ABB Ability™ platform, for better energy management, condition monitoring and predictive maintenance to enable up to 30% reduction of operational cost.

MNS® Power Motor Control Center

MNS® is ABB's low-voltage switchgear and controlgear assembly for power distribution and motor control. The MNS design is verified in accordance with the latest IEC standards, IEC 61439 -1/-2 and IEC TR 61641, up to 690V, up to 6300A, up to 100kA.
MNS® switchgear assembly is of scalable design, enabling ABB to supply integrated solutions for today's challenging business environment. It is the leading technology combining maintenance-free frame structures and busbars, a fully modular construction and the capability to integrate feeder, motor starter, variable speed drives, power factor compensation etc. and even UPS technologies in safety focused,

Power Distribution
Low Voltage Switchgear and Components

System pro E power

System pro E power is a range of primary distribution boards with rated current up to 6300 A and short-circuit current up to 120 kA. These units are designed to meet all electrical system requirements in terms of protection, form of segregation and electrical features,according to the latest international standards in perfect cooperation with ABB's low voltage equipment, modular circuit breakers, molded case circuit breakers, air circuit breakers.

System pro E Energy

System pro E energy is a complete range of switchboards for standard energy distribution inside any building, from main distribution switchboards to floorboards, to department cabinets. The range is available both for wall installation (up to 400A) and floor installation (up to 800A) with over 400 sizes. The overall dimensions are reduced thanks to a depth of 200 mm for the wall versions and 240 mm for the floor versions. All versions can be placed side by side with other structures or cable housing columns. Kit solutions and a fully open structure simplify all assembly steps.

Power Distribution
Low Voltage Switchgear and Components

Emax 2
Air circuit breakers

SACE Emax 2 air circuit breakers up to 6300A are designed to increase efficiency in different types of systems: from industrial applications to naval applications, to power generation, advanced tertiary uses, including hospitals, datacenters, and commercial buildings. They are the only switches that protect electrical circuits reducing power consumption at the same time based on user demand. This series is equipped with integrated breaker release and Power Controller, which measures and assesses power consumption, managing loads to maintain constant power or reduce power surges absorbed by users. The exclusive load management reduces absorbed power by up to 20%. Integrated multimeters measure voltage (0.5% precision), current (1% precision) and power (2% precision), and provide for remote monitoring.
These devices offer a complete integration in intelligent networks, buildings, and industrial structures. Simplified wiring allows time savings up to 30%.
SACE Emax 2 air circuit breakers are available in four different envelopes.

Tmax XT
Series molded case circuit breakers

Tmax XT are moulded case circuit breakers wich guarantee an extremely high performance level while being progressively smaller in size, simple to install and able to provide increasingly better safety.
Range is complete with four frame sizes, suitable for applications from 160 A to 1.600 A.

Power Distribution
Low Voltage Switchgear and Components

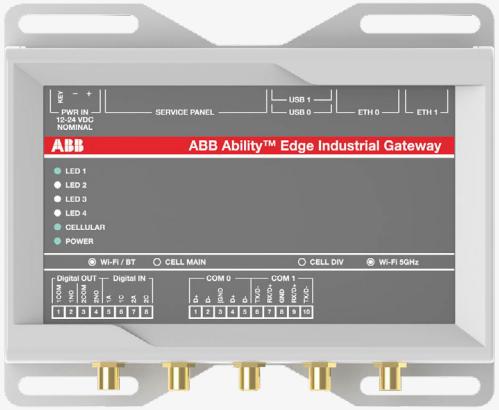
Ekip UP

Ekip UP is the low-voltage digital unit able to monitor, protect and control the next generation of plants. Thanks to the built-in software-based function, Ekip UP is the unit that digitalizes the plant performance. Sharing all the electronics solutions of “all-in-one” platform, Ekip UP completes the ecosystem to fit all the market opportunities. The result is a unit suitable for all the different applications including all the needed functionalities without the need of additional external devices.

Ekip UP in the best way, will be able to:
- UP-date old facility with the latest innovation in the fastest way.
- UP-grade plant and get more functionalities in order to cover all the opportunities.
- UP-load measures and enable true energy management function.
- Maximize UP-time thanks to easy commissioning without impact on switchboard design.

Edge Industrial gateway

Designed to collect all generated field device and parameter data across smart facilities, the ABB AbilityTM Edge Industrial Gateway feeds all data into one simplified and accessible platform to provide a full overview of system and building performance. Using IoT technology, the Edge Industrial Gateway allows facilities to monitor all downstream low- and medium-voltage devices across a range of connections, including Wi-Fi and cellular, either in the cloud or on-premise.
The new ABB AbilityTM Edge Industrial Gateway has been designed to unlock the full potential of equipment and assets from the factory floor to operational teams, for complete and straightforward energy and asset management.



Power Distribution
Low Voltage Switchgear and Components

TruONE
Network/Group switches

This new ATS (Automatich transfert switch) is the first real automatic switch available on the market, especially developed to offer switching and control functions in a single unit. With tested capabilities far beyond the standard, this series always guarantees power supply in critical power applications.
The adopted design solutions significantly reduce the number of wires and connections, guaranteeing rapid installation, reducing the risk of connection errors to a minimum, and offering superior reliability. Diagnostic maintenance and modular components reduce standby times and service costs.
In contrast to other traditional ATS solutions, TruONE allow to perform manual emergency operations under voltage, making it possible to quickly restore power supply in the case of equipment faults.

Compact ATS

Compact without compromise
The Compact ATS by ABB is an all-in-one device that delivers all the safety and performance you would expect from an automatic transfer switch… and more. 100% ease and efficiency in a 40% more compact package.

The Compact ATS range includes automatic transfer switches from 40 to 125 Amperes (IEC) and will be in two versions:
- OTM_C20D - For Network/Network application, with fixed version with pre-defined delay times and voltage thresholds.
- OTM_C21D - For Network/Network and Network/Genset applications, with configurable transfer and back-switching delays and Adjustable over and under-voltage thresholds. New: Modbus RTU communication is now available.

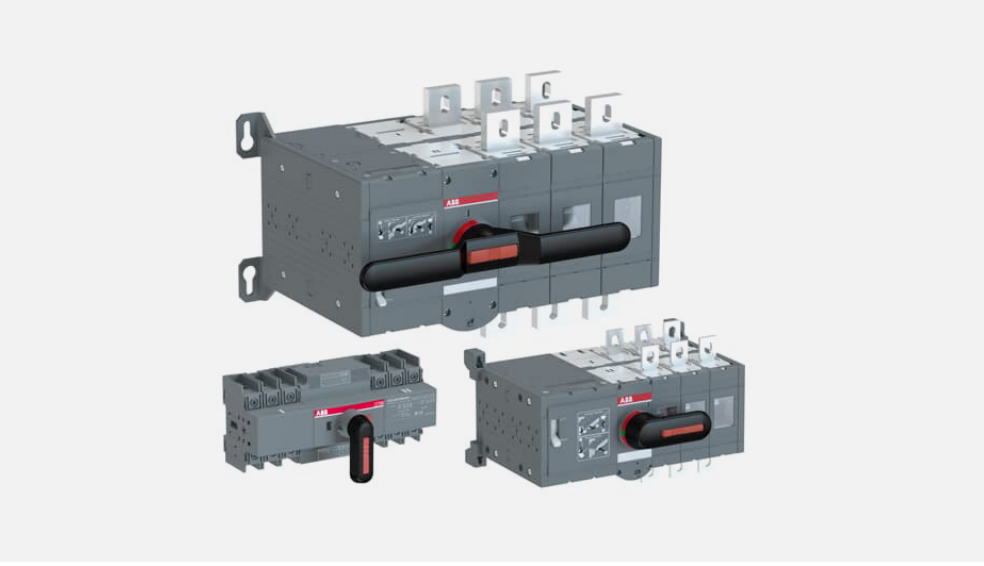
Power Distribution
Low Voltage Switchgear and Components

Manual transfer switches

ABB offers a wide variety of manual change-over switches, from 16 to 3200 Amperes in range. Manual change-over switches are available with three different transition types; Open, fast or closed. Change-over switches by ABB are extremely well suited for heavy duty applications. They are equipped with CTI (comparative tracking index) of over 600 V, making them great for use in tropical environments.
Our switches come with a real one pole construction in even higher ratings (one line per power line), creating savings in terms of energy consumption by reducing power loss. A single terminal per pole across the entire range also eliminates the need to use additional fixing sets to do connections.
The modular and flexible construction, which can even include an adjustable periscopic shaft, allows for different arrangements of the poles and handle, providing you with the opportunity to create unique space saving solutions for your customers.
To complement our wide range of manual change-over switches, we also offer open transition manual change-over switches designed according to UL/CSA certification standards in a power range from 160 to 800 Amperes.

Motorized transfer switches

Uninterrupted power supply with motorized functionality
ABB offers a wide variety of open transition motorized change-over switches from 40 to 3200 Amperes in range. All of our motorized change-over switches come equipped with a cover with clear operating instructions and improved motor operator performance.
ABB motorized change-over switches are fast and easy to install. The voltage sensing connectors have been designed to save time, as there is no need to drill holes into the busbars. Also, the control and power cables are screw mounted, providing a safe and secure connection that stays tight even during transportation.
Our switches come equipped with a comprehensive range of inbuilt safety features such as mechanical interlock, which ensures the isolation of the two asynchronous power supplies. This eliminates risk of short-circuiting between them. The motorized change-over switches are also equipped with a handle for manual operation in case of emergency.



Power Distribution
Low Voltage Switchgear and Components

TVOC-2
Arc Guard system

The Arc Guard System TVOC-2 protects people and equipment in the case of an electrical arc, drastically reducing relative stoppage times.
The TVOC-2 is the most sophisticated Arc Monitor solution by ABB, for protection from arc faults in all applications and with full functional safety, for low and medium voltage power panels. Its features and capabilities guarantee reliability, flexibility, and simplicity.
Certified in compliance with the function safety standard (SIL-2).
Pre-calibrated optical sensors, current sensors with Rogowski technology, factory calibrated for both low and medium voltage applications.
High degree of protection, IP54.
Can be expanded with 30 optical sensors.
System configuration based on specific requirements.

Contactors and relays

ABB offers a comprehensive selection of contactors for simple and extreme application as well as products with specific purposes. The AF contactor technology revolutionizes how we use contactors and allows use in all parts of the world and in all network conditions. Furthermore, mini-contactor range offers compact dimensions and specific connection possibilities. The AS contactor is efficient and allows you to optimize your equipment design. You can choose terminals between screw, push-in spring and ring tongue through our ranges. So whatever your need of a contactor might be, ABB will have a variant meeting just that.

Power Distribution
Low Voltage Switchgear and Components

Overload relays

ReliaGear® ND metal-clad switchgear offers increased reliability and improved safety. Flexibility of engineering is based on a truly modular concept with many configurations and options. ReliaGear ND meets/exceeds the requirements of IEEE C37.20.2 and has been seismically certified to IBC Region D, Ip1.0, and is rated up to 15 kV, 2,000 A, 31.5 kA with one and two-high construction available. ReliaGear ND utilizes the Vmax/A spring charge mechanism breaker, the easiest breaker to maintain in the industry resulting in the lowest total cost of ownership. Quality is assured by extensive design and production tests, coupled with ISO-9001-certified manufacturing facilities.

Manual Motor Starters

SafeGear Motor Control Centers are a complete line of UL-listed arc-resistant motor control centers in ANSI/NEMA ratings. They are designed for heavy industrial applications, including mining, power plants, steel mills, petrochemical and marine applications, transportation and general industry.

Features:
- Rated main BUS current at 1,200, 2,000 or 3,000 A
- Fully compliant with CSA and UL 347 for Motor Control Centers and meets the
- IEEE C37.20.2 standard for metal-clad switchgear construction
- Type 2B arc-resistance accessibility

Power Distribution
Low Voltage Switchgear and Components

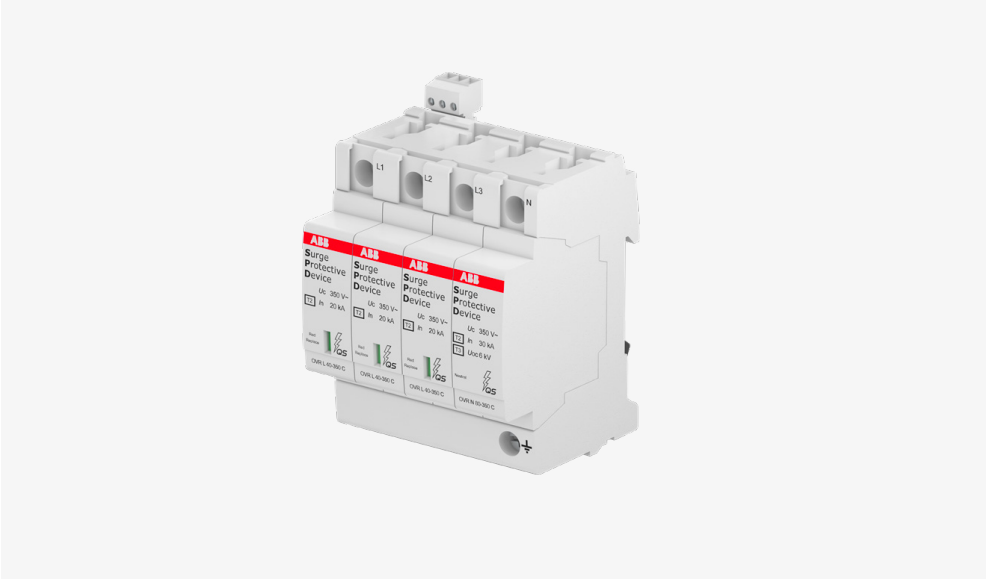
System pro M DIN-Rail products

TSystem pro M portfolio modular DIN-Rail products
System pro M, is a complete assortment of first-class quality products for controlling and monitoring electricity as well as protection of the end users life, property and for energy efficiency. The portfolio includes miniature circuit breakers, residual current devices, surge protection devices, control, signaling, measuring and smart accessories.

Surge protective devices – OVR series

Surge Protective Devices are designed to protect against transient surge conditions. Large single surge events, such as lightning, can reach hundreds of thousands of volts and can cause immediate or intermittent equipment failure. However, lightning and utility power anomalies only account for 20% of transient surges.

The remaining 80% of surge activity is produced internally. Although these surges may be smaller in magnitude, they occur more frequently and with continuous exposure can degrade sensitive electronic equipment within the facility



Power Distribution
Low Voltage Switchgear and Components

System pro M® compact Insite SCU 100

Control unit as single access point in the sub- distribution panelboard
- Data aggregator and collector from field devices
- Data storage at edge level
- Send information to ABB Ability™ digital portfolio

Operations
- In addition to branch monitioring sensors, control unit receives data from I/O modules (to support all main application functionalities), and metering via Modbus RTU

Compatibility
- •Through I/O to integrate 3rd party information in webserver

M4M Network Analyzer

Improve energy efficiency, reduce energy costs and increase power quality: three goals to achieve in order to run sustainable buildings. 'Internet of Things' devices -like the new M4M Network Analyzers- allow real-time and accurate energy data monitoring and enable customers to improve performance while reducing impact on the environment.
The new M4M range of network analyzers ensures complete power quality analysis and high-accurate energy efficiency monitoring of electrical parameters and advanced power quality KPIs.

Moreover, energy data gathered by the M4M can leverage on the integration into a common architecture that, together with other smart components, promote the ability to 'Give Your Buildings a New Dimension' – a scalable portfolio for energy and asset management solutions.

Power Distribution
UPS

DPA UPScale
High efficiency modular UPS unit

The DPA UPScale UPS system, independent of the rack, is one of the most popular UPS systems customizable on the market and provides the best technical solutions e commercial to meet individual power protection needs.
ABB's DPA UPScale is available for high density applications requiring an all-in-one power protection solution that includes UPS modules, maintenance bypass, batteries, I/O terminals and communications. A single system delivers power protection from 10 kW to 200 kW in 10 kW or 20 kW modular steps. For a continuously growing mid- sized infrastructure, DPA UPScale can be paralleled horizontally to increase the capacity up to 400 kW. The ability to increment the power as the critical load grows optimizes the operating efficiency and reduce the initial cost for installations.

Uninterruptible power supply (UPS)

The UPS system guarantees constant and high-quality energy, without power interruption. ABB offers a complete range of UPS for the protection of applications from low to extremely high voltages.
The range includes single-phase UPS, modular
three-phase UPS, three-phase monolithic UPS, industrial UPS and voltage stabilizers and UPS for MV/LV transformer substations compliant with CEI-016 standards.
Thanks to the remote monitoring systems, updated and detailed information on UPS operation can be accessed directly via the web, including setup, internal alarms, and operating conditions. The system notifies alarms and critical events via e-mail or SMS.

Power Distribution
Bill of Materials

Purpose	Type	Order Code	Description
Soalr PV system Protection and Monitoring			
String combiners 1000V DC	MISTRAL65H, Gemini		switchboards: Gemini; Consumer units:
Fuse disconnectors	E 90 PV	2CSM204713R1801	E90 PV Fuse Holders and fuses for solar Photovoltaic applications
Fuses:	E 9F PV	2CSM213476R1801	
Switch-disconnectors	OTDC; S800 PV-SD		Switch disconnector for DC side isolation of PV systems
Current measurement system	CMS600	2CCA880000R0001	Circuit monitoring systems
Surge protection devices	OVR PV T1-T2 QS	2CTB812120R1000	
Power supplies	CP-x		
Miniature Circuit-Breakers	S200 M UC Z, S800 PV-SP		
Switch-disconnectors	Tmax PV, OTDC series		
Contactors	GAF Series	1SFL637025R6811	Contactors for DC switching
Insulation monitoring devices	CM-IWx		CM-IWx Insulation Monitoring Relays
GFDI Application	S804U-PVS5	2CCP824017R1159	
Residual current devices	F202, F204	2CSF202001R1250	
		2CSF204101R1400	
Residual current blocks	DDA200	2CSB202592R3630	
Residual current Circuit-Breakers	F200		
Miniature Circuit-Breakers	S 200		
Moulded Case Circuit-Breakers	Tmax XT, Tmax T,		
	Tmax XT RCD		
Contactors	AF Contactor Series		
Grid-feeding monitoring relays	CM-UFD.MxxM	1SVR560730R3401	
Power supplies	CP-x		
Energy	EQ meters and current transformers		
Meters			
Surge protective devices	OVR T1 / T1-T2 / T2 QS	2CTB815710R1900	
Fuse disconnector	E 90	2CSM204703R1801	

Purpose	Type	Order Code	Description
Interface protection CEI 0-16 on LV side	Ekip UP		
	Medium-voltage products		
Modular Systems	Secondary Skid Unit,		
transformer	oil-immersed transformers		
Gas-insulated secondary switchgear	SafeRing / Safeplus		
Recloser	Gridshield®		
Circuit-Breaker	VD4		
Interface protection system	ABB Relion® Family		
Powerdistribution Sub Distribution Board Conponents Applicable for offices, Common Area, Reception and Canteen			
Circuit Breakers	S203M-C63	2CDS273001R0634	Miniature Circuit Breaker - 3P 63 A
Circuit Breakers	F204 A-25/0.03	2CSF204101R1250	Residual Current Circuit Breaker 25 A
Circuit Breakers	S200 -1P -C -10	2CDS251001R0104	Miniature Circuit Breaker
Circuit Breakers	S200 -1P -C -10	2CDS251001R0104	Miniature Circuit Breaker
Circuit Breakers	S200 -1P -C -10	2CDS251001R0104	Miniature Circuit Breaker
Circuit Breakers	S200 -1P -C -10	2CDS251001R0104	Miniature Circuit Breaker
Circuit Breakers	S200 - 1P - B - 6 ampere	2CDS251001R0065	Miniature Circuit Breaker
Circuit Breakers	DS201 C16 A30 U	2CSR255140U1164	RCBO
Circuit Monitoring Systems Accessories	INS135	2CCG000244R0001	Connector set (35pcs) - InSite pro M compact
Circuit Monitoring Systems Accessories	INS105	2CCG000243R0001	Flat Cable 5 m
Circuit Monitoring Systems Controller	SCU100	2CCG000242R0001	Sub-Distribution Control Unit
Circuit Monitoring Systems Current senso	CMS-121PS	2CCA880211R0001	Open-Core Sensor 40A
Circuit Monitoring Systems Accessories	DM11	2CCG000245R0001	Digital input modules
Circuit Monitoring Systems Accessories	S2C-H6R	2CDS200912R0001	Auxiliary contact 1CO
Single-Phase UPS	11 RT 3kVA B	4NWP100102R0001	UPS PowerValue
UPS Battery	11 RT 3kVA	4NWP100107R0001	External Battery PowerValue

Power Distribution
Bill of Materials

Purpose	Type	Order Code	Description
Low Voltage Switch Gear Essential			
Circuit Breaker - Incoming	E2.2H/E9 2000 Ekip Touch LSI 3p FHR	1SDA104356R1	Circuit Breaker Rated Voltage 690 V and Rated Current 2000 A
Accessories Circuit Breaker	YO E1.2..E6.2-XT7-XT7M 24 VAC/DC	1SDA073668R1	Accessories for Emax 2, Accessories for Tmax XT-SHUNT OPENING RELEASE 24V AC-DC E1.2..E6.2-XT7-XT7M
Accessories Circuit Breaker	YC E1.2..E6.2-XT7M 24 VAC/DC	1SDA073681R1	Accessories for Emax 2, Accessories for Tmax XT-SHUNT Closing RELEASE 24V AC-DC E1.2..E6.2-XT7-XT7M
Accessories Circuit Breaker	M E2.2...E6.2 24-30 VAC/DC	1SDA073722R1	Accessories for Emax 2, Motor operator for power circuit-breakerGEARED MOTOR DEVICE 24...30V AC-DC E2.2...E6.2
Accessories Circuit Breaker	RTC 250VAC E2.2... E6.2	1SDA073773R1	Accessories for Emax 2, CHANGEOVER CONTACT OPEN-CLOSED FOR CONSENT CLOSING V
Accessories Circuit Breaker	S51 24V E2.2...E6.2	1SDA073779R1	Accessories for Emax 2, ELECTRICAL S51 INDICATION TRIP V <(><<)> 24V DC E2.2...E6.2
Communication Module Accessories	EKIP SUPPLY 24-48VDC E1.2.. E6.2-Tmax XT	1SDA074173R1	EKIP SUPPLY POWER SUPPLY MODULE 24...48V DC E1.2.. E6.2-XT7-XT7M-XT2-XT4-XT5-XT7-XT7M
Communication Module Accessories	EKIP COM MODBUS TCP E1.2..E6.2	1SDA074151R1	EKIP COM COMMUNICATION MODULE MODBUS TCP E1.2...E6.2
Communication Module Accessories	EKIP COM ACTUATOR E1.2..E6.2-XT7-XT7M	1SDA074166R1	Accessories for Emax 2, Accessories for Tmax XT
Communication Module Accessories	YR 24 VDC E2.2... E6.2	1SDA073747R1	ELECTRICAL YR INDICATION WITH REMOTE RESET ELECTRICAL SUP.VOL. 24V DC E2.2...E6.2 Trip indicator
Communication Module Accessories	Ekip Signalling 3T-1	1SDA085693R1	Module for 3 temperature probes type PT100/PT1000 + 1 input 4..20mA
Software Pacakage	SW Measuring package for Emax 2	1SDA107525R1	Software Packages for Emax 2
Software Pacakage	Class 1 Power&Energy Metering E2.2 Ex Co	1SDA107675R1	
Bus Tie Circuit Breaker	E2.2H/E9 1250 Ekip Touch LSI FHR	1SDA104351R1	Circuit Breaker Rated Voltage 690 V and Rated Current 1250
Accessories Circuit Breaker	YO E1.2..E6.2-XT7-XT7M 24 VAC/DC	1SDA073668R1	Accessories for Emax 2, Accessories for Tmax XT-SHUNT OPENING RELEASE 24V AC-DC E1.2..E6.2-XT7-XT7M
Accessories Circuit Breaker	YC E1.2..E6.2-XT7M 24 VAC/DC	1SDA073681R1	Accessories for Emax 2, Accessories for Tmax XT-SHUNT Closing RELEASE 24V AC-DC E1.2..E6.2-XT7-XT7M

Purpose	Type	Order Code	Description
Accessories Circuit Breaker	M E2.2...E6.2 24-30 VAC/DC	1SDA073722R1	Accessories for Emax 2, Motor operator for power circuit-breakerGEARED MOTOR DEVICE 24...30V AC-DC E2.2...E6.2
Accessories Circuit Breaker	RTC 250VAC E2.2... E6.2	1SDA073773R1	Accessories for Emax 2, CHANGEOVER CONTACT OPEN-CLOSED FOR CONSENT CLOSING V
Accessories Circuit Breaker	S51 24V E2.2...E6.2	1SDA073779R1	Accessories for Emax 2, ELECTRICAL S51 INDICATION TRIP V <(><<)> 24V DC E2.2...E6.2
Communication Module Accessories	EKIP SUPPLY 24-48VDC E1.2.. E6.2-Tmax XT	1SDA074173R1	EKIP SUPPLY POWER SUPPLY MODULE 24...48V DC E1.2.. E6.2-XT7-XT7M-XT2-XT4-XT5-XT7-XT7M
Communication Module Accessories	EKIP COM MODBUS TCP E1.2..E6.2	1SDA074151R1	EKIP COM COMMUNICATION MODULE MODBUS TCP E1.2...E6.2
Communication Module Accessories	EKIP COM ACTUATOR E1.2..E6.2-XT7-XT7M	1SDA074166R1	Accessories for Emax 2, Accessories for Tmax XT
Communication Module Accessories	YR 24 VDC E2.2... E6.2	1SDA073747R1	ELECTRICAL YR INDICATION WITH REMOTE RESET ELECTRICAL SUP.VOL. 24V DC E2.2...E6.2 Trip indicator
Communication Module Accessories	Ekip Signalling 3T-1	1SDA085693R1	Module for 3 temperature probes type PT100/PT1000 + 1 input 4..20mA
Software Pacakage	SW Measuring package for Emax 2	1SDA107525R1	Software Packages for Emax 2
Metering functionality	Class 1 Power&Energy Metering E2.2 Ex Co	1SDA107675R1	
Transfer Switching from Generator	OXB200E3X3QT	1SCA153435R1001	Automatic Transfer Switch
Accessories of ATS	OXEA1	1SCA148926R1001	Auxiliary power supply module
Accessories of ATS	TCP-OX	1SDA104052R1	Ekip Com Modbus for Level 3 and Level 4 controllers
Outgoing Circuit Breaker	XT4N 250 BREAKING PART 3p F F	1SDA068173R1	XT4 Circuit Brekaer
Ekip Touch Screen	Ekip Touch LSI In=250A XT4 3p	1SDA100281R1	
Ekip Touch Screen Communication	EKIP COM MODBUS TCP XT2-XT4 INT	1SDA105177R1	EKIP COM COMMUNICATION MODULE MODBUS TCP INTERNALLY INSTALLED FOR CIRCUIT BREAKER XT2-XT4
Software package module Measuring Ekip Touch XT2-XT4	Measuring for XT2-XT4	1SDA105208R1	

Power Distribution
Bill of Materials

Purpose	Type	Order Code	Description
Low Voltage Switch Gear Non Essential			
Circuit Breaker - Incoming	E2.2H/E9 2000 Ekip Touch LSI 3p FHR	1SDA104356R1	Circuit Breaker Rated Voltage 690 V and Rated Current 2000 A
Accessories Circuit Breaker	YO E1.2..E6.2-XT7-XT7M 24 VAC/DC	1SDA073668R1	Accessories for Emax 2, Accessories for Tmax XT- SHUNT OPENING RELEASE 24V AC-DC E1.2..E6.2-XT7-XT7M
Accessories Circuit Breaker	YC E1.2..E6.2-XT7M 24 VAC/DC	1SDA073681R1	Accessories for Emax 2, Accessories for Tmax XT- SHUNT Closing RELEASE 24V AC-DC E1.2..E6.2-XT7-XT7M
Accessories Circuit Breaker	M E2.2...E6.2 24-30 VAC/DC	1SDA073722R1	Accessories for Emax 2, Motor operator for power circuit-breakerGEARED MOTOR DEVICE 24...30V AC-DC E2.2...E6.2
Accessories Circuit Breaker	RTC 250VAC E2.2...E6.2	1SDA073773R1	Accessories for Emax 2, CHANGE-OVER CONTACT OPEN-CLOSED FOR CONSENT CLOSING V
Accessories Circuit Breaker	S51 24V E2.2...E6.2	1SDA073779R1	Accessories for Emax 2, ELECTRICAL S51 INDICATION TRIP V <(><<)> 24V DC E2.2...E6.2
Communication Module Accessories	EKIP SUPPLY 24-48VDC E1.2..E6.2-Tmax XT	1SDA074173R1	EKIP SUPPLY POWER SUPPLY MODULE 24...48V DC E1.2..E6.2-XT7-XT7M-XT2-XT4-XT5-XT7-XT7M
Communication Module Accessories	EKIP COM MODBUS TCP E1.2..E6.2	1SDA074151R1	EKIP COM COMMUNICATION MODULE MODBUS TCP E1.2...E6.2
Communication Module Accessories	EKIP COM ACTUATOR E1.2..E6.2-XT7-XT7M	1SDA074166R1	Accessories for Emax 2, Accessories for Tmax XT
Communication Module Accessories	YR 24 VDC E2.2...E6.2	1SDA073747R1	ELECTRICAL YR INDICATION WITH REMOTE RESET ELECTRICAL SUP.VOL. 24V DC E2.2...E6.2 Trip indicator
Communication Module Accessories	Ekip Signalling 3T-1	1SDA085693R1	Module for 3 temperature probes type PT100/PT1000 + 1 input 4..20mA

Purpose	Type	Order Code	Description
Software Pacakage	SW Measuring package for Emax 2	1SDA107525R1	Software Packages for Emax 2
Software Pacakage	Class 1 Power&Energy Metering E2.2 Ex Co	1SDA107675R1	
Outgoing Circuit Breaker	XT2N 160 BREAKING PART 3p F F	1SDA068163R1	XT2 Circuit Brekaer
Ekip Touch Screen	Ekip Touch LSI In=160A XT2 3p	1SDA100103R1	
Ekip Touch Screen Communication	EKIP COM MODBUS TCP XT2-XT4 INT	1SDA105177R1	EKIP COM COMMUNICATION MODULE MODBUS TCP INTERNALLY INSTALLED FOR CIRCUIT BREAKER XT2-XT4
Software package module Measuring Ekip Touch XT2-XT4	Measuring for XT2-XT4	1SDA105208R1	
Outgoing Circuit Breaker	XT5N 630 Breaking part 3P	1SDA100551R1	
Ekip Touch Screen	Ekip Touch Measuring LSI In=630 XT5 3p	1SDA100601R1	
Accsories for Circuit Breaker	YO XT5-XT6 24...60 Vac/dc	1SDA104925R1	
Power Supply for EKIP	EKIP SUPPLY 110-240VAC/DC E1.2..E6.2-XT	1SDA074172R1	
Communication card for Ekip Touch	EKIP COM MODBUS TCP Tmax XT	1SDA105167R1	

Power Distribution
Bill of Materials

Purpose	Type	Order Code	Description
Main Distribution Board Factory Processing Area and Packaging Area			
Structure	4 GALVANIZ.SHEET CROSSPIECES W/D=300MM	1STQ001678M0000	Column-1
Structure	4 GALVANIZ.SHEET CROSSPIECES W/D=500MM	1STQ001680M0000	Column-1
Structure	GALVANIZED SHEET METAL UPRIGHT H2000	1STQ002875M0000	Column-1
Structure	N.1 INT.UPRIGHT H=2000	1STQ002877M0000	Column-1
Top/Bottom Panel	AL.CABLE ENTRY FLANGE W400	1STQ005492M0000	Column-1
Top/Bottom Panel	AR.BOT PLATE WITH FL.400D600	1STQ004054M0000	Column-1
Top/Bottom Panel	AR.TOPPLATE 400D600	1STQ004115M0000	Column-1
Rear/Side Panel	IP31 AERATED REAR PANEL W400 H2000	1STQ002412M0000	Column-1
Rear/Side Panel	IP31 AERATED REAR PANEL W600 H2000	1STQ002414M0000	Column-1
Plinth	4 GALV. SHEET CORNERS PLINTH H=100MM	1STQ002406M0000	Column-1
Plinth	2 F/R/S PLINTH FLANGES H=100MM W/D=300MM	1STQ007050A0000	Column-1
Plinth	2 F/R/S PLINTH FLANGES H=100MM W/D=500MM	1STQ007052A0000	Column-1
Interior Fitting	KIT E1.2/XT7F 3P 400 M	1STQ005605M0000	Column-1
Interior Fitting	PAN.LE XT7E1.2 F 3P W400	1STQ005230M0000	Column-1
Interior Fitting	BL.PAN.COL BOT H750W400 ARC	1STQ005303M0000	Column-1
Interior Fitting	BL.PAN.COL TOP H750W400 ARC	1STQ005296M0000	Column-1
Busbar Holders	2 BUSBAR HOLDERS H=200MM	1STQ001355M0000	Column-1
Busbar Holders	N.2 RBS BRACKET FOR PE/N BUSBAR	1STQ001498M0000	Column-1
Busbar Holders	CYL 20+CLOS.ELEM+SCREW 5070 x3	1STQ001558M0000	Column-1
Busbar Holders	2 CLOSING COVER FOR HOLDERS H=200MM	1STQ001559M0000	Column-1
Busbar Holders	GPO3 1xXT7 P2 1250A/1600A 3P	1STQ005154M0000	Column-1
Busbar Holders	ISOLATOR 40X40MM M10	1STQ003834M0000	Column-1
Busbar Holders	1xX7/T7/E1.2F P2 8/1000A 3P D6/8/1000 C Anch.	1STQ004627M0000	Column-1
Busbar Holders	1xX7/T7/E1.2F P2 1250/1600A 3P D6/8/1000 C Anch.	1STQ004630M0000	Column-1
Busbar Holders	MOUNTING SCREWS 2 BUSBARS PER PHASE	1STQ002527M0000	Column-1
Busbar Holders	12 SPACERS H=20MM	1STQ002655M0000	Column-1
Busbar Holders	BUSBAR HOLDER F. 60X10MM	1STQ003629M0000	Column-1
Copper Parts	N_PE BUSBAR 1000A; W=400/1X30X10	1STQ001374M0000	Column-1
Copper Parts	sep.N 1000A W400 1X40x10	1STQ004509M0000	Column-1
Copper Parts	MAIN BUSBAR 1000A; W=400/2X20X10	1STQ001582M0000	Column-1
Copper Parts	X7E1FP2 125/1600A3PD6/8/1 CO	1STQ005061M0000	Column-1

Purpose	Type	Order Code	Description
Copper Parts	MBBS JOINT 1000A 3P+N PE25% C-C	1STQ008736B0000	Column-1
Copper Parts	RBS CONN.T7_E1.2 FIX 4PHS 1250/1600A_POS1_D=600	1STQ002159M0000	Column-1
Accessories	CABL. FAST RAIL W400	1STQ003753M0000	Column-1
Accessories	MIXED KIT FOR JOINING STRUCTURES	1STQ005273B0000	Column-1
Structure	4 GALVANIZ.SHEET CROSSPIECES W/D=300MM	1STQ001678M0000	Column-2
Structure	4 GALVANIZ.SHEET CROSSPIECES W/D=500MM	1STQ001680M0000	Column-2
Structure	GALVANIZED SHEET METAL UPRIGHT H2000	1STQ002875M0000	Column-2
Structure	N.1 INT.UPRIGHT H=2000	1STQ002877M0000	Column-2
Top/Bottom Panel	AL.CABLE ENTRY FLANGE W400	1STQ005492M0000	Column-2
Top/Bottom Panel	AR.BOT PLATE WITH FL.400D600	1STQ004054M0000	Column-2
Top/Bottom Panel	AR.TOPPLATE 400D600	1STQ004115M0000	Column-2
Rear/Side Panel	IP31 AERATED REAR PANEL W400 H2000	1STQ002412M0000	Column-2
Plinth	4 GALV. SHEET CORNERS PLINTH H=100MM	1STQ002406M0000	Column-2
Plinth	2 F/R/S PLINTH FLANGES H=100MM W/D=300MM	1STQ007050A0000	Column-2
Interior Fitting	KIT E1.2/XT7F 3P 400 M	1STQ005605M0000	Column-2
Interior Fitting	PAN.LE XT7E1.2 F 3P W400	1STQ005230M0000	Column-2
Interior Fitting	BL.PAN.COL BOT H750W400 ARC	1STQ005303M0000	Column-2
Interior Fitting	BL.PAN.COL TOP H750W400 ARC	1STQ005296M0000	Column-2
Busbar Holders	2 BUSBAR HOLDERS H=200MM	1STQ001355M0000	Column-2
Busbar Holders	N.2 RBS BRACKET FOR PE/N BUSBAR	1STQ001498M0000	Column-2
Busbar Holders	CYL 20+CLOS.ELEM+SCREW 5070 x3	1STQ001558M0000	Column-2
Busbar Holders	2 CLOSING COVER FOR HOLDERS H=200MM	1STQ001559M0000	Column-2
Busbar Holders	GPO3 1xXT7 P2 1250A/1600A 3P	1STQ005154M0000	Column-2
Busbar Holders	ISOLATOR 40X40MM M10	1STQ003834M0000	Column-2
Busbar Holders	1xX7/T7/E1.2F P2 8/1000A 3P D6/8/1000 C Anch.	1STQ004627M0000	Column-2
Busbar Holders	1xX7/T7/E1.2F P2 1250/1600A 3P D6/8/1000 C Anch.	1STQ004630M0000	Column-2
Busbar Holders	MOUNTING SCREWS 2 BUSBARS PER PHASE	1STQ002527M0000	Column-2
Busbar Holders	12 SPACERS H=20MM	1STQ002655M0000	Column-2
Busbar Holders	BUSBAR HOLDER F. 60X10MM	1STQ003629M0000	Column-2
Copper Parts	N_PE BUSBAR 1000A; W=400/1X30X10	1STQ001374M0000	Column-2
Copper Parts	sep.N 1000A W400 1X40x10	1STQ004509M0000	Column-2
Copper Parts	MAIN BUSBAR 1000A; W=400/2X20X10	1STQ001582M0000	Column-2

Power Distribution
Bill of Materials

Purpose	Type	Order Code	Description
Copper Parts	X7E1FP2 125/1600A3PD6/8/1 CO	1STQ005061M0000	Column-2
Copper Parts	MBBS JOINT 1000A 3P+N PE25% C-C	1STQ008736B0000	Column-2
Copper Parts	RBS CONN.T7_E1.2 FIX 4PHS 1250/1600A_POS1_D=600	1STQ002159M0000	Column-2
Accessories	CABL. FAST RAIL W400	1STQ003753M0000	Column-2
Accessories	MIXED KIT FOR JOINING STRUCTURES	1STQ005273B0000	Column-2
Structure	4 GALVANIZ.SHEET CROSSPIECES W/D=300MM	1STQ001678M0000	Column-3
Structure	4 GALVANIZ.SHEET CROSSPIECES W/D=500MM	1STQ001680M0000	Column-3
Structure	GALVANIZED SHEET METAL UPRIGHT H2000	1STQ002875M0000	Column-3
Structure	N.1 INT.UPRIGHT H=2000	1STQ002877M0000	Column-3
Top/Bottom Panel	AL.CABLE ENTRY FLANGE W400	1STQ005492M0000	Column-3
Top/Bottom Panel	AR.BOT PLATE WITH FL.400D600	1STQ004054M0000	Column-3
Top/Bottom Panel	AR.TOPPLATE 400D600	1STQ004115M0000	Column-3
Rear/Side Panel	IP31 AERATED REAR PANEL W400 H2000	1STQ002412M0000	Column-3
Plinth	4 GALV. SHEET CORNERS PLINTH H=100MM	1STQ002406M0000	Column-3
Plinth	2 F/R/S PLINTH FLANGES H=100MM W/D=300MM	1STQ007050A0000	Column-3
Interior Fitting	KIT E1.2/XT7F 3P 400 M	1STQ005605M0000	Column-3
Interior Fitting	PAN.LE XT7E1.2 F 3P W400	1STQ005230M0000	Column-3
Interior Fitting	BL.PAN.COL BOT H750W400 ARC	1STQ005303M0000	Column-3
Interior Fitting	BL.PAN.COL TOP H750W400 ARC	1STQ005296M0000	Column-3
Busbar Holders	2 BUSBAR HOLDERS H=200MM	1STQ001355M0000	Column-3
Busbar Holders	N.2 RBS BRACKET FOR PE/N BUSBAR	1STQ001498M0000	Column-3
Busbar Holders	CYL 20+CLOS.ELEM+SCREW 5070 x3	1STQ001558M0000	Column-3
Busbar Holders	2 CLOSING COVER FOR HOLDERS H=200MM	1STQ001559M0000	Column-3
Busbar Holders	GPO3 1xXT7 P2 1250A/1600A 3P	1STQ005154M0000	Column-3
Busbar Holders	ISOLATOR 40X40MM M10	1STQ003834M0000	Column-3
Busbar Holders	1xX7/T7/E1.2F P2 8/1000A 3P D6/8/1000 C Anch.	1STQ004627M0000	Column-3
Busbar Holders	1xX7/T7/E1.2F P2 1250/1600A 3P D6/8/1000 C Anch.	1STQ004630M0000	Column-3
Busbar Holders	MOUNTING SCREWS 2 BUSBARS PER PHASE	1STQ002527M0000	Column-3
Busbar Holders	12 SPACERS H=20MM	1STQ002655M0000	Column-3
Busbar Holders	BUSBAR HOLDER F. 60X10MM	1STQ003629M0000	Column-3
Copper Parts	N_PE BUSBAR 1000A; W=400/1X30X10	1STQ001374M0000	Column-3
Copper Parts	sep.N 1000A W400 1X40x10	1STQ004509M0000	Column-3
Copper Parts	MAIN BUSBAR 1000A; W=400/2X20X10	1STQ001582M0000	Column-3

Purpose	Type	Order Code	Description
Copper Parts	X7E1FP2 125/1600A3PD6/8/1 CO	1STQ005061M0000	Column-3
Copper Parts	MBBS JOINT 1000A 3P+N PE25% C-C	1STQ008736B0000	Column-3
Copper Parts	RBS CONN.T7_E1.2 FIX 4PHS 1250/1600A_POS1_D=600	1STQ002159M0000	Column-3
Accessories	CABL. FAST RAIL W400	1STQ003753M0000	Column-3
Accessories	MIXED KIT FOR JOINING STRUCTURES	1STQ005273B0000	Column-3
Structure	4 GALVANIZ.SHEET CROSSPIECES W/D=300MM	1STQ001678M0000	Column-4
Structure	4 GALVANIZ.SHEET CROSSPIECES W/D=500MM	1STQ001680M0000	Column-4
Structure	GALVANIZED SHEET METAL UPRIGHT H2000	1STQ002875M0000	Column-4
Structure	N.1 INT.UPRIGHT H=2000	1STQ002877M0000	Column-4
Top/Bottom Panel	AL.CABLE ENTRY FLANGE W400	1STQ005492M0000	Column-4
Top/Bottom Panel	AR.BOT PLATE WITH FL.400D600	1STQ004054M0000	Column-4
Top/Bottom Panel	AR.TOPPLATE 400D600	1STQ004115M0000	Column-4
Rear/Side Panel	IP31 AERATED REAR PANEL W400 H2000	1STQ002412M0000	Column-4
Plinth	4 GALV. SHEET CORNERS PLINTH H=100MM	1STQ002406M0000	Column-4
Plinth	2 F/R/S PLINTH FLANGES H=100MM W/D=300MM	1STQ007050A0000	Column-4
Interior Fitting	KIT E1.2/XT7F 3P 400 M	1STQ005605M0000	Column-4
Interior Fitting	PAN.LE XT7E1.2 F 3P W400	1STQ005230M0000	Column-4
Interior Fitting	BL.PAN.COL BOT H750W400 ARC	1STQ005303M0000	Column-4
Interior Fitting	BL.PAN.COL TOP H750W400 ARC	1STQ005296M0000	Column-4
Busbar Holders	2 BUSBAR HOLDERS H=200MM	1STQ001355M0000	Column-4
Busbar Holders	N.2 RBS BRACKET FOR PE/N BUSBAR	1STQ001498M0000	Column-4
Busbar Holders	CYL 20+CLOS.ELEM+SCREW 5070 x3	1STQ001558M0000	Column-4
Busbar Holders	2 CLOSING COVER FOR HOLDERS H=200MM	1STQ001559M0000	Column-4
Busbar Holders	GPO3 1xXT7 P2 1250A/1600A 3P	1STQ005154M0000	Column-4
Busbar Holders	ISOLATOR 40X40MM M10	1STQ003834M0000	Column-4
Busbar Holders	1xX7/T7/E1.2F P2 8/1000A 3P D6/8/1000 C Anch.	1STQ004627M0000	Column-4
Busbar Holders	1xX7/T7/E1.2F P2 1250/1600A 3P D6/8/1000 C Anch.	1STQ004630M0000	Column-4
Busbar Holders	MOUNTING SCREWS 2 BUSBARS PER PHASE	1STQ002527M0000	Column-4
Busbar Holders	12 SPACERS H=20MM	1STQ002655M0000	Column-4
Busbar Holders	BUSBAR HOLDER F. 60X10MM	1STQ003629M0000	Column-4
Copper Parts	N_PE BUSBAR 1000A; W=400/1X30X10	1STQ001374M0000	Column-4
Copper Parts	sep.N 1000A W400 1X40x10	1STQ004509M0000	Column-4
Copper Parts	MAIN BUSBAR 1000A; W=400/2X20X10	1STQ001582M0000	Column-4

Power Distribution
Bill of Materials

Purpose	Type	Order Code	Description
Copper Parts	X7E1FP2 125/1600A3PD6/8/1 CO	1STQ005061M0000	Column-4
Copper Parts	MBBS JOINT 1000A 3P+N PE25% C-C	1STQ008736B0000	Column-4
Copper Parts	RBS CONN.T7_E1.2 FIX 4PHS 1250/1600A_POS1_D=600	1STQ002159M0000	Column-4
Accessories	CABL. FAST RAIL W400	1STQ003753M0000	Column-4
Accessories	MIXED KIT FOR JOINING STRUCTURES	1STQ005273B0000	Column-4
Structure	4 GALVANIZ.SHEET CROSSPIECES W/D=300MM	1STQ001678M0000	Column-5
Structure	4 GALVANIZ.SHEET CROSSPIECES W/D=500MM	1STQ001680M0000	Column-5
Structure	GALVANIZED SHEET METAL UPRIGHT H2000	1STQ002875M0000	Column-5
Structure	N.1 INT.UPRIGHT H=2000	1STQ002877M0000	Column-5
Top/Bottom Panel	AL.CABLE ENTRY FLANGE W400	1STQ005492M0000	Column-5
Top/Bottom Panel	AR.BOT PLATE WITH FL.400D600	1STQ004054M0000	Column-5
Top/Bottom Panel	AR.TOPPLATE 400D600	1STQ004115M0000	Column-5
Rear/Side Panel	IP31 AERATED REAR PANEL W400 H2000	1STQ002412M0000	Column-5
Plinth	4 GALV. SHEET CORNERS PLINTH H=100MM	1STQ002406M0000	Column-5
Plinth	2 F/R/S PLINTH FLANGES H=100MM W/D=300MM	1STQ007050A0000	Column-5
Interior Fitting	KIT E1.2/XT7F 3P 400 M	1STQ005605M0000	Column-5
Interior Fitting	PAN.LE XT7E1.2 F 3P W400	1STQ005230M0000	Column-5
Interior Fitting	BL.PAN.COL BOT H750W400 ARC	1STQ005303M0000	Column-5
Interior Fitting	BL.PAN.COL TOP H750W400 ARC	1STQ005296M0000	Column-5
Busbar Holders	2 BUSBAR HOLDERS H=200MM	1STQ001355M0000	Column-5
Busbar Holders	N.2 RBS BRACKET FOR PE/N BUSBAR	1STQ001498M0000	Column-5
Busbar Holders	CYL 20+CLOS.ELEM+SCREW 5070 x3	1STQ001558M0000	Column-5
Busbar Holders	2 CLOSING COVER FOR HOLDERS H=200MM	1STQ001559M0000	Column-5
Busbar Holders	GPO3 1xXT7 P2 1250A/1600A 3P	1STQ005154M0000	Column-5
Busbar Holders	ISOLATOR 40X40MM M10	1STQ003834M0000	Column-5
Busbar Holders	1xX7/T7/E1.2F P2 8/1000A 3P D6/8/1000 C Anch.	1STQ004627M0000	Column-5
Busbar Holders	1xX7/T7/E1.2F P2 1250/1600A 3P D6/8/1000 C Anch.	1STQ004630M0000	Column-5
Busbar Holders	MOUNTING SCREWS 2 BUSBARS PER PHASE	1STQ002527M0000	Column-5
Busbar Holders	12 SPACERS H=20MM	1STQ002655M0000	Column-5
Busbar Holders	BUSBAR HOLDER F. 60X10MM	1STQ003629M0000	Column-5
Copper Parts	N_PE BUSBAR 1000A; W=400/1X30X10	1STQ001374M0000	Column-5
Copper Parts	sep.N 1000A W400 1X40x10	1STQ004509M0000	Column-5
Copper Parts	MAIN BUSBAR 1000A; W=400/2X20X10	1STQ001582M0000	Column-5

Purpose	Type	Order Code	Description
Copper Parts	X7E1FP2 125/1600A3PD6/8/1 CO	1STQ005061M0000	Column-5
Copper Parts	MBBS JOINT 1000A 3P+N PE25% C-C	1STQ008736B0000	Column-5
Copper Parts	RBS CONN.T7_E1.2 FIX 4PHS 1250/1600A_POS1_D=600	1STQ002159M0000	Column-5
Accessories	CABL. FAST RAIL W400	1STQ003753M0000	Column-5
Accessories	MIXED KIT FOR JOINING STRUCTURES	1STQ005273B0000	Column-5
Structure	4 GALVANIZ.SHEET CROSSPIECES W/D=300MM	1STQ001678M0000	Column-6
Structure	4 GALVANIZ.SHEET CROSSPIECES W/D=500MM	1STQ001680M0000	Column-6
Structure	GALVANIZED SHEET METAL UPRIGHT H2000	1STQ002875M0000	Column-6
Structure	N.1 INT.UPRIGHT H=2000	1STQ002877M0000	Column-6
Top/Bottom Panel	AL.CABLE ENTRY FLANGE W400	1STQ005492M0000	Column-6
Top/Bottom Panel	AR.BOT PLATE WITH FL.400D600	1STQ004054M0000	Column-6
Top/Bottom Panel	AR.TOPPLATE 400D600	1STQ004115M0000	Column-6
Rear/Side Panel	IP31 AERATED REAR PANEL W400 H2000	1STQ002412M0000	Column-6
Rear/Side Panel	IP31 AERATED REAR PANEL W600 H2000	1STQ002414M0000	Column-6
Plinth	4 GALV. SHEET CORNERS PLINTH H=100MM	1STQ002406M0000	Column-6
Plinth	2 F/R/S PLINTH FLANGES H=100MM W/D=300MM	1STQ007050A0000	Column-6
Interior Fitting	KIT E1.2/XT7F 3P 400 M	1STQ005605M0000	Column-6
Interior Fitting	PAN.LE XT7E1.2 F 3P W400	1STQ005230M0000	Column-6
Interior Fitting	BL.PAN.COL BOT H750W400 ARC	1STQ005303M0000	Column-6
Interior Fitting	BL.PAN.COL TOP H750W400 ARC	1STQ005296M0000	Column-6
Busbar Holders	2 BUSBAR HOLDERS H=200MM	1STQ001355M0000	Column-6
Busbar Holders	N.2 RBS BRACKET FOR PE/N BUSBAR	1STQ001498M0000	Column-6
Busbar Holders	CYL 20+CLOS.ELEM+SCREW 5070 x3	1STQ001558M0000	Column-6
Busbar Holders	2 CLOSING COVER FOR HOLDERS H=200MM	1STQ001559M0000	Column-6
Busbar Holders	MOUNTING SCREWS 2 BUSBARS PER PHASE	1STQ002527M0000	Column-6
Busbar Holders	12 SPACERS H=20MM	1STQ002655M0000	Column-6
Busbar Holders	BUSBAR HOLDER F. 60X10MM	1STQ003629M0000	Column-6
Copper Parts	N_PE BUSBAR 1000A; W=400/1X30X10	1STQ001374M0000	Column-6
Copper Parts	sep.N 1000A W400 1X40x10	1STQ004509M0000	Column-6
Copper Parts	MAIN BUSBAR 1000A; W=400/2X20X10	1STQ001582M0000	Column-6
Copper Parts	RBS CONN.T7_E1.2 FIX 4PHS 1250/1600A_POS1_D=600	1STQ002159M0000	Column-6
Accessories	TOUCH. PROT. VCB 400	1STQ003744M0000	Column-6

Power Distribution
Bill of Materials

Purpose	Type	Order Code	Description
Low voltage switchgear and motor control center			
For Processing Are opering different Motors and Mach-nies .HVAC system Pumps and motors	MNS® switchgear	FAIWOWPP1	Switchgear using withdrawable execution on incoming and outgoing feeder to maximize availability; fixed and plug-in options are also available as option for secondary outgoing feeders. Front accessibility allows wall standing installation to optimize foot print; all the routine and maintenance operations can be performed from the front. Safety is guarantee by tested and certified switchgear arc proof execution; is also possible installation of active arc proof protection able to detect at the very early stage the arc ignition limiting thermal and pressure effect of an internal arc; such solutions guarantee the safety of the personnel and limit to the minimum the damage to the switchgear. To guarantee uninterrupted power to critical load the switchgear is combined with UPS units connected to selected critical loads; modules of 100 kW allows the creation of a tailor made solution with the possibility to reach a total power of 3 MW just adding plug-in modules in the spare slots. The single layout including switchgear and UPS units guarantee an optimized layout minimizing interconnection and relevant cost.

Lighting Control

Lighting management is a key part for safety and comfort of a building.
By automatically adjusting the temperature and light intensity, occupants are more alert and less error prone.
This is an issue for all human activities but is crucial in certain situations.

Lighting Control

Overview - Motivation & Key Elements

The building automation system for lighting and shading control enables the realization of a complete solution according to the wishes of project partners and customer. The single system is based on the KNX protocol.

Switching & Dimming of Lighting
- The dimming control system is ideally based on DALI (Digital Addressable Lighting Interface) in combination with KNX
- These functions can be extended with constant light control, in this case the ceiling-mounted presence detectors work in addition also as light sensor and light controller
- DALI-Gateways enable human centric lighting and is also compatible with self-contained emergency lighting

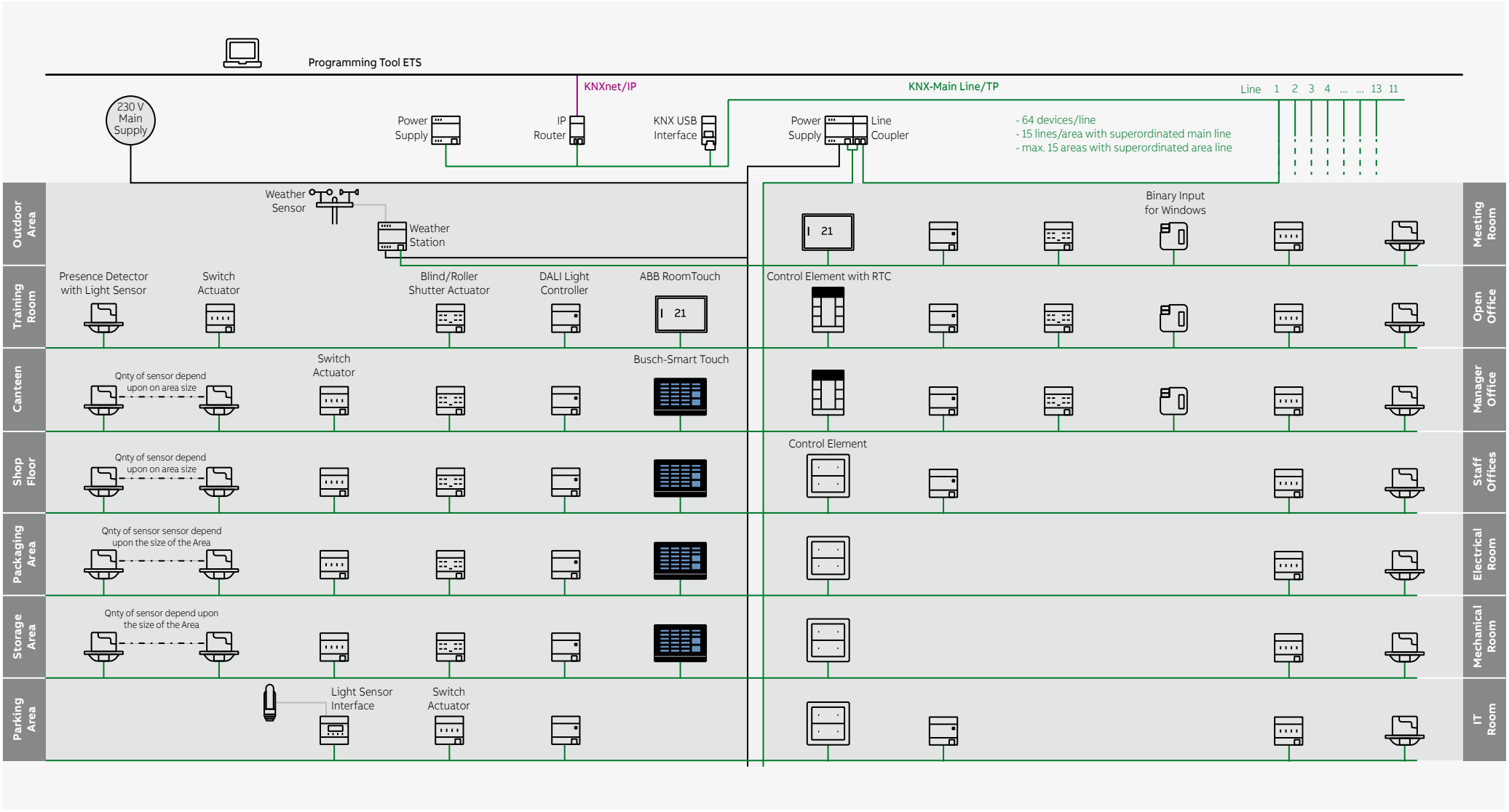
Time-Based and Occupancy-Dependent Control
- A dedicated KNX radio time switch shall execute this with the possibility to change time schedules directly on the device without programming tools
- An occupancy-dependent control is a control form that uses motion or presence detectors: the presence detector shall have a KNX interface in order to connect it to the KNX bus directly. The KNX bus then transmits the appropriate signals to switch actuator channels carrying out the command.

Blind/Curtain/Shutter Control
- Curtain and blind control shall be possible via local operation with switches/push-buttons while motors are interfaced to the appropriate actuators.
- Furthermore, the outside brightness value provided by the brightness sensor of the weather system can be used to realize basic automated shading functionality

Operation via Switches/Push-buttons
- Conventional switches/push-buttons with floating contacts shall be integrated in the bus system via binary inputs with contact scanning by means of universal interfaces which can be directly mounted in back boxes.
- Alternatively, direct KNX coupling units shall be installed. The coupling units shall be configurable to send various types of commands in order to be pairable with several applications

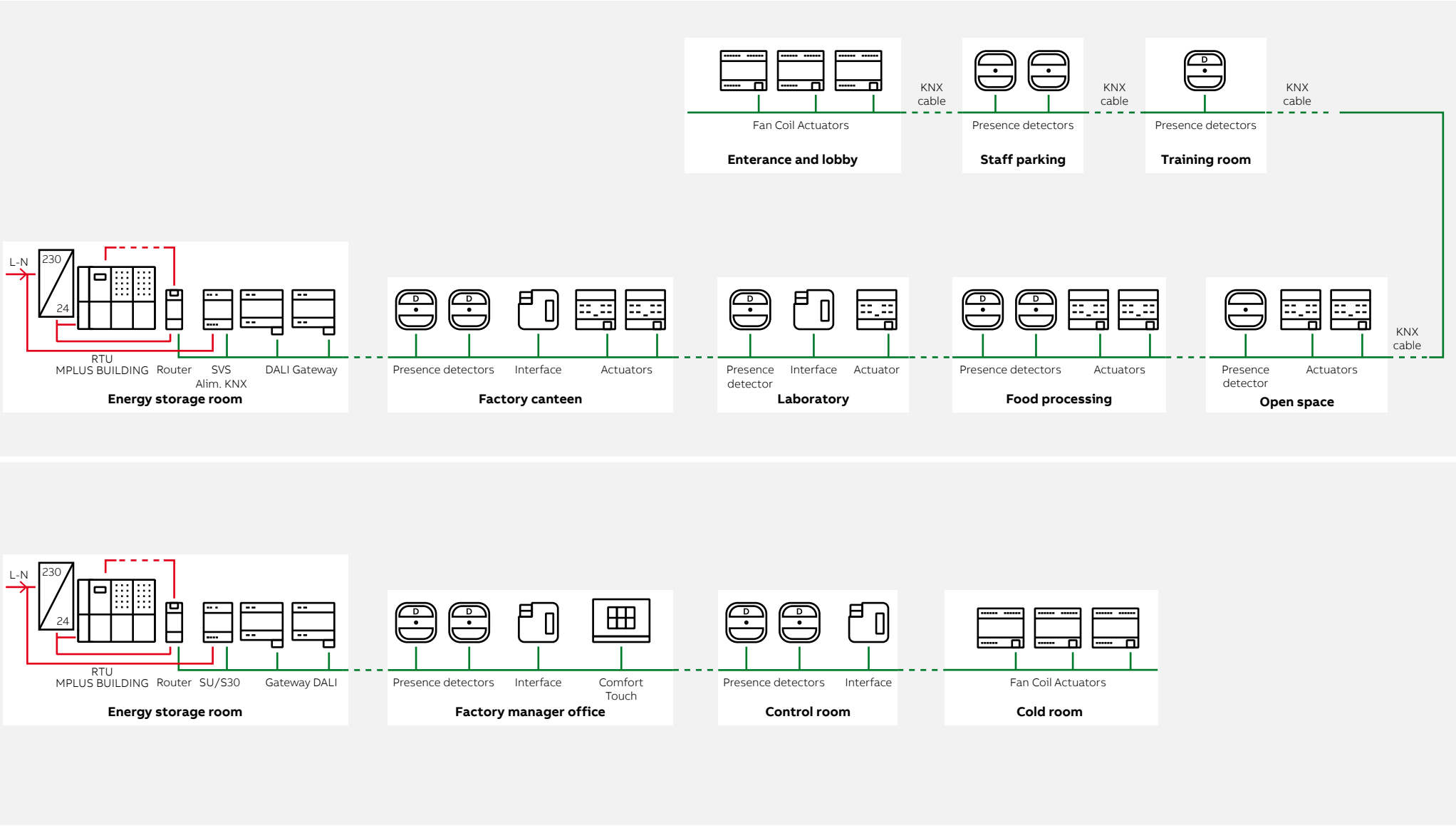
Lighting Control

Reference Architecture



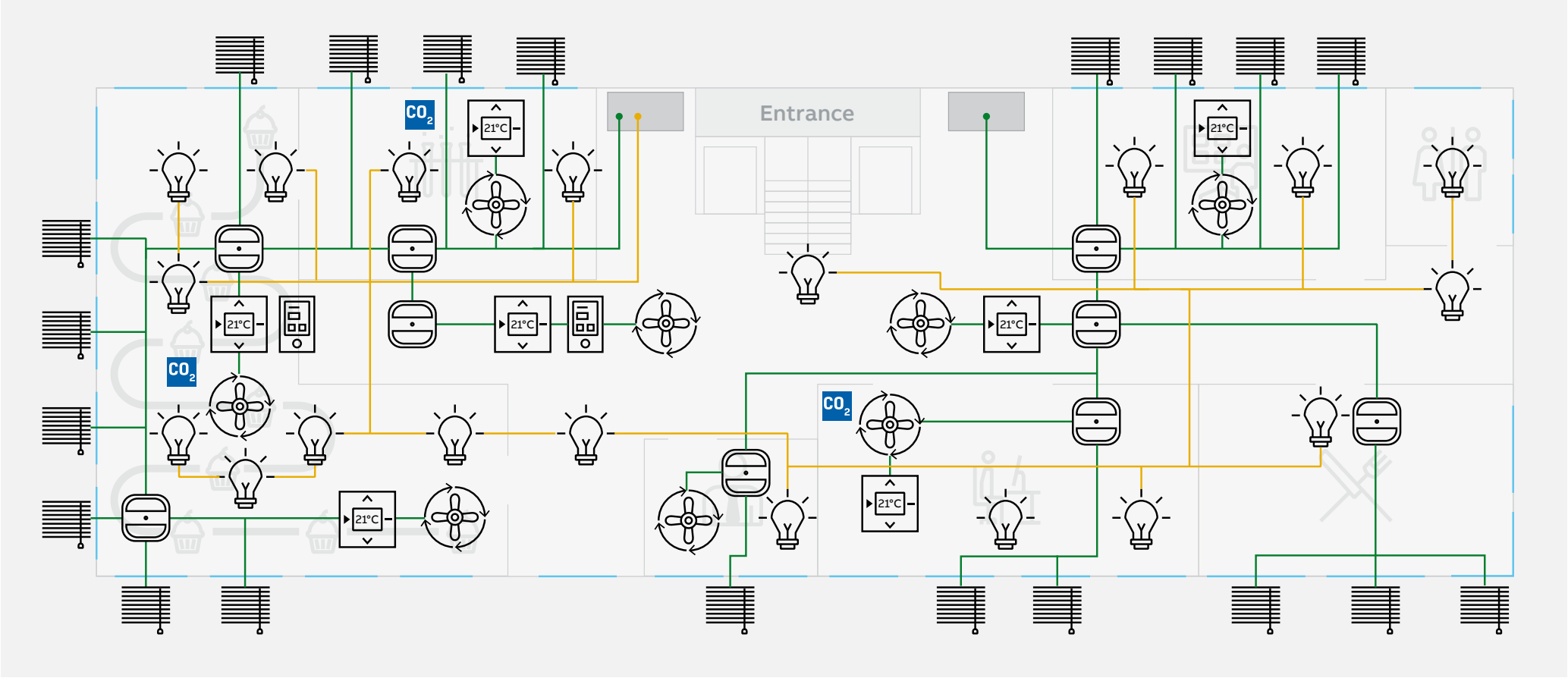
Lighting Control

Control, automation and supervision of the enviroment



Lighting Control
Room Automation

—
Application example



Curtains control
Presence and light sensors
Thermostats
Control via Smartphone/Panel
Fancoil control
Air quality
Lighting fixtures

Lighting Control

High quality presence detector 6131/31 and Dali DG/S gateway

This group of devices can perfect the lighting levels in different environments by adjusting the system based on the presence of occupants or on different distribution of the light within the environment itself.
This ensures the best level of lighting comfort and a significant reduction in consumption. It can be supported with a thermoregulation system which activates or deactivates the cooling or heating function based on the same parameters.
The platform can be integrated with the anti-intrusion systems to switch automatically off all the lights when the alarm system is activated.

Premium DALI Gateway

Together with the KNX building automation systems, this unit offers the most innovative solution for lighting control and management in all buildings during normal activities.
ABB's Gateway Premium allows for variable adjustment of the color temperature of artificial light according to natural light variation over the day.
When the color temperature and illuminance are correctly dosed, artificial light can improve people's well-being for all day. The system also allows to track the working period of the lamps, programming maintenance cycles in advance.

Lighting Control

KNX Switch Actuator

Flexibility combined with compact design – the Combi Switch Actuators offer switching and shading functionality in a device half the size. Ideally suited to meet the dynamic requirements of modern residential projects.

The Combi Switch Actuators feature high channel density, freely selectable switching and shading functionality in a single device, increased safety and intuitive usage thanks to the unified manual operation concept – offering customers maximum flexibility and comfort in planning, installing and commissioning.

KNX Lighting Control

ABB i-bus® KNX ensures optimum lighting of industrial and office buildings as well as private dwellings. The illuminance is monitored and remotely controlled depending on the lighting requirements. In addition, subsystems (such as 1 - 10 V lighting control and DALI) and their interfaces are supported.

Main benefits

- Increases energy efficiency by constant lighting and presence dependent control
- Maximum flexibility in lighting design, improved comfort and wellbeing with light scenes and sequences
- More flexibility through reprogramming or adding devices while in operation to meet changing needs

Lighting Control

KNX Shading Control

Sensor controlled roller shutters, windows and blinds with sun position controlled louvres not only provide pleasant shading, it also allow optimal lighting and room climate conditions and assist in responsible use of energy.

Main Features
- Control of independent drives via ABB i-bus® KNX
- Electro-mechanically interlocked outputs prevent possible destruction of the drives
- Additional safety is possible when used in combination with weather station e.g. protection of shutters against frost, wind, precipitation

KNX Power Supply

ABB i-bus® KNX power supplies provide the safe bus voltage for the connected KNX devices. Three versions for bus loads of 160, 320 and 640 mA are available, each with integrated choke and wide range mains input for worldwide usage. In addition, the 320 mA and 640 mA versions are available with expanded diagnostics for monitoring, e.g. bus voltage and current.

Main Features
- Bus line is decoupled from the power supply by an integrated choke
- Voltage output is short-circuit and overload protected
- Premium range with enhanced diagnostics provides bus state via LED display and KNX communication objects

Lighting Control

KNX Room Display

Networked structures work much more efficiently than individual systems. In residential buildings and on business premises, they reduce energy consumption and operating costs. At the same time, they provide added comfort and security. Busch-Jaeger KNX control elements form the interface between this state-of-the-art technology and the user.

Presence Detection

Knowing if people are in or moving around the building is a valuable asset for the efficient automation of any property. The ABB i-bus® KNX range of innovative motion and presence detectors helps to control and manage daily tasks in every sector of the building – indoors and outdoors. Whether lighting, heating, air-conditioning or security related functions, this portfolio of premium design, high quality detectors can significantly improve levels of safety, efficiency and comfort throughout the building.

Lighting control
Bill of Materials

Purpose	Type	Order Code	Description
Lighting Control Office Area			
KNX Power Supply	SV/S 30.640.5.1	2CDG110146R0011	Power Supply with Diagnostics, 640 mA, MDRC
IP Router	IPR/S 3.5.1	2CDG110176R0011	IP Router Secure, MDRC
Application Controller	AC/S 1.2.1	2CDG110206R0011	Application Controller with BACnet Gateway, MDRC
Lighting Control	DG/S 2.64.5.1	2CDG110274R0011	DALI Gateway Premium, MDRC
Switching Control (On / Off)	SA/S8.10.2.2	2CDG110259R0011	witch Actuator, 8-fold, 10 A, MDRC
Binary Inputs	BE/S 4.20.2.1	2CDG110090R0011	Binary Input, 4-fold, Contact Scanning, MDRC
Shutter Control	JRA/S 4.230.5.1	2CDG110125R0011	Blind / Roller Shutter Actuator with Travel Detection and Manual Operation, 4-fold, 230 V AC, MDRC
	JSB/S 1.1	GHQ6310084R0111	Shutter Control Unit, MDRC
Presence Detector	6819/39-24-500	2CKA006800A2759	DALI Presence Detector
Lighting Control Staff Area			
Lighting Control	DG/S 2.64.5.1	2CDG110274R0011	DALI Gateway Premium, MDRC
Switching Control (On / Off)	SA/S8.10.2.2	2CDG110259R0011	witch Actuator, 8-fold, 10 A, MDRC
Binary Inputs	BE/S 4.20.2.1	2CDG110090R0011	Binary Input, 4-fold, Contact Scanning, MDRC
Shutter Control	JRA/S 4.230.5.1	2CDG110125R0011	Blind / Roller Shutter Actuator with Travel Detection and Manual Operation, 4-fold, 230 V AC, MDRC
	JSB/S 1.1	GHQ6310084R0111	Shutter Control Unit, MDRC
Presence Detector	6819/39-24-500	2CKA006800A2759	DALI Presence Detector
Lighting Control Common and Reception Area			
Lighting Control	DG/S 2.64.5.1	2CDG110274R0011	DALI Gateway Premium, MDRC
Switching Control (On / Off)	SA/S8.10.2.2	2CDG110259R0011	witch Actuator, 8-fold, 10 A, MDRC
Presence Detector	6819/39-24-500	2CKA006800A2759	DALI Presence Detector
Lighting Control Maufacturing - Processing Space			
Lighting Control	DG/S 2.64.5.1	2CDG110274R0011	DALI Gateway Premium, MDRC
Switching Control (On / Off)	SA/S8.10.2.2	2CDG110259R0011	witch Actuator, 8-fold, 10 A, MDRC
Presence Detector	6819/39-24-500	2CKA006800A2759	DALI Presence Detector

Purpose	Type	Order Code	Description
Lighting Control Warehouse - Storage Area			
Lighting Control	DG/S 2.64.5.1	2CDG110274R0011	DALI Gateway Premium, MDRC
Switching Control (On / Off)	SA/S8.10.2.2	2CDG110259R0011	witch Actuator, 8-fold, 10 A, MDRC
Presence Detector	6819/39-24-500	2CKA006800A2759	DALI Presence Detector
Lighting Control Warehouse - Parking and Fleet Area			
Switching Control (On / Off)	SA/S8.10.2.2	2CDG110259R0011	witch Actuator, 8-fold, 10 A, MDRC
Outside Light Sensor	HS/S 4.2.1	2CDG120044R0011	The device can be used as a twilight switch (1 ... 100 lux) or as a light value switch (100 ... 20.000 lux). One Outside Light Sensor LFO/A 1.1 is supplied with the device.
Lighting Control Warehouse - Control Room			
Lighting Control	DG/S 2.64.5.1	2CDG110274R0011	DALI Gateway Premium, MDRC
Switching Control (On / Off)	SA/S8.10.2.2	2CDG110259R0011	witch Actuator, 8-fold, 10 A, MDRC
Presence Detector	6819/39-24-500	2CKA006800A2759	DALI Presence Detector

HVAC Control

Heating, ventilation and air conditioning (HVAC) systems have a significant impact on both comfort and costs in any building. They represent about 50% of total energy cost.
Modern buildings require smart HVAC systems that create comfortable, healthy and safe environments for the occupants, while minimizing energy consumption and increasing sustainability.

HVAC Control

Controlling, monitoring, and recording functionalities are achieved using DDC controller & server software via either hardware interface to individual equipment using various sensors like temperature, pressure etc. and actuators like control valve, relays, damper actuator etc. or high-level interface to other systems using building automation protocols such as BACnet, Modbus, LON, KNX etc.

Car park ventilation system

Due to continuous vehicular movement inside closed car park, airborne contaminants such as co and no2 can accumulate and cause significant concerns to occupants. The co and no2 levels must be controlled or ventilated when concentrations approach unsafe levels. Carbon monoxide and nitrogen dioxide sensors are installed and connected to ddc controller to monitor the contaminant level. Based on the algorithm output written inside the ddc controller, output signal is generate to control supply air fan, exhaust air fan and jet fans to maintain required ventilation.

Thermal comfort

Thermal comfort is “that condition of mind that expresses satisfaction with the thermal environment and is assessed by subjective evaluation” thermal comfort can be impacted by temperature and humidity of surrounded environment. Thermal comfort applications ensure installation of necessary instrumentation system to monitor and control thermal comfort panel. In occupied space thermal comfort can be achieved using hvac equipment such as ahu, fcu, vav and chilled beam among others.

Indoor air quality

Indoor air quality (iaq) refers to the air quality within and around buildings and structures, especially as it relates to the health and comfort of building occupants. Considering human spent 70% of time indoors, it is vital parameters in overall health and wellness of occupant. Indoor air quality can be improved by 2 ways i.E. Replacing existing air with fresh air or removing pollutants, particulate matter or pathogen from existing air. In both cases, air pollutants or particulate matters needs to be measured. Device which is used to measure quality of air is referred as an indoor air quality (ioq) sensor and it measure concentration of air pollutants such as co, so2, nox, o3, thc and particulate matters such as pm25 and pm 10 continuously all year round. The measured data can be remotely monitored and exported in various formats. Robust monitoring helps to guard against extreme events by alerting people and initiate action. Indoor air quality sensors data can be monitored by integrating it with building management system via bacnet or modbus or directly via cloud if sensors are iot enabled.

HVAC Control

Chilled water system

In medium and large size buildings chilled water system is probably act as a single source of cooling energy. Chilled water system typically have a chiller or set of chillers, in which water is cooled to a temperature from 44.6 To 48.2 °F (7–9 °c) and then circulated by means of pipes. The chilled water system may consist of chillers, primary and secondary pumps, heat exchangers, condenser pumps, cooling tower, pump starters, sensors, valves, actuators and controllers. Ddc controller can be programmed with various chilled water control loops such as on/off control, temperature control, pressure control, staging control, sequencing control, equipment scheduling etc.

Hot water system

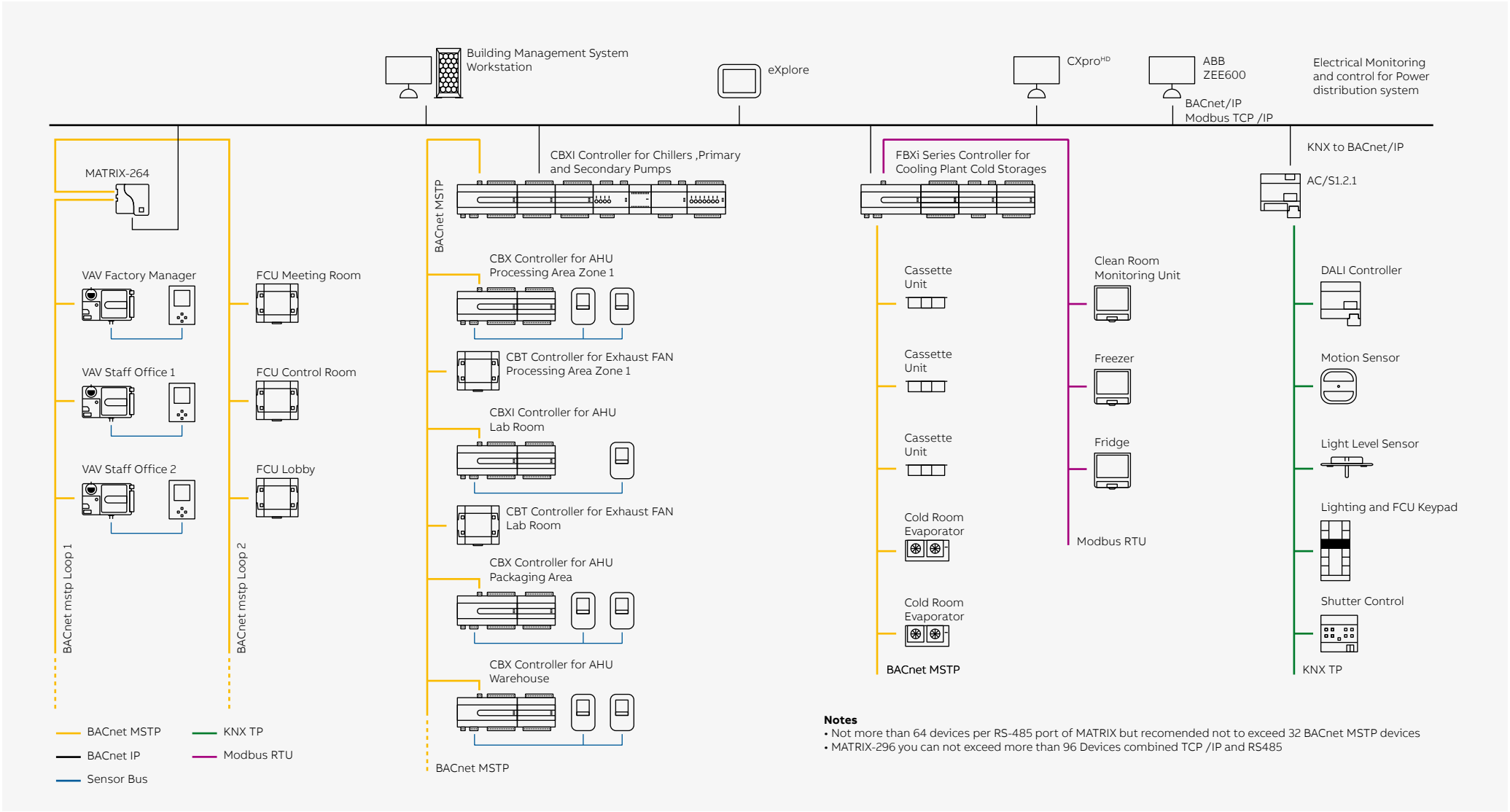
Hot water is an essential building service used for thermal comfort, washing, cleaning, cooking, heating etc. Hot-water systems typically have a central boiler, in which water is heated to a temperature from 140 to 180 °f (60–83 °c), and then circulated by means of pipes. Hot water system may consist of boiler, hot water pump, heat exchanger, supply and exhaust fan, fuel tank, pump and fan starters, sensors, valve, actuator and controllers. Ddc controller can be programmed with various hot water control loops such as on/off control, temperature control, pressure control, staging control, sequencing control, equipment scheduling etc.

Water management system

Water management system in building includes potable water system, grey water system, irrigation water system and firefighting water system. Water management system may consist of water pumps, pumps starters, water tanks, sensors, valve, actuator and programmable controllers. Ddc controller can be programmed with various water management system control loops such as on/off control, level control, pressure control, staging control, equipment scheduling etc.

HVAC Control

Reference Architecture with Matrix 264

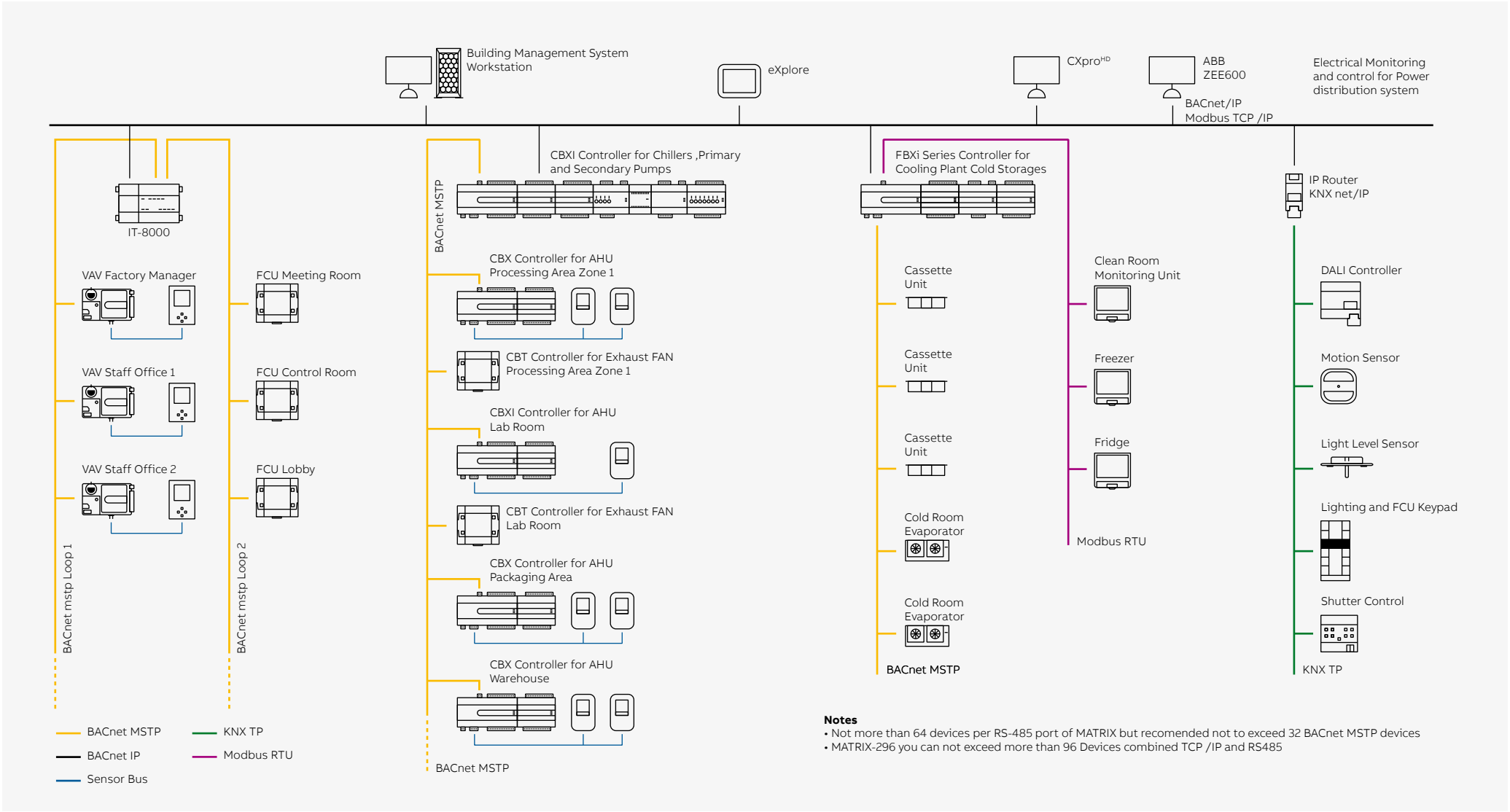


Notes

- Not more than 64 devices per RS-485 port of MATRIX but recomended not to exceed 32 BACnet MSTP devices
- MATRIX-296 you can not exceed more than 96 Devices combined TCP /IP and RS485

HVAC Control

Reference Architecture with Matrix and IT-8000



Notes

- Not more than 64 devices per RS-485 port of MATRIX but recomended not to exceed 32 BACnet MSTP devices
- MATRIX-296 you can not exceed more than 96 Devices combined TCP /IP and RS485

HVAC Control

ABB CYLON® NEXUS-3 Series

The NEXUS-3 is an Internet of Things (IoT) integrated ASPECT® control engine designed to provide flexible site control applications for medium to large building automation systems. It can be used for connection to the Cylon CB series and AAM NB series of BACnet® MS / TP field level controllers. The NEXUS-3 supports serial communication protocols such as BACnet®, AAM PUP and Modbus®. Additionally, TCP / IP communications using Cylon's FT / Net, BACnet®, Modbus® and Unitron protocols (when used with UC32.netK) are available when using the RJ-45 connection.
When implemented with the integrated ASPECT® Runtime Engine, the NEXUS-3 is capable of performing supervision-based control functions, including but not limited to energy management routines, custom sequences, alarm and event announcements, alarms and trends history and planning of the main control. ASPECT® uses secure web technologies to enrich the user experience through common Internet applications for the announcement and programming of alarms.

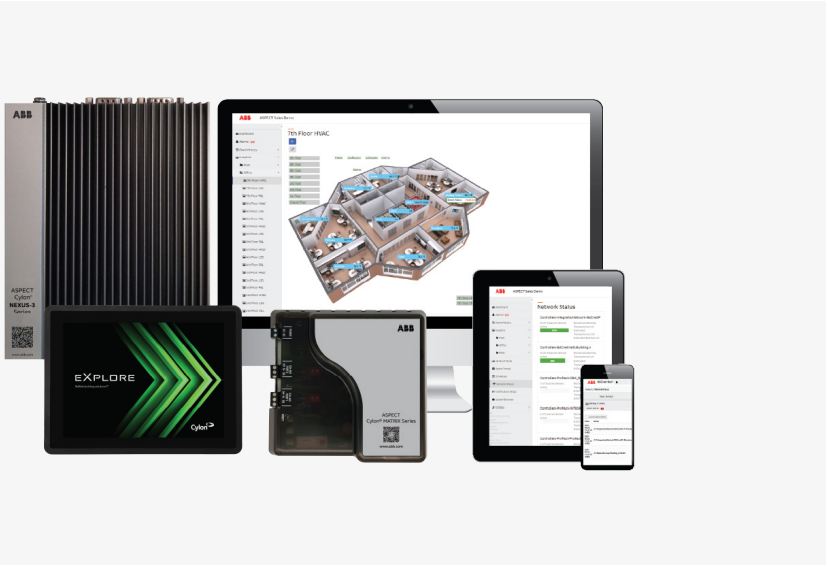
ABB CYLON® MATRIX Series

MATRIX is an Internet of Things (IoT) integrated ASPECT® control engine designed to provide flexible site control applications for medium to large building automation systems. It can be used for connection to the Cylon CB series and AAM NB series of BACnet® MS / TP field level controllers. MATRIX supports serial communication protocols such as BACnet®, AAM PUP and Modbus®. Additionally, TCP / IP communications using Cylon's FT / Net, BACnet®, Modbus® and Unitron protocols (when used with UC32.netK) are available when using the RJ-45 connection.
A capacity-based licensing model makes the MATRIX controller family scalable for medium to large building applications, including a campus environment when combined with ASPECT®-Enterprise server software. When implemented with the integrated ASPECT® Runtime Engine, MATRIX is capable of performing supervision-based control functions, including but not limited to energy management routines, custom sequences, alarm and event announcements, historical alarms and trends, and planning main control. In addition, streaming of connected data in real time is displayed in rich HTML5 graphics using a web browser.

HVAC Control

ASPECT®

ASPECT® is an award-winning scalable building energy management and control solution designed to allow users seamless access to their building data through standard building protocols (BACnet, Modbus, Ethernet, etc.) and common IT technologies, available on a wide array of computers and smart devices, both iOS, and Android.
ASPECT® provides all the tools to gain intelligence into buildings' performance with the ability to rapidly react to any situation that may adversely affect energy costs and business performance. eXplore touchscreen display provides users an intuitive experience to view system status, override setpoints and schedules, and much more.



INTEGRA supervisor

INTEGRA™ is a compact, embedded Internet of Things (IoT) controller and server platform for connecting multiple and diverse devices and sub-systems, the IT-8000 controller provides integrated control, supervision, data logging, alarming, scheduling and network management, and streams data and rich graphical displays to a standard Web browser via an Ethernet or wireless LAN, or remotely over the Internet.

Main features
- Protocol Integrator
- Scheduling
- Datalogging
- Supervision
- Alarming
- Network Management

HVAC Control

ABB CYLON® CBXI Series

The CBXi Series is a freely programmable range of BACnet® Controllers with native BACnet/IP communications support. The controllers are BTL listed BACnet Building Controller (B-BC) and are ideally suited for a wide range of applications for intelligent control of HVAC equipment, and electrical systems including lighting control and metering applications.

The CBXi-8R8 and CBXi-8R8-H controllers support multi-protocol communications simultaneously including BACnet/IP, BACnet MS/TP, Modbus® TCP and Modbus RTU. Part of Cylon's CB Line of BACnet field controllers, the CBXi-8R8 controller features 8 UniPuts™ with Relay, 8 Universal Inputs, as well as support for up to five FLX (Field Level eXpansion) series extension modules providing up to 96 points of control, and a dedicated input for Cylon's CBT-STAT or UCU Room Display intelligent room sensors.

ABB CYLON® CBX Series

CBX-8R8 and CBX-8R8-H are fully programmable BTL-listed BACnet® Advanced Application Controllers (B-AAC) that communicate on an RS-485 local area network using the BACnet MS/TP and feature support for Modbus® RTU devices. Modbus allows the integration of devices into control strategies such as motor drives, meters, and other sensors.

HVAC Control

ABB CYLON CBT Series

The CBT-4T4-2U1R is a freely programmable BACnet® Unitary Controller with native MS/TP communications support. The controller is BTL listed as a BACnet Advanced Application Controller (B-AAC) and is ideally suited for the control of Fan Coil Units with ECM motors, Heat Pumps, Unit Ventilators, Unit Heaters, Chilled Ceilings/Beams and custom unitary equipment.

The HVAC field controller accommodates available pre-engineered strategies or can be tailored to custom applications using the CXpro programming software.

This controller provides the connectivity and flexibility needed for unitary applications as well as automation of miscellaneous points such as exhaust fans and unit heaters and provides operators the tools they need to help reduce energy consumption, improve occupant comfort and achieve sustainable building operations.

ABB CYLON® CBV Series

The CBV-2U4-3T features 2 UniPutsTM, 4 Universal Inputs, 3 Digital (Triac) Outputs, 1 on-board Airflow Sensor and an integrated Belimo Actuator with brushless DC motor. The CBV-2U4-3T can be used in new building or retrofit applications.
The fully programmable CBV-2U4-3T and CBV-2U4-3T-N controllers are designed to control any variable air volume box application with a pre-loaded and configurable application shipped from the factory pre-programmed into the controller.

With the CBV-2U4-3T and CBV-2U4-3T-N controllers you can add a demand ventilation application, and occupancy sensors or lighting control to further enhance your energy savings. The CBV Series is part of ABB Cylon's CB line of controllers. The new VAV controllers are designed to work as part of our dual-platform offering and can be used as a field level BACnet® MS/TP controller for the ASPECT® Control Engine (MATRIX™ and NEXUS™) or INTEGRA™ N4 (IT-8000).

HVAC Control

FUSIONAIR® Series

Balancing the health and safety of building occupants while delivering a comfortable and productive environment with touch free control is now here. The FusionAir Smart Sensor series provides a slim, compact, and visually appealing room control display with a high-definition capacitive touch backlit LCD display for use with ABB Cylon® FBXi and CB Line BACnet® field controllers. The intelligent temperature and humidity sensor allow users to view and adjust selected parameters within the field controller to which it is connected. Other sensing options available for integration with the CXproHD control strategy are CO2 or Volatile Organic Compound (VOC) sensing.

Important features

- Temperature sensor
- Relative humidity sensor
- CO_2 sensor or Volatile Organic Compound sensor
- Touch-free virus safe operation

HVAC-Control
Bill of Materials

The bill of material for the HVAC Control equipment in the reference architecture is summarized in the following table:

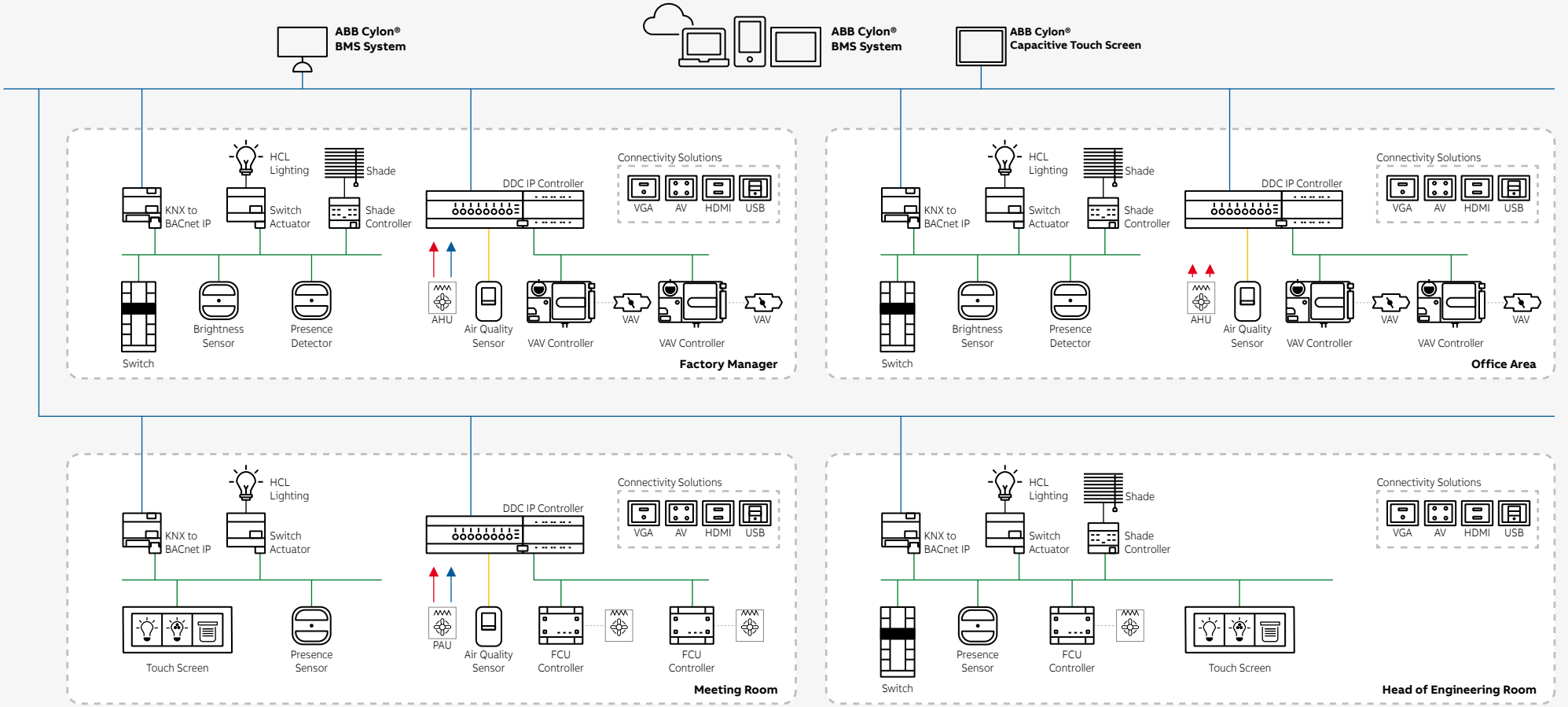
Purpose	Type	Order Code	Description
HVAC Control Components -Manager Office			
24 AC Power Supply			
FCU Controller	CBT-3T6-5R	2CQG201309R1021	3 UniPuts™ with Triac outputs , 6 UI and 5 Digital (Relay) Outputs
HVAC Control Components -Staff Office			
24 AC Power Supply	FLXPS24	2CQG205601R1021	
FCU Controller	CBT-3T6-5R	2CQG201309R1021	3 UniPuts™ with Triac outputs , 6 UI and 5 Digital (Relay) Outputs
Fusion Smart Sesnor	FA-THC-D		Temperature + RH + CO2 + Display
HVAC Control Components -Individual Office			
24 AC Power Supply	FLXPS24	2CQG205601R1021	
VAV Controller	" CBV-2U4-3T-FA-SI"	2CQG201518R1011	CBV Series
VAV Room thermostat		2CQG256501R1021	UCU Room Keypad
HVAC Control Components Open Common Area			
24 AC Power Supply	FLXPS24		
AHU	CBX-8R8	2CQG201003R1021	
AHU Expansion Unit	FLX-8R8	2CQG200706R1021	
AHU Expansion Unit	FLX4R4	2CQG200705R1021	
Fusion Smart Sesnor	FA-THV		Temperature + RH + VOC sensor No Display
HVAC Control Components Manufacturing Space			
24 AC Power Supply	FLXPS24	2CQG205601R1021	
AHU	CBX-8R8	2CQG201003R1021	
AHU Expansion Unit	FLX-8R8	2CQG200706R1021	
AHU Expansion Unit	FLX4R4	2CQG200705R1021	
Fusion Smart Sesnor	FA-THV		Temperature + RH + VOC sensor No Display
Exhasut Fan Control	CBT-4T4-2U1R	2CQG201308R1021	
HVAC Control Components WareHouse			
24 AC Power Supply			
FAHU	CBX-8R8	2CQG201003R1021	
FAHU Expansion Unit	FLX-16DI	2CQG200703R1021	
Fusion Smart Sesnor	FA-THV		Temperature + RH + VOC sensor No Display

Purpose	Type	Order Code	Description
HVAC Control Components - Lab			
24 AC Power Supply	FLXPS24	2CQG205601R1021	
VAV Controller	CBV-2U4-3T-FA-SI	2CQG201518R1011	CBV Series
VAV Room thermo-stat		2CQG256501R1021	UCU Room Keypad
24 AC Power Supply	FLXPS24	2CQG205601R1021	
AHU	CBX-8R8	2CQG201003R1021	
AHU Expansion Unit	FLX-8R8	2CQG200706R1021	
AHU Expansion Unit	FLX4R4	2CQG200705R1021	
HVAC Control Components Control Room			
24 AC Power Supply	FLX-PS24	2CQG205601R1021	
FCU Controller	CBT-3T6-5R	2CQG201309R1021	3 UniPuts™ with Triac outputs , 6 UI and 5 Digital (Relay) Outputs
FCU Termostat	CBT-STAT-CYL		Back-lit LCD Display with temperature sensing. Cylon Logo.
Bacnet Router and In Built in Aspect Installed	Nexus-264	2CQG100103R2021	Aspect Control Engines (ACE)
Touch screen	eXplore-c7	2CQG202003R2021	eXplore-c7 is a 7" touchscreen
HVAC Control Components Mechnical Room			
24 AC Power Supply	FLX-PS24	2CQG205601R1021	
Chiller water system control	CBXi-8R8	2CQG201001R1021	
	FLX-8R8	2CQG200706R1021	
	FLX4R4	2CQG200705R1021	
Touch screen	eXplore-c7	2CQG202003R2021	eXplore-c7 is a 7" touchscreen
Cylon® FBXi	FBXi-X256		
24 AC Power Supply	FLX-PS24	2CQG205601R1021	For integration with VRF and Cold Room Unit

Room Wiring & Control

Creating maximum passenger comfort thru easy-to-use operation, reliable room control products as well as to reduce the consumed energy during un-occupancy and reduce the operational cost for the operator.

Room Wiring & Control



Room Wiring & Control

Room master

The Room master controller provides an integrated modular DIN rail device to control power to the lighting circuits, power sockets, Fan Coil Unit and shades dedicated in each care units.
The integrated Room master Controller controls up to three fan speed via a stage switch or two-way connection. Electronic outputs are protected against short-circuit.
The fan coil controller regulates the fan speed as required to maintain the room temperature at the desired set-point in care units providing comfort in every care.
The three-level fan speed control is operated via a changeover switch actuator inbuilt with the controller depending on the required cooling demand.
Also depending on the balcony & window status the AC in care units can be set to standby mode to provide maximum energy saving.

Imput and Output controller

Inputs
- Processing binary and analogue signals
- ABB i-bus® KNX inputs serve as an interface for the operation of KNX systems via conventional push buttons and switches as well as for processing binary and analogue signals. In addition, weather data can be transmitted to the KNX bus for further evaluation via an appropriate weather sensor.

Output
- Switching and controlling loads in all application areas
- ABB i-bus® KNX actuators enable the reliable switching and controlling of different electrical loads in the KNX system.
- ABB offers a comprehensive range of actuators covering all application areas.

Room Wiring & Control

Heating, Ventilation and Air Conditioning

ABB i-bus® KNX intelligent building control integrates the heating, air-conditioning and ventilation to a coherent and efficient climate control. Measured temperature values in the rooms are recorded and supplied to the heating and cooling control to generate the optimum temperature and air quality.

Main benefits
- More efficient and precise room climate control
- Increases potential savings in energy consumption through the combination of room climate control and central HVAC control
- Quick, efficient and detailed device analysis without ETS software, even remotely, thanks to the ABB i-bus® tool

Main features
- From individual room control right up to full control of the entire building
- Control of valve drives, fan coil units, blowers and heating and cooling circuits
- Accurate measurement of CO_2 concentration, air temperature and humidity

Tenton®

The ABB Tenton® sensors are easy-to-use, high quality sensors. A surface-mounted and flush-mounted installation is possible, all versions can be connected via a FM box.

Main benefits
- High quality display with illumination for excellent readability
- Room device with three functionalities in one device: control element, room temperature control and CO_2 / humidity sensor
- Control of all room functions from HVAC to shading and lighting
- Clean and elegant design that fits perfectly into modern commercial buildings
- Now also in black matt, studio white matt and aluminium silver

Main features
- CO_2 / Humidity sensor, RTC and control element
- Large Labelling field to make the buttons easier to control
- Separate anti-theft protection (same like ABB tacteo®)

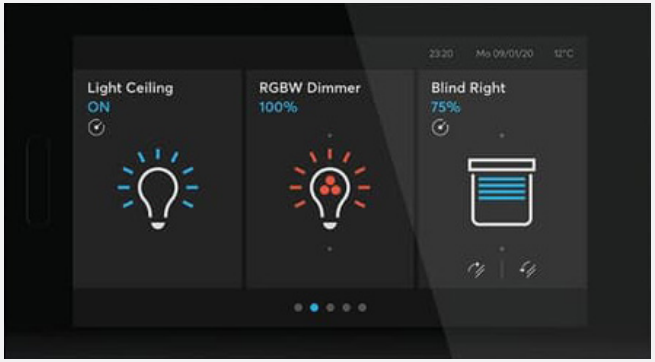
Room Wiring & Control

Busch-ControlTouch®

Simple KNX visualization for smartphones, tablets and Windows computers. MDRC devices with associated IOS and Android apps. Application for Windows computers. Easy control using intuitive navigation concept. Representation of individual operating pages with list view. Display of individual control pages with room images with small controls. Fully web-based commissioning with wizard function. Home automation, switching, dimming, blind, RTC control, scene/sequences, Sonos control element, timing, Philips Hue. Entertainment: Sonos - KNX bridging, multimedia integration via UPnP. Infotainment: monitoring of usage data for up to 3 years. Security: Video surveillance with IP cameras, notification via push notifications or e-mail (including a picture from an IP camera). Time programs and scenes can be created by the end customer. Presence simulation.

ABB RoomTouch® KNX

ABB RoomTouch® KNX is a capacitive device for multiple control.
It allows intelligent control of all active and inactive functions in a room or area of a building, such as lighting, shutters, curtains, scenarios, temperature, external inputs, and so on. Every interaction can be easily controlled and managed from a single device. Up to 30 functions distributed on 10 pages can be supported.
Icons can be associated to switches, dimmers, sliders, actuators, thermostats, and complex commands like scenarios, display of a value, audio control, split unit control and more. Beyond integrated logic and timing functions, it features a temperature sensor, proximity and brightness sensors, binary input, and analog input.



Room Wiring & Control

Fan Coil Controller

A Fan Coil Controller FCC/S (internal controller function) controls a Fan Coil Unit (2-pipe system). Control of the complete spectrum of Fan Coil Units.

- Successor to the FCA/S series.
- With integrated Room Temperature Controller
- Support of variable 0-10V fans
- Support of 6-way valves

The Control Element or we can say thermostat SBS/U is used for

- Measurement the actual room temperature Setting the target temperature (setpoint)
- Change fan speed, switching control on/off and heating/cooling mode
- Displaying actual and setpoint temperature

BMS Smart Sensors – Fusion Air Sensor

FusionAir Smart Sensor monitors Carbon Dioxide (CO_2) and Volatile Organic Compounds (VOC) in addition to temperature and humidity. Coupled with an interactive touch free interface and patent pending occupancy sensing technology, FusionAir works with ABB Cylon system to ensure proper ventilation based on schedule and dynamic room conditions.

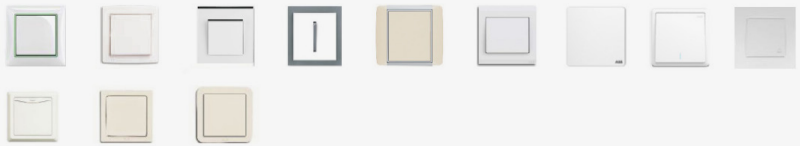
Wiring accessories

There are many wiring accessories that can compliment the Industrial offering from global and local standard ranges to suit local installation habits, with colours to match or combine in aesthetically pleasing ways to enhance the experience of the end user.

Products for industries
Various Product ranges for industry are available dependent upon level and budget constraints and to suit local regulations and market requirements.

Basic

Mid Range



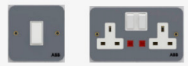
Dimmers, Thermostats to ad lighting and heating control

Blind and shutter control

Premium
High quality plastic, metal finishes and Glass ranges are available

Colours align with Tacteo

Metal Clad range for workshops and garages



Outdoor installations

Sockets with USB outlets and USB Outlets high current applications for charging mobile phones

Multimedia outleys with USB, HDMI and Bluetooth connectivity

Presence Detectors and Whatchdogs to add Safety and security i and around the residence

Proximity sensor to switch loads by close sensing of hands

Room Wiring & Control
Bill of Materials

The bill of material for the In-room Controls equipment in the reference architecture is summarized in the following tables:

Purpose	Type	Order Code	Description
Room Wiring and Control Manager Office			
Window Contacts	MRS/W	GHQ3201972R0001	Magnet Reed Contact
Temperature Control and operation	SBR/U6.0.1-84	2CKA006330A0004	Room temperature controller with control function 6gang ABB Tenton®
Application Controller	AC/S 1.2.1	2CDG110206R0011	Application Controller with BACnet Gateway, MDRC
Room Wiring and Control Open Office			
Window Contacts	MRS/W	GHQ3201972R0001	Magnet Reed Contact
Control and operation Lighting	SB/U8.0.1-84	2CKA006330A0014	Control element 8gang ABB Tenton®
Room Wiring and Control - Lab			
Control and operation Lighting	SB/U8.0.1-84	2CKA006330A0014	Control element 8gang ABB Tenton®
Room Wiring and Control - Reception			
Control and operation Lighting	SB/U8.0.1-84	2CKA006330A0014	Control element 8gang ABB Tenton®
Touch Screen	6136/07-811-500	2CKA006136A0205	SmartTouch 7 -811
Room Wiring and Control - Warehouse			
Touch Screen	6136/07-811-500	2CKA006136A0205	SmartTouch 7 -811
Room Wiring and Control -Control Room			
Touch Screen	6136/07-811-500	2CKA006136A0205	SmartTouch 7 -811

Emergency Lighting

The emergency lighting concept of ABB offers reliable and complete solutions for safe evacuation.
The buildings emergency lighting provides 24-7 protection to visitors and employees.
ABB solutions provide harmony with the interior and reduced total cost of ownership throughout the building life cycle.

Emergency Lighting

Overview - Motivation & Key Elements

Emergency lighting is a vital and effective life safety tool, providing reassurance and guidance to people at critical times when they need to escape quickly and safely from a building.

Escape route signalization and lighting

- Escape route signalization uses pictograms to show the direction to the nearest (emergency) exit. These exit signs have different geometries, dimensions and colors to comply to local standards
- Escape route lighting illuminates this route to the (emergency) exit so that people can escape safely in the event of an emergency, as there is a high risk of damaging someone when the mains is off. Escape route luminaires can be permanently on or off

Central battery systems or self-contained lighting

- The power system must provide a secure power source in case of emergency to supply the evacuation systems
- A central battery system will normally be located in the basement of the building or in centralized place in each floor

Monitoring, testing and connectivity

- Advanced monitoring systems bring the benefit of a constant 24/7, 365 days per year monitoring scheme
- The automatic testing system comprises the light and the battery duration. Data logging software will keep the test results for up to four years, so that there is evidence to local regulators
- Connected luminaires allows for a remote installation, diagnostic and testing of the luminaires that translates into time and resource savings as well as safer buildings assuring the functionality of each luminaire

Emergency Lighting
DALI Emergency Lighting (Europe)

Integration for safe monitoring in smart buildings DALI emergency lighting from ABB can easily provide a safe and reliable solution to meet smart building emergency lighting requirements. Automatic testing to ensure your building is safely lit. With status information and test reports available to download. Low-cost installation with low-cost maintenance. ABB and DALI: the smart way to install emergency lighting. Ensuring building occupant safety, Touch screen to control, test and monitor emergency lighting. Simple to group and easy to install

Emergency Lighting has dedicated DALI codes for testing, monitoring and reporting of emergency luminaire status.

Function tests
A function test is a test that simulates a mains failure and checks the operation of the emergency light from the battery supply If there is a failure during a function test the local indicator LED changes its status.

Duration tests
A duration test simulates a mains power failure and checks the operation of the emergency light from the battery supply for the rated duration of product e.g. 3hrs

Local testing
Function and duration tests are initiated by the emergency light fitting itself. It performs automatic self-testing according to the locally stored settings.

Central testing
Function and duration tests are initiated by the ELDCS1/DALI if the automatic self-testing is disabled.

DALI Portfolio is suitable in most of the countries in Europe following EN1838, except France, Italy, Russia…. Please verify your local regulation

Advantages of using DALI with emergency lighting

1. Proven DALI technology specific for emergency lighting

2. Our DALI solution is based on non-proprietary systems. As long as all component of a system are DALI compliant, they will be able to communicate with each other

3. Cost-effective solution with reduced maintenance costs after commissioning

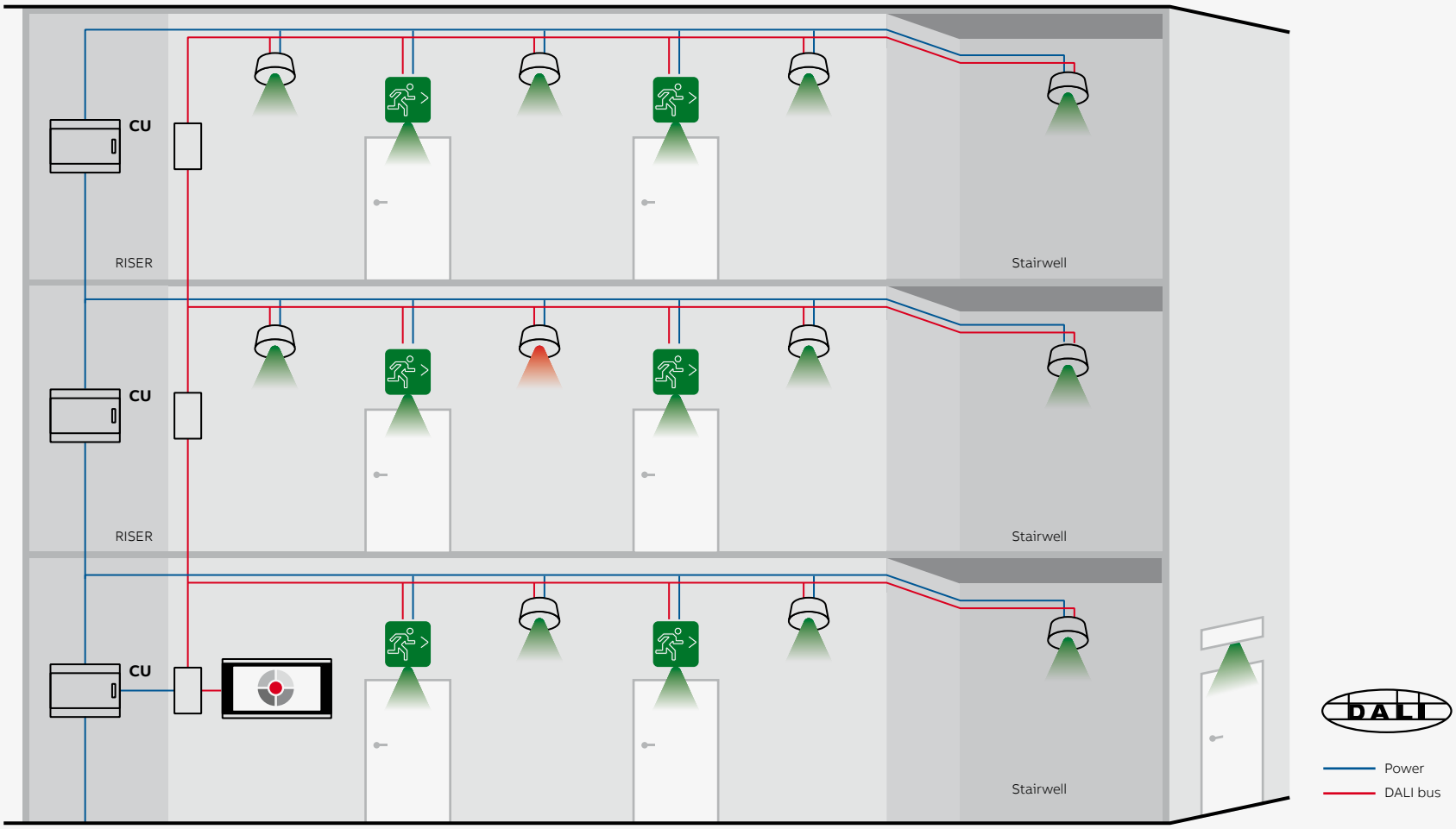
4. With the addiction of the ABB gateway, we can connect our DALI luminaires with KNX systems and BMS

5. DALI (DHA) Certified

Emergency Lighting

DALI Emergency Lighting (Europe)

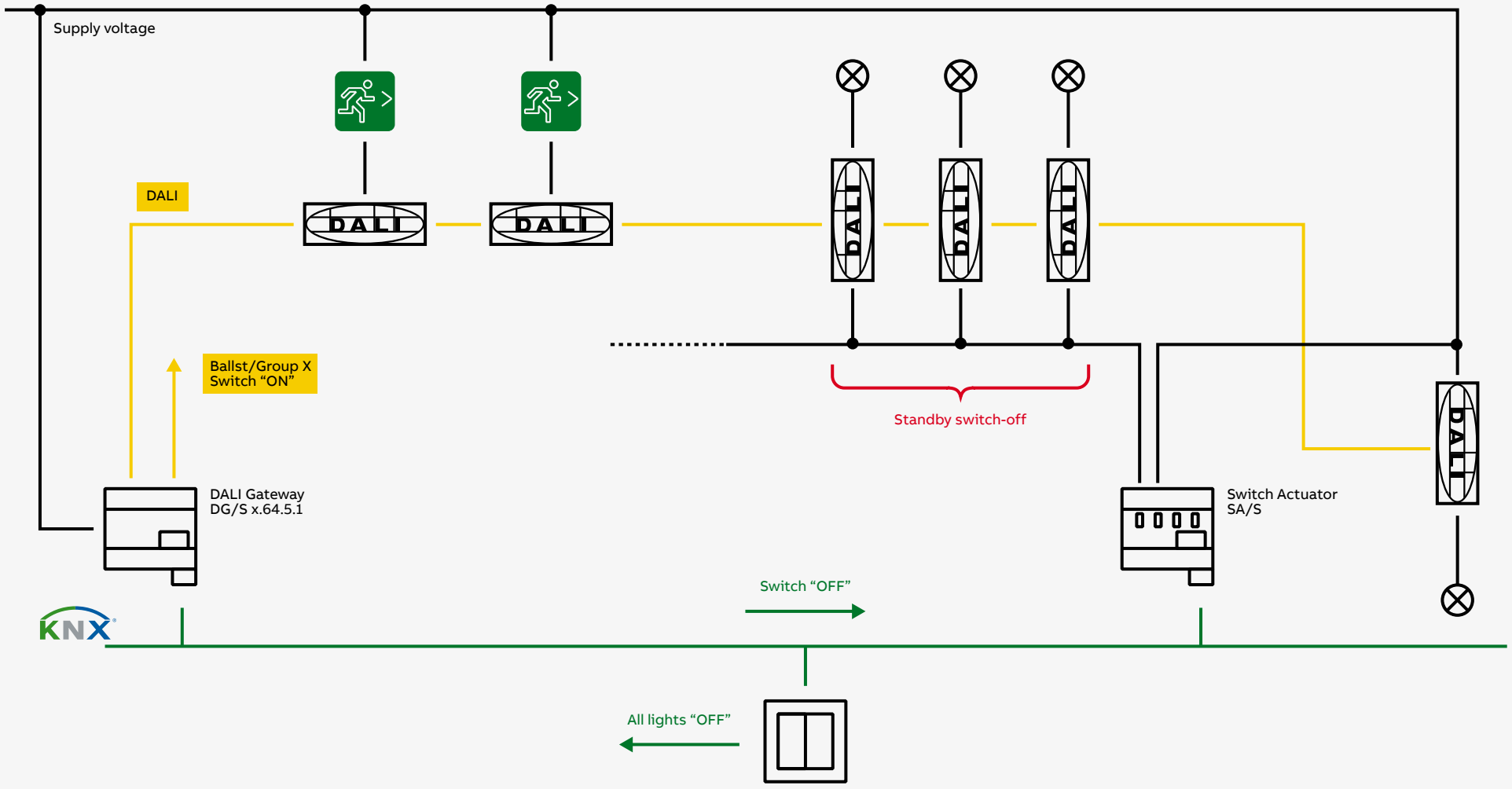
Reference Architecture



Emergency Lighting

DALI Emergency Lighting (Europe)

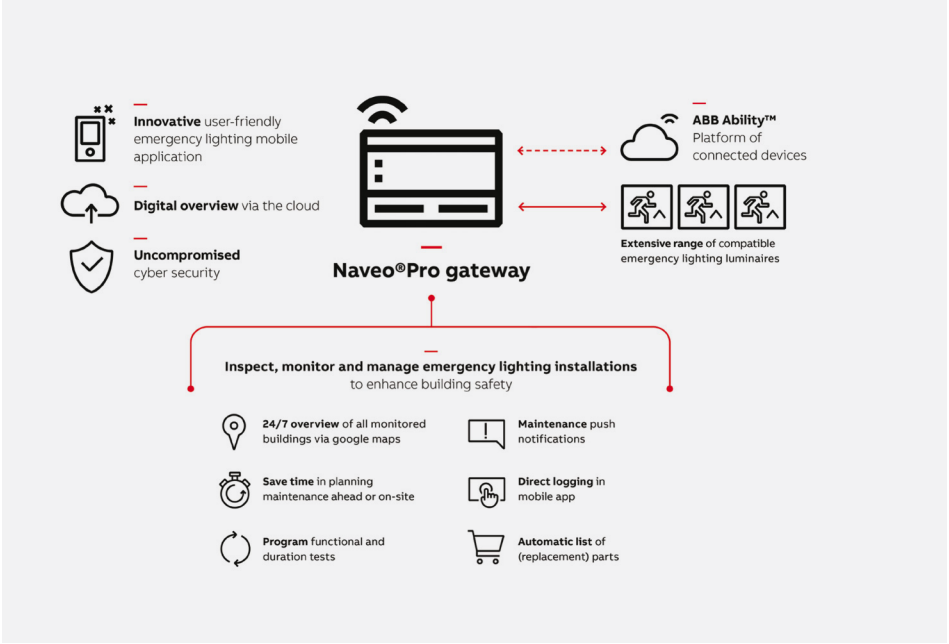
Reference Architecture



Emergency Lighting
DALI Emergency Lighting (Europe)

Naveo®Pro

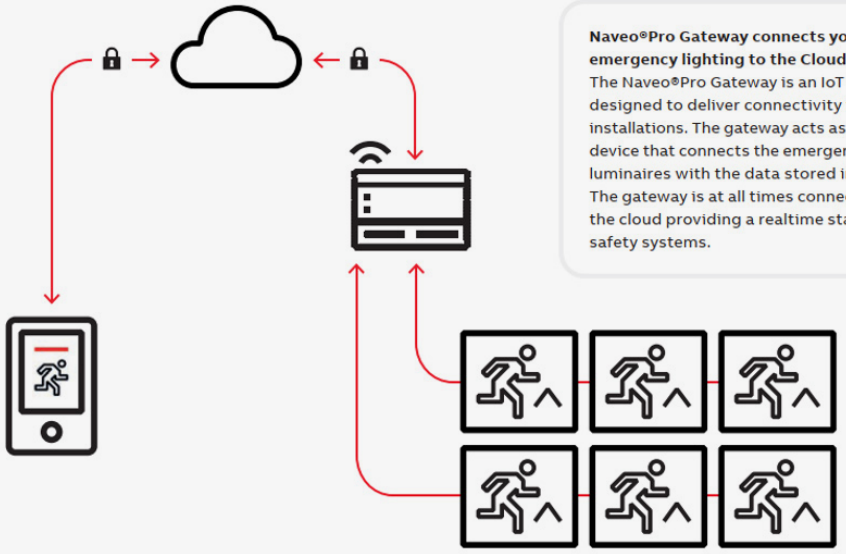
Naveo®Pro ensures to maintain and record the health status of emergency lighting in all types of buildings. Naveo®Pro is a way to install, monitor and maintain emergency lighting systems with the mobile device. The system provides a digital overview via the cloud, giving instant information to assist resource planning and enhance building safety.
Emergency luminaires can be easily installed and programmed into a building in a fast and intuitive way, offering various functionalities to reduce time and costs on inspection and maintenance.
Being part of the ABB Ability™ platform, this solution offers uncompromised cybersecurity and allows secure integration of data that enables key benefits for all users of the system.



Emergency Lighting
DALI Emergency Lighting (Europe)

Naveo®Pro Gateway

Naveo®Pro being connected all the time, your emergency lighting system is always fully up to date. You can easily set up the connection. The Gateway continuously receives all luminaires data and pushes this information to the Naveo®Pro app.
On continuous request from the cloud the Gateway automatically sends all (test) data to the Naveo®Pro app. With Naveo®Pro you are therefore constantly in touch with your system status anytime and anywhere.



Naveo®Pro Gateway connects your emergency lighting to the Cloud
The Naveo®Pro Gateway is an IoT Gateway designed to deliver connectivity to all types of installations. The gateway acts as a networking device that connects the emergency lighting luminaires with the data stored in the cloud. The gateway is at all times connected to the cloud providing a realtime status of your safety systems.

02 The Naveo®Pro Gateway.

03 ABB offers an extensive range of compatible luminaires.

02

03

Naveo®Pro system components

Order Code	Description
51000040	Naveo®Pro GW 1.0
758740	Naveo®Pro Gateway mounting plate
51000041	Naveo®Pro GW 1.0 wired and iPad wifi
51000042	Naveo®Pro GW 1.0 wired and iPad cell
758730	Naveo®Pro antenna 5 GHZ wifi

Extensive range of compatible luminaires
ABB offers a broad range of lumininaires which are compatible with the Gateway and can enable your system to join the internet of things with all the benefits that an app and the Cloud can bring.

Emergency Lighting
DALI Emergency Lighting (Europe)

DALI Control Unit (DCU)

- Ensuring building occupant saferty
- Touch screen to control, test and monitor emergency lightning
- Simple to group and easy to install

Escape Route Lights

- Compatible with DALI control unit to control, test and monitoring emergency lighting
- Injection moulded - high grade polycarbonate body ang geartray of aluminium die cast
- Specially designed lens for optimised light distribution
- Modular, First-Fix installation

Emergency Lighting
EML-Central Battery (UK, MEA)

Reducing your total cost of inspection & maintenance
In addition to our portfolio of dedicated emergency lighting products, we offer a comprehensive range of central power supply systems that offer advantages for specific building types where inspection & maintenance time is critical and needs to be minimized.

With our central power supply system's, we offer reliable and high-quality products for AC/AC applications with advanced commissioning and testing functionality for easy operation

Static Inverter Systems (AC/AC)
Static Inverter Systems (AC/AC) Static inverter systems operate in a similar manner to AC/DC Central Power Supply Systems, with the exception that the system constantly gives a 230V AC output.
The advantages of this approach are numerous. Firstly, luminaires do not need to be converted, as any slave 230V luminaire can be used (there are some restrictions to this on the grounds of suitability for emergency lighting). Luminaires also operate at full light output, as they are being fed from a full mains voltage supply, meaning fewer luminaires are required for equivalent light outputs.

Advantages:
- Suitable for medium to large installations.
- Almost any luminaire may be used
- Easy to maintain • 10-to-25-year design life batteries
- Distribution is standard 230V AC (standard DBs)
- Reduced volt-drop problems on output cabling
- Luminaires operate at full light output • Ideal for modern LED lighting installations to capitalize on energy reduction

Constraints
- Bigger systems are physically large and may require a special battery room
- Smaller installations are ideal for EMEX mini-installations (See EMEX mini section for suitable solution)

Reference Projects:
- Riyadh metro - Saudi Arabia,
- Oman Hospital
- Doha Marriot Hotel – Qatar…

Product line Emergi-Lite

Emex Mini
Space saving & high performance central power supply system

Emex Power
Modular AC/AC central power supply system

Emex 110
110 volt AC/AC power supply system

Emel
110, 50 & 24 volt AC/DC central power supply system

Emex Test
Introduction

Guideway Serenga Weatherforce Navigator compact

Serenga 2

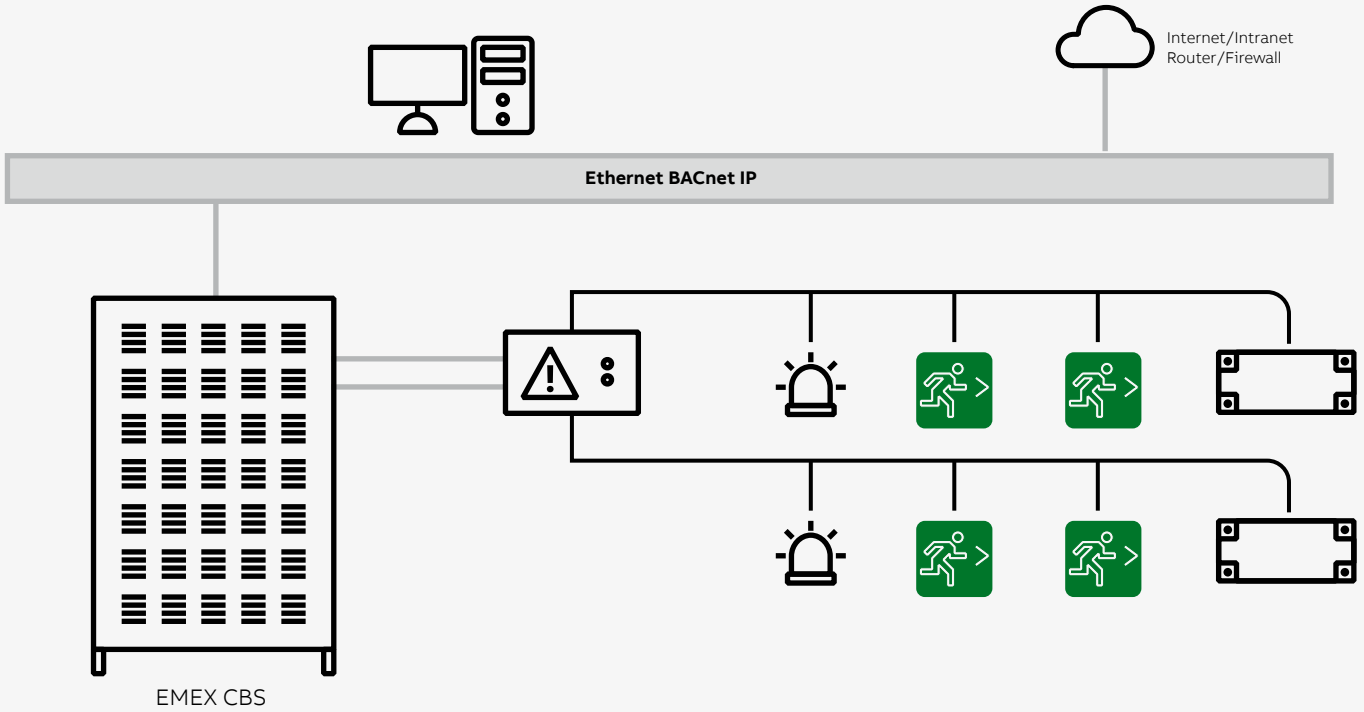
Hy-LED

Silver-Scape Weatherforce

Cordona Camarque

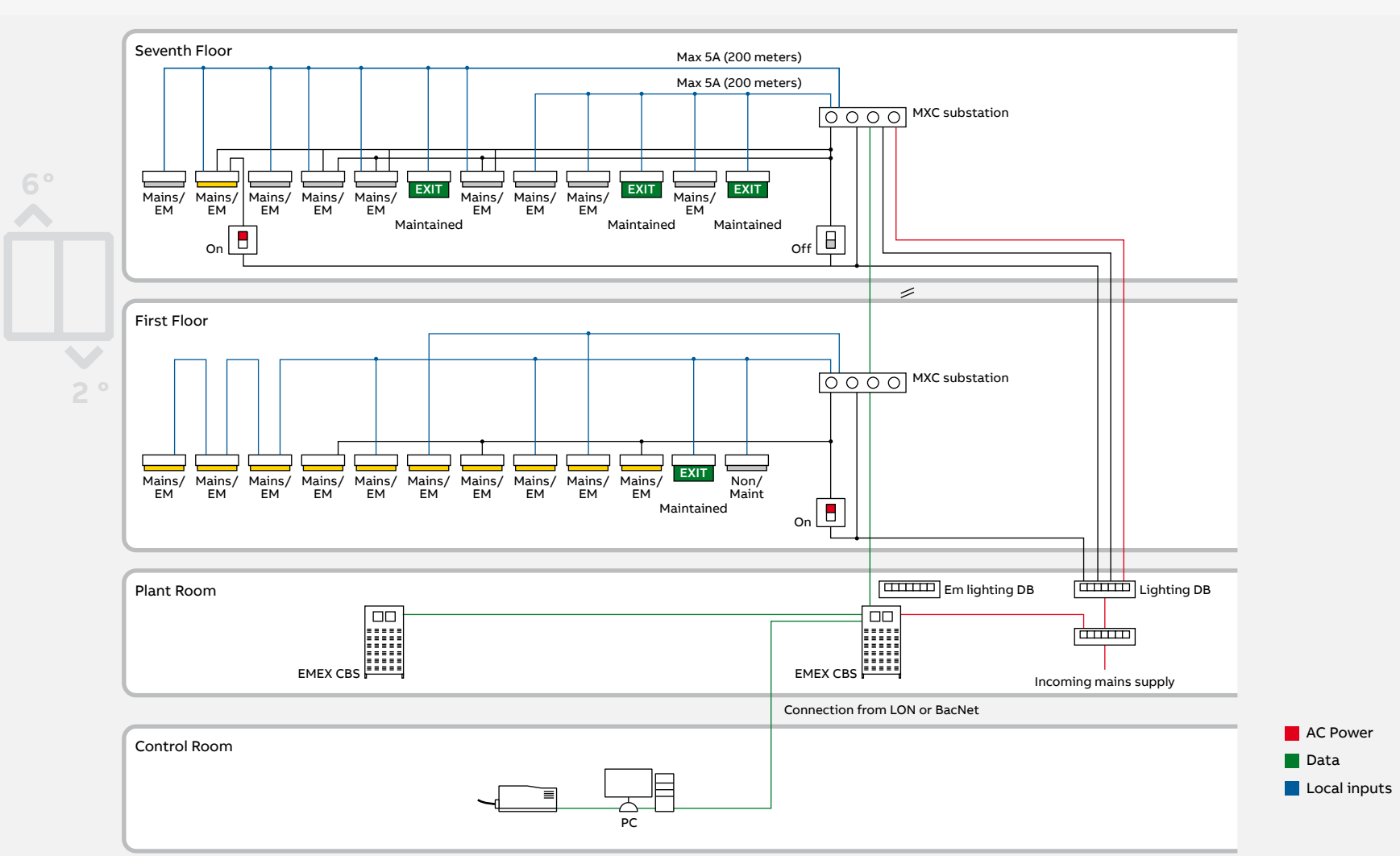
Emergency Lighting
EML-Central Battery (UK, MEA)

Reference Architecture



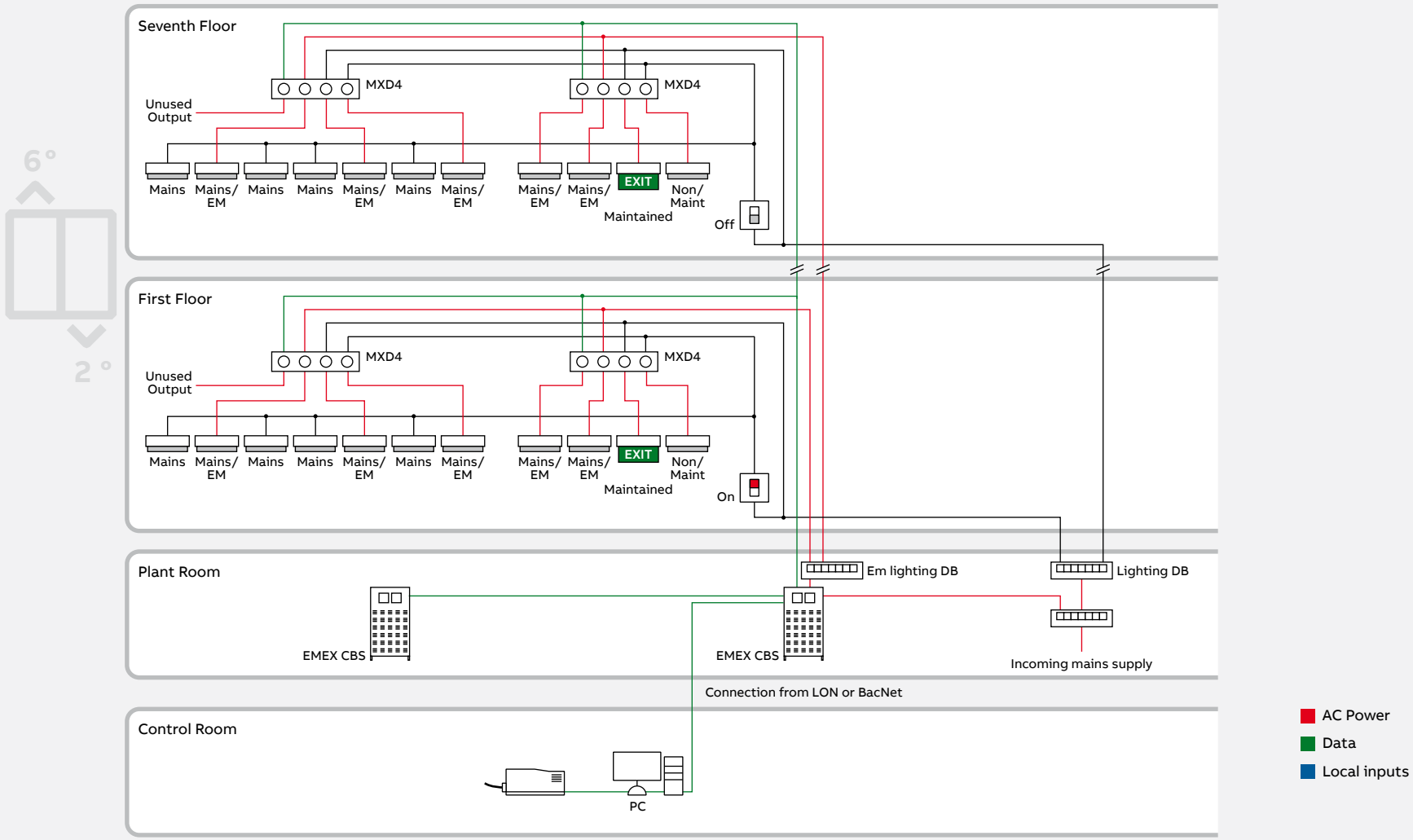
Emergency Lighting
EML-Central Battery (UK, MEA)

Layout schematic - MXD4 substations



Emergency Lighting
EML-Central Battery (UK, MEA)

Layout schematic - MXC substations



Emergency Lighting
Nexus®Pro (USA and Canada)

Building owners or managers cannot afford uncertainty when it comes to their building safety including their emergency lighting fixtures that need to be working properly so that people can easily be guided out to safety in case of an emergency evacuation. With the Nexus®Pro system, you can concentrate on what matters: letting your smart emergency lighting system manage itself and reduce monitoring and testing times. This will quickly reduce maintenance costs, allowing you to focus on problems quickly and as they happen right from your smart device.

Safety and protection
Reduce human error while enhancing safety for all building occupants by meeting code and compliance and 24/7 monitoring.

Cost-saving
Simple, user-friendly app makes emergency lighting management easier and more efficient while reducing maintenance costs.

Robust cybersecurity
Wireless ABB Gateway keeps fixtures secure with Bluetooth mesh technology to exchange data between emergency lighting devices.

Remote monitoring
Designed to easily maintain and test emergency lighting right from your smart phone, without the need to visually verify performance or disrupt the power supply.

Scalable and flexible
Gateway can establish a secure wireless connection with up to 200 units. Available offering for institutional, architectural, healthcare and industrial applications.

Nexus®Pro Value proposition:

Set-Up
Easily install and add new devices on your building through a or map

Maintain
Defective devices are automatically and reported on your interface in addiction to push notifications

Test
Run test instancly or program them to ensure that all your devices are working property

Share
Easily share the results of tests with team members, maintenance staff and technicians

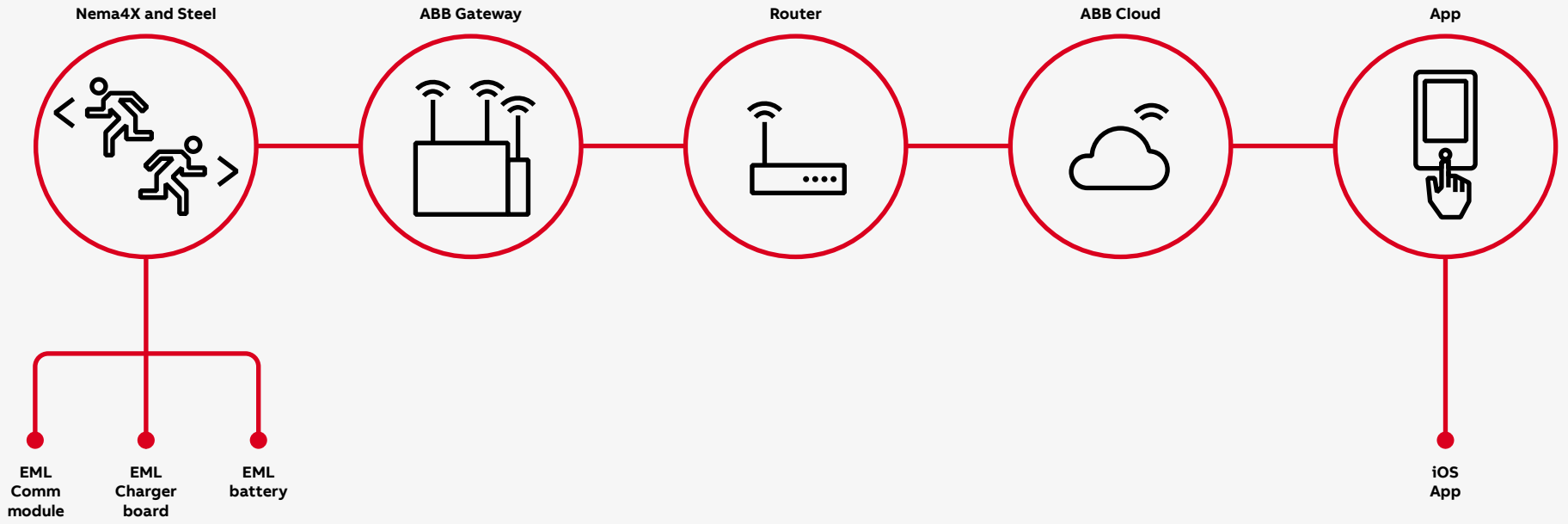
2d floorplans make it easier to find emergency lighting devices that are not functioning

Schedule tests in advance and get reports sent straight to your smart devices

Get push notifications sent to your smart device when malfunctions

Emergency Lighting
Nexus®Pro (USA and Canada)

Reference Architecture



Emergency Lighting
Nexus®Pro (USA and Canada)

Nexus Pro Gateway

IoT Gateway designed to deliver Bluetooth® Mesh connectivity Gateway can be connected wired or wirelessly to WiFi Routers.

Nexus Pro Luminaries

Nexus®Pro is compatible with various emergency lighting devices. Based on the type of environment, you can select the right device for your application. Each device is equipped to act as a node in the Bluetooth mesh network.

Central System

Provide emergency power for multiple lighting units at a remote distance meeting the unique needs of emergency lighting loads with a high-efficiency pure sine wave inverter. Additionally minimizes maintenance and automates code compliance with optional advanced diagnostics and NEXUS® wired and wireless central monitoring system compatibility.

Emergency Lighting
Bill of Materials

The bill of material for all luminaires and required accessories in the reference architecture is sum-marized in the following table:

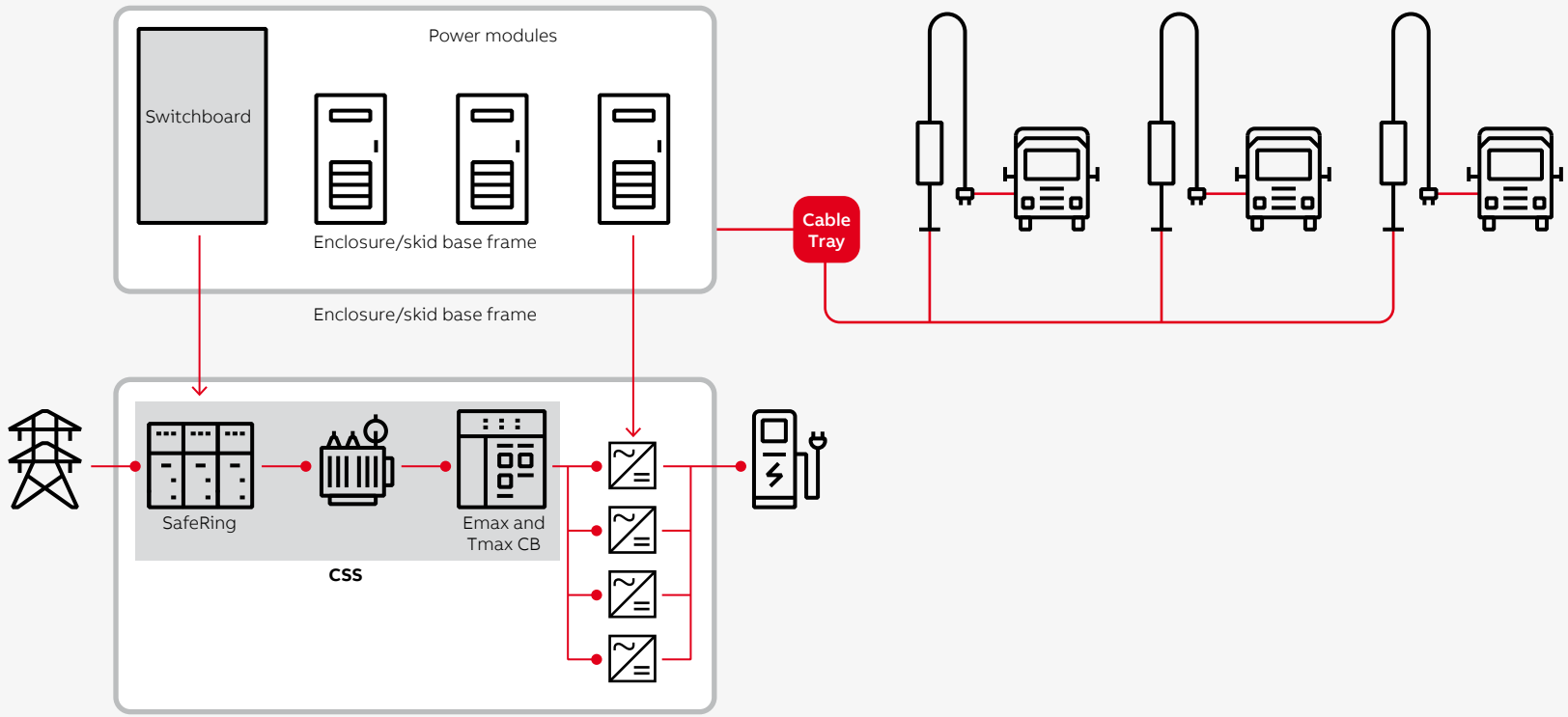
Purpose	Type	Order Code	Description
Central Power System	C1E. C2E, DE, NE, EXT BE, EXT FE	ELD9310.060X	EMEX Power 6KVA 5100W 3 Hour Single Phase In/ Out.
Central Power System		ELD9310.060B	Battery Kit for The Above System
Commissioning (1 Central Power Systems and 309 Luminaires)		UK-EML-COMM (7TCA308010R0026)	Commissioning Days
		UK-EML-O/N (7TCA308010R0031)	Commissioning Overnight
		UK-EML-TRAV1 (7TCA308010R0029)	Travel 1
EMEX Test Components		ELD9500.030	MXC Addressable Sub-Station, 2 x 5A Outputs
		C-LTC70HF	Integral LTC Addressable Interface 13 – 70W, Conversion by ABB
		C-LTC70HFRW	Remote LTC Addressable Interface 13 – 70W, Conversion by ABB
		C-LTC230HF	Integral LTC Addressable Interface 230W, Conversion by ABB
		C-LTC230HFRW	Remote LTC Addressable Interface 230W, Conversion by ABB
Slave & LTC Emergency Luminaires	EXIT (IP65)	OW1L261LTC	Aqualux 230v AC IP65 EMEX Test Surface
	EXIT (IP65)	XEN2W	Aqualux ISO7010 Format Arrow Down Legend
	EXIT	EG1LS1LTC-S22	Guideway 230v AC 22M IP40 EMEX Test Surface/ Wall
	EXIT	XEN2EG22	Guideway ISO7010 Format Arrow Down Legend
	EXIT	XEN5EG22	Guideway ISO7010 Format Arrow Up Legend
	EXIT	XEN3EG22	Guideway ISO7010 Format Arrow Left Legend
	EXIT	XEN6EG22	Guideway ISO7010 Format Arrow Right Legend
	EAR	SR2-DAD-230LT	Serenga 2 230v AC Open Area IP42 EMEX Test Recess
	EER	SR2-DEA-230LT	Serenga 2 230v AC Escape Route IP42 EMEX Test Recess
	EAS	SR2-SA230LT-D1	Serenga 2 230v AC Open Area IP54 EMEX Test Surface
	EES	SR2-SE230LT-A1	Serenga 2 230v AC Escape Route IP54 EMEX Test Surface

EV Charging

An electric vehicle charging service is an opportunity to add value to retail and mall buildings and contribute to sustainable mobility.
ABB charging infrastructures can offer an efficient solution at all levels, for both short- and long-term stays.

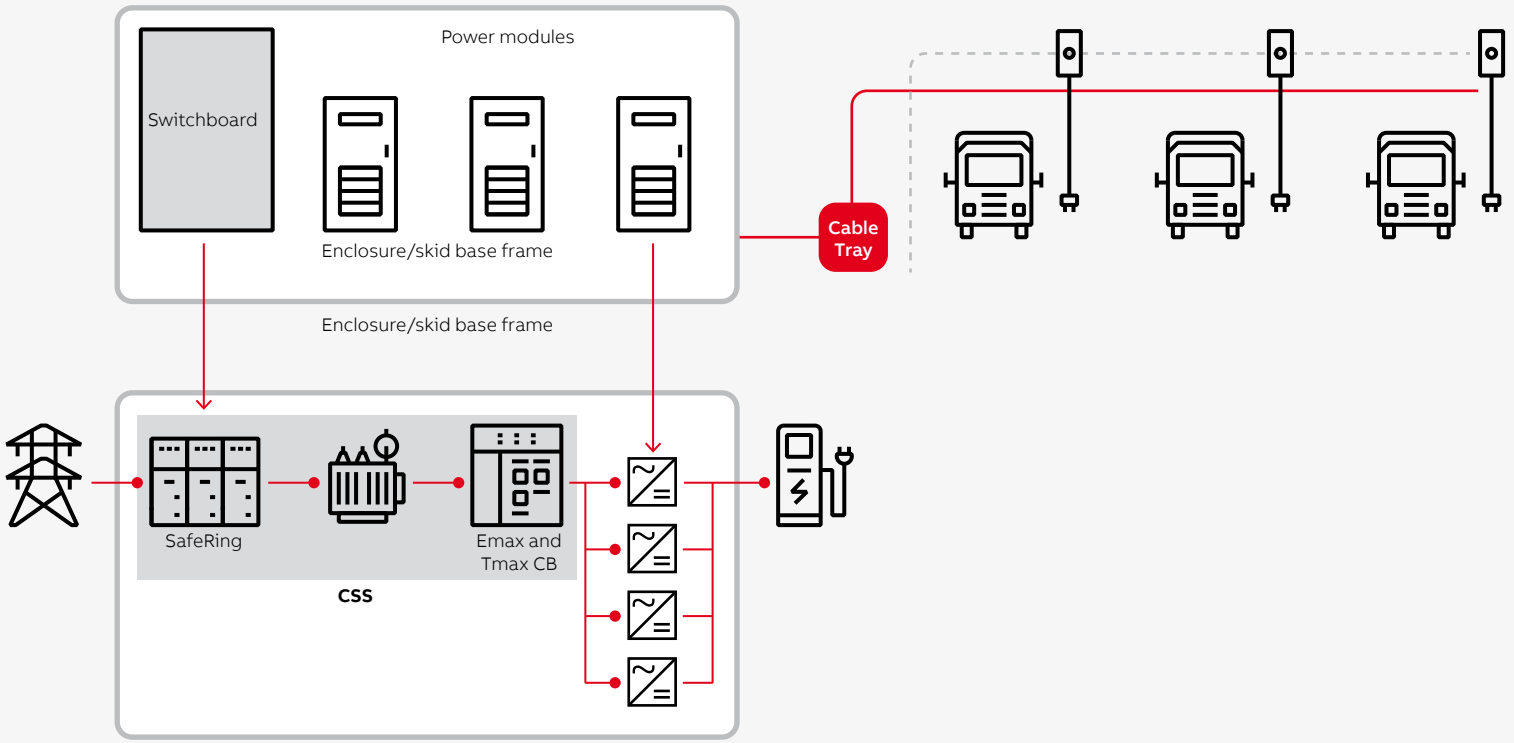
EV Charging

CSS with HVC depot box -Pedestal mounting



EV Charging

CSS with HVC depot box -Wall mounting



EV Charging
TERRA 94 /124/184 DC fast charger

The Terra chargers can provide a quick "refill" adding 100 km (62 mi) of range in as little as 15 minutes (Terra 94).

Terra 124 and Terra 184 charger can provide a full charge to two vehicles simultaneously while shopping or dining plus a third vehicle via the AC outlet (CE models).

The Terra 124 and Tera 184 charger can provide a full battery charge to two vehicles simultaneously while drivers are shopping, dining or at the movies. Supports all open charging standards in flexible configurations Safety certified to the highest standard

one EV up to **120 kW**

two EVs each up to **60 kW**

CONNECTED by cellular modem for 24/7 remote services, receiving updates over-the-air to support every new EV on the road - plus easy remote OCPP integration.

COMPACT power modules to support increasing demand from more EVs with bigger batteries - in a very easy to service package.

LCD touchscreen with high brightness and graphical visualization of the charging process

ROBUST all-weather powder-coated stainless steel enclosure

SAFETY: Emergency stop push button to immediately stop charging operation

CONVENIENCE and hassle-free reach for users – with retractable cable management option

GREATER revenue potential with simultaneous charging for 2 electric vehicles, including CCS and CHAdeMO combinations

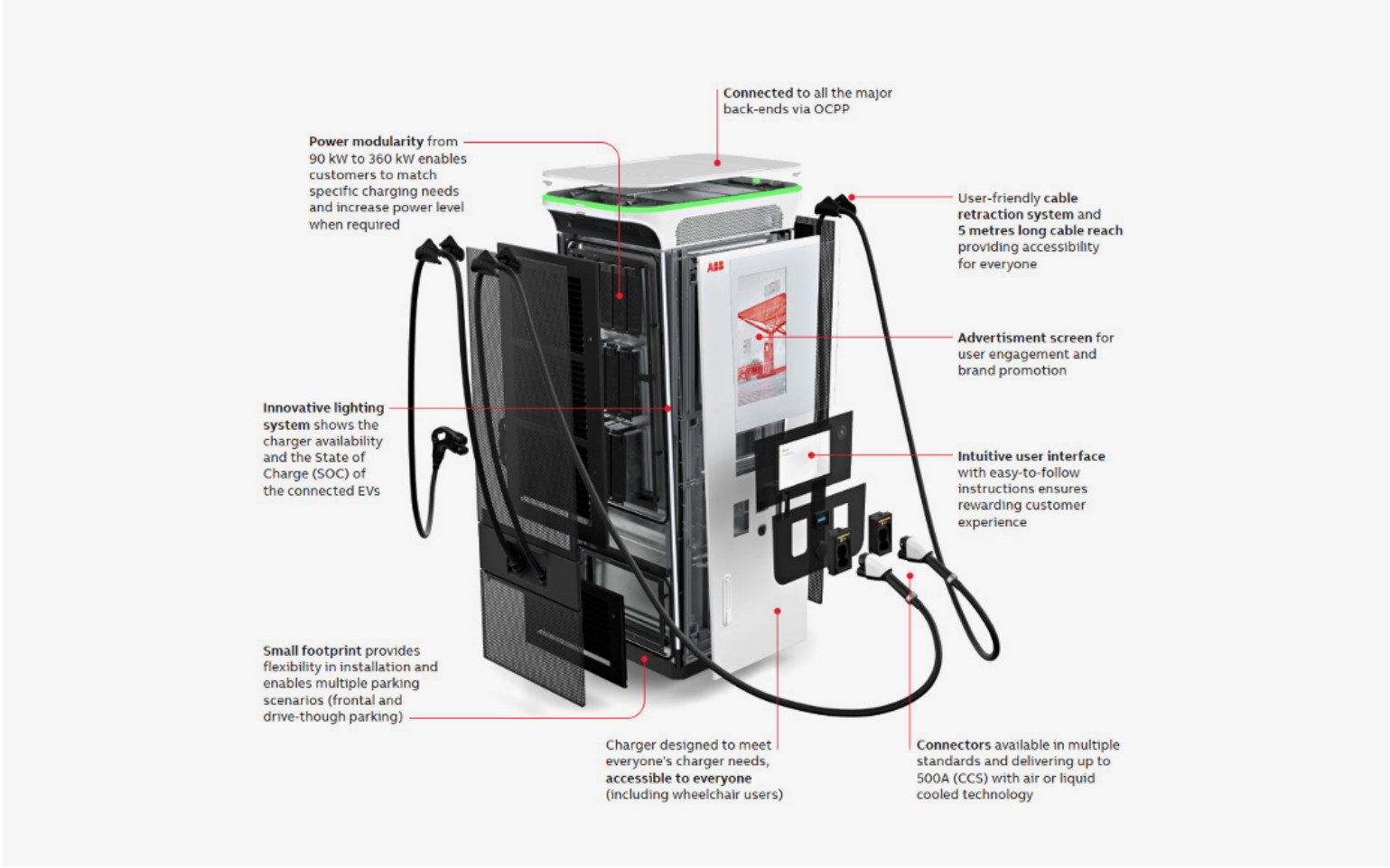
EASY installation design with fast remote commissioning and start-up

AUTOMATIC authentication capability via CCS connector in the vehicle thanks to easy OCPP integration and Autocharge functionality

EV Charging
TERRA 360

Terra 360’s unique design enables easy frontal parking and charging, ideal for factories and industries.

Its compact footprint makes the Terra 360 a perfect fit for curbside charging. Terra 360 can serve up to four users at the same time, depending on the parking layout. Terra 360’s distinctive design provides customization options for easy integration of your own brand identity.



EV Charging
TERRA AC Wallbox

Terra AC wall box enables a slow charging perfect for employee cars.

The Terra wallbox can be connected to the internet via GSM, WiFi or LAN for perfect integration into smart building system and configuration via app. Simplified authentication via either RFID or App provides flexibility for public-use case applications.

Protection and safety of power supply are ensured by System Pro M compact protection devices and OT switches. Consumptions are kept under control thanks to Insite Pro M and energy meters that perfectly integrates into ABB Ability Energy and Asset Manager. For what concern status and consumption of eV chargers, an intuitive overview is available on website.

Explore the technical features of the Terra AC wallbox

Load management

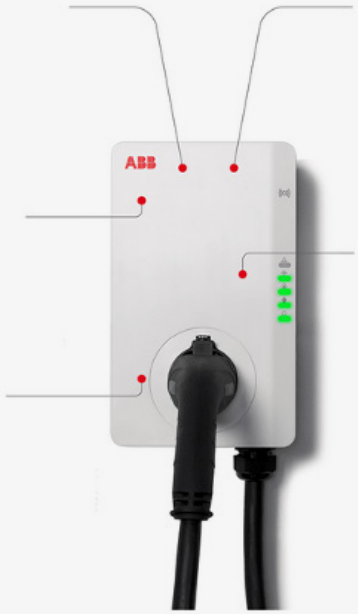
- Build-in energy meter
- Set up for external energy meter integration for dynamic load management
- Ready for integration with advanced smart building energy system

Built-in safety

- Overcurrent
- Overvoltage and undervoltage
- Ground fault
- Surge protection
- PE (protective earth) continuity monitoring

Connectors

- Type 1 and type 2 cable
- Type 2 socket with or without shutter
- No need of extra hook, attached cable can be wrapped around the charger



Design

- IEC variants:
  - Single phase up to 7.4 kW / 32A
  - Three phase up to 22 kW / 32 A
- UL variants up to 19 kW / 80 A
- NEMA 3 enclosure
- All variants: IP54, IK10

Connectivity

- Ethernet RJ45
- Bluetooth
- Wifi
- 4G variants
- RS485 for connection to energy meter
- OCPP 1.6
- Authentication via ChargerSync™ app and portal or RFID
- Configuration through TerraConfig app and portal

EV Charging
TERRA DC Wallbox

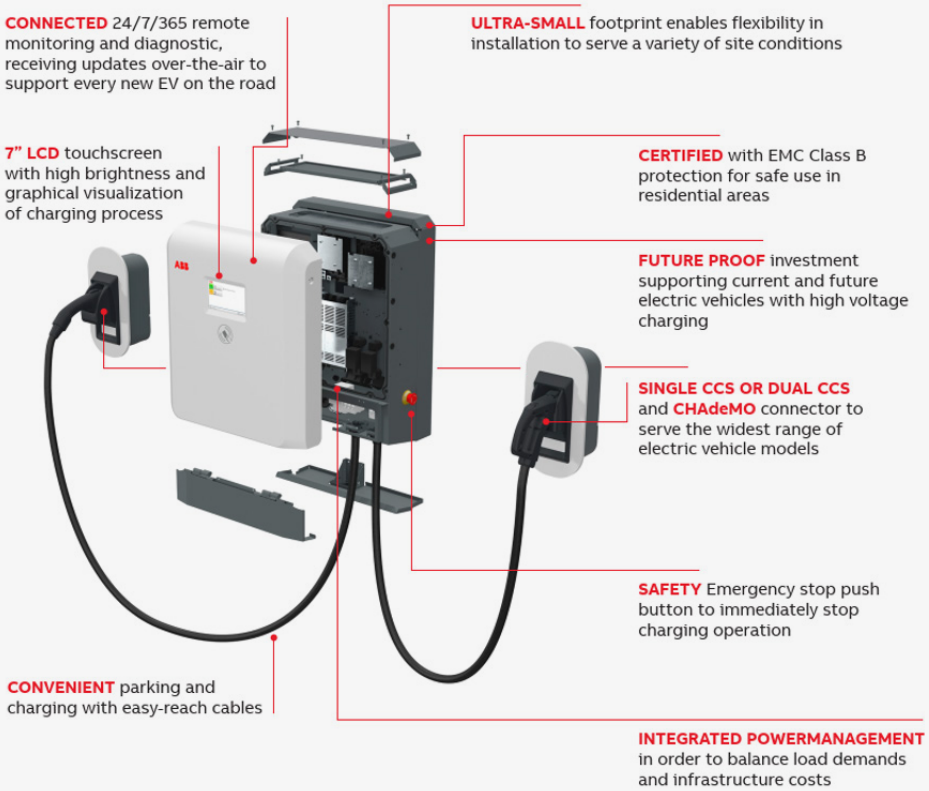
Destination DC offers a faster charging level than what AC chargers can typically achieve, but has a lower power, footprint, installation and investment cost than higher power DC fast charging systems often seen around metro regions and across highways.

Destination DC chargers usually offer 20-24kW in power rating, which falls efficiently between the typical 7-11kW charging power delivered by an AC charger yet below the 50kW to 350kW provided by public DC fast charging stations.

Terra DC wallbox is a futureproof investment supporting current and future EVs with high voltage charging, applicable to a wide variety of use cases, in an ultra-compact footprint, that is safe and reliable.

Main benefit

- Futureproof investment supporting current and future EVs with high voltage charging
- Space-savings with easy-to-install design
- Broad range of connectivity options
- Remote software updates



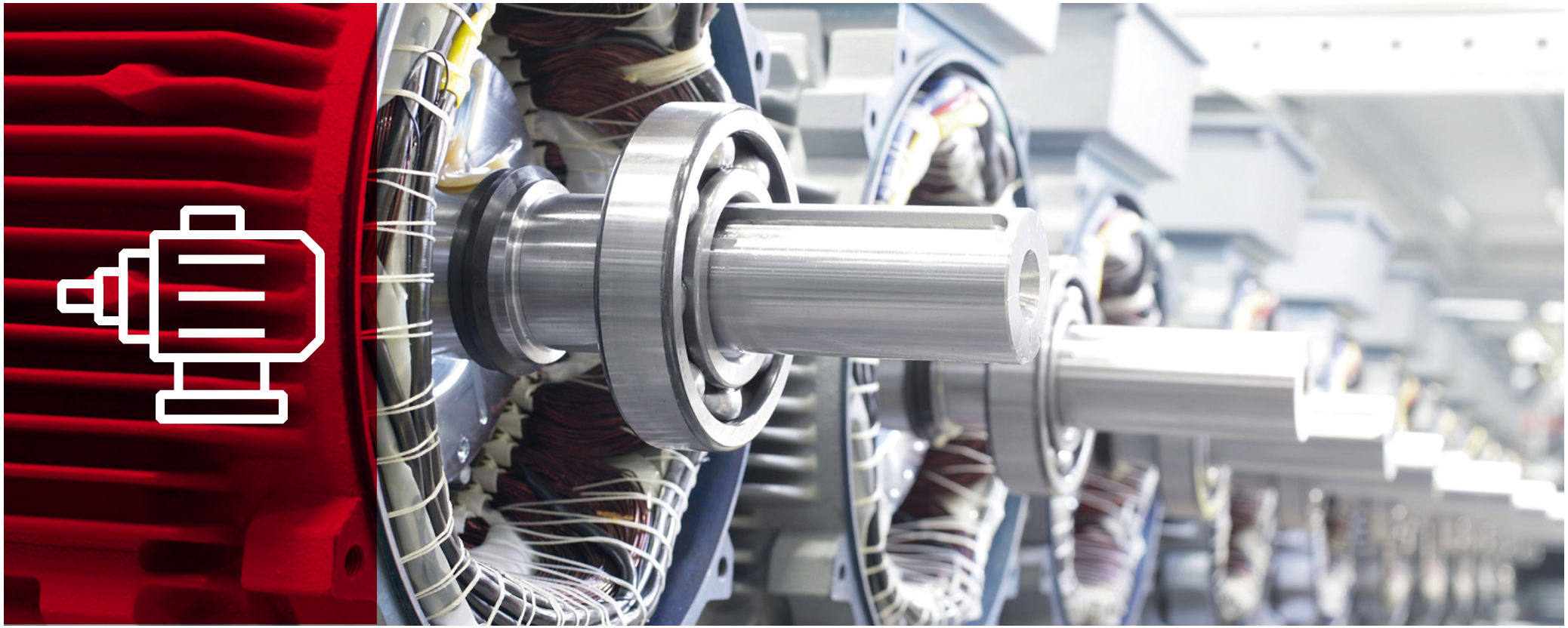
EV Charging
Bill of Materials

The bill of material for all luminaires and required accessories in the reference architecture is sum-marized in the following table:

Order Code	Part Number	Description
Hardware / Equipment		
6AGC105896	TAC-W11-G5-RD-MC-0	Terra AC wallbox type 2, 5 m cable, 3-phase/16 A, MID certi-fied, with RFID, display and 4G
6AGC102584	TWB CE 24 C 7T-7M-0-0	Mobile cart Terra DC Wallbox CE 24 kWp, 3 phase, CCS, 7 m cable, EMC Class B + Mobile cart, CE
6AGC077781	Terra CE 54 HV CJT 0-7M-0-0	Terra 54 HV
6AGC080806	Terra CE 94 CJT 4N4-7M-H-0	Terra 94 Charger
6AGC085487	Terra CE 124 CJT 6N4-7M-H-0	Terra 124 HC
6AGC085490	Terra CE 184 CJT 4N4-7M-H-0	Terra 184 HC
2CGD000366A1000	SDCS 63026	Distributon Board Items
2CGX063300549	MARK-S 73	Distributon Board Items
2CGX063050109	SLD 2	Distributon Board Items
2CGD000502A1000	ADU 300	Distributon Board Items
6AGC069024	HVC DCB CE Pedestal	Depot charge box
6AGC069251	HVC C Sequential Charge	Depot charge box
Annual Services - Connected Services		
"Driver Care 4EPY450059R1"		Web tool to view charger status, user access control via PIN/RFID, data reporting, case management
6AGC064781		Charger Connect (first year)
		Includes GSM connectivity, live software updates and 24/7 NOC monitoring
Other Services		
Project – EVCI		Engineering - Commissioning (Hourly Rate)
Connected Services		
4EPY450046R1		OCPP Integration - One time fee

Motor & Variable Speed Drives

ABB drives are flexible to optimize all processes and control, and reliable for less downtime.
Applications such as air handlers, water pumps, cooling towers and chillers - all use electric motors that ABB variable speed drives (VFD) for HVAC, which ensure they run in the most efficient and reliable manner.



Motor & Variable Speed Drives

Overview - Motivation & Key Elements

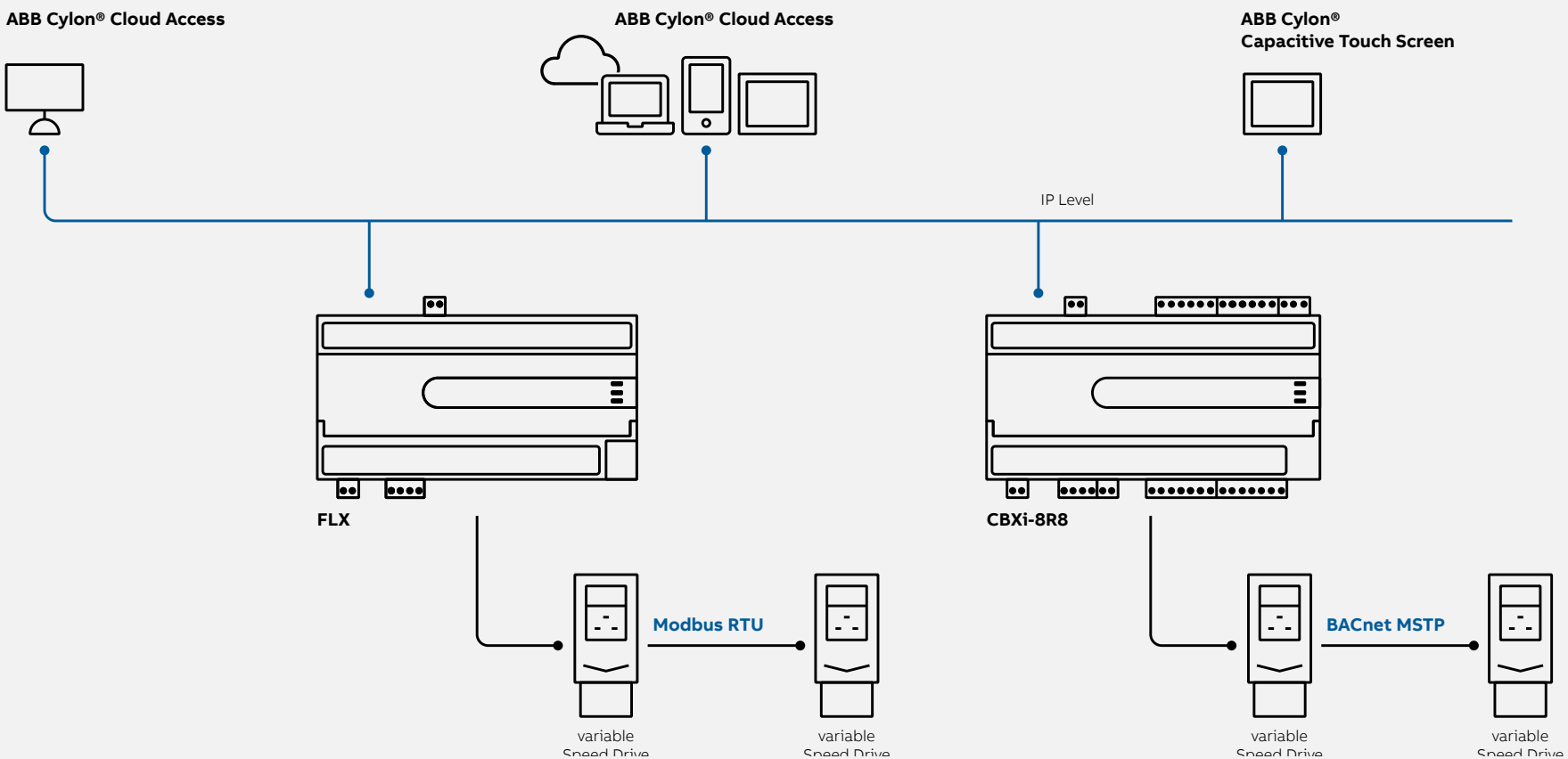
ABB's variable speed drives for HVAC help save on average 20 to 60% of energy. Receiving the information from (Cylon) controllers /temperature, humidity or CO_2 sensors, they adjust the motor speed of fans, pumps and compressors to a current building need.

- Comfort of the occupants vital for hospitality segment
- Healthy environment thanks to supplying fresh air and keeping CO_2 concentration low
- Reduced fan motor noise and resonance control for increased comfort
- Smooth start/stop of HVAC applications to reduce mechanical and electrical stress of the equipment to increase its lifetime and ensure HVAC process continuity
- Filter clogging detection to ensure fresh air and avoid extra energy losses in the system
- Application performance monitoring to alarm about possible upcoming failure so preventive measures could be taken
- Seamless integration into any BMS with extensive support of all common building automation protocols including Modbus and BACnet

Fireman's override feature making ventilation appications ignore faults and warnings during emergency and run until distruction ensuring smoke extraction and evaquation route maintenance as long as possible for the hotel occupants' highest safety

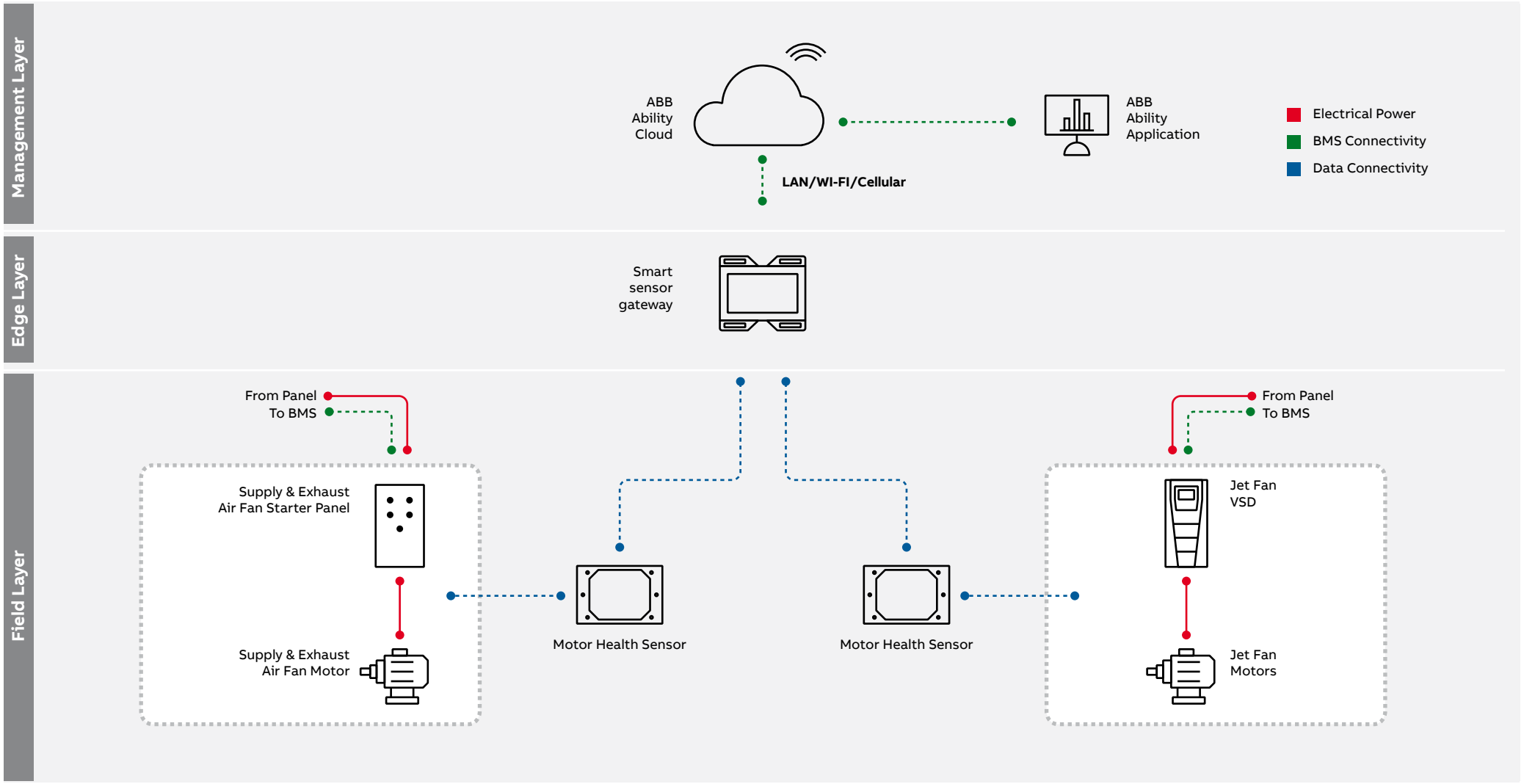
Motor & Variable Speed Drives

Reference Architecture



Motor & Variable Speed Drives
Motor and Pumps

Reference Architecture with Smart Sensors and VFD



Motor & Variable Speed Drives

ABB motors run applications in shopping malls and retail stores – like HVAC, refrigeration, water supply or elevators – reliably and efficiently offering up to IE5 energy efficiency class in the portfolio. ABB drives are flexible to optimize the reliability and efficiency further adjusting the application speed based on the store need and saving massive amounts of energy.

HVAC Drives

Shopping malls and food stores often host large groups of visitors meaning the safe as well as comfortable environment is crucial. At the same time, to operate commercial buildings efficiently and decrease the carbon footprint, high efficiency solutions should be applied.
It is well known, that about 50% of energy consumed by an average commercial building is used in HVAC. In food retail stores, over 50% of energy can go for refrigeration. So, making HVACR systems efficient is a priority.
ABB's variable speed drives help save on average 20 to 60% of energy in HVAC and refrigeration. Receiving the information from Cylon controllers or temperature, humidity and CO2 sensors directly, they adjust the motor speed of fans, pumps and compressors to a current store building need, making the environment comfortable and keeping food fresh, while saving energy.

Drive-based filter clogging detection ensures fresh air and limits the spread of airborne deceases in shopping malls.
Should a fire emergency occur, HVAC drives will act as part of fire suppression system cutting fresh air supply to the areas on fire, while extracting smoke and maintaining evacuation routes. Drive's Override mode allows to run the fans as long as possible ignoring faults and warning like overtemperature.

Multi pump or multi compressor control ensure efficient energy use in water supply and refrigeration. Drives start additional units as the load increases and run those as close to the best efficiency point as possible to maximize food retail store or shopping mall energy savings.

ABB Ability TM condition monitoring digital services increase the system reliability further allowing to track the equipment performance remotely and alarm about the upcoming failures before they occur, so predictive maintenance actions could be taken, and maintenance costs optimized.

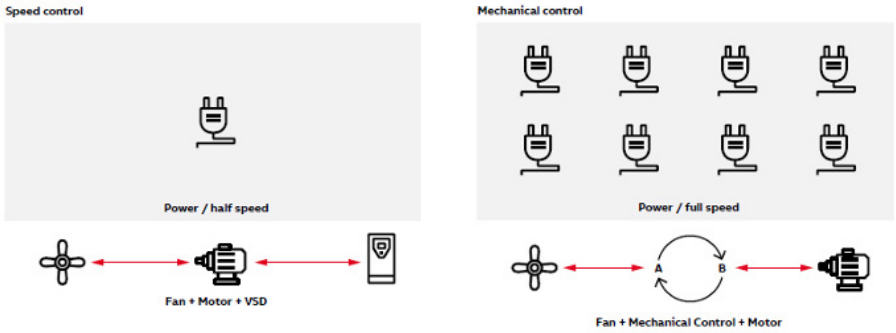
ABB's ultra-low harmonic drives take a special care of power quality in store buildings, reducing power network disturbances to a minimum. This makes building power network reliable and allows to optimize electrical equipment size and go with smaller generators, transformers, switchgears and so on.

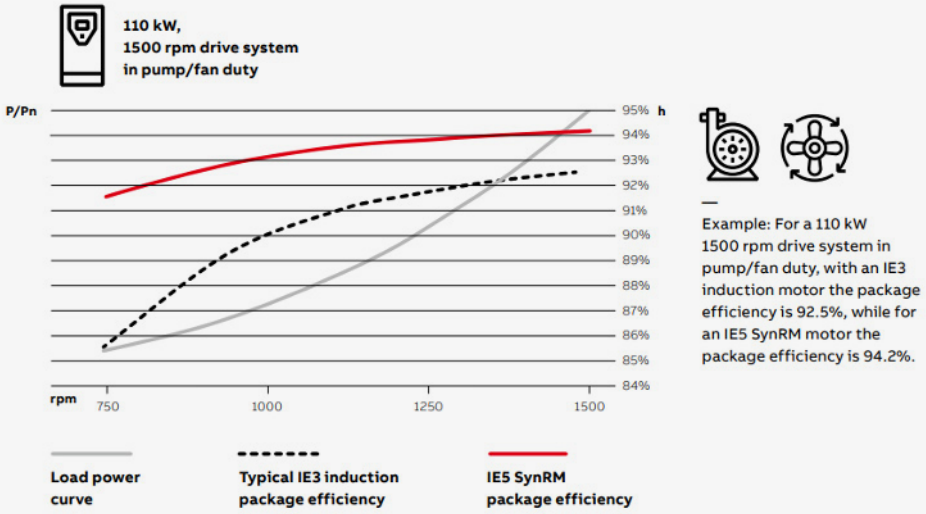
Seamless drive integration into any BMS is possible with extensive support of all common building automation protocols including Modbus and BACnet

Motor & Variable Speed Drives

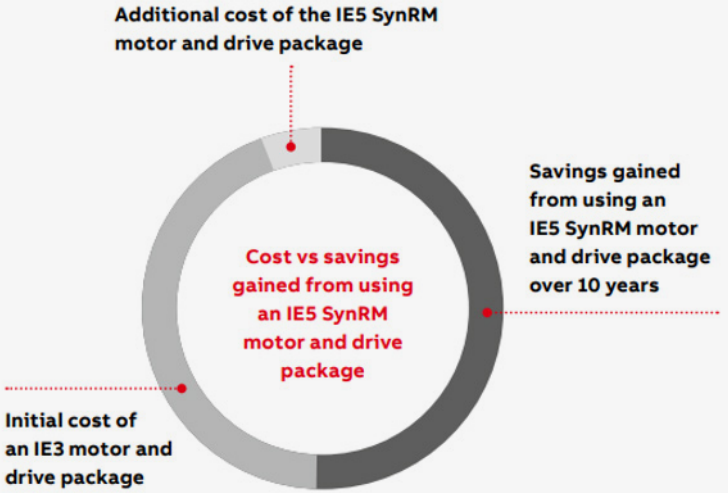
Motor Technology

Motor technology chosen for store building applications plays a big role as well. The optimal companion to variable speed drive is a high efficiency motor like ABB's IE5 synchronous reluctance motor (SynRM).
Compared to an IE3 energy efficiency class induction motor, it offers up to 40 percent reduced energy losses. This makes SynRMs the new first choice to meet the growing global demand for improved energy efficiency.
Synchronous reluctance motors offer even higher project sustainability in comparison to other motor technologies thanks to no rare earth magnets in the motor design.
The reliability is also increased. SynRM technology offers up to 30°C lower winding temperatures and up to 15°C lower bearing temperatures, which prolongs the motor lifetime and reduces the need for maintenance.





Example: For a 110 kW 1500 rpm drive system in pump/fan duty, with an IE3 induction motor the package efficiency is 92.5%, while for an IE5 SynRM motor the package efficiency is 94.2%.



Motor & Variable Speed Drives

LV Regenerative Drives

ACS880 regenerative drives are a compact and complete regenerative drive solution, with everything you need for regenerative operation in cyclic or continuous braking applications. Such applications include cranes, elevators, centrifuges, downhill conveyers and test benches.

With regenerative functionality, the braking energy of the motor is returned to the drive and distributed to the supply network so that it can be utilized by other equipment. Everything needed for regenerative operation, such as active supply unit and LCL line filter are included in the drive. The active supply unit allows full power flow in both motoring and generating modes.

LV Motors for HVAC and Water Supply

Motors designed to meet the demands of HVACR and water supply applications. These applications include air supply and return fans, exhaust fans, air handling units, cooling and refrigeration compressors, heat pumps, water supply pumps, circulators and many more. Up to IE5 motor energy efficiency ensures energy savings.

Motor & Variable Speed Drives

Smoke extraction motors

In case of fire, dispersing the toxic fumes quickly and efficiently can be lifesaving.
It is therefore necessary to use specialized, certified smoke extraction motors for fans for special applications, like Strair ways. en-closed car parks etc.

Titanium Integrated Motor Drives

Integrated motor drive that combines synchronous reluctance and permanent magnet technologies for an IE5 efficient, sustainable, wirelessly connected compact solution that improves customers' bottom line while reducing installation effort.

Motor & Variable Speed Drives

Smart sensor for mounted bearing

ABB Ability Smart Sensor for mounted bearing is an easy-to-use, wireless sensor which monitors the health of your ABB Dodge mounted bearings, allowing users to reduce downtime, improve reliability and operate safely.

Changes in temperature and vibration can indicate potential problems in mounted bearings. Yet understanding the health of the bearing is usually overlooked, leaving problems unnoticed until the bearing fails. ABB now makes it easier and safer to know how your bearing feels

Smart sensor for motor

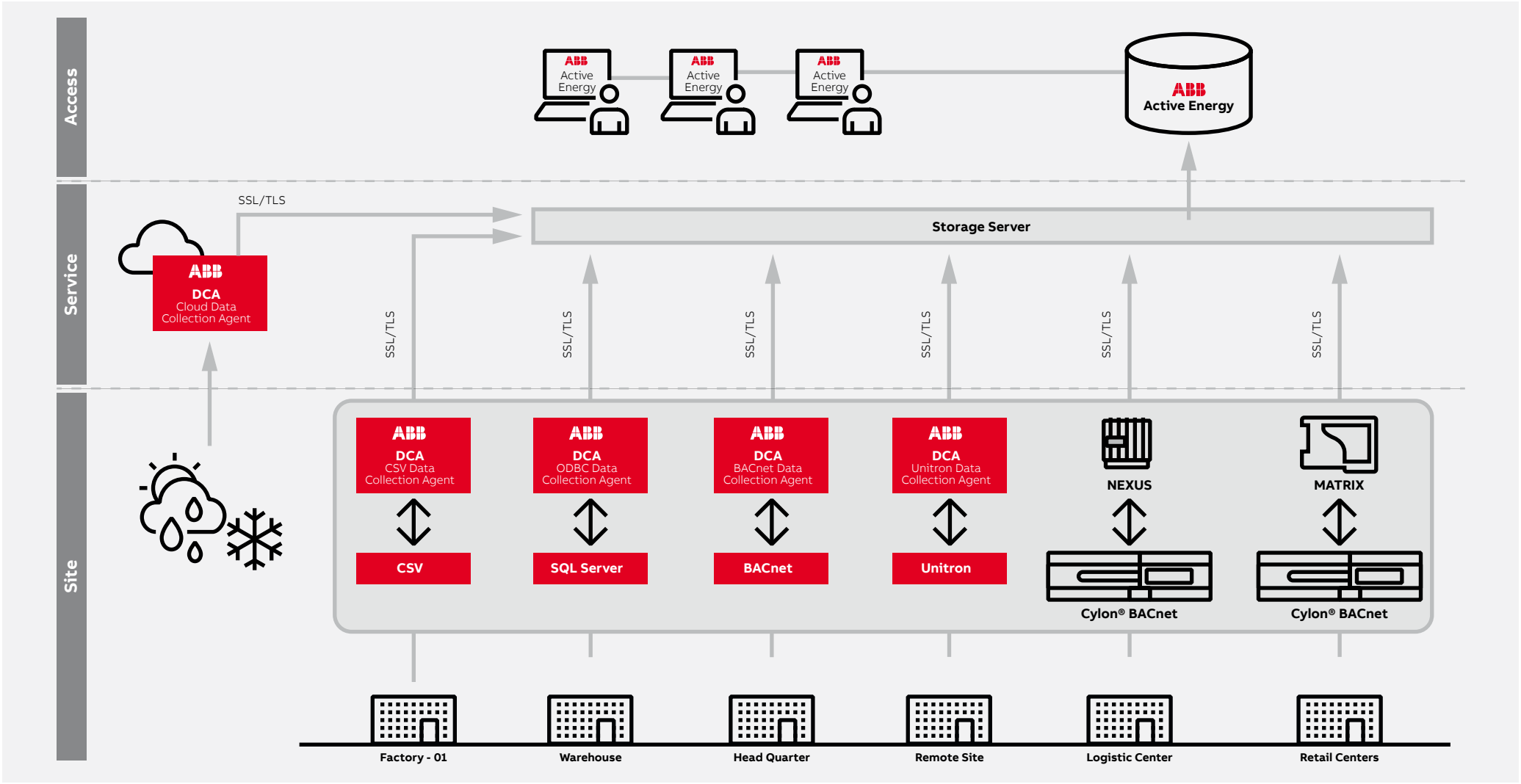
The ABB Ability Smart Sensor converts traditional motors into smart, wirelessly connected devices. It enables users to monitor the health of their motors and to plan maintenance in advance.
Unplanned downtime can be avoided, efficiency optimized, and safety improved.

Energy Management

The first and most important step in energy management is to understand your baseline energy consumption. This includes measuring consumption of electricity, natural gas, steam, water, etc., which will enable you to ascertain your building's energy profile and help understand the operational aspects and overall building energy requirements. ABB metering devices connect with the building automation system providing the ability to acquire, store and analyze your key area within your facility.

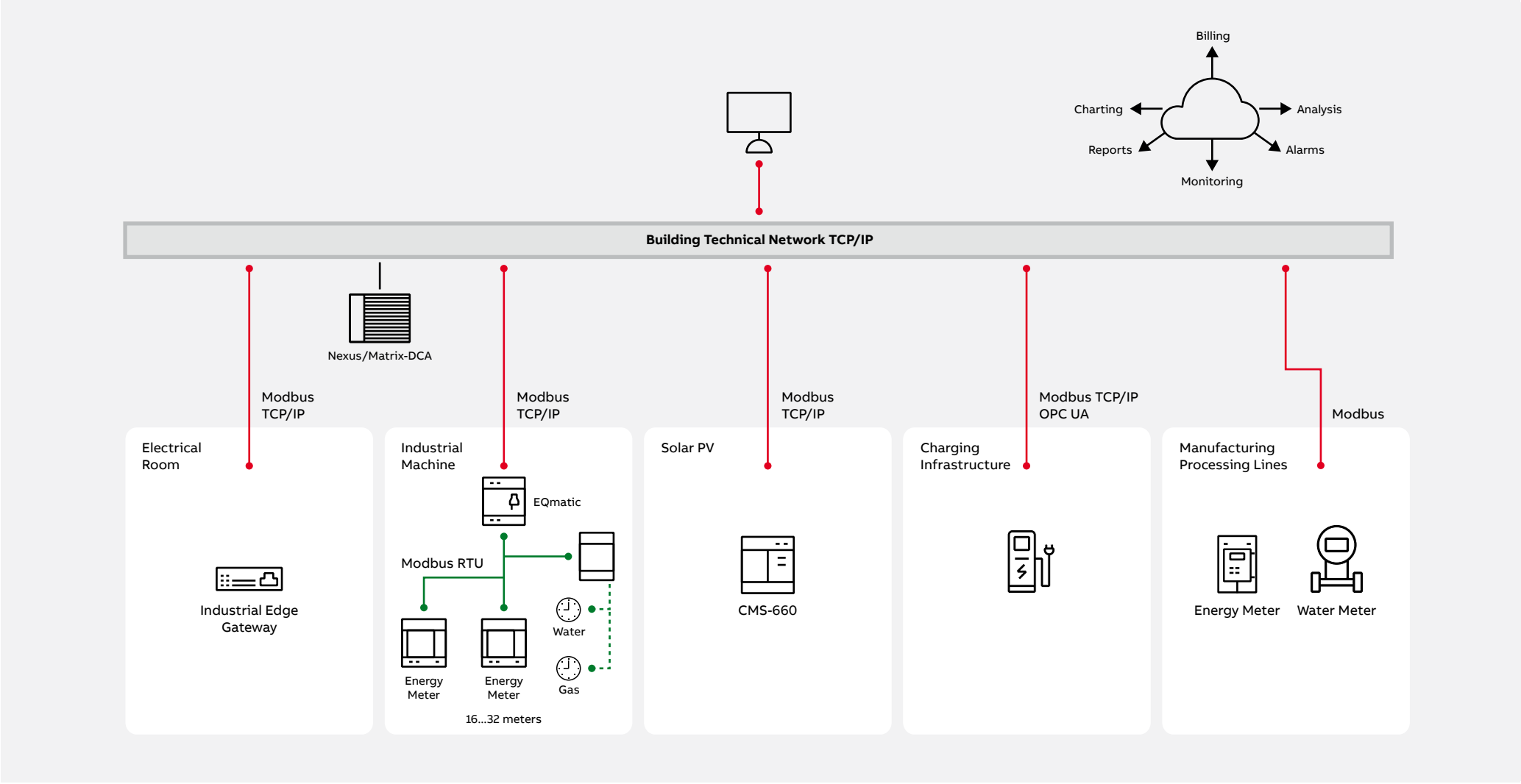
Energy Management
Active Energy Manager (for NAM)

Reference Architecture



Energy Management
Active Energy Manager (for NAM)

Reference Architecture



Energy Management
Active Energy Manager (for NAM)

Features of ABB Ability BE Sustainable with Active Energy

Analysis and charting
Analysis and charting show you how, where, and when you are consuming energy. Energy consumption data can be analyzed in several different ways from spectral analysis displays, regression analysis, actual versus target graphing, and more. Allows you to compare meters, view data by time period, calculate energy costs and carbon emissions, and more. Data can be exported to CSV and Excel for additional analysis and sharing

Charting:
- View real-time energy information in a day, week, month, year, and a custom view
- Compare time periods, meters, and export data

Analysis:
- View energy patterns using the Spectral Analysis tool
- Set targets based on driving factors or fixed parameters
- Compare actual versus target
- Access regression analysis, overspend, and custom charts
- Analyze energy consumption compared to a smart target for real-time energy management

Reports
A fully customized reporting feature allows you to generate instant or scheduled reports on energy consumption, costs, carbon emissions, performance versus targets, as well as tenant costs reports. Export reports in pdf format to share with key stakeholders.
Reports are an important tool for ongoing energy control by helping managers and key decision-makers keep track of energy-saving initiatives, verify if and where savings have been made, and when targets have been achieved.

Monitoring and Alarms
Alarms can be viewed via the map-based interface, particularly useful for a quick overview of multiple buildings in multiple locations for bureau or monitoring centers.
- Set, edit, and monitor alarms on-line
- Receive alarms by email

Reports anomalies detected in energy consumed versus expected consumption. Alarm reports can be issued via email. Analysis of historical alarms can help identify potential ongoing issues.

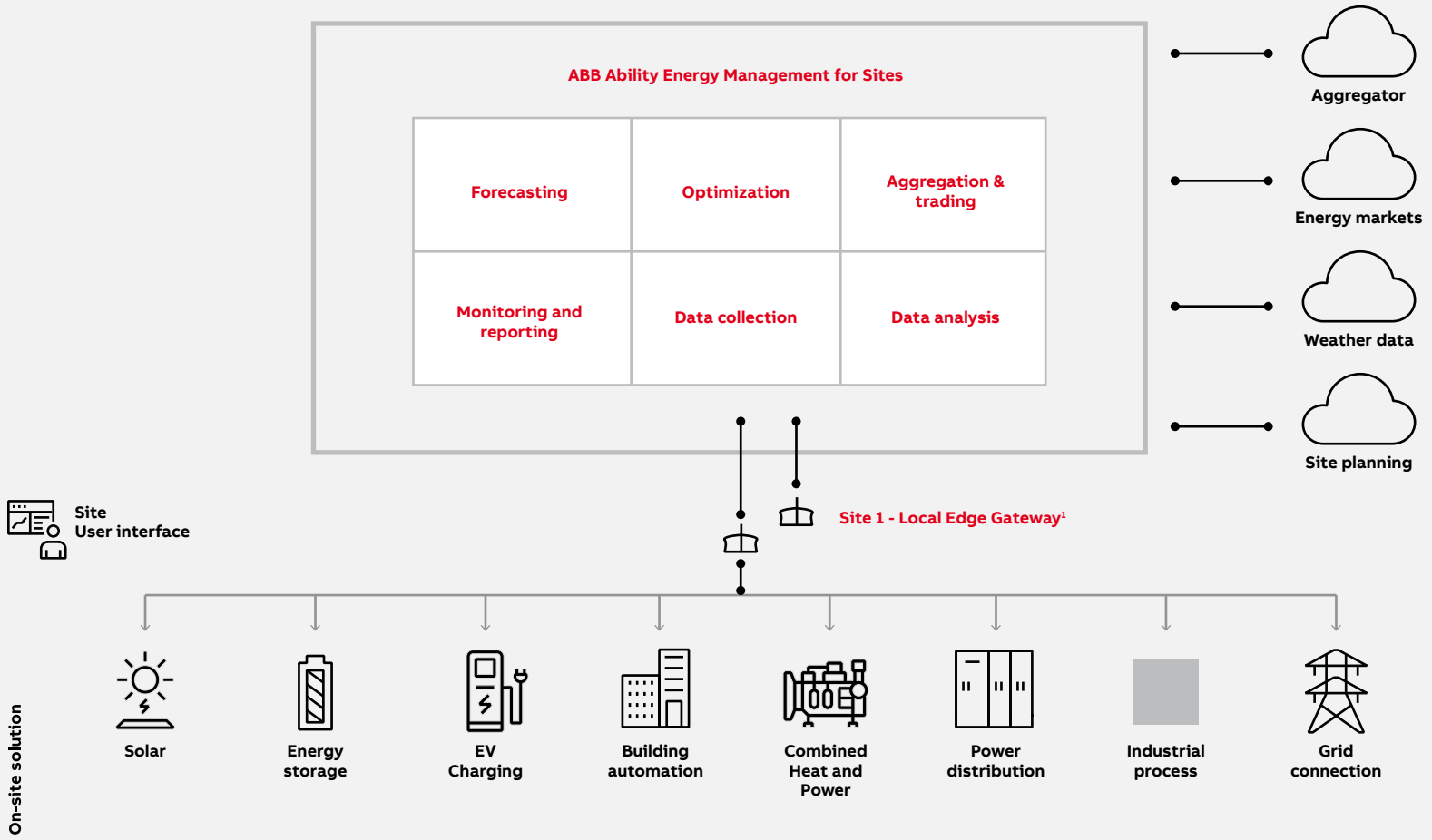
Data Integrity
Continuously monitors data collection and alerts you if data has not been collected. This ensures full data integrity.

Data Collection
ABB Ability BE SustainableTM with Active Energy is an agnostic energy management platform that can collect data from most BMS, data logging, AMR, and Enterprise Level systems. ABB offers a range of metering and data collection hardware solutions to collect data from a building where no existing data collection solution is available. In addition, historical data can be manually uploaded to the system to enable trend analysis.

Energy Management

OPTIMAX Energy Management for Site

Reference Architecture



Energy Management
OPTIMAX Energy Management for Site

Features of OPTIMAX

OPTIMAX® for Industrials and Commercials optimizes power consumption, while reducing energy costs, and minimizing environmental impact. The solution allows customers to take control of their energy operations, maximizing self-consumption of generation, minimizing operations during peak load times, and reducing grid purchases.

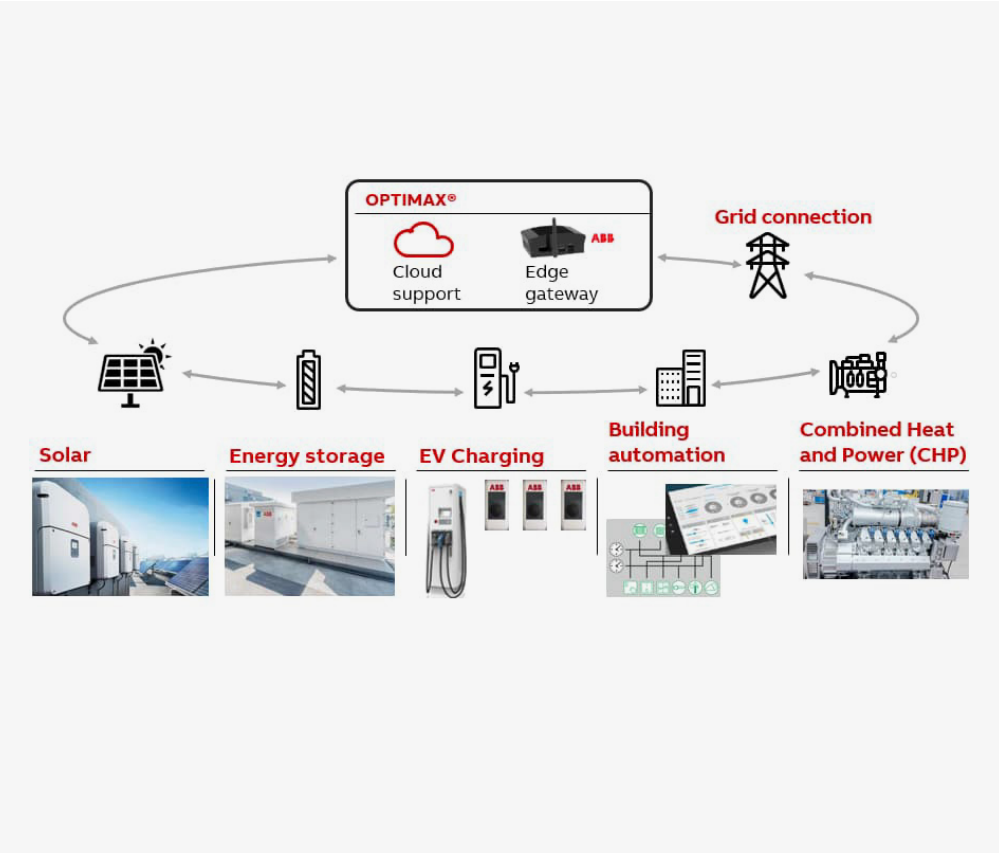
The system provided can be extended later on (not in the scope of this offer) to integrate further conventional and other kind of renewable generation units as well as energy storage units and combined heat and power applications. A highlight of this solution is the scalability for the considered technologies as well as for the functional scope. This allows reacting on constantly changing customer and market requirements. Our agile team with many years of experience in the area is driving this technology to meet future requirements.
OPTIMAX gets installed on an industrial PC which shall be installed in an enclosure. The IPC needs a connection to the communication network, which comprises all controlled assets. For more detail refer to the product manual, section 2.1. An internet connection is required for remote commissioning and service. Later this connection may be used to add cloud services.

The OPTIMAX user interface is accessible in the same network through webserver.
OPTIMAX target function:

- Minimization of energy cost - Store energy when there is solar excess (plus between PV power and consumption);
- Peak shaving - To reduce the energy demand during peak times and to reduce the Peak demand charge
- Simple PV forecasts: Based on the last days, the expected solar generation is calculated operation in island mode depend on project requirement

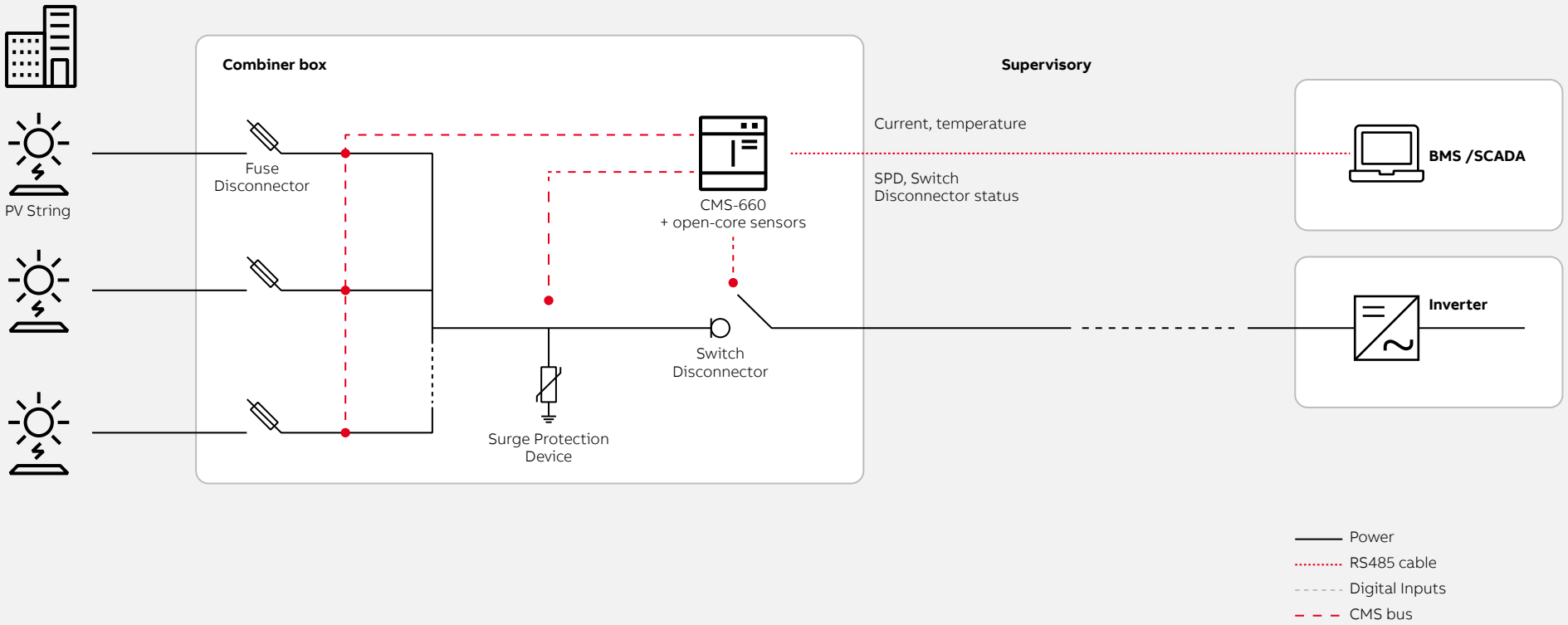
Objective:

- EMS target function is executed automatically
- Customer can observe operation on web interface - Monitoring of energy consumption / production / storages / alarm notifications
- Customer can change operation modes.
- Reporting and documentation - Csv Reports can be configured in OPTIMAX and be sent via SFTP to a customer server.



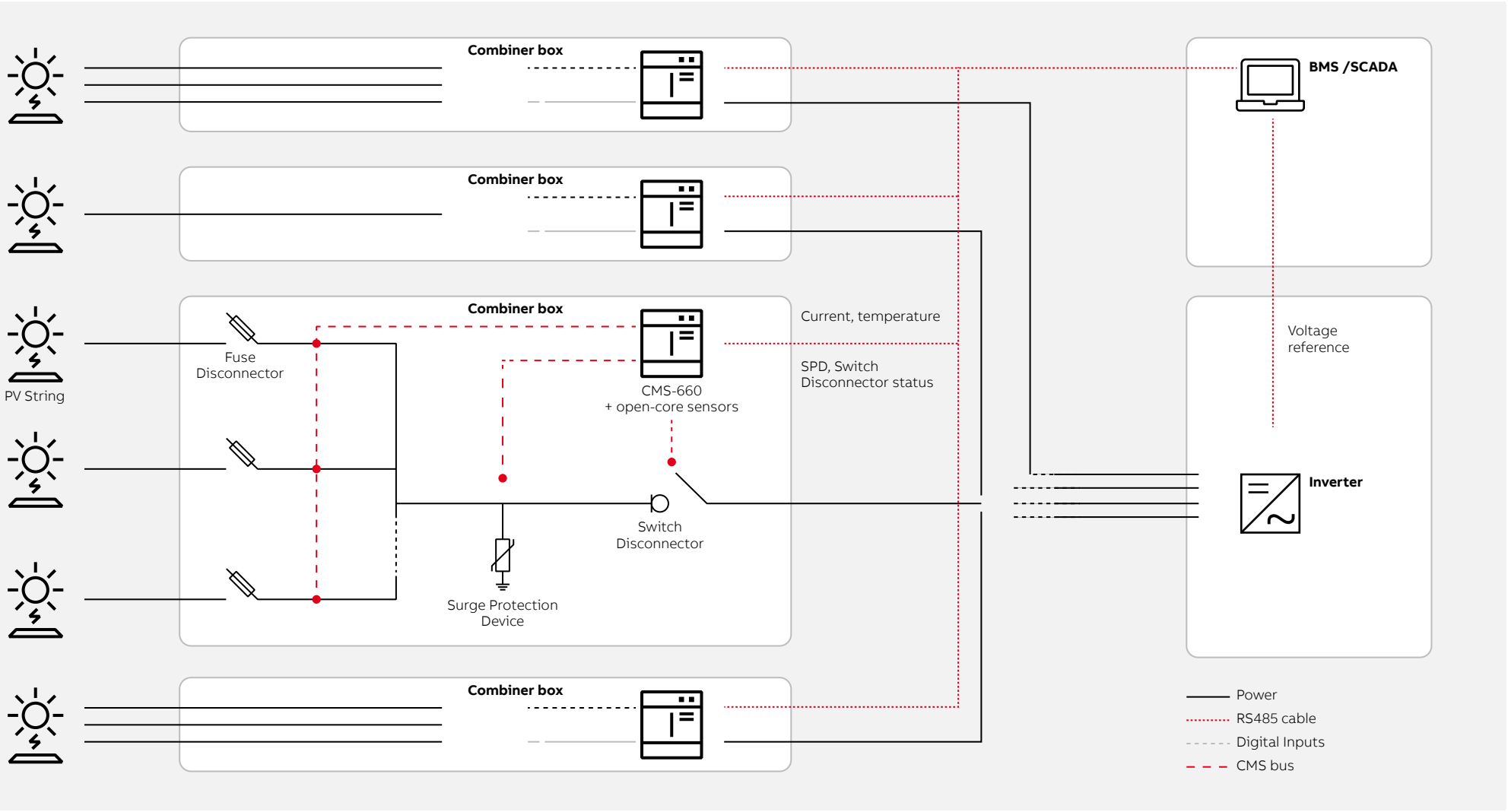
Energy Management
Solar PV Energy Monitoring

Scenario 1: string monitoring of commercial installations



Energy Management
Solar PV Energy Monitoring

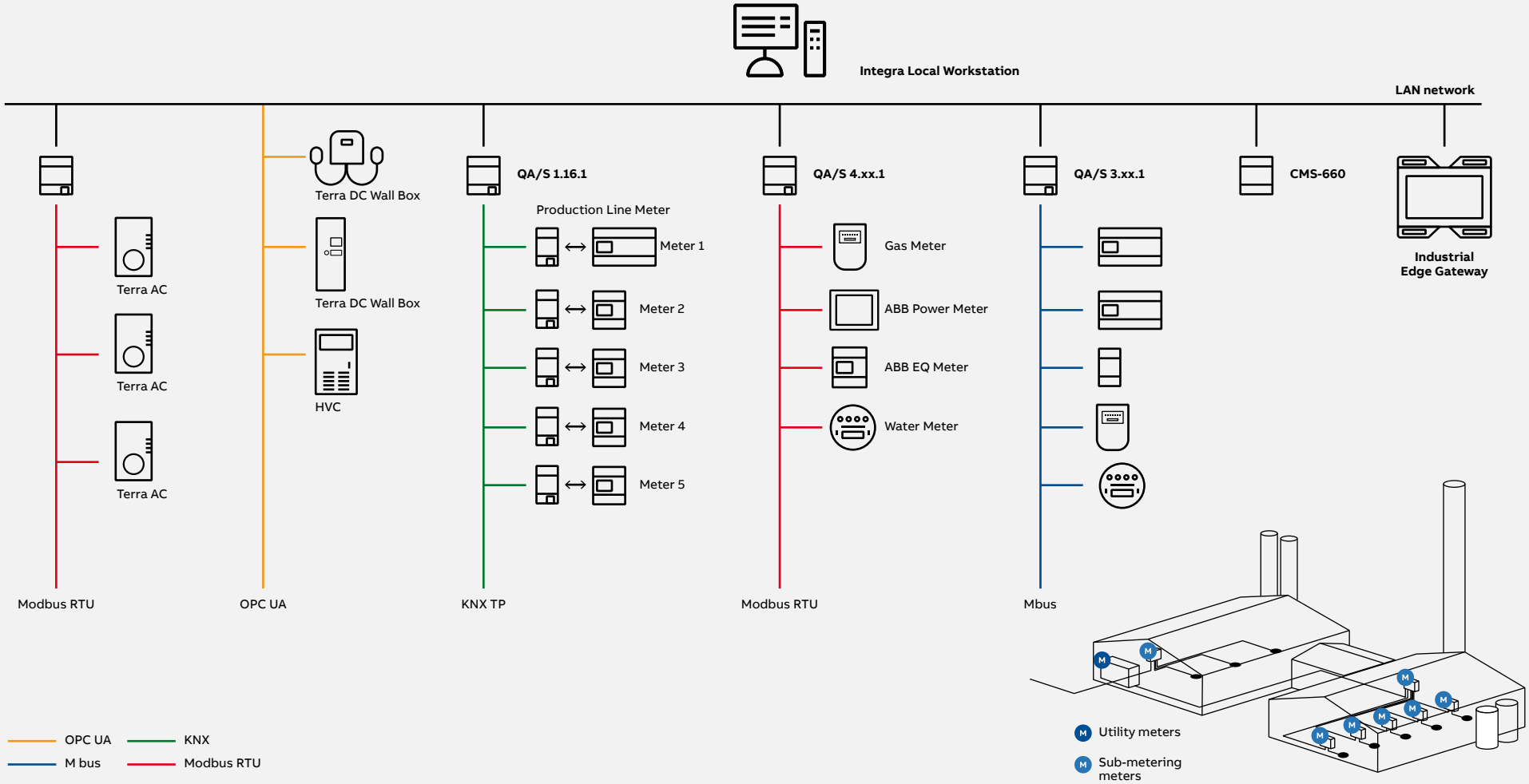
Scenario 2: Largescale solar PV installation (individual string monitoring)



Energy Management

EV Charging and Energy Metering monitoring

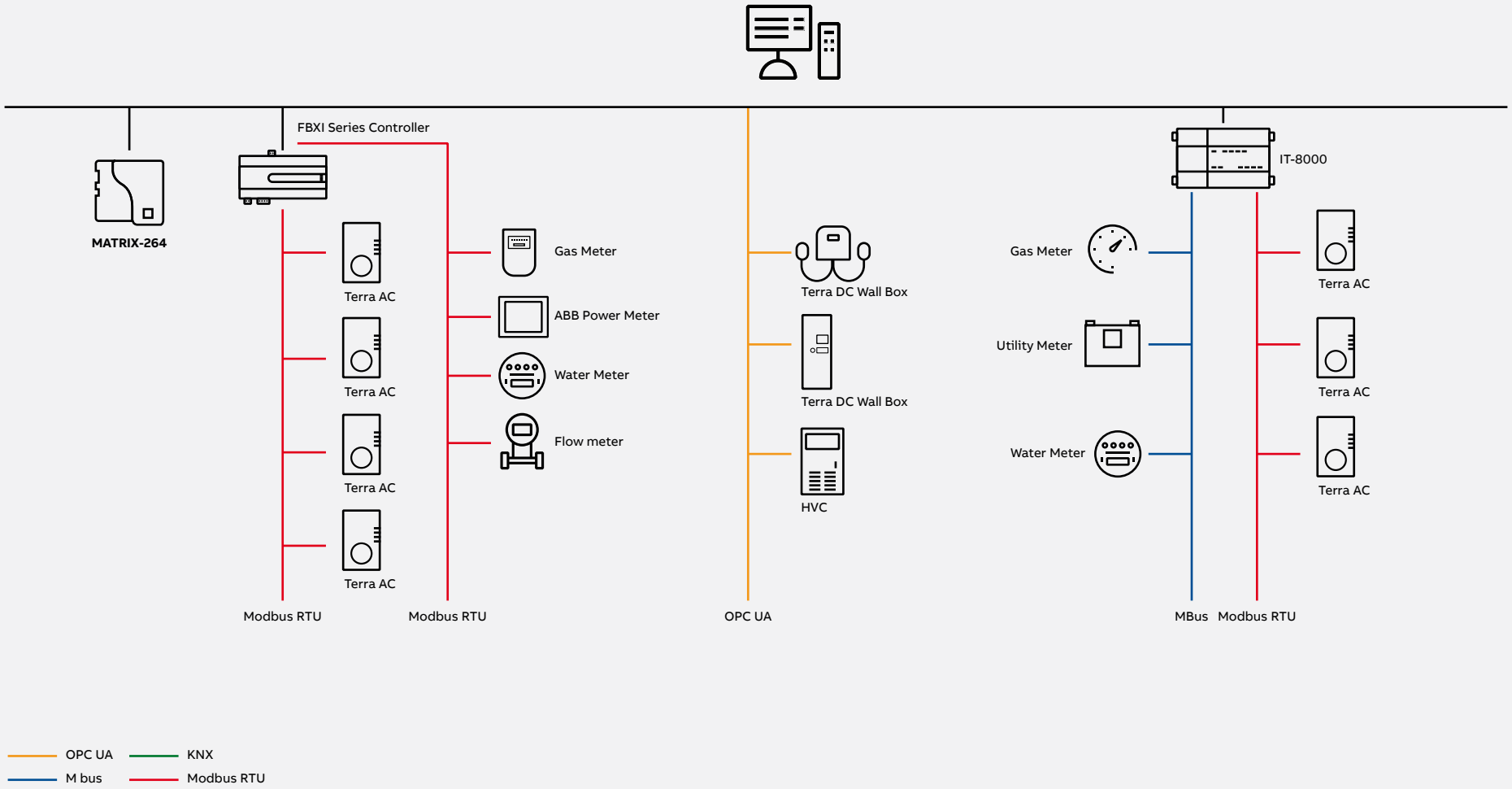
Reference Architecture



Energy Management

Energy Management with Cylon offering

Reference Architecture



Energy Management

Energy Meters

Energy consumption awareness is key to reduce energy costs and improve energy efficiency on your machines and electrical assets. Energy meters allow to identify areas for improvement and to generate benefits for owners, facility managers and users. They enable to run smarter buildings in a more energy and cost efficient manner. With Energy Meters you can also split the bill received from the utility within different household thanks to the MID certification.
Sub-metering provides a detailed picture of the energy consumption and the specific areas where energy is used.

ABB Energy Meters have the following instrumentation values as a minimum:
- Active power
- Voltage
- Current
- Power factor

CMS700 Circuit Monitoring System

The new control unit CMS-700 completes the range of Circuit Monitoring Systems, which enable multi-channel measurement system in alternating (AC) as well as direct current (DC). The CMS consists of a control unit and sensors, allowing easy monitoring of the individual lines of a facility.
CMS-700 enables detailed monitoring of energy consumption of up to 96 sensors (96 single-phase or 32 three-phase lines or a mix of the two up to the limit of 96 sensors). Easy to install, it is a versatile and efficient solution, which can be integrated into already wired panels.

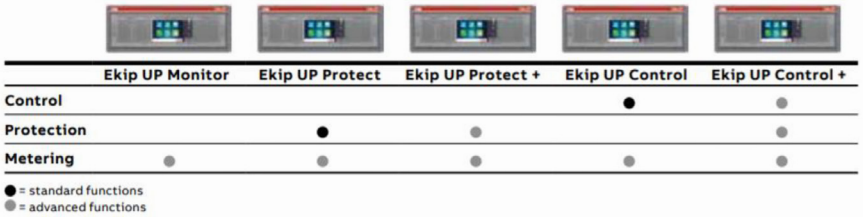
Using the integrated web server, the CMS-700 control unit provides easy access to data collection, analysis and download in order to optimize energy consumption, efficiency and energy management of the system. All CMS-700 central units can be accessed remotely via different communication protocols.

Energy Management
Communication Gateways

EkipUP Hub series

Ekip UP is the low-voltage digital unit able to monitor, protect and control the next generation of plants. Thanks to the built-in software-based function, Ekip UP is the unit that digitalizes the plant performance. Sharing all the electronics solutions of “all-in-one” platform, Ekip UP completes the ecosystem to fit all the market opportunities. The result is a unit suitable for all the different applications including all the needed functionalities without the need of additional external devices.

Ekip UP in the best way, will be able to:
- UP-date old facility with the latest innovation in the fastest way.
- UP-grade plant and get more functionalities in order to cover all the opportunities.
- UP-load measures and enable true energy management function.
- Maximize UP-time thanks to easy commissioning without impact on switchboard design.



	Ekip UP Monitor	Ekip UP Protect	Ekip UP Protect +	Ekip UP Control	Ekip UP Control +
Control				●	○
Protection		●	○		○
Metering	○	○	○	○	○

● = standard functions
○ = advanced functions

Main Features
- The ABB plug&play solution improves the plant efficiency, increases awareness of resources and process behaviors, and delivers an easier, more intuitive user experience.
- As multifunctional unit, there are five different commercial versions that guarantee flexibility and modularity to meet the needs of all measurement, protection and control applications.
- All units can also be equipped with optional connectivity and signally modules, in addition to the standard accessories.
- The main software functions can also be uploaded into Ekip UP Protect, Protect+ and Control+. These versions are ready for external toroids that enable more earth fault protections

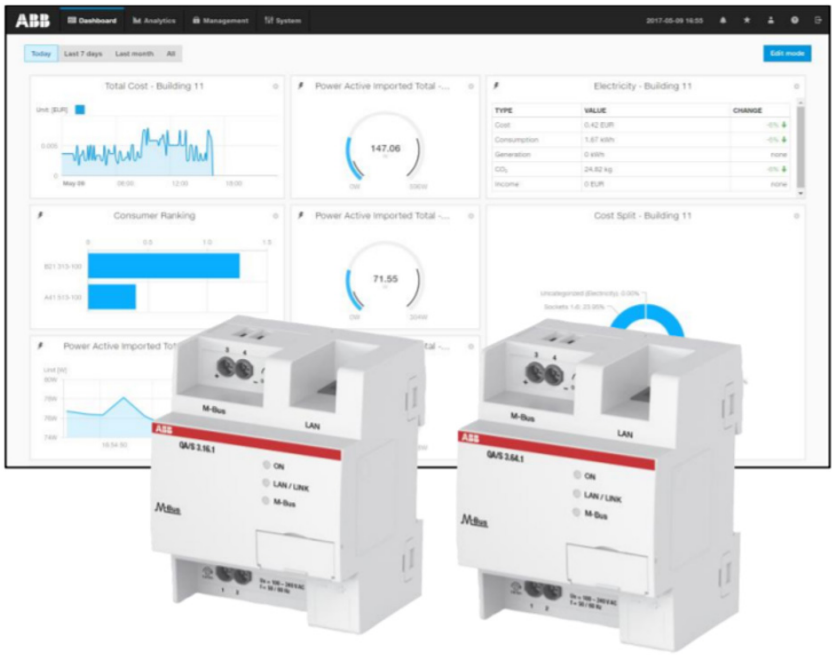
Metering
- Measurement capability of main energy parameters.
- Network analyzer to evaluate the power quality.
- Datalogger based on event triggers for fast fault diagnosis.
- Connectivity for system integration up to 8 field-bus protocols, plus a property bus for power automation applications that require advanced cyber-security.
- Embedded gateway that ensures power understanding by cloud-based energy management system.

Protection
- Distribution protection based on current and voltage measurement.
- Generator protection and interface protection systems
- Adaptive threshold according to grid topology.
- Digital selectivity for resource coordination.
- Load shedding algorithms to prevent blackouts.
- Programmable logics to manage transfer-switching operations and maximize service continuity.
- Synchrocheck function of different power sources inside.

Control
- Power management systems to optimize plant resources and enable Demand Response applications

Energy Management
EQ Matic Network Analyzer

ABB EQmatic Energy Analyzers are a compact solution for monitoring, logging, visualizing and analyzing energy and consumption data from electricity, gas, water or heat meters via KNX, M-Bus or Modbus RTU. The web-based user interface is individually configurable to the respective requirements and makes it possible to identify energy thieves and optimize energy costs sustainably.



Commissioning and operation are carried out via the web-based graphical user interface. For a detailed monitoring the devices offer several analysis functions such as historical data analysis, benchmark functions, cost analysis according to consumer, instantaneous values, etc. The configurable dashboard page provides a quick overview of most relevant metering data and analytic charts according to customer needs. Various export functions (E-mail, FTP) for further processing of the data and connectivity options (Modbus/TCP, RestAPI) for integration into supervisory systems (e.g. SCADA, BMS, etc.) are available.

The recording of energy variables and values, as well as their processing, is continually gaining in significance This is not just due to the rising energy costs but also due to the frequently demanded evaluation and reading possibilities via a decentralized reading station The features of the EQmatic series help to meet these requirements and can provide operators and users with convenient, cost-effective solutions for modern energy management ABB offers a wide range of devices and solutions specially designed for these applications.

Important features:

- Automatic detection of ABB EQ meters (A- and B-Series) and M2M network analyzers (QA/S 3.xx.1, M-Bus, and QA/S 4.xx.1, Modbus)
- Load control function, alarm function and monitoring of environmental parameters (QA/S 1.16.1, KNX)
- Local data storage and data sharing options
- Integration into ABB Ability™ Energy and Asset Manager
- Graphical data analysis via dashboard/chart diagrams and data export options

Energy Management
Bill of Materials

The bill of material for all luminaires and required accessories in the reference architecture is sum-marized in the following table:

Purpose	Type	Order Code	Description
Energy Management Parking Are - First Option			
Energy Management	QA/S 4.16.1	2CDG110228R0011	Energy Analyzer Energy Analyzer, Modbus RTU, 16 Devices, MDRC
Energy Management Parking Area - Second Option			
Energy Management	QA/S 4.16.1	2CDG110228R0011	Energy Analyzer Energy Analyzer, Modbus RTU, 16 Devices, MDRC
Meter Interface Module	ZS/S1.1	2CDG110083R0011	Meter Interface Module, MDRC
Electricity meter	B21 311-400	2CMA100255R1000	Energy meter'Silver', IR port, Single-phase, 65 A
Energy Management Parking Area - Manufcturing Process Area			
Energy Management	QA/S 4.16.1	2CDG110228R0011	Energy Analyzer Energy Analyzer, Modbus RTU, 16 Devices, MDRC
Electricity meter	EV3 012-100	2CMA290881R1000	Basic electricity meter, 3 phase, Active energy Cl. 1 & B, Import/Export, MID Approved, Modbus communication.
Energy Management	QA/S 4.16.1	2CDG110228R0011	Energy Analyzer Energy Analyzer, Modbus RTU, 16 Devices, MDRC
Water Meters	By Others		
Gas Meters	By Others		
Energy Management Parking Area - Packing Area			
Energy Management	QA/S 4.16.1	2CDG110228R0011	Energy Analyzer Energy Analyzer, Modbus RTU, 16 Devices, MDRC
Electricity meter	EV3 012-100	2CMA290881R1000	Basic electricity meter, 3 phase, Active energy Cl. 1 & B, Import/Export, MID Approved, Modbus communication.

ABB Ability™
Energy and Asset Manager

ABB Ability™ Energy and Asset Manager is a state-of-the-art cloud solution that integrates energy and asset management in a single intuitive dashboard. Providing full remote visibility of asset and electrical-system behavior, ABB Ability™ Energy and Asset Manager provides insights that help to minimize cost and risk and maximize performance and safety across operations.

A powerful building-management tool that lets stakeholders:
- View, manage, and optimize building systems from anywhere, at any time
- Implement predictive (condition-based) maintenance, ensuring the reliability and availability of your power system and equipment
- Optimize energy-usage in real time to achieve maximum energy efficiency and lower costs

ABB Ability™
Energy and Asset Manager

Energy Manager →

Facility Manager →

Asset and Maintenance Manager →

Field Service →

ABB Ability™ Energy and Asset Manager

Energy Manager

- Optimize energy bill
- Avoid energy waste
- Cost allocation

Asset Manager

- Reduce total cost of ownership
- Maximize uptime
- Improve safety

Energy and Asset Manager
Energy and Asset Manager

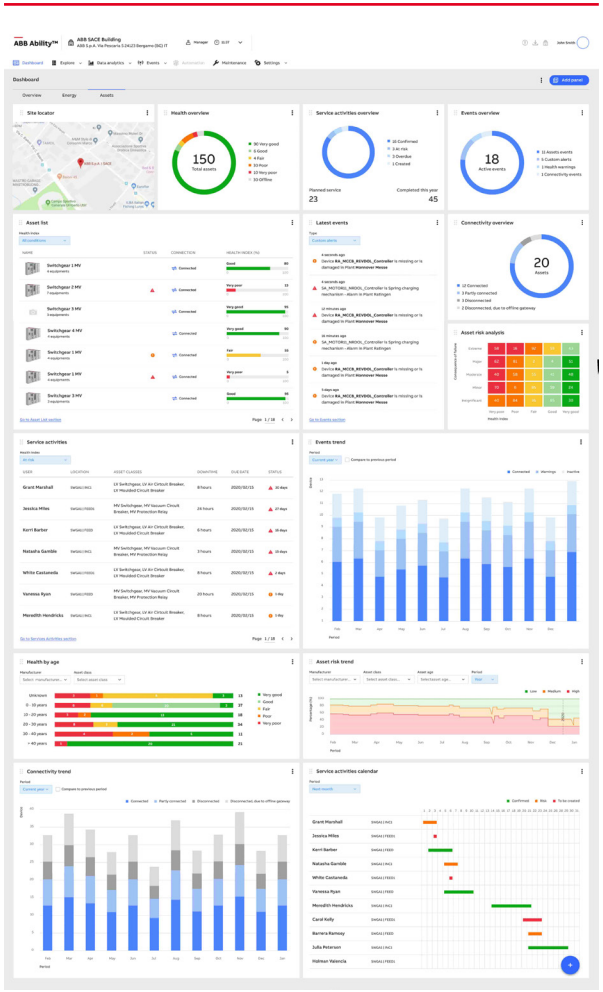
Energy Manager

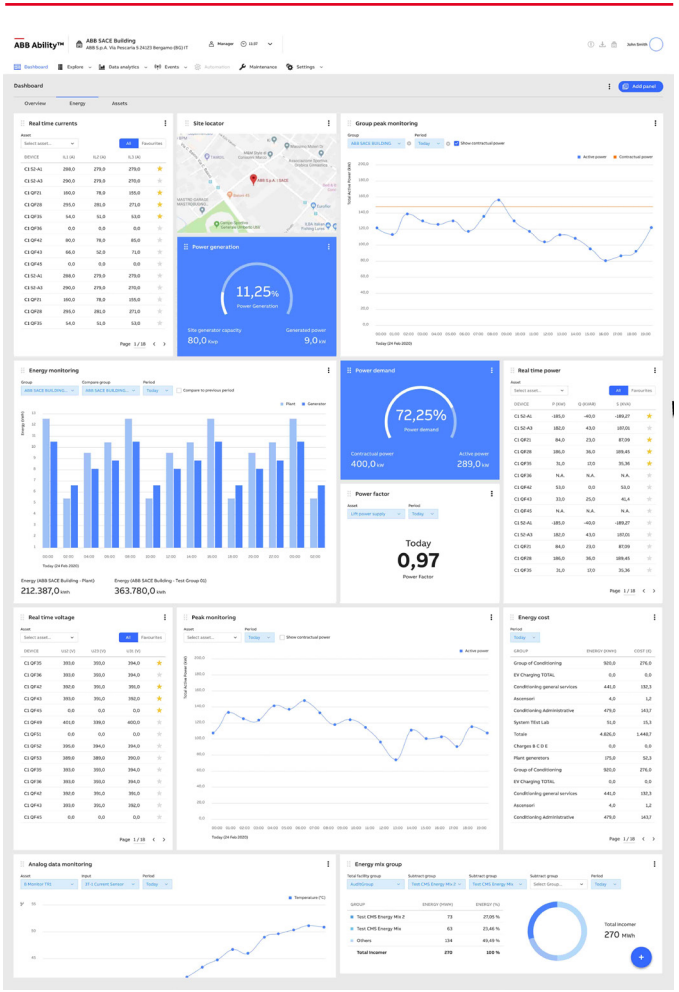
Energy efficiency has become essential to running cost-efficient operations. ABB Ability™ Energy Manager provides real-time understanding of your energy consumption and identifies areas of improvement.
And it's scalable, from a single site to a multi-facility system with hundreds of users.

- **Monitor**
  Discover Site performance, supervise the electrical system and allocate costs.

- **Analyze**
  Schedule automatic data exports, improve the use of assets and take the right business decision.

- **Act**
  Set up alerts and notify to key personnel and remotely implement an effective efficiency strategy to achieve energy savings in a simple way.





Energy and Asset Manager
Energy and Asset Manager

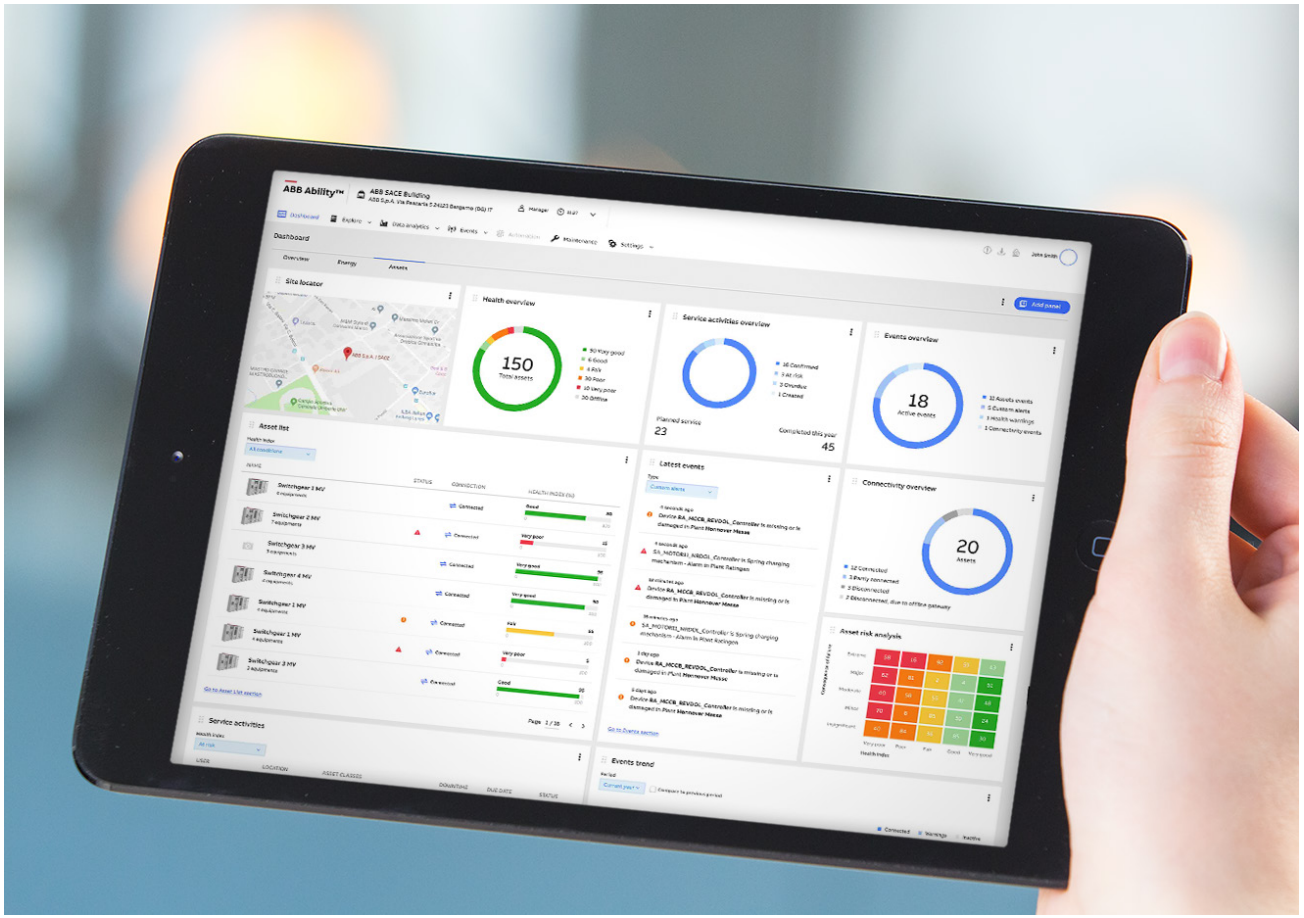
Asset Manager

ABB Ability™ Asset Manager sets a new benchmark for simplicity and flexibility in asset-performance management. It gives you the power of seeing and optimizing your site equipment behavior anytime, anywhere via an intuitive graphic interface, resulting in greater reliability and availability and minimized unplanned maintenance.

- **Condition Monitoring**
  Provide granular visibility of your asset behavior in real time for both LV and MV environments.

- **Predictive Analytics**
  Detect potential faults through condition assessment, performance trends and pre-alarm notifications.

- **Maintenance Planning**
  Root-cause analysis of asset condition enables predictive maintenance that significantly reduces unplanned downtime and operational costs.



Designing innovative solutions for manufacturing

General Reference
Main technical normative references

Standard IEC 60364 “Low-voltage electrical installations”

The main reference standard for electrical installations in offices is the IEC 60364 standard and its national implementation.
The standard specifies the requirements for the design and construction of a low voltage electrical system. low voltage electrical system.
The standard is composed by 8 main different parts.

EN 12464-1 ”Light and lighting - Lighting of work places - Part 1: Indoor work places”

The standard specifies lighting requirements for people, in indoor workplaces, that meet the visual comfort and visual performance needs of people with normal ophthalmic (visual) ability. All usual visual tasks are considered, including those involving the use of equipment with video display terminals.

EN 1838 “Lighting applications - Emergency lighting”

The standard defines the lighting requirements for emergency lighting systems, installed in buildings or premises where such systems are required. It applies, primarily, to places intended for the public or workers.

EN 15232 “Energy Performance of Buildings - Energy performance of buildings - Part 1: Impact of Building Automation, Controls and Building Management”

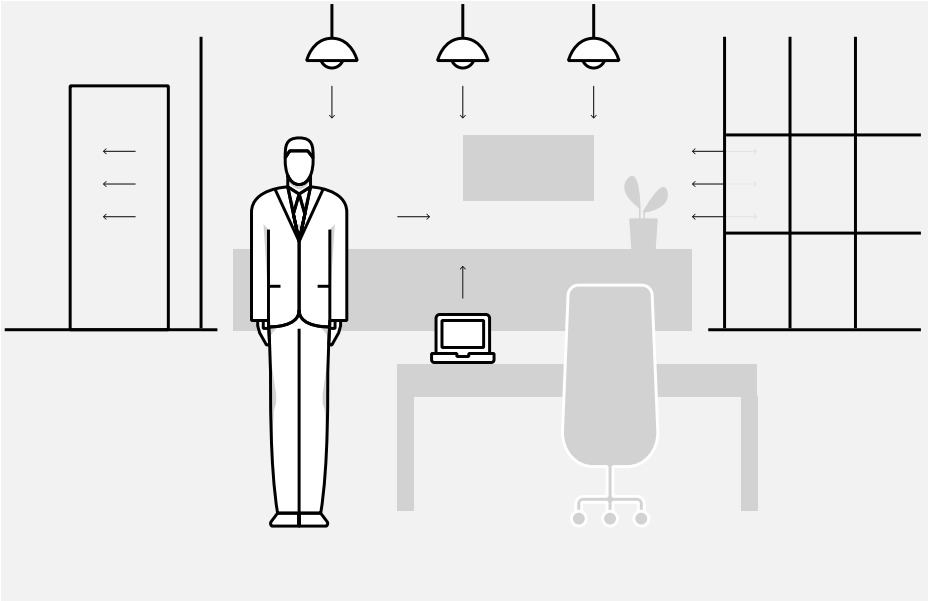
The EN 15232 standard specifies:
- a structured list of building control, automation and technical management functions that contribute to a building’s energy performance; the functions have been classified and structured according to building regulations and so called Building Automation and Control (BAC);
- a method for defining minimum requirements or any other specifications for building control, automation and technical management functions that contribute to the energy efficiency of a building, which can be implemented in buildings of varying complexity;
- a simplified method for arriving at an initial estimate of the impact of these functions on representative buildings and use profiles;
- detailed methods for assessing the impact of these functions on a given building.

General Reference
Load classification

The first information that should be known when setting up the design of an electrical system for an office building is the quality of the power supply to be guaranteed to the various loads, i.e. when the economic consequences of an outage are particularly important or when the power supply cannot fail for safety reasons.

Loads that typically require the most attention are:

- IT (PCs, workstations, data centers)
- networking applications (WAN-LANs, structured cabling, VoIP, ISP centers)
- building management and control
- telecommunications (transmission devices)
- protection and control equipment in the distribution of electrical energy (transformer rooms)
- emergency and security (emergency lights, alarms).



The classification of the loads with respect to the continuity of the power supply can be carried out on the basis of the categories defined in Tabella 1.
On the basis of this classification, preferential and privileged loads can be identified and the right power supply associated with them.

In addition to the ordinary, he power supply can be:

- BACK-UP:
  electrical system intended to guarantee the supply of user appliances or parts of the system for reasons other than the safety of persons (Standard IEC 60364-2 - art. 21.6);

- SAFETY:
  electrical system intended to ensure the supply of power to user appliances or parts of the installation necessary for the safety of persons. The system includes the source, the circuits and the other electrical components (Standard IEC 60364-2 - art. 21.5).

General Reference
Load classification

Classification of loads with respect to power availability.

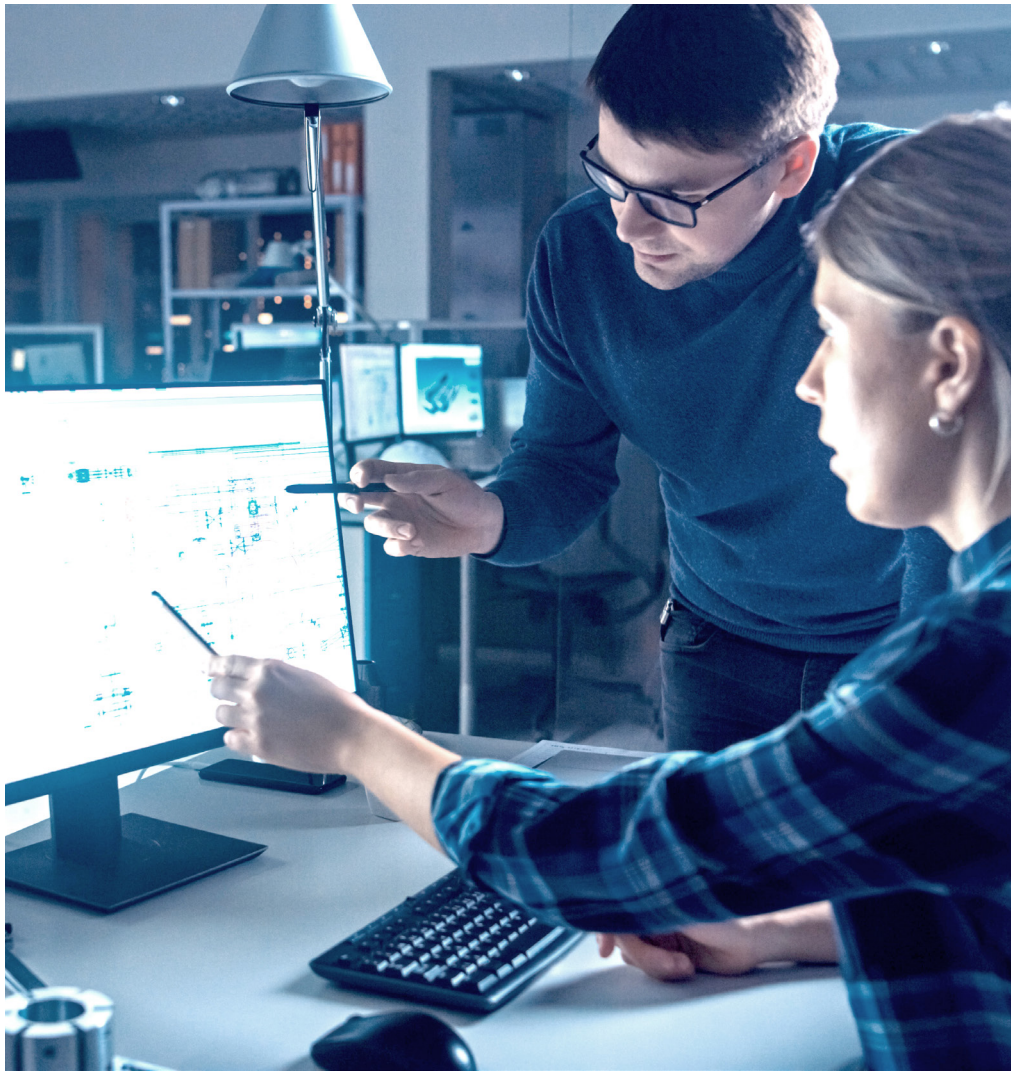
Type	Definition	Power Supply
Ordinary	They affect the smooth operation of all services, but their absence does not lead to situations of danger or serious discomfort	Ordinary
Preferential	They affect the smooth operation of all services, but their absence does not lead to situations of danger	Reserve
Privileged	They affect people safety or essential services	Safety

Example of preferred loads and their power source.

Preferred Loads	Power	Source Supply
Loads that guarantee the operation of the structure	Reserve	MV network, absolute uninterruptible power supply or stand-alone unit, generator set

Example of privileged loads and their power source.

Preferred Loads	Power	Source Supply
MV/LV cabin safety and alarm circuits	Security	Redundant and independent MT network, absolute UPS or stand-alone group
External lighting		
Security lighting		
Smoke and fire detection system		
Fire alarm		
CED utilities		
Office privileged users		



General Reference
Power quality

The public network of electric power supply is affected in a more or less relevant way by disturbances coming from the distribution networks and from the loads supplied by them that can easily lead to malfunctions and failures.
In other words, the characteristics of the power supply do not always correspond to the expected ideal characteristics.

The increasing diffusion of sensitive components has progressively made previously accepted levels of power quality critical.
Beyond the well-known contractual obligations that exist in the purchase, from the point of view of a user the electrical energy product is requested to have two fundamental characteristics: it should have a high availability and not cause malfunction, degradation or damage to the supplied loads.
The quality of the electric energy that a generic user considers necessary for his activity is not an absolute concept, but it depends on the susceptibility of the users to the phenomena considered (technical aspect) and on the consequences of the inefficiencies (economic aspect) resulting therefore variable from case to case.
In general, responsibility for satisfying this requirement depends only partially on the distribution company.

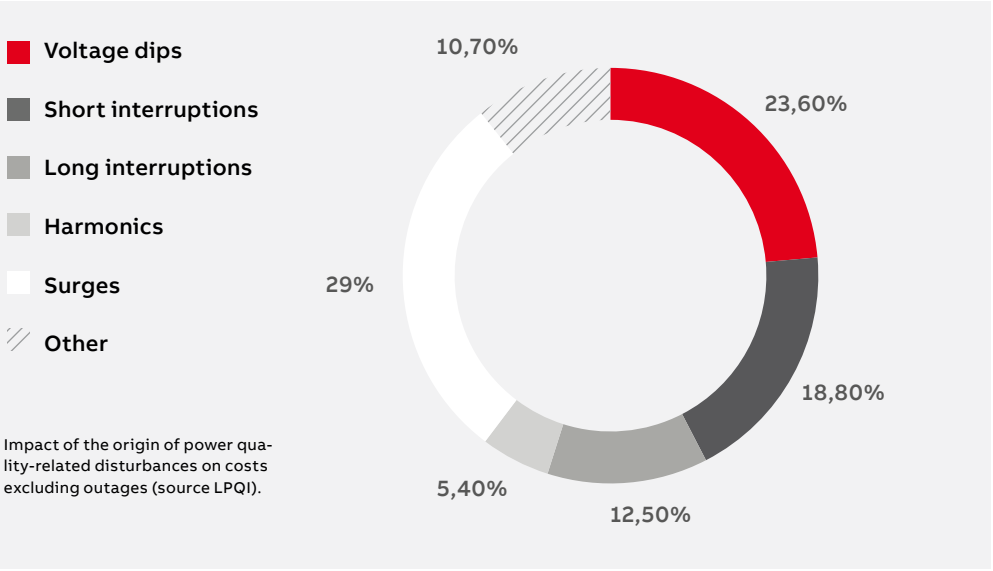
Electricity is in fact a particular product: it is never used as such by those who buy it, but it is always transformed and modified. In general terms, comparing electrical energy with other consumer products, it can be said that while the quality of most of these is completely determined by the producer and his distribution chain, in the case of electrical energy the quality of the final product is determined not only by the above mentioned figures, but also by the final consumer, or rather by the user at the very moment in which he uses it.

Moreover, achieving the best technical-economic compromise is not always easy and must be carefully evaluated.

General Reference
Power quality

The disturbances of greatest interest affecting the operation of an electrical component or user are:

- long or short duration power interruptions due to faults in the network;
- Voltage variations of short duration due to the insertion of heavy loads or faults in the network;
- dissymmetries in the power supply voltage system;
- flicker due to large intermittent loads;
- the distortion of currents and voltages due to the effect of non-linear loads present in the same system or in the systems of other users, etc.



Impact of the origin of power quality-related disturbances on costs excluding outages (source LPQI).

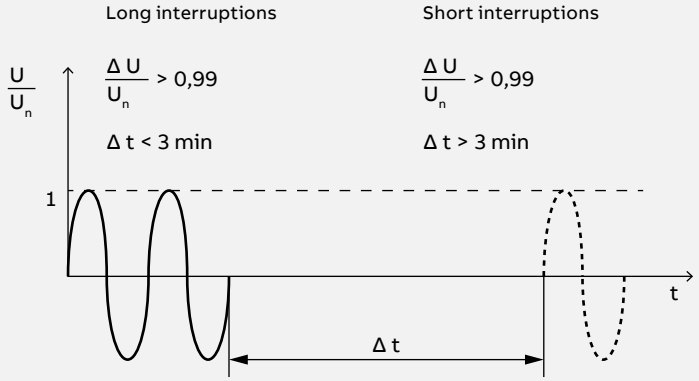
Origin and effects of power quality disturbances.

Disturbance	Origin	Effects
Frequency Variations	Disconnection of large generators Switching of large loads Faults Generator set operation	Speed variation in motors
		Malfunctioning of electronic devices that use frequency
Rapid voltage variations	Insertion of loads Loads with variable absorption Natural overvoltage Interruption and disconnection	Untimely intervention of protections
		Flicker (if the variations are repetitive)
		Malfunctioning of electronic equipment
		Irreversible equipment failures
Voltage dips and short interruptions	Faults Transients	Irregularities in the operation of motors
		Malfunctioning of electronic equipment
		Improper intervention of relays
Harmonics	Non-linear loads Variable speed drives Fluorescent lamps Static converters Arc furnaces Welders	Malfunctioning of protections
		Increase in copper losses
		Increase in dielectric losses
		Increased iron losses in electrical machines
		Unstable operation of motors
		Interference on telecommunication circuits
		Irreversible damage to power factor correction filters
		Aging of components
Dissymmetry	Unbalanced loads	Overheating of rotating machines and rectifiers

General Reference
Power quality

Interruptions are characterized in terms of duration.

Long duration outages depend on permanent faults occurring in public distribution networks or within the user's facility.
The duration can vary from a few minutes to several hours in the most critical cases.
European standard EN 50160 defines short interruptions as those lasting less than three minutes.
Micro-interruptions are linked to faults occurring on the distributor's networks that are eliminated by automatic reclosure operations. The duration is normally less than one second. Micro-interruptions do not have a regulatory definition.

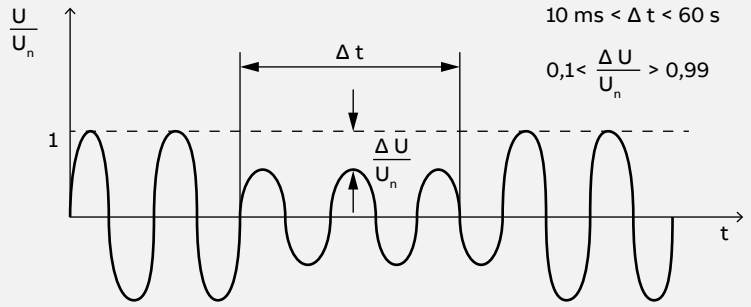


Accidental power outages

All elements of an electrical system are sensitive, in different ways, to long or short voltage interruptions.

Voltage dips are commonly characterized in terms of amplitude and duration.

In addition to the events already mentioned that directly result in a power failure, a load can also be disturbed by events that occur on other lines in the same system, causing voltage drops on the power system. The magnitude of the disturbance may vary within wide limits depending on the distance between the point where the event occurs and the cabin busbars or the switchboard.

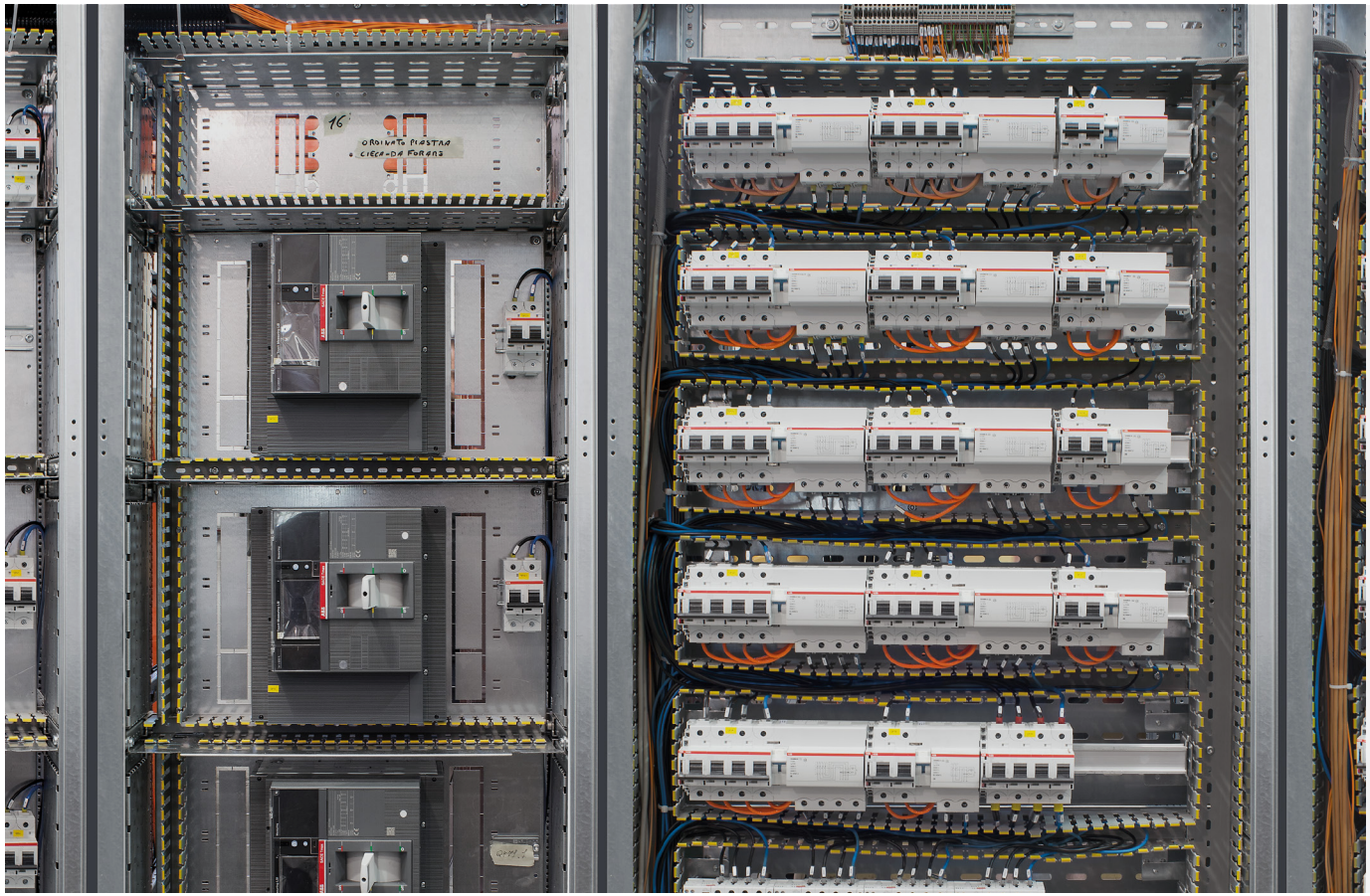


Schematic representation of a voltage dip.

Voltage fluctuations cause undesired effects in all those users that require a stable power supply for proper operation. It is worth mentioning among others the whole IT world.

General Reference
Scheme

Electricity distribution systems are a fundamental infrastructure in the advanced service sector, which contributes to determining its performance in terms of safety, availability, reliability and maintainability.



If the safety of the plant is an essential property as a legal requirement, the reliability, availability and maintainability instead are characteristics of the plant that have a direct impact on the business.
In this sense, the choice of the distribution scheme is one of the fundamental elements of the design of an electrical system, regardless of the greater or lesser complexity of the system on which the analysis and development of the solution will depend.

General Reference
Scheme

Simple radial scheme

In a simple radial scheme, the power is derived from a system of main busbars, from which the energy is then distributed radially to individual consumers or secondary busbar systems.

The simple radial scheme has the following advantages:
- Minimum material and installation costs;
- extreme simplicity in the operation of the plant (operations, maintenance).

On the other hand, the simple radial scheme has the following disadvantages:
- a failure in any point of the system starting from the supply point causes the total outage of the downstream elements;
- a failure on the power supply or on the main busbars causes total out of order of the plant;
- no flexibility in case of maintenance, checks, modifications, expansions because of the impossibility to temporarily put an element of the plant out of service, without this implying the shutdown of a part or, at the limit, of the whole plant.

Double radial scheme

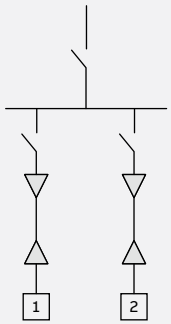
The double radial scheme basically consists of the combination of two simple radial systems, which from upstream to downstream extend associated with each other.

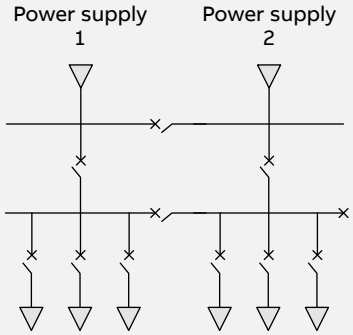
The double radial scheme has the following advantages:
- The out-of-service of one element of the system does not cause the downstream elements to be completely out-of-service;
- Flexibility in case of maintenance, verifications, modifications, expansions, since it is possible to temporarily put an element of the system out of service, without stopping a part or, at the limit, the whole system.

On the other hand, the double radial scheme involves the following disadvantages:
- Cost of materials and installation;
- more complex plant operation (operations, maintenance).

The duplication of system components can be extended to a single user, or, more frequently, to one or more distribution nodes. Redundancy must be achieved not only with respect to the power components but also with respect to the components of a possible command and control system.
In a double radial scheme all distribution boards are equipped with two sections of busbars separated by a switch (junction), which can be open or closed army.

Example of simple radial diagram





Example of double radial diagram

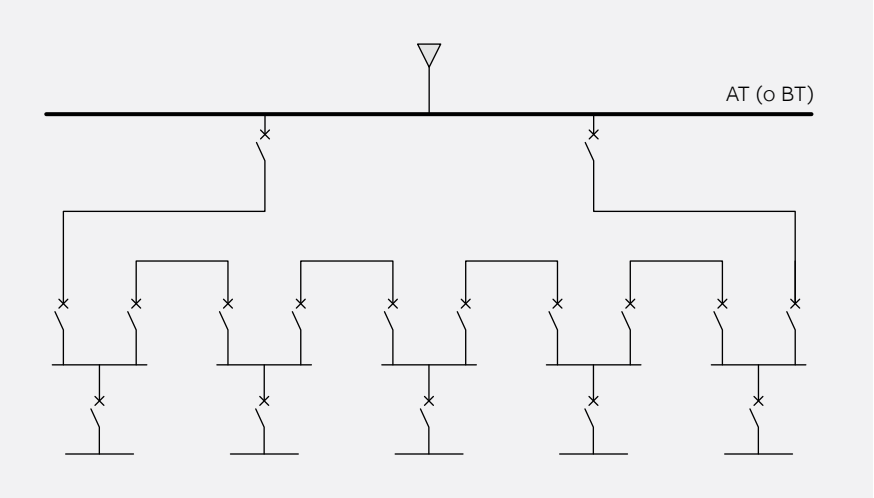
It is therefore clear that, if higher levels of reliability are to be achieved (which is desirable if a dual radial distribution system is to be set up), an alternative power source characterized by a much higher level of reliability than that considered must be provided, such as, for example, a generator set or static uninterruptible power supply system.

General Reference
Scheme

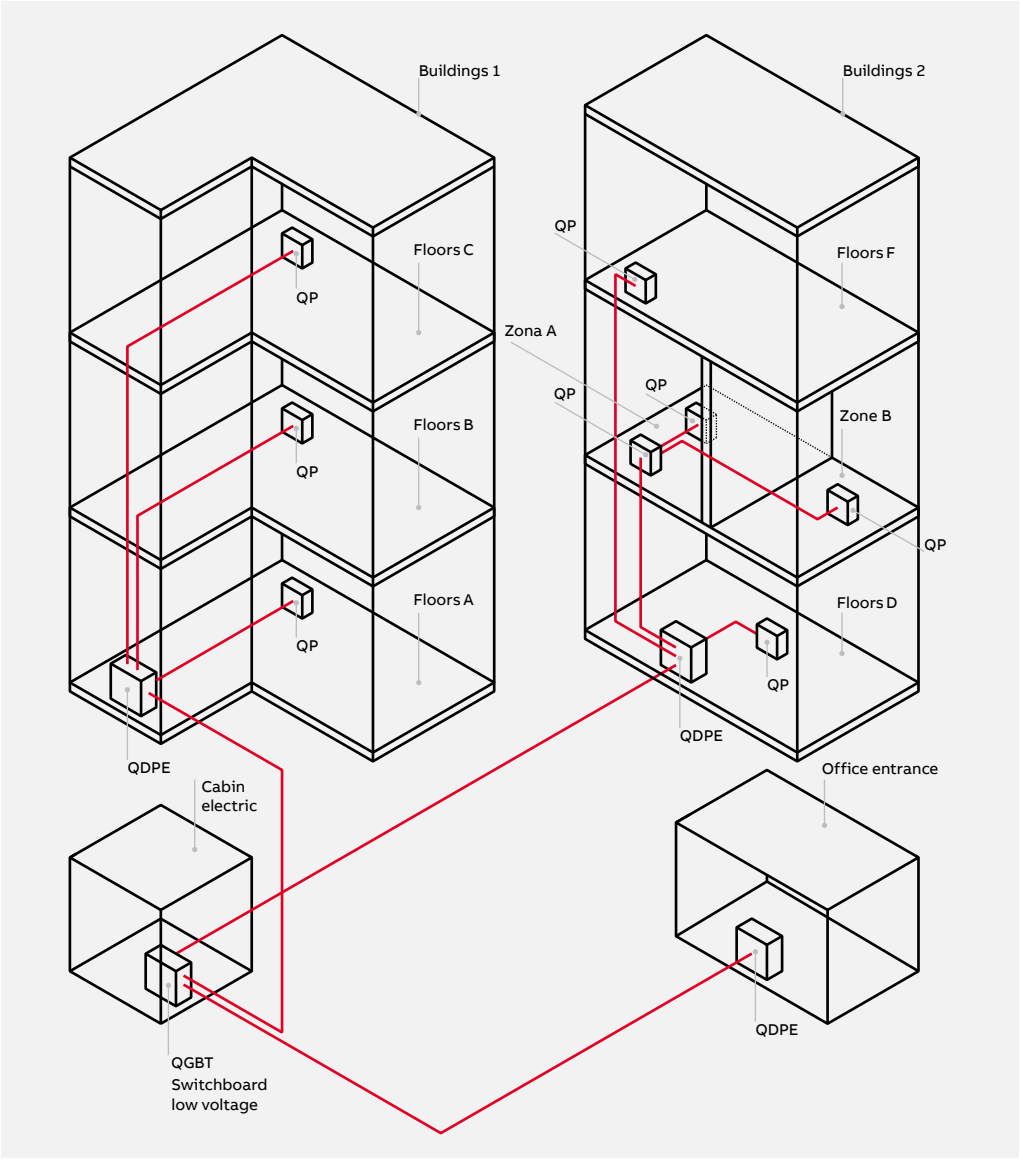
Ring scheme

This scheme connects the various user nodes in a ring, for each of which two alternative supply routes are available.
The ring scheme is a compromise between the previous schemes and as such has the following advantages and disadvantages:

- failure of one element of the supply causes the total outage of the plant, while downstream failures can be managed to keep the remaining part of the plant live;
- flexibility, cost of materials and installation are lower than those of the double radial scheme, but higher than those of the simple radial scheme.



Power Distribution
Electrical switchboard



—
Representation of the star distribution system

All electrical panels must comply with the safety requirements of EN 61439-1 and, where applicable, EN 61439-3.

In medical environments, the following types of switchboards may be required, depending on their size (reference in the figure):
- general low voltage (QGBT);
- main building distribution (QDPE);
- floor or zone (QP)

The main switchboard and the distribution board of the building should be located in special rooms that are not directly communicating with the public areas and not near combustible structures or deposits of combustible material.

Switchboard protection

For protection against direct contacts		Protection against external influences	
IPXXD (IP4X)	for horizontal surfaces at your fingertips	IPX4	in rooms where liquids are usually spilled
IPXXB (IP2X)	for all other cases	IPX5	in rooms for which jets of water are to be used for cleaning

Power Distribution
Electrical switchboard

LV general switchboard

Switchboard intended for the distribution of ordinary energy (from the grid) in which are installed, for example:
- general protection and isolation devices
- measuring instruments and any devices for remote control;
- protection devices for the lines that supply, for example: auxiliary cabin services; auxiliary generator services; main distribution lines to buildings; distribution lines for services outside buildings; technological plants (air conditioning system, heating and water plant).

Building main distribution switchboard

Switchboard intended for ordinary and safety distribution (through the generator set) in which are installed
- general protection and isolation devices;
- measuring instruments and any devices for remote control;
- protection devices, preferably suitable for isolating the lines that supply the utilities that require power from the generating set (fire-fighting system, lifting systems).

Floor and/or Zone switchboard

When these switchboards are located on the floor being served, it is preferable that they be placed in a special room. It is advisable that they be equipped with glass doors (or transparent plastic material) to facilitate checking the status of the equipment.
In smaller structures, the floor and zone switchboards may coincide.

Power Distribution
RCD

It is important to choose the type of earth leakage circuit breaker according to the type of application and ground fault current that may occur.

Earth leakage circuit breakers are classified into different categories, as follows, according to their ability to provide protection against different types of earth fault currents:

AC differential circuit breaker

The opening of the circuit breaker is ensured for differential sinusoidal alternating currents applied instantaneously or slowly increasing

Type A differential switch

the opening of the switch is ensured as for the type AC; for unidirectional pulsating currents and for unidirectional pulsating currents, applied instantaneously or slowly increasing

Type B residual current circuit breaker

the opening of the circuit breaker is ensured as for type A and in addition for differential sinusoidal alternating currents up to 1000 Hz, for continuous differential currents without ripples, applied instantaneously or slowly increasing.

Power Distribution
Permanent leakage current at mains frequency

Generally, the permanent leakage currents in a circuit are related to the deterioration of the insulation or to the presence of filters or capacitors between phase and earth.

If the total leakage currents are higher than 0,3 I_{dn}, in order to avoid untimely interventions it is advisable to divide the protected circuit in sub-circuits, each protected by single differential devices. The total leakage current coming from different devices generally does not coincide with the arithmetic sum of the single currents due to phase differences so it is advisable to consider a multiplication factor equal to 0,7/0,8.

For an estimate of the permanent leakage current in the design phase, it may be useful to refer to the IEC 61140 standard which recommends the values shown in the table.

Table 1 – Electrical equipment connected to a single-phase or polyphase system via plug-in receptacles rated 32 A or less.

Rated current (In)	Maximum leakage current
In ≤ 4 A	2 mA
4 A < In ≤ 10 A	0,5 mA/A
In > 10 A	5 mA

Table 2 – Stationary electrical equipment connected to a single-phase or polyphase system permanently or by means of plug-in receptacles having a current rating greater than 32 A.

Rated current (In)	Maximum leakage current
In ≤ 7 A	3,5 mA
7 A < In ≤ 20 A	0,5 mA/A
In > 20 A	10 mA

Table 3 – Typical leakage current levels of common appliances.

Devices	Maximum leakage current
Appliances	da 1 a 2 mA
Computers	da 0,5 a 1 mA
Printers	da 0,5 a 0,75 mA
Small portable devices	da 0,5 a 1 mA
Copiers	da 0,5 a 1,5 mA
Photocopiers	circa 1 mA

Power Distribution
Harmonics and high frequency leakage current

The immunity of residual current devices to high-frequency leakage currents is ensured by compliance with standard IEC 61543 whose requirements are based on standards IEC 61000-4-3; IEC 61000-4-6 and IEC 61000-4-16.

Selectivity

The installation of a residual current circuit breaker upstream of another residual current circuit breaker without special precautions can create selectivity problems: a fault that causes a residual current in a downstream circuit leads to the tripping not only of the residual current circuit breaker that protects the downstream circuit but also of the upstream one, unless the fault lasts longer than a certain period of time.

The general rule for ensuring selectivity is based on two basic conditions:

- the minimum non-intervention time of the upstream residual current device must be greater than the interruption time of the downstream residual current devices;
- the rated tripping differential current of the upstream device must be at least 3 times the rated tripping differential current of the downstream installed earth leakage circuit breakers.

Power Distribution
Overvoltage protection

Surges are the primary cause of electronic device failure and business interruption. The most dangerous surges are caused by lightning strikes, electrical maneuvering on the distribution grid, and parasitic interference.

Surge incidents and damage are of paramount importance in a world where applications that rely on electrical distribution networks and computer systems for their operation have increased dramatically.

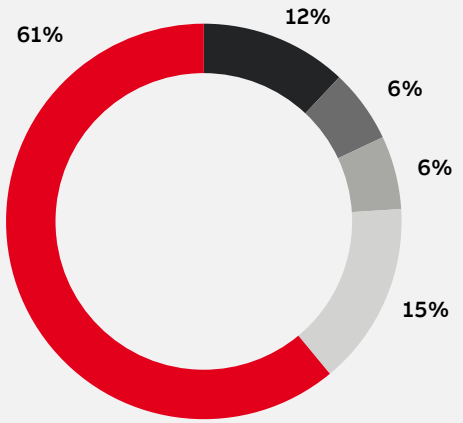
Electronic equipment is increasingly sensitive.

With the process of miniaturization of circuits and components, modern equipment is more prone than ever before to being damaged by surges.
Distribution and telecommunications networks are increasingly interconnected and complex. In densely populated cities, the effects induced by lightning discharges are devastating, as they can propagate for several kilometers.

Surge protection begins at the origin of the electrical system and ends near the most sensitive equipment. The energy of the discharges is reduced in several stages, first with the most robust arresters (Type 1), then with the finest protections (Type 2 or 3). This logic of coordination in protection is represented with the LPZ protection zones, which divide the environment according to the effect of lightning.

For the purpose of protecting equipment and systems against the electromagnetic effects of the lightning current LEMP (Lightning Electromagnetic Impulse), a structure can be divided into protection zones (LPZ: Lightning Protection Zones), understood as homogeneous electromagnetic environments, not necessarily confined (by walls, floor and ceiling), but ideal, in which therefore the protection measures adopted, represented by LPS, shielding and SPDs, are homogeneous. The type of electrical and electronic installations and their vulnerability to LEMP also contribute to the identification of the various zones.

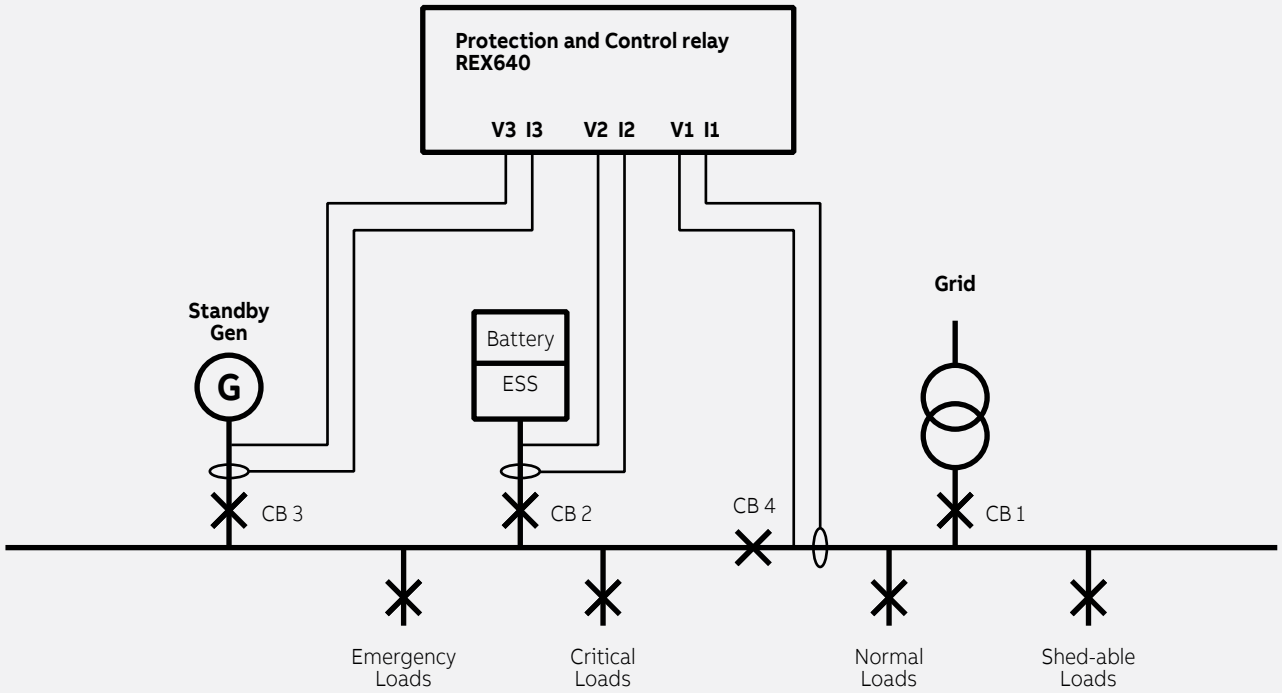
Surge protection is therefore of paramount importance.



Damage to electronic equipment. Analysis conducted in France for the residential segment by AVIVA, the world's sixth largest insurance company

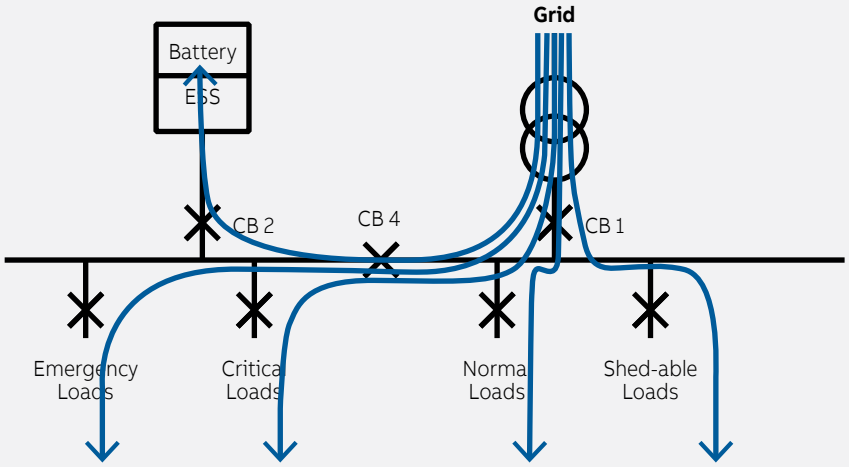
Microgrids
Used Case Example

Relay REX640 Configuration



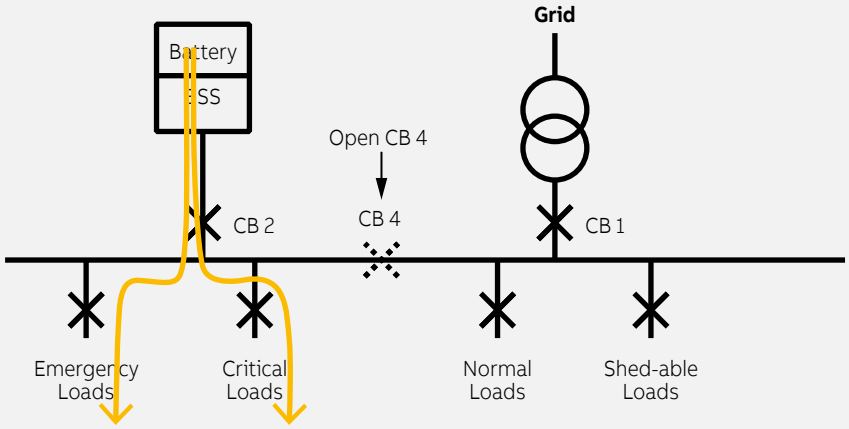
Microgrids
Operating Scenarios

Under normal operating condition



The Grid Power supply to all loads and charging of Battery

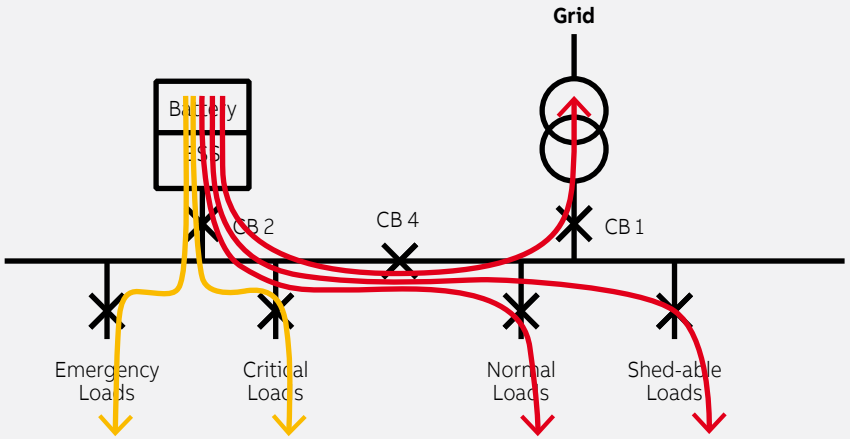
Under Grid Power abnormal (lost or dip) condition



CB 4 open and ESS supply to essential loads in Island mode

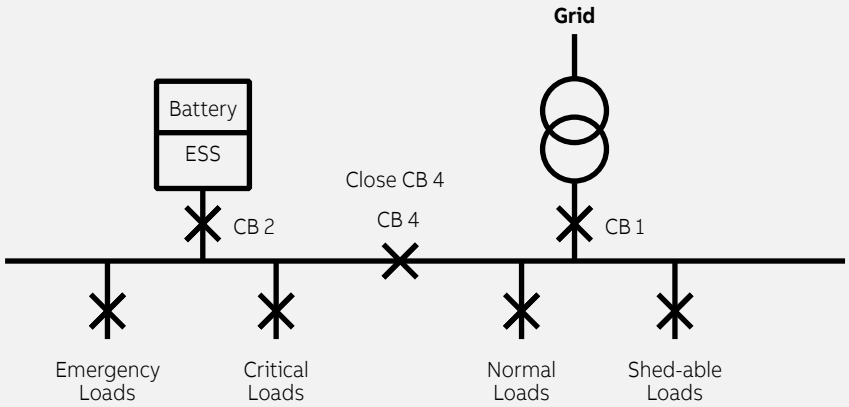
Microgrids
Operating Scenarios

Condition to be avoided



The SCADA and Protection Relay (Control System) is to control and determine the opening of CB 4 to ensure minimum energy could feedback to the undesired load or network.

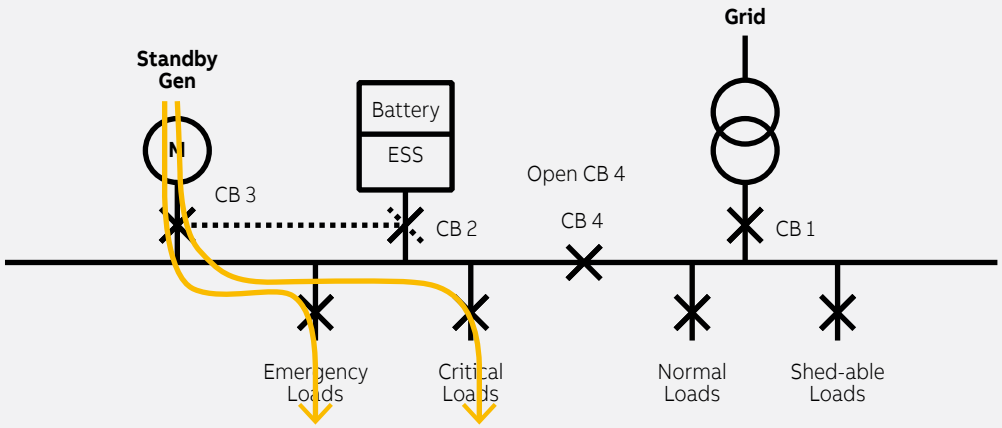
When Grid power resumed



- The Control System will check the quality and stability of the Grid source
- With the suitable (adjustable) delay
- Ensured synchronization with the ESS and the Grid source by the control system and determine the right time to close CB 4
- Turn ESS from “Supply Mode” to “Charging Mode”

Microgrids
Operating Scenarios

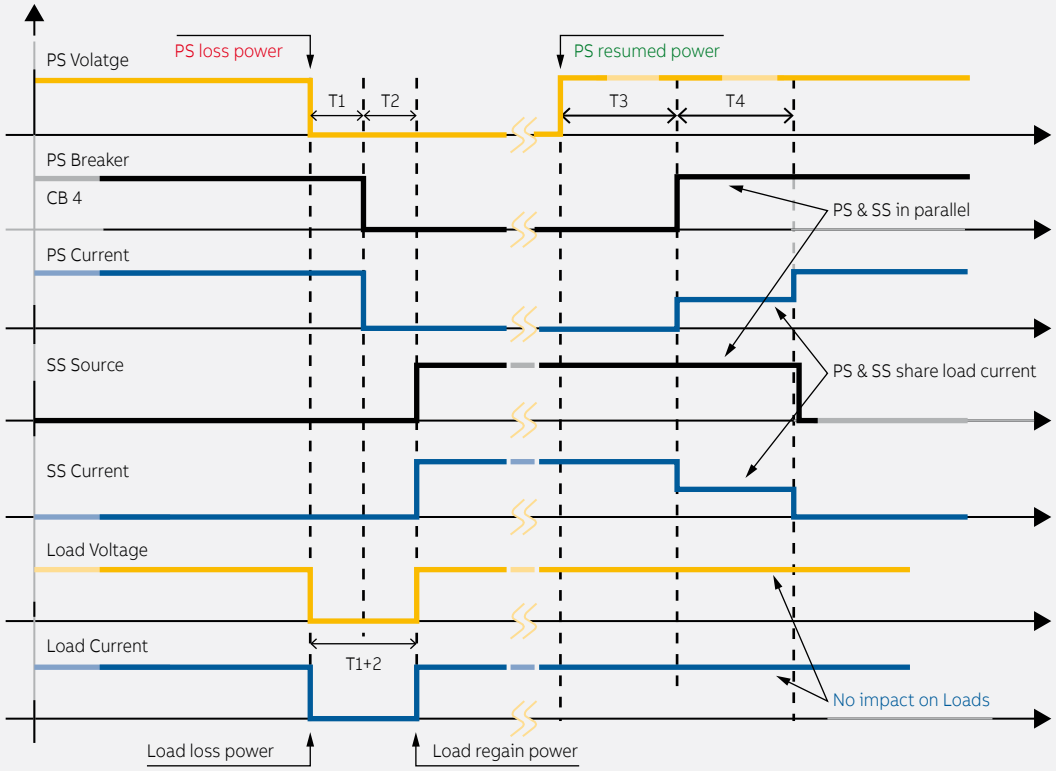
Under prolong Grid power outage



When Grid power resumed after prolong outage.

- The Control System will check the quality and stability of the Grid source
- With the suitable (adjustable) delay
- Synchronous the Gen-set and the Grid source by the control system and determine the right timew to close CB 4
- Open CB 3 in around 100ms
- Shut down Gen-set

Microgrids
Switching Sequence



Abbreviations

- **PS – Powergrid Source**
- **SS – Secondary source ESS or Standby Gen**
- **Ip – PS Current**
- **Is – SS Current**
- **IL – Load Current**

In the above figure we can see different power sources state . Voltage and current state with respect to the operation of Microgrid sequence

The start of the sequence is when Grid voltage becoming Zero and as a result the circuit breaker is turnoff by the relay and secondary source of power are turned on.

Lighting Control
Architecture and configuration of a KNX system

Coupler (line, field, repeater)

For a bus line equipped with a power supply, a maximum limit of 64 connectable devices is normally considered, taking into account the total power consumption of the devices and the maximum current that can be supplied by the power supply.

However, up to 256 bus devices can theoretically be connected on each KNX line if the line is structured in four segments, each equipped with its own power supply and connected to each other by repeaters.

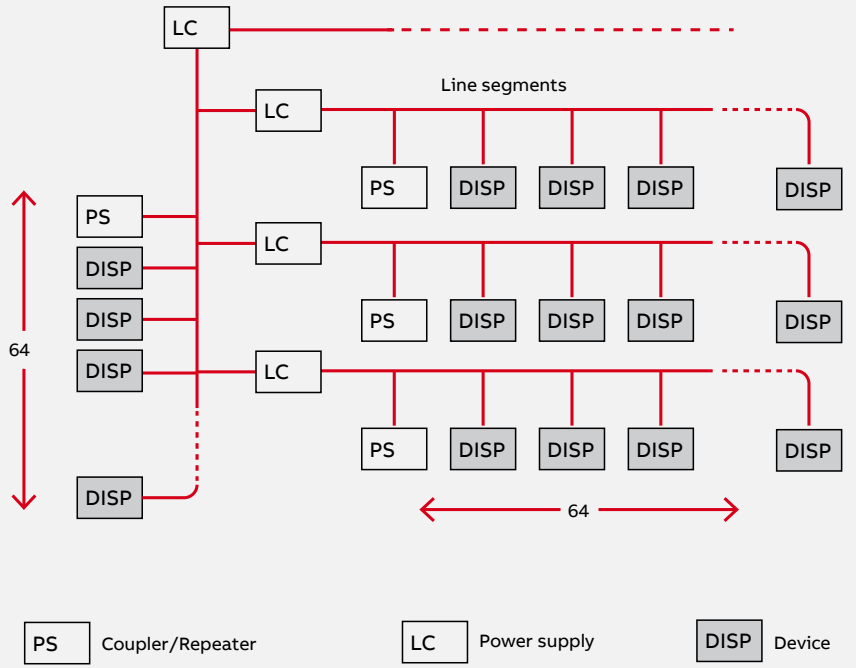
The repeater is a special way of using a system device called a “coupler” which galvanically separates the bus lines, regenerates the signal, prevents an electrical fault in one line from propagating to the other lines and also allows the overall architecture of a KNX system to be extended up to a maximum limit of 65,536 devices.

The coupler device can therefore be used in several ways:

- **area/area coupler:** it connects areas together along the main backbone (backbone line)
- **2 line/area coupler:** connects the lines in an area along the main line (main line)
- **3 repeater:** connects two line segments together, regenerating the signal that could be degraded.
- **4 telegram filter:** the coupler device can be set to block the passage of certain telegrams, thus preventing them from being sent unnecessarily throughout the network; this would in fact limit the communication capacity and increase the probability of errors and collisions between packets.

The couplers must be addressed like any other KNX device, and can be configured with the ETS software.

Maximum extension of a KNX line



Lighting Control
Architecture and configuration of a KNX system

Twisted pair copper cables (TP)

It is a communication through a twisted two-core cable (helical winding), shielded and with double insulation (main and functional).

In a KNX system, the EIB-derived TP-1 bus is used, with a speed of 9,600 bits/s. By means of this transmission medium KNX and EIB devices communicate and are fully interoperable with each other.

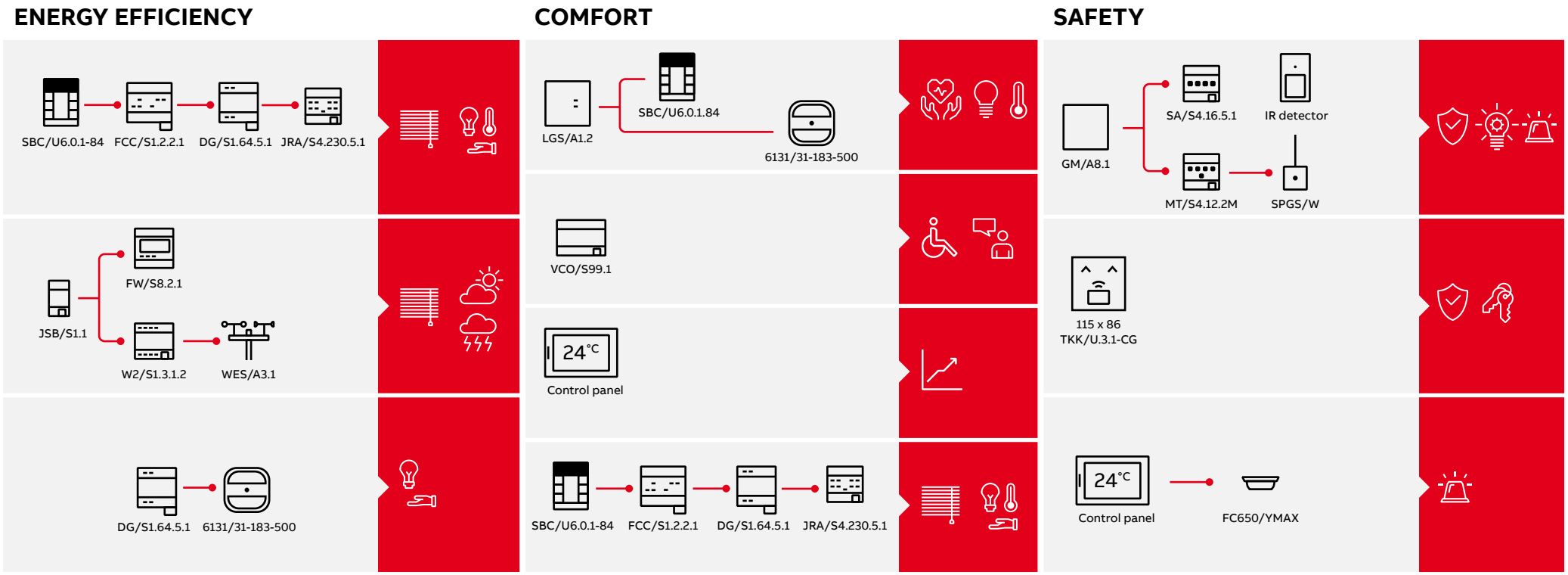
The cable to be used must be KNX-certified of type YCYM 1 x 2 x 0.8 or 2 x 2 x 0.8 mm; in the case of the 4-conductor cable, the red-black pair is dedicated to signal and power transmission and the yellow-white pair to additional SELV applications. Where the use of halogen-free cables is required, KNX-certified cable type J-H(St)H 2 x 2 x 0.8 can be used.

Ethernet

In this case the communication is carried out by transferring KNX telegrams over the Ethernet network “encapsulated” in packets in the widely used IP (Internet Protocol) standard, regardless of the particular transmission medium.

In larger KNX installations, the IP network can therefore be used as a high-speed backbone (Fast-Backbone) to transmit KNX telegrams, according to a procedure known as “KNX/IP routing”.

Lighting Control
Device Configuration



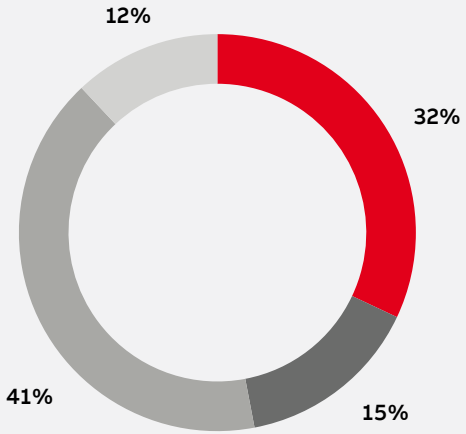
Lighting Control
Temperature control

Restricting heating or cooling to the periods and conditions in which it is actually necessary makes it possible to achieve significant reductions in energy requirements in both the residential and tertiary sectors.

The main automation functions that can lead to a reduction in consumption by acting on the thermoregulation in contexts sometimes residential sometimes different are:

- Independent microzones with chronothermostats and electrovalves: saving and optimizing comfort and consumption: Advanced configuration with a master chronothermostat and several slave thermostats.
- When the system is for heating only, you can avoid blocking the valves during the long summer shutdown period by setting the protection function that periodically opens and closes the electromechanical devices completely (antisticking).
- Indoor air quality (IAQ): a sensor analyzes the air quality and, once it becomes stale, activates the air exchange system.
- Scheduled air change at times that are not too cold in winter and not too hot in summer to avoid excessive temperature gradients and therefore waste.
- Integration of weather station (rain, wind, brightness) with temperature control to avoid waste and implementation of awnings, blinds, outdoor lighting and irrigation.
- Regulation of climatic comfort conditions for the entire building, zones or individual rooms. Automatic control according to the presence of people or timed, attenuation at the opening of doors or windows to the outside with automatic reset at closure.
- Possibility of local or centralized manual switching between different operating modes (comfort, precomfort, economy, off), timed extension of comfort mode.
- Antifreeze function to protect furniture and systems for rooms with occasional occupation.

Stratification of energy consumption in the Italian tertiary sector



Lighting Control
Lighting

Limiting artificial lighting to the necessary intensity and to the conditions in which it is actually needed can have an important impact on electricity consumption, especially in the tertiary sector where consumption related to it is more important.

The main automation functions that can lead to a reduction in consumption by acting on lighting in contexts sometimes residential sometimes different are:

- Switching on and off of lighting fixtures with all types of lamps manually (with traditional push-buttons or remote controls) or automatically (by means of timers or presence or twilight sensors).
- Switching on of the marker lamps and/or localization LEDs integrated in the push-buttons and control units connected to the twilight sensor.
- Automatic switching on and off according to movement (in passage areas) or the presence of people.
- Command and control of even very large groups of luminaires
- (zones/floors/whole building).
- Automatic control of external luminaires, luminous signs and shop window lighting with twilight logic.
- Temporary disconnection of non-priority luminaire groups.
- Adjustment of light intensity by means of electronic devices to increase or decrease the illuminance of the rooms by acting on traditional buttons of various kinds (two-position rocker switches, traditional, etc.) or by using twilight or brightness sensors.
- Automatic adjustment to constant brightness with maximum use of natural lighting and integration of the artificial component only if actually necessary.
- Programmed alternation between different groups of luminaires to optimize the life of the sources.
- Possibility of counting the operating hours of the luminaires with optimization of preventive and routine maintenance.
- Replication of the control points (single and group) wherever there is bus wiring.
- Local (push-button) or centralized (on synoptic, Touch-Screen or PC with visualization) status signaling of individual or group luminaires.

Find out more

OWNERS OR MANAGERS

Innovate your building.
Ask for a free **business advice**.

We build evolution

DESIGNERS AND INSIDERS

Ask for free **design** technical support.

Learn more. Learn better.

05.2022