WHITE PAPER

RELIABLE POWER. SEAMLESS CHARGING.

Power solutions supporting Charge & Go applications

- Support switchgear selection for EVCI applications;
- Showcase enclosures and breaker options;
- Present load management options and protection strategies.

ENGINEERED TO OUTRUN

TABLE OF CONTENTS

ELECTRICAL INFRASTRUCTURE FOR EV CHARGING

E-mobility market overview

Driven by widespread electrification, the transportation sector is entering a pivotal phase marked by practical innovation, environmental responsibility, and the integration of advanced technologies into everyday mobility. This change is influencing travel patterns and the way infrastructure supports interconnected communities.

BUILDING & WORKPLACE

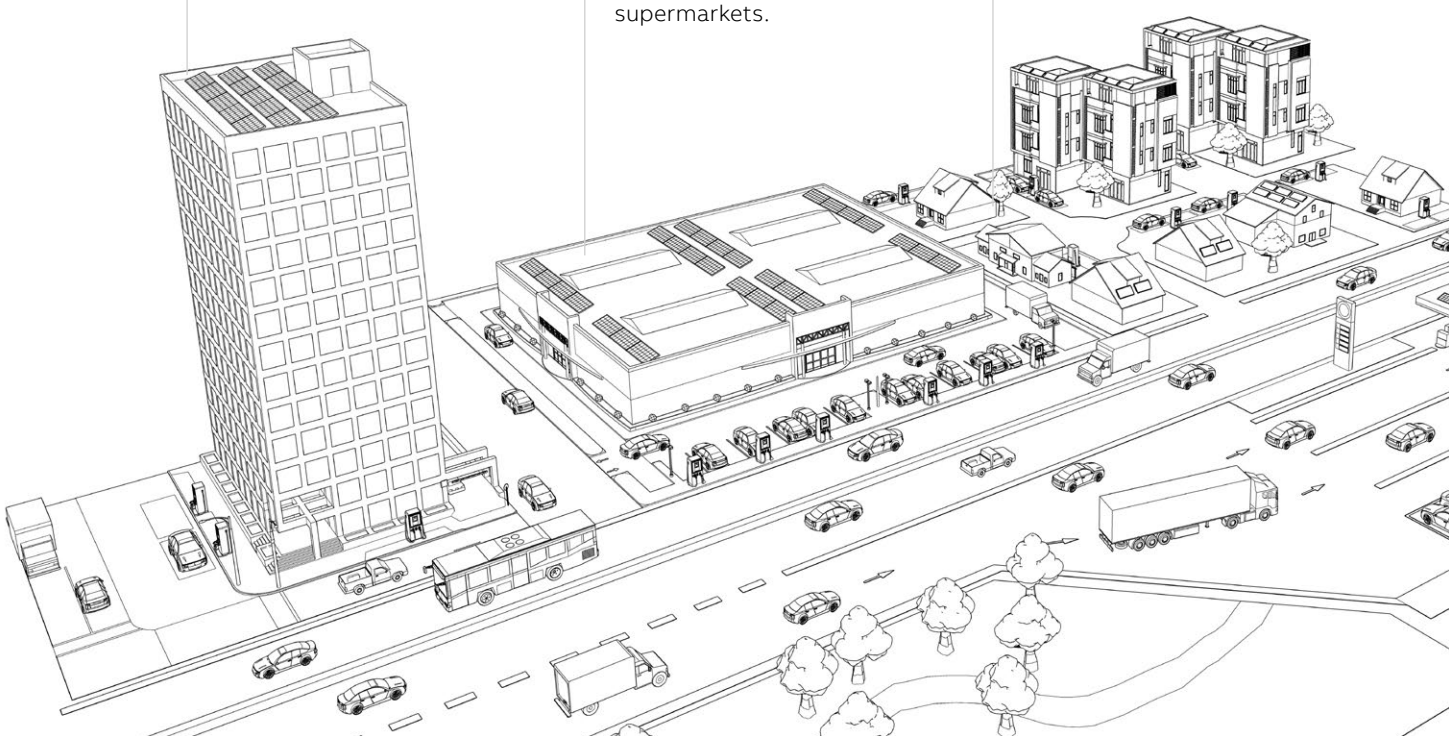
Offices, industrial sites with parking slots, commercial buildings.

DESTINATION CHARGING

Hotels, restaurants, supermarkets.

RESIDENTIAL

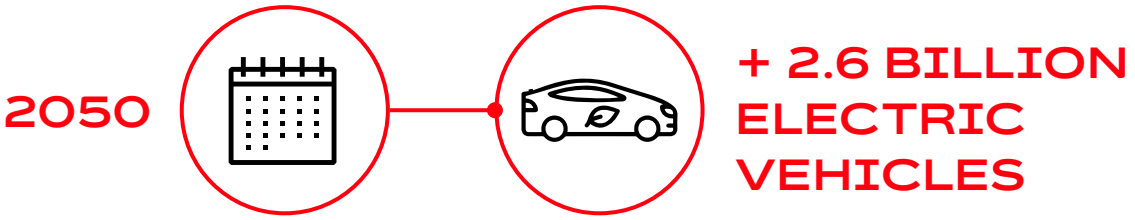
Residential houses.



With projections indicating up to 2.6 billion electric vehicles on the road by 2050, the demand for robust charging infrastructure and advanced grid architectures has never been greater.
Projections show that by 2050, the number of electric vehicles worldwide may reach 2.6 billion, driving an enormous demand for charging infrastructure. By 2040, up to 350 million charging connectors are expected to be installed—together requiring an estimated 2997 TWh of electricity.

This significant increase in energy demand underscores the necessity for a robust and upgraded grid, ensuring that future electrification is both reliable and sustainable.

This transformation is reshaping every aspect of the transportation sector, driving changes in mobility networks and infrastructure across different environments.

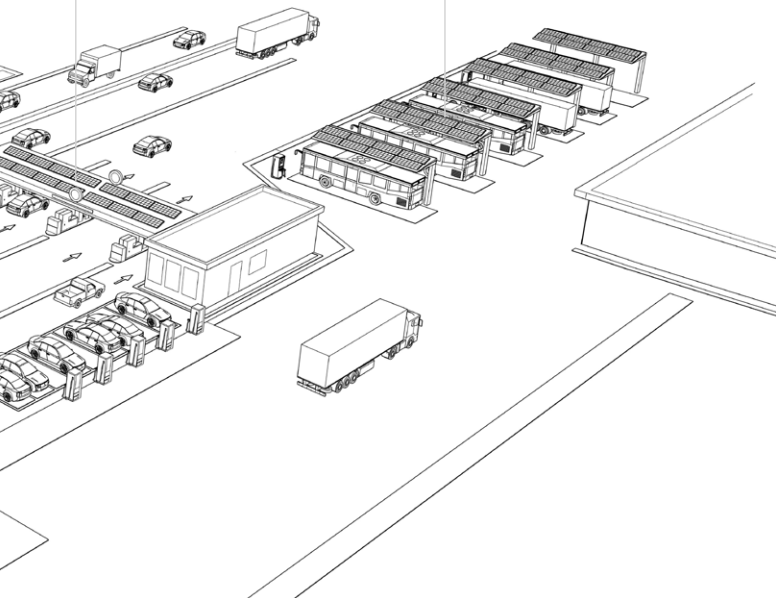


CHARGE & GO

Highway charging stations, petrol stations.

FLEET AND TRANSIT CHARGING

Logistic hubs, fleets, public transport depots.



The Charge & Go use case

The "Charge & Go" use case focuses on providing efficient, reliable, and user-friendly charging experiences for electric vehicle drivers across a range of environments, from urban centers to remote locations. It emphasizes the need for accessible charging stations that enable quick plug-in and seamless payment, minimizing downtime and inconvenience for users.
Key features of this use-case include intuitive interfaces for drivers, charging service availability, and safety. Operators benefit from scalable solutions that integrate with existing infrastructure and backend platforms, ensure maximum uptime, and optimal energy management.

ELECTRICAL INFRASTRUCTURE FOR EV CHARGING

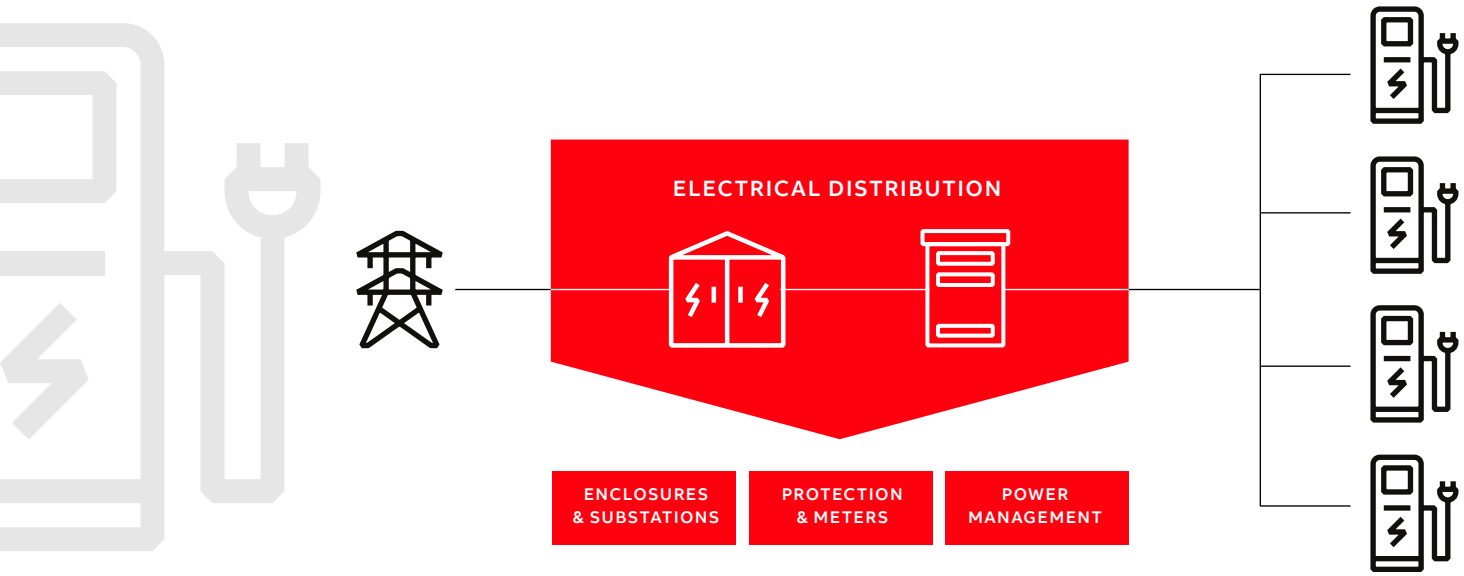
The grid to charger infrastructure

The “grid to charge” scope refers to the segment of the electrical network that bridges the utility grid and electric vehicle (EV) charging stations. It encompasses all the necessary components, design considerations, and technical standards required to deliver power safely and efficiently from the main grid to the point where EVs recharge.

This application note provides a comprehensive reference design for the low-voltage (LV) distribution network that links the utility grid to EV chargers, with a particular focus on supporting the "Charge & Go" use case. Specifically, it is tailored to address the requirements of efficient, user-friendly charging experiences for electric vehicle drivers in environments such as highway corridors, dedicated e-stations, and suburban areas—where rapid charging, seamless payment, and high service availability are essential. By centering on these scenarios, the document ensures infrastructure solutions are designed to meet the fast-paced needs of long-distance travel and commuter routes, streamlining the charging process and minimizing downtime for drivers on the move.

It details functional architectures, outlines principles for protection and coordination, and places a strong emphasis on the importance of effective power management to ensure reliable operation, grid stability, and efficient scaling of electrified transportation infrastructure.

To facilitate efficient planning and deployment, the document recommends ABB solutions designed to streamline system design, accelerate installation, and ensure adherence to IEC standard. Included are practical resources such as single-line diagrams, bills of materials, and step-by-step guidelines for installation and commissioning, empowering users to confidently develop reliable and compliant charging infrastructures.



THE IMPORTANCE OF POWER MANAGEMENT

Overview

Effective power management is fundamental to the sustainable and reliable operation of electric vehicle (EV) charging infrastructure. **The primary challenge is not simply meeting peak demand but rather optimizing how that demand is distributed and controlled.**

A frequent misconception is to size the electrical infrastructure based on the sum of all installed charging capacities. In practice, when an EV connects to a charger, it becomes part of a complex energy ecosystem where the actual power absorbed at any given moment depends on multiple variables: charger output, battery state of charge, vehicle type, ambient and battery temperatures, and—critically—the current availability of energy from the grid.

For instance, the power curve of a fast charge typically features a peak only in the initial phase (from 20–30% to 50% battery charge), after which it declines significantly. If infrastructure is always designed to accommodate the continuous maximum output of all chargers, the result is unnecessary oversizing, increased capital expenditures, and operational hurdles that are more perceived than real. This is precisely why intelligent power management strategies are indispensable. Incorporating smart control systems and energy storage solutions allows for the flexible and efficient handling of demand peaks, preventing grid overloads. By distributing available power dynamically and sharing peak loads, organizations can guarantee reliable, efficient, and scalable EV charging solutions. This approach maintains high quality service and enables future expansion, all while optimizing infrastructure investments and minimizing stress on the electrical grid.

HOW TO CHOOSE A POWER MANAGEMENT SOLUTION

Parameter	Specification	Description
Site size	Number of charging points	Indicates the maximum number of EV chargers the controller can manage simultaneously.
Interoperability & Communication Protocols	Charger supported Integration with meters Other system integrations Backend connection	**Charger Supported:** Assesses the controller's ability to integrate with various charger brands and protocols (e.g., OCPP, Modbus). **Integration with Meters:** Required for precise energy measurements and dynamic load management, especially when integrating non-EV loads. **Other System Integrations:** Evaluates compatibility with external systems such as: MSP backends (for billing and user management); SCADA systems (for industrial control); BMS (Building Management Systems). **Backend connection:** the ability of the controller to connect to the Chargers and connect to a charger backend via OCPP.
Deployment Model	Cloud vs Local	Local controllers offer faster response and higher reliability, ideal for mission-critical sites. Cloud-based solutions provide easier remote access and updates but depend on internet connectivity.
Business Model	Annual fee vs One-time payment	Defines the commercial model: either a recurring subscription or a one-time upfront investment.
Load Management Strategy	Static vs Dynamic	**Static:** Fixed power allocation, simple to implement but less flexible. **Dynamic:** Real-time power adjustment based on demand, ideal for scalable and adaptive systems.
Key Algorithms	Intelligent load distribution and prioritization	Advanced controllers may include logic for optimizing load distribution, forecasting usage, and prioritizing charging sessions.
Scope of Controller Solution	EV only, PV and BESS integration, Full microgrid	Determines whether the controller is dedicated to EVs or part of a broader energy management system (e.g., integrating solar PV, battery storage, HVAC, or lighting).
Solution Type	Project-based vs Preconfigured	**Project-based:** Highly customizable, tailored to specific site needs. **Preconfigured:** Ready-to-deploy solutions with minimal setup and limited customization.

INTEROPERABILITY AND KEY COMMUNICATION PROTOCOLS

Why interoperability matters

Interoperability refers to the capability of diverse systems, devices, and networks to seamlessly communicate and function together, regardless of manufacturer, service provider, or software platform.

In the fast-evolving EV charging industry, achieving interoperability is essential. Without it, drivers would encounter a fragmented experience, restricted by varying access, payment methods, and data standards across different charging networks. Industry standards such as OCPP, OCPI, OCHP, and eMIP are specifically designed to address these challenges, enabling smooth, unified operation throughout the EV charging ecosystem.

HOW PROTOCOLS ENABLE INTEROPERABILITY

Platform	Role in interoperability
OCPP	Connects chargers to backend systems, enabling centralized control
OCPI	Facilitates peer-to-peer roaming between networks
OCHP	Provides roaming via a centralized clearing house
eMIP	Adds contract management, validation, and trust layers to roaming

The communication protocols for the grid to charge: OCPP

OCPP (Open Charge Point Protocol) serves as the backbone for communication between EV charging stations and backend management platforms, enabling a suite of advanced features:

- Remotely initiate or stop charging sessions when a vehicle is connected
- Continuously monitor charging progress and station status
- Deploy firmware and software updates efficiently
- Gather comprehensive data on usage patterns and energy consumption
- Activate smart charging capabilities and integrate seamlessly with the power grid

By decoupling charging hardware from management software, OCPP empowers operators to select equipment and platforms from various vendors, reducing the risk of vendor lock-in and supporting scalable network expansion.

Key OCPP Versions

- **OCPP 1.6:** The industry standard, offering reliable smart charging, remote control, and detailed session data. It supports both JSON and SOAP integrations for flexibility.
- **OCPP 2.0.1 (latest):** Introduces Plug & Charge functionality through ISO 15118, enhanced security and encryption, advanced smart charging profiles, reservation capabilities, and improved diagnostics and notifications.

Smart Charging and Grid Integration

Protocols like OCPP 2.0.1 and ISO 15118 enable advanced energy management features, including **smart charging**, **load balancing**, and **even vehicle-to-grid (V2G)** functionality. These tools are critical for grid stability as EV demand scales, allowing charge point operators to optimize based on time-of-use rates and grid load.

WHY OCPP IS ESSENTIAL

- **Open and vendor-neutral:** freely available for implementation, encouraging adoption and innovation
- **Extensive compatibility:** supported by thousands of EV charging station models worldwide
- **Future-proof:** supports cutting-edge applications like V2G, dynamic load management, and flexible pricing

ABB POWER MANAGEMENT OFFERING

Static VS dynamic load management

There are two primary load management strategies: Static Load Management and Dynamic Load Management.

STATIC LOAD MANAGEMENT

Charging stations operate using a preset power allocation. This method is straightforward and generally cost-efficient, resulting in consistent performance with minimal real-time intervention. However, it offers limited flexibility for shifting demand, may cause underutilization of available power when other critical loads exist, and requires manual modification if the system configuration changes.

DYNAMIC LOAD MANAGEMENT

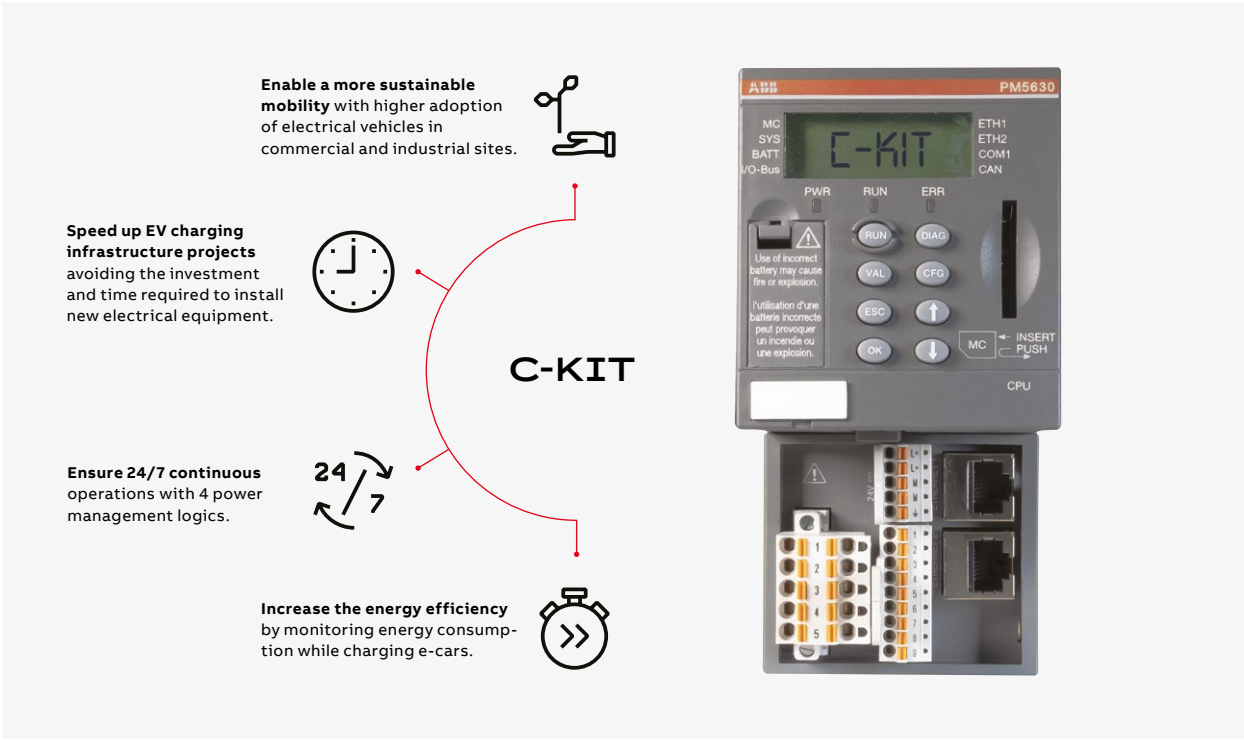
Power usage at the site is continuously monitored, and the system adjusts the allocation among all chargers in real time. This enables adaptation to varying demand, increases utilization of available power — particularly when other types of loads are present — and can mitigate the need for additional infrastructure as electric vehicle usage expands.

In summary, **static load management** is appropriate for smaller installations with less variability (for example, sites with only EV loads), where simplicity and low cost are prioritized.

Dynamic load management is suitable for locations that have additional priority loads (such as a nearby restaurant or cafe) or for high-traffic sites where demand varies, and flexible efficient power use is necessary to maintain site operations.

C-KIT FOR DYNAMIC LOAD MANAGEMENT

ABB C-Kit connects to Electric Vehicle chargers to dynamically manage their power profiles, ensuring service continuity and most efficient use of the available power, while providing flexibility in operation. C-Kit is a pre-configured, off the shelf solution for the load management of EV Chargers. Speed up EV charging infrastructure projects avoiding the investment and time required to install new electrical equipment or complex energy management systems.



For optimal dynamic load management, the C-kit requires real-time visibility into total site power consumption. ABB offers two flexible metering solutions:

1. Smart Breakers

2. Smart Meters – ABB or third-party meters

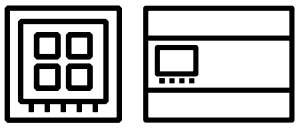
ABB POWER MANAGEMENT OFFERING

Smart Breakers

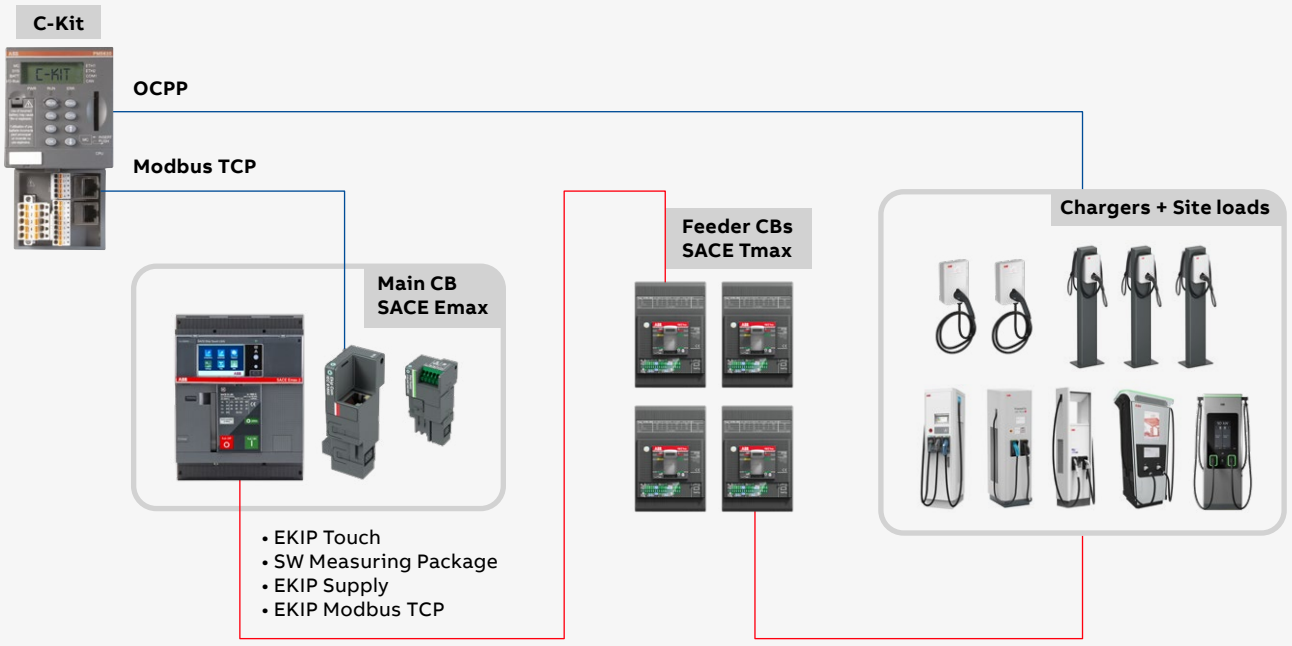
In this scenario the C-Kit system reads metering data direct from the SACE Emax and Tmax Circuit breakers using the embedded metering capability.

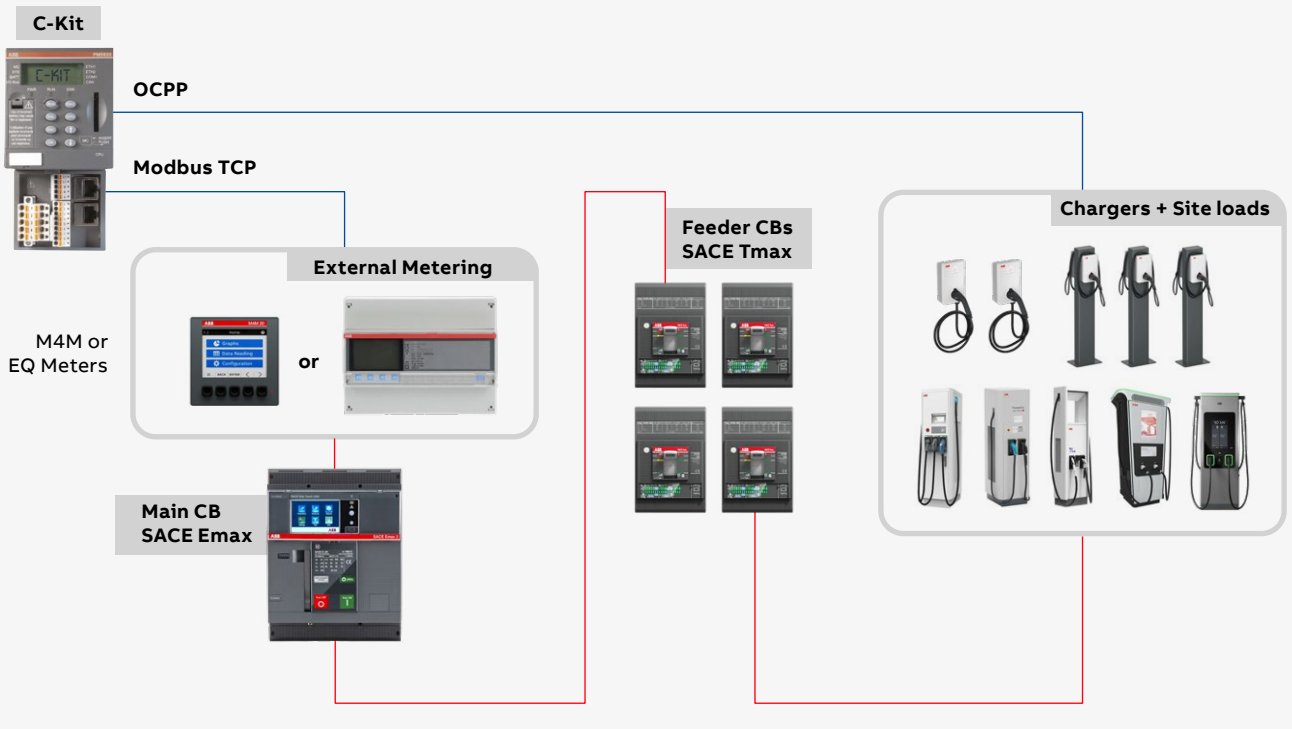
By making use of the ABB Measuring package for SACE Emax and Tmax as well as the EKIP Modbus TCP communication module, the SACE Emax and Tmax Circuit breakers are equipped with advanced metering capabilities.

Smart Meters - ABB or 3rd Party meters



In this scenario the C-Kit system reads metering data from the meter via Modbus TCP or Modbus RS485. ABB M4M or EQ Meters are equipped with communication protocols for sending data to control systems.


C-Kit
OCPP
Modbus TCP
Main CB
SACE Emax
• EKIP Touch
• SW Measuring Package
• EKIP Supply
• EKIP Modbus TCP
Feeder CBs
SACE Tmax
Chargers + Site loads


C-Kit
OCPP
Modbus TCP
External Metering
M4M or
EQ Meters
or
Main CB
SACE Emax
Feeder CBs
SACE Tmax
Chargers + Site loads

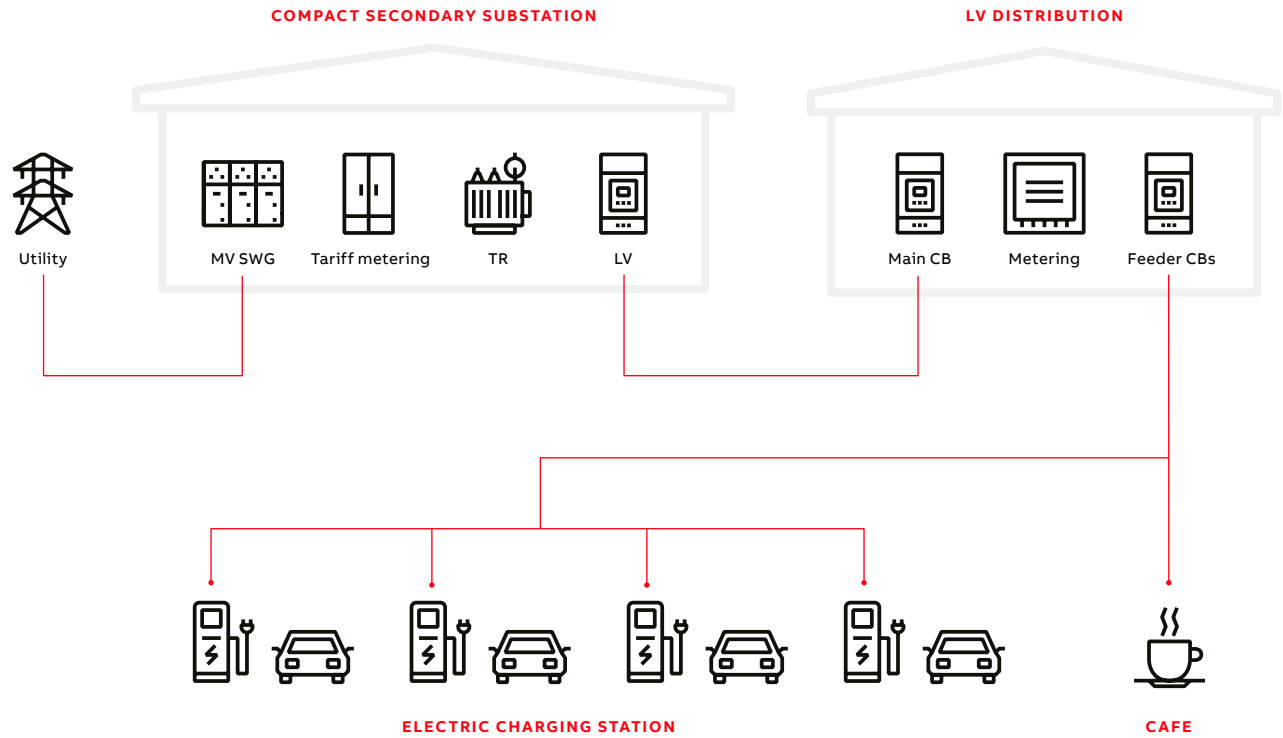
CHARGE & GO TYPICAL REFERENCE ARCHITECTURE

Typical Connection to the grid architecture Charge & Go

As roadside infrastructure evolves to support electric mobility, fast chargers at petrol stations, service stations, and similar facilities are becoming the most demanding assets on the grid.

For Charge Point Operators (CPOs) ensuring grid security and system reliability is critical while also delivering a seamless, high-availability charging experience for EV drivers.

A utility connection to an existing site is available, an LV distribution cabinet is utilized to distribute power throughout the site.



APPLICATIONS FOR IEC STANDARD

Application Bundle: designing for back-up protection scenario

- The site comprises 4 X 180KW DC fast chargers and a Cafè/convenience store
- The incoming supply to the site is 11KV. For more information about ABB MV/LV solutions refer to our Compact Secondary Substation solutions (*Link*)
- Coordination between the Compact Secondary Substation and the EVCI Distribution board has been confirmed therefore a Switch disconnector is used in the EVCI distribution board
- 4 x 180 KW DC chargers are protected by circuit breakers
- The Cafè load is about 50KW
- The system fault level is 28KA and the system Voltage Level is 400V 50Hz

MAIN CIRCUIT

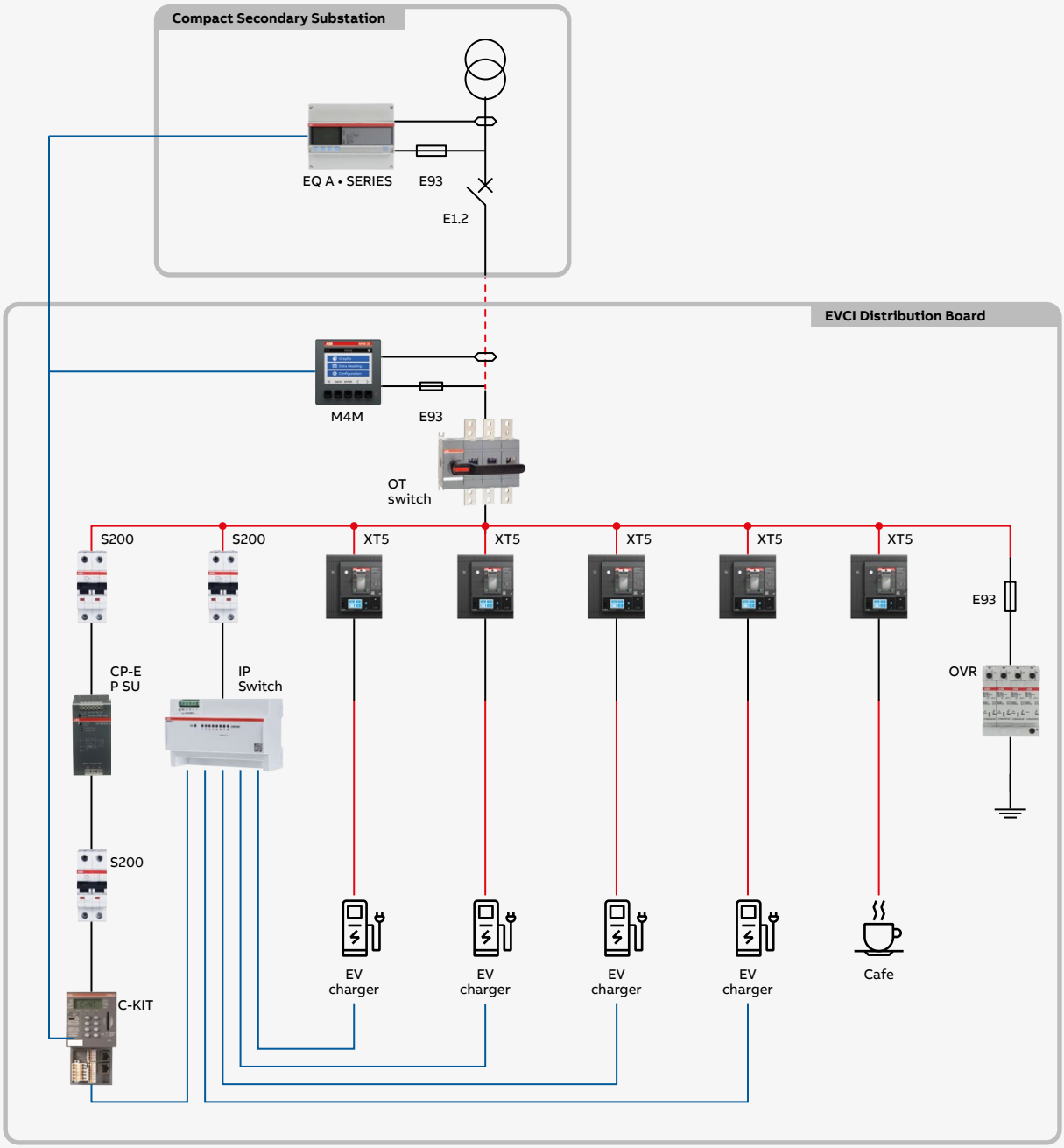
Distribution Board	3 Pole Solution		4 pole Solution		QTY
Main Switch	1SCA022860R6580	OT1600E03P	1SCA022860R6740	OT1600E04P	1
Feeder CB for Chargers	1SDA100344R1	XT5N 400 TMA 320-3200 3p	1SDA100383R1	XT5N 400 TMA 320-3200 4p	4
Feeder CB for Café	1SDA067415R1	XT1N 160 TMD 80-800	1SDA067423R1	XT1N 160 TMD 80-800	1
Surge Protection	2CTB803973R1100	OVR T2 3N 40-275 P QS	2CTB803973R1100	OVR T2 3N 40-275 P QS	1
Surge Protection Fuse Back up	2CSM296532R1801	E 93N/125	2CSM296532R1801	E 93N/125	1
Fuse	2CSM258363R1801	E 9F22 AM125	2CSM258363R1801	E 9F22 AM125	4
Power meter	2CSG251141R4051	M4M 20 Modbus	2CSG251141R4051	M4M 20 Modbus	1
Fuse Holder For Metering	2CSM204733R1801	E 93N/32	2CSM204733R1801	E 93N/32	1
Fuse For Metering	2CSM257553R1801	E 9F10 AM10	2CSM257553R1801	E 9F10 AM10	4

CONTROL CIRCUIT

Ckit	Control Circuit	
Power Supply	1SVR427034R0000	CP-E 24/5.0
IP Switch	2CDG120082R0011	IP Switch, 8 Ports, Fast Ethernet, MDRC
Input for PSU	2CDS252001R0064	S202-C6
output for PSU	2CDS252001R0064	S202-C6
input CB for IP Switch	2CDS252001R0164	S202-C16

ALTERNATIVES

Alternative products to Consider		
Din Mount Meter As an option to the M4M Front panel Meter	2CMA170537R1000	A44 352 - 100


Compact Secondary Substation
EQ A • SERIES
E93
E1.2
EVCI Distribution Board
M4M
E93
OT
switch
S200
S200
XT5
XT5
XT5
XT5
XT5
E93
OVR
CP-E
P SU
IP
Switch
S200
C-KIT
EV
charger
EV
charger
EV
charger
EV
charger
Cafe

APPLICATIONS FOR IEC STANDARD

Application Bundle: designing for full selectivity scenario

- The site comprises 4 X 180KW DC fast chargers and a Cafè/convenience store
- Coordination between the Utility Substation and the EVCI Distribution board has not been confirmed therefore a Circuit breaker is used in the EVCI distribution board to ensure Selective coordination – Full Selectivity
- 4 x 180 KW DC chargers are protected by circuit breakers
- The Cafè load is about 50KW
- The system fault level is 28KA and the system Voltage Level is 400V 50Hz

MAIN CIRCUIT

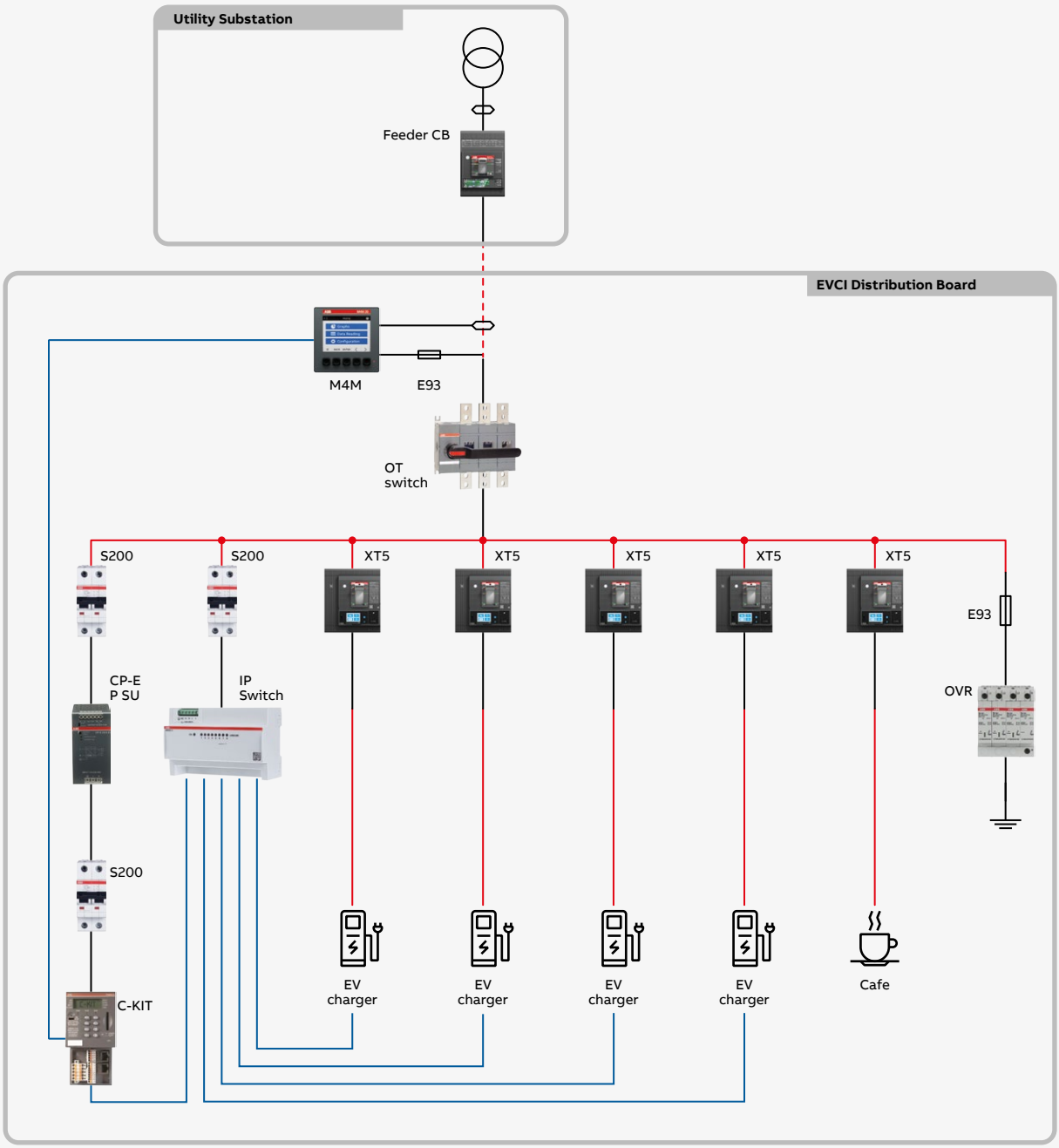
Distribution Board	3 Pole Solution		4 pole Solution		QTY
Main Circuit Breaker	1SDA124773R1	E1.3B 1600 Ekip Aware LSI 3P	1SDA125045R1	E1.3B 1600 Ekip Aware LSI 4P	1
Feeder CB for Chargers	1SDA100344R1	XT5N 400 TMA 320-3200 3p	1SDA100383R1	XT5N 400 TMA 320-3200 4p	4
Feeder CB for Café	1SDA067415R1	XT1N 160 TMD 80-800	1SDA067423R1	XT1N 160 TMD 80-800	1
Surge Protection	2CTB803973R1100	OVR T2 3N 40-275 P QS	2CTB803973R1100	OVR T2 3N 40-275 P QS	1
Surge Protection Fuse Back up	2CSM296532R1801	E 93N/125	2CSM296532R1801	E 93N/125	1
Fuse	2CSM258363R1801	E 9F22 AM125	2CSM258363R1801	E 9F22 AM125	4
Power meter	2CSG251141R4051	M4M 20 Modbus	2CSG251141R4051	M4M 20 Modbus	1
Fuse Holder For Metering	2CSM204733R1801	E 93N/32	2CSM204733R1801	E 93N/32	1
Fuse For Metering	2CSM257553R1801	E 9F10 AM10	2CSM257553R1801	E 9F10 AM10	4

CONTROL CIRCUIT

Control Circuit - load management		
C-Kit	1SDA126136R1	C-Kit
C-Kit battery	1SDA128384R1	C-Kit battery
Power Supply	1SVR427034R0000	CP-E 24/5.0
IP Switch	2CDG120082R0011	IP Switch, 8 Ports, Fast Ethernet, MDRC
Input for PSU	2CDS252001R0064	S202-C6
Output for PSU	2CDS252001R0064	S202-C6
Input CB for IP Switch	2CDS252001R0164	S202-C16

ALTERNATIVES

Alternative products to Consider		
using the Ekip Supply Evo Modbus TCP, the measuring capability of the Breaker is enabled and no meter is required	1SDA126472R1	Ekip Supply Evo Modbus TCP


Utility Substation
Feeder CB
EVCI Distribution Board
M4M
E93
OT
switch
S200
S200
XT5
XT5
XT5
XT5
XT5
E93
CP-E
P SU
IP
Switch
OVR
S200
C-KIT
EV
charger
EV
charger
EV
charger
EV
charger
Cafe

APPLICATIONS FOR IEC STANDARD

Application Bundle: designing for modular growth, grow your station with the market needs.

- The site comprises 3 X 180KW DC fast chargers and a Cafè/convenience store, the total site capacity can handle 6+ stations. The application below highlights the ability to add as your station grows
- Coordination between the Compact Secondary Substation and the EVCI Distribution board has been confirmed therefore a Switch disconnector is used in the EVCI distribution board
- 3 x 180 KW DC chargers are protected by circuit breakers
- The Cafè load is about 50KW
- The system fault level is 28KA and the system Voltage Level is 400V 50Hz

MAIN CIRCUIT

Distribution Board	3 Pole Solution		4 pole Solution		QTY
Main Circuit Breaker	1SDA100831R1	XT7S 1000 Ekip Dip LSI In=1000A 3p F F	1SDA101119R1	XT7S 1000 Ekip Dip LSI In=1000A 4p F F	1
Feeder CB for Chargers	1SDA100344R1	XT5N 400 TMA 320-3200 3p F F	1SDA100383R1	XT5N 400 TMA 320-3200 4p F F	4
Feeder CB for Café	1SDA067415R1	XT1N 160 TMD 80-800	1SDA067423R1	XT1N 160 TMD 80-800	1
Sub DB Surge Protection	2CTB803973R1100	OVR T2 3N 40-275 P QS	2CTB803973R1100	OVR T2 3N 40-275 P QS	1
Surge Protection Fuse Back up	2CSM296532R1801	E 93N/125* type AM fuse to be used	2CSM296532R1801	E 93N/125* type AM fuse to be used	1
Fuse	2CSM258363R1801	E 9F22 AM125	2CSM258363R1801	E 9F22 AM125	4

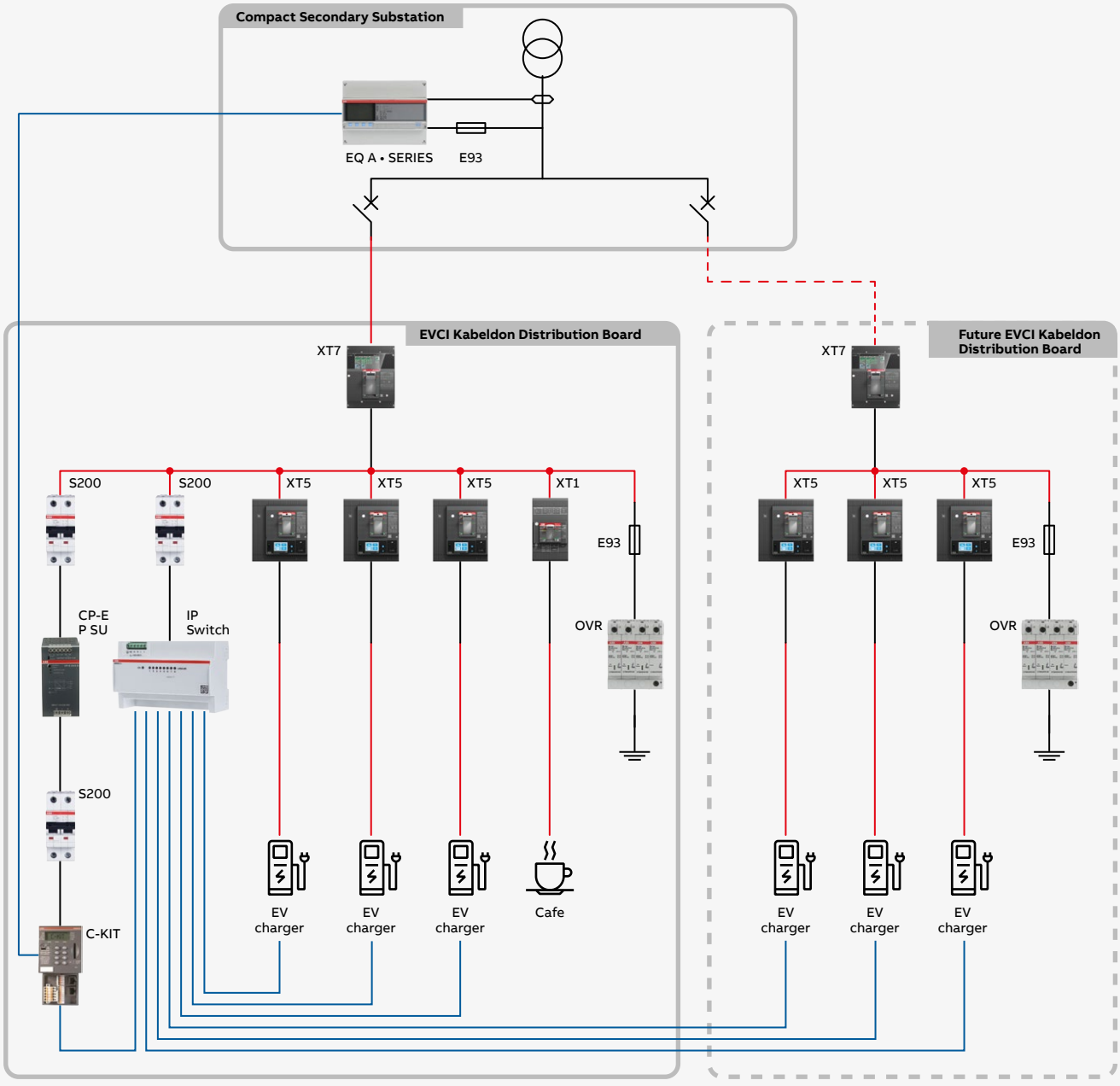
* For a rated current of 125A only fuse link type aM can be used in combination with a device which guarantees protection against overload.

CONTROL CIRCUIT

Control Circuit - load management		
C-Kit	1SDA126136R1	C-Kit
C-Kit battery	1SDA128384R1	C-Kit battery
Power Supply	1SVR427034R0000	CP-E 24/5.0
IP Switch	2CDG120082R0011	IP Switch, 8 Ports, Fast Ethernet, MDRC
Input for PSU	2CDS252001R0064	S202-C6
output for PSU	2CDS252001R0064	S202-C6
input CB for IP Switch	2CDS252001R0164	S202-C16

ALTERNATIVES

Alternative products to Consider		
using the the XT7 Measuring touch Circuit breaker, you can eliminate the need for a smart meter. In addition to the measuring capabilities the interface of the protection trip unit is a touch screen that allows PC interface for configuration	1SDA100851R1	XT7S 1000 Ekip Touch Meas.LSIG 1000 3P
	1SDA101139R1	XT7S 1000 Ekip Touch Meas.LSIG 1000 4P
	1SDA074172R1	Ekip Supply 110-240V AC/DC
	1SDA107402R1	Ekip Com R Modbus TCP


Compact Secondary Substation
EQ A • SERIES
E93
EVCI Kabeldon Distribution Board
Future EVCI Kabeldon Distribution Board
XT7
XT7
S200
S200
XT5
XT5
XT5
XT1
XT5
XT5
XT5
E93
E93
OVR
OVR
CP-E
P SU
IP
Switch
S200
C-KIT
EV
charger
EV
charger
EV
charger
Cafe
EV
charger
EV
charger
EV
charger

PRODUCT OFFERING

SACE Emax 3

WEB PAGE

CATALOG

EKIP Measuring Modules

WEB PAGE

CATALOG

SACE Tmax XT

WEB PAGE

CATALOG

S200 miniature CB

WEB PAGE

CATALOG

CP Power Supplies

WEB PAGE

CATALOG

System Pro E Power

WEB PAGE

CATALOG

Kabeldon

WEB PAGE

CATALOG

EQ meters, M4M Meters

WEB PAGE

EQ METER CATALOG

M4M METER CATALOG

C-Kit

WEB PAGE

LEAFLET

OVR surge Protection

WEB PAGE

CATALOG

OT Switches

WEB PAGE

E90 Fuse Holders

WEB PAGE

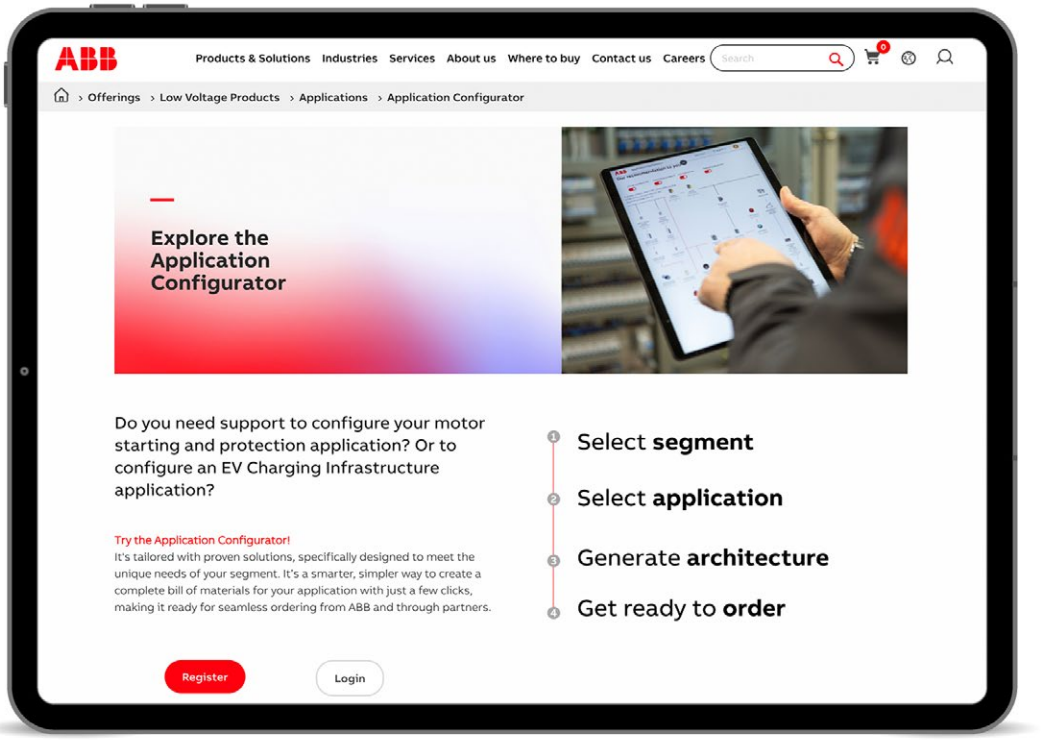
CATALOG

APPLICATION CONFIGURATOR

Do you need support to configure an EV Charging Infrastructure application?
Try the Application Configurator!

It's tailored with proven solutions, specifically designed to meet the unique needs of your segment. It’s a smarter, simpler way to create a complete bill of materials for your application with just a few clicks, making it ready for seamless ordering from ABB and through partners.

Flexible **Intuitive** **Time-saving** **Built around you**



EBOOK FOR EV CHARGING

Is your electrical infrastructure ready to support the EV charging evolution? **To know more, download the ebook “Reliable power, from grid to charge".**

The rise of electric mobility is transforming the way we move, bringing with it a significant increase in energy demand. To effectively manage this shift, a smart grid is essential: it’s not just a choice, but a necessity for ensuring stability, efficiency, and reliability of energy systems.

Additional information
We reserve the right to make technical changes or modify the contents of this document without prior notice. With regard to purchase orders, the agreed particulars shall prevail. ABB AG does not accept any responsibility whatsoever for potential errors or possible lack of information in this document.

ABB S.p.A.
5, Via Pescaria
I-24123, Bergamo (Italy)
Phone: +39 035 395.111

abb.com/lowvoltage

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