

EVlink

Cluster Cabinet Including EVlink MS Energy Management and EVlink MS Supervision Recommendation Guide

04/2013



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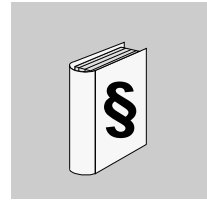
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Safety Information



Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a Danger safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

NOTICE

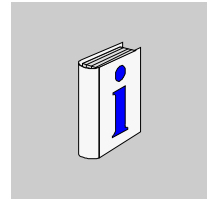
NOTICE is used to address practices not related to physical injury.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

About the Book



At a Glance

Document Scope

This guide illustrates the design of a cluster cabinet including the EVlink MS Energy Management and EVlink MS Supervision options.

The cluster cabinet includes

- the electrical distribution equipment that supplies power to a cluster of charging stations and helps the protection of people and goods.
- the monitoring and control equipment that manages a cluster of charging stations.
- the energy management and remote monitoring solutions provided by the EVlink MS Energy Management and EVlink MS Supervision options.

The guide provides recommendations on

- how to design the electrical distribution equipment used in the cluster cabinet,
- how to design the PLC-based control and monitoring of the cluster cabinet equipment.

The recommendations are provided with an example of a cluster cabinet with a PLC to show

- how to power and electrically protect the EVlink charging stations,
- how the PLC manages the control and monitoring functions of the charging stations.

The example of a cluster cabinet is intended to

- show how to design a cluster cabinet to control charging stations with communication,
- provide an example which can be modified to design a cluster cabinet adapted to specific applications.

This guide is aimed at local Schneider Electric engineering departments and Schneider Electric installers dealing with charging solutions for electric vehicles.

Validity Note

The information described in this guide is valid for the cluster cabinets including the EVlink MS Energy Management and EVlink MS Supervision options.

To design their own cluster cabinet, the local engineering departments and installers must follow all local and national standards, regulations, and safety codes concerning electrical installations, specifically to adapt the earthing system and electrical distribution system to the chosen charging stations.

Related Documents

Title of Documentation	Reference Number
Electrical Installation Guide	EIGED306001EN
Electrical Installation Guide (Wiki version)	www.electrical-installation.org
PowerLogic™ Series 800 Power Meter Installation Guide	63230-500-282
PowerLogic™ Series 800 Power Meter User Guide	63230-500-225
iEM3150 / iEM3155 Instruction Sheet	S1B46583
PowerLogic™ Ethernet Gateway EGX100 Installation Guide	63230-319-200
PowerLogic™ Ethernet Gateway EGX100 User Guide	63230-319-204
EVlink NCA91000 GPRS Modem Instruction Sheet	HRB18361
EVlink NCA91000 GPRS Modem Installation Guide	DOCA0033EN
EVlink Commissioning Guide	DOCA0060EN

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User Comments

We welcome your comments about this document. You can reach us by e-mail at techcomm@schneider-electric.com.

Introduction to the Cluster Cabinet

Overview

Having a cluster cabinet in addition to the standard EVlink charging stations for electric vehicles is valuable and useful for both customers and maintenance personnel.

The cluster cabinet is an element for making charging station management faster and more reliable. When several charging stations are supplied, each line must be protected: thus the importance of the cluster cabinet.

Many standards apply to electrical installations. To provide protection of material, several levels of protection are required. The cluster cabinet is used at the level closest to the charging station protection therefore the protection circuit is dedicated to each plug available on the charging station.

The cluster cabinet can gather information from all the connected charging stations and the electrical state of the complete network. Checking the electrical circuit can be done using the electric vehicle simulation tool NCA93100.

The different types of communicating EV•1S••••• EVlink charging stations can be installed on the same electrical system and managed by a single PLC in the cluster cabinet.

The PLC installed in the cluster cabinet can be used to provide:

- energy and distribution management of the electric vehicle fleet through the EVlink MS Energy Management option, and
- remote monitoring services through the EVlink MS Supervision option.

EVlink MS Energy Management Option

The EVlink MS Energy Management option provides energy management to manage the power delivered to the charging stations.


There are 2 power control modes available:


- Dynamic mode: the available power is constantly updated by a power control system using a power meter on the customer main incoming line. The deliverable power is then sent to the management system of the charging stations.
- Static mode: the maximum power is set in the energy management system when commissioning the cluster of the EVlink charging stations.

EVlink MS Supervision Option

The EVlink MS Supervision option provides remote monitoring services through web pages and web services, using a GPRS modem wired to the Ethernet network of the cluster cabinet.

Safety Guidelines

 DANGER
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH
The wiring rules used for a cluster cabinet must comply with electrical installation standards: <ul style="list-style-type: none">• standard NF C15-100 in France, or• the local version of standard IEC/EN 60364 (depending on the country of installation), or• local and national regulations, and safety codes concerning electrical installations.
Failure to follow these instructions will result in death or serious injury.

 WARNING
UNINTENDED EQUIPMENT OPERATION
<ul style="list-style-type: none">• Implementing the cluster cabinet requires expertise in electrical installation. Only persons with such expertise are allowed to design, install, modify, or operate the cluster cabinet.• Install all equipment according to the drawings specified in the relevant documentation.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

General Recommendations

Overview

The recommendations provided in this guide deal with the most common cases. If you encounter a case which is not covered by this documentation, contact the Schneider Electric EVlink Customer Care Center.

Safety Instructions

NOTICE

HAZARD OF IMPROPER OPERATION AND EQUIPMENT DAMAGE

Ensure that the protection of cables and charging stations connected in the cluster cabinet are correctly dimensioned:

- Follow your local standards applicable for low voltage electrical installations.
- Carry out electrical calculations required to size cable cross-sections and dimension protection devices to confirm architecture suitability.

Failure to follow these instructions can result in equipment damage.

Dimensions of the Cluster Cabinet

The dimensions of the cluster cabinet depend on the number of charging stations connected in the cabinet. Space should be reserved for later cluster developments, for example, installing additional charging stations.

The ingress protection (IP) and mechanical impact resistance (IK) ratings depend on where the cluster cabinet is installed. The IP and IK ratings must follow the standards IEC 60364 and IEC 60529 and their local versions.

Installation Recommendations

The installation recommendations described below correspond to charging infrastructures implemented in temperate climate.

Characteristics of temperate climate:

- Temperature: $-25\dots+50$ °C
- Altitude: 0...1000 m
- Relative humidity:
 - over 24 hours: ≤ 95 %
 - over 1 month: ≤ 90 %

NOTICE

HAZARD OF IMPROPER OPERATION AND EQUIPMENT DAMAGE

Make sure that the environmental conditions correspond with the equipment operating specifications (relative humidity, operating temperature, for example).

To preserve proper operating conditions, install heating resistors or ensure adequate ventilation, depending on the on-site environment.

Failure to follow these instructions can result in equipment damage.

Connecting the Cluster According to the Earthing System

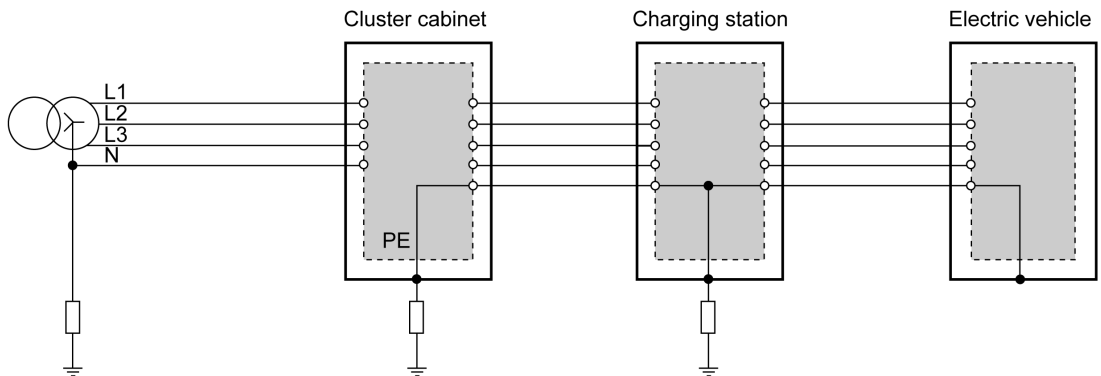
The cluster can be connected directly to the following earthing systems:

- TT earthing system with installation earth resistance less than 150Ω
- TN earthing system with installation earth resistance less than 150Ω , with the variants:
 - TN-S system with separate conductors PE and N
 - TN-C with a combined PEN conductor: not to be used in very unbalanced networks

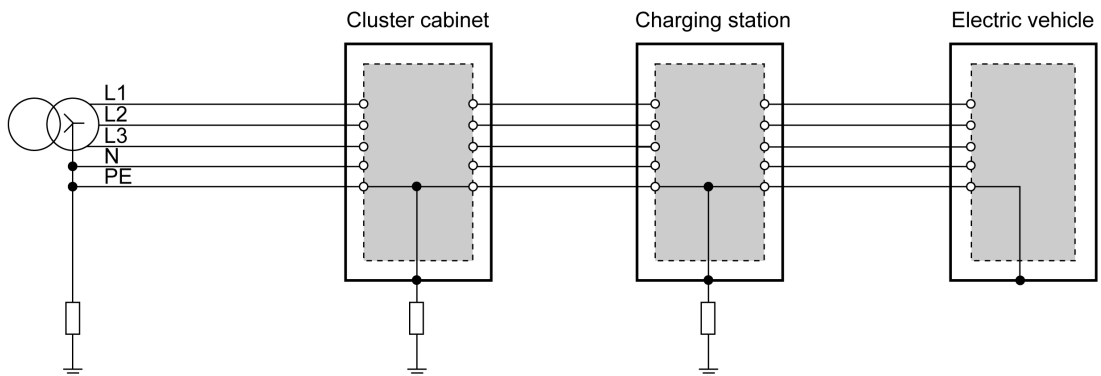
Charging stations must not be connected directly to IT earthing systems. In case of an existing IT earthing system, install an insulation transformer on the IT earthing system, and then create a TT or TN earthing system between the transformer and the cluster cabinet.

For comprehensive details about the different earthing schemes and earthing of equipment, refer to the *Electrical Installation Guide*, chapter E - LV Distribution.

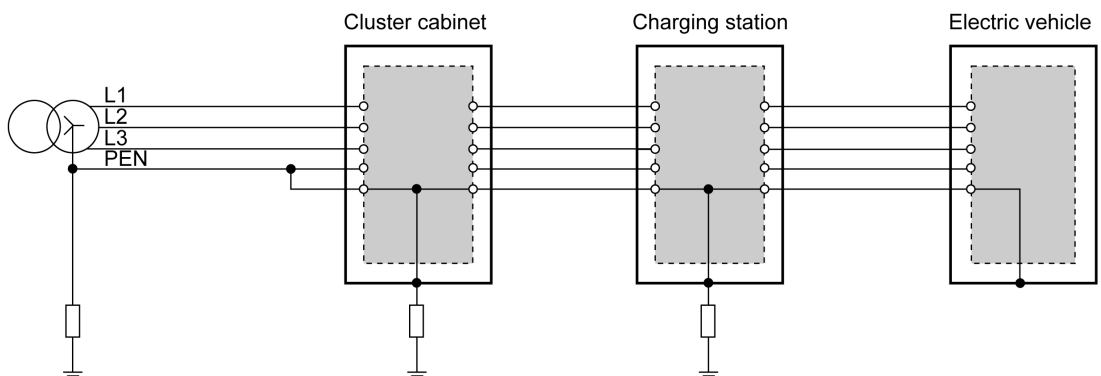
Wiring Diagram in TT Earthing System



Wiring Diagram in TN-S Earthing System

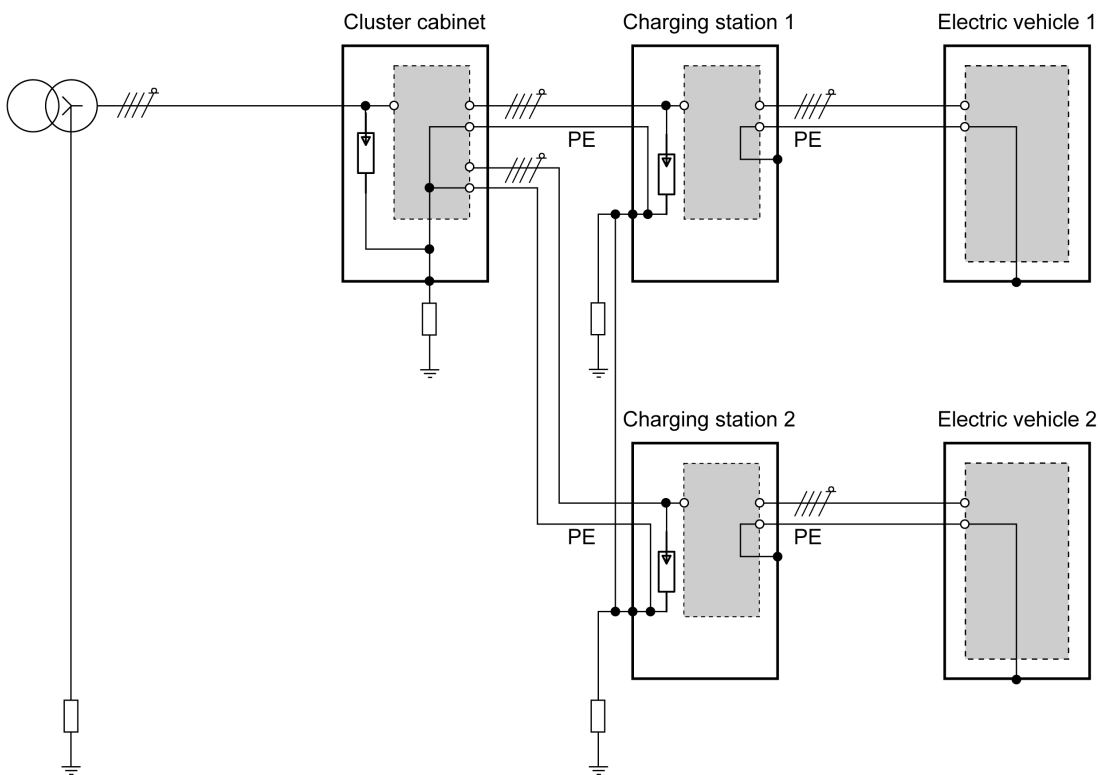


Wiring Diagram in TN-C Earthing System



Earth Connections

- Each outdoor charging station must be connected to the local earth.
- The resistance of each earth connection must be less than $150\ \Omega$
- All earth connections must be connected to one another. See the following diagram.



Ideally, use a mesh covering the areas of the charging stations and electric vehicles to interconnect the earth connections to help ensure equipotentiality of equipment.

Short Circuit Current I_{sc}

The short circuit current (I_{sc}) value is an essential element in the calculations to dimension the equipment used in the cluster cabinet.

The recommendations given in this document for the equipment used in the cluster cabinet are based on an $I_{sc} = 10\ \text{kA}$.

In case of an $I_{sc} > 10\ \text{kA}$, adequately dimension the equipment to be installed upstream. Refer to the Schneider Electric coordination and cascading tables.

Maintenance Documentation

After the cluster cabinet is installed, it is recommended to provide in the cluster cabinet the wiring diagram of the cluster cabinet for later use by the maintenance personnel.

Recommendations for the Incoming Line

Overview

The equipment used on the incoming line in the cluster cabinet consists of:

- 1 switch disconnecter with an MX shunt trip coil or an MN voltage release at the head of the cluster cabinet to allow the disconnection of the cluster cabinet electrical circuit
- 1 mushroom head push-button or fire switch on the cabinet front side for emergency stop to open the switch disconnecter in case of risk of injury to persons or damage to the equipment
- 1 surge arrester and dedicated circuit breaker to protect the cluster cabinet
- 1 socket with dedicated 4 A circuit breaker (to connect a PC, for example)

Switch Disconnecter

The switch disconnecter is defined depending on the power delivered by the cluster cabinet.

It must be compatible with the upstream circuit breaker protection on the customer side.

A switch disconnecter with an MX shunt trip coil or an MN voltage release can be used for emergency stops.

Emergency Stop

An emergency stop is installed in the cluster cabinet to isolate all the connected charging stations in case of an emergency. It triggers the tripping auxiliary of the switch disconnecter.

Associate the tripping auxiliary depending on the priority requested on the electrical installation:

- For high-grade service continuity and performing a warm start, use an MX shunt trip coil.
- For improved safety and performing a cold start, use an MN voltage release.

Surge Arrester

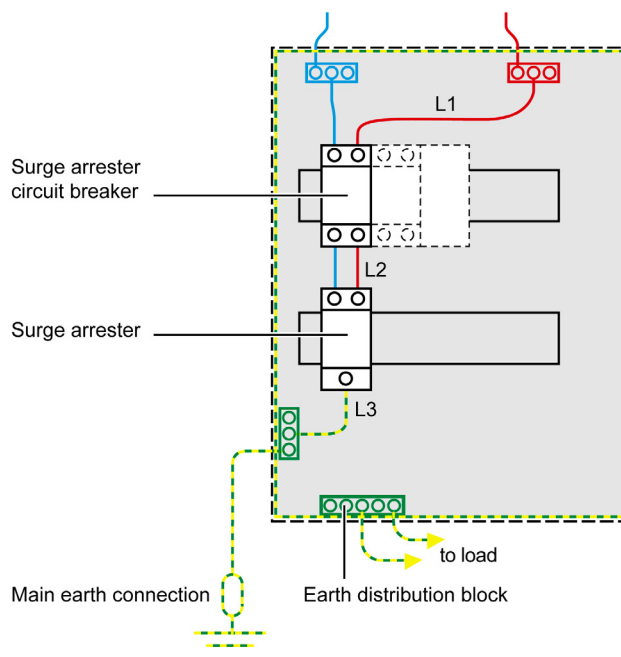
The Isc typically used at the cluster cabinet is less or equal to 10 kA.

A suitable surge arrester type 2 and the dedicated circuit breaker curve C must be installed in the cluster cabinet.

In case of a short-circuited surge arrester, the circuit breaker current limitation curve must be compatible with the surge arrester thermal stress withstand.

Connections of the cluster cabinet surge arrester to the earth should be as short as possible in order to reduce the value of the voltage protection level on the terminals whatever the protected equipment. The total length of surge arrester connections to the network and the earth terminal block should not exceed 50 cm in the cluster cabinet.

See diagram below with a metallic cluster (IEC/EN 61439 compliant): $L1+L2+L3 < 50 \text{ cm}$



NOTE: Each socket outlet of an EVlink charging station is protected with a surge arrester.

For more details about lightning protection, refer to the *Electrical Installation Guide*, chapter J - Protection against voltage surges in LV.

EVlink MS Energy Management Option

To be able to use the dynamic power control mode of the EVlink MS Energy Management option, install a communicating power meter on the customer main incoming line. For example, a PowerLogic PM8•0 power meter with a PM8ECC Ethernet communication card.

To use other power or energy meters, contact the Schneider Electric EVlink Customer Care Center.

Recommendations for the Outgoing Lines

Overview

The charging stations are connected in the cluster in a star network. This architecture enables the use of earth leakage protection devices in the cluster cabinet and provides individual protection for each charging station socket-outlet.

Outgoing Lines for One Charging Station

3 different types of outgoing lines are connected to every charging station:

- 1 or 2 power outgoing lines (one per charging station socket-outlet), delivering the charging power to the vehicle. To use the EVlink MS Energy Management option, each power outgoing line must be equipped with an energy meter.
- 1 auxiliary power outgoing line, supplying the control circuits of the charging station equipped with socket-outlets type 2 or 3.
- 1 communication outgoing line, supplying control and monitoring via the PLC for EVlink Parking charging stations.

Power Outgoing Lines

The power outgoing lines have overcurrent and insulation fault protections. If the 2 protections are provided by 2 separate devices, the insulation fault protection device must be connected downstream of the overcurrent protection device.

Automatic reset systems of the protections are prohibited according to standard IEC 61851-22.

The following table shows the characteristics of the recommended protections of the power outgoing lines, depending on the power and type of socket-outlet:

Maximum Power	Maximum Charging Current	Socket-Outlet Type	Overcurrent Protection	Protection Against Insulation Faults
2 kW	8 A (1P+N)	Residential	10 A curve D circuit breaker	30 mA earth leakage, type A SI
3 kW	16 A (1P+N)	<ul style="list-style-type: none">● Type 2● Type 3	20 A curve D circuit breaker with MNx voltage release	30 mA earth leakage, type A SI
7 kW	32 A (1P+N)	<ul style="list-style-type: none">● Type 2● Type 3	40 A curve D circuit breaker with MNx voltage release	30 mA earth leakage, type A SI
11 kW	16 A (3P+N)	<ul style="list-style-type: none">● Type 2● Type 3	20 A curve D circuit breaker with MNx voltage release	30 mA earth leakage, type B SI
22 kW	32 A (3P+N)	<ul style="list-style-type: none">● Type 2● Type 3	40 A curve D circuit breaker with MNx voltage release	30 mA earth leakage, type B SI

NOTE: When connecting several single-phase charging stations to a 3-phase supply network, it is recommended to balance the single-phase power outgoing lines between the 3 phases.

 DANGER
RISK OF FIRE The residential socket-outlets always must be protected by a 10 A maximum circuit breaker. Failure to follow these instructions will result in death or serious injury.

The maximum length of the power cables is 280 m to avoid nuisance tripping.

Control Outgoing Lines

The control outgoing lines have overcurrent and insulation fault protections:

- Overcurrent protection:
 - 4 A curve C circuit breaker, and
 - control cable length < 280 m
- Insulation fault protection: 30 mA earth leakage protection (type A SI)

If the 2 protections are provided by 2 separate devices, the insulation fault protection device must be connected downstream of the overcurrent protection device.

Number of Control and Power Cables in a TT or TN-S Earthing System

In the case of a TT or a TN-S earthing system with a 300 or 500 mA Residual Current Device (RCD) installed upstream, the maximum number of control and power cables must comply with the following rules:

- with a 300 mA RCD: Cable length x Number of cables < 2,800
- with a 500 mA RCD: Cable length x Number of cables < 4,600

Example with a 300 mA RCD upstream protection and charging stations with 2 socket-outlets:

Cable Length	Maximum Number of Control and Power Cables
280 m	6 power cables and 3 control cables
140 m	10 power cables and 5 control cables

Example with a 500 mA RCD upstream protection and charging stations with 2 socket-outlets:

Cable Length	Maximum Number of Control and Power Cables
280 m	12 power cables and 6 control cables
140 m	20 power cables and 10 control cables

Power Cables Between Cluster Cabinet and Charging Stations

The cable cross-section depends notably on the cable length between the charging station and the cluster cabinet in order to have a limited voltage drop. Beyond a distance of 30 m, the cable cross-section must be increased to keep the limit of the voltage drop to a maximum of 3 %.

The following table indicates the cable cross-section values depending on the cable length between the cluster cabinet and a single-phase charging station.

Cable Length	Cu Cable Cross-section for Single-Phase 16 A 3 kW Charging Station	Cu Cable Cross-section for Single-Phase 32 A 7 kW Charging Station
0...30 m	2.5 mm ²	6 mm ²
30...50 m	4 mm ²	10 mm ²
50...70 m	6 mm ²	16 mm ²
70...120 m	10 mm ²	25 mm ²

The following table indicates the cable cross-section values depending on the cable length between the cluster cabinet and a three-phase charging station.

Cable Length	Cu Cable Cross-section for Charging Station Three-Phase 16 A 11 kW	Cu Cable Cross-section for Charging Station Three-Phase 32 A 22 kW
0...60 m	2.5 mm ²	6 mm ²
60...100 m	4 mm ²	10 mm ²
100...140 m	6 mm ²	16 mm ²
140...240 m	10 mm ²	25 mm ²

NOTE:

- The cable cross-section is limited by the cross-section of the terminal blocks used in the charging stations.
- The cable cross section also depends on the method of installation, type of insulation, and temperature. See the local version of standard IEC/EN 60364 in the country of installation, for example, NF C15-100 in France.

Control Cables Between Cluster Cabinet and Charging Stations

The cross-section of control cables is 2.5 mm², regardless of the length between the cluster cabinet and the charging station.

EVlink MS Energy Management Option

To use the dynamic or static power control modes of the EVlink MS Energy Management option, install an Acti 9 iEM3155 energy meter on each power outgoing line, that is, on each charging station socket-outlet. The Acti 9 iEM3155 energy meter provides multi-tariffs feature and is compliant with the Measuring Instruments Directive (MID) 2004/22/EC.

The energy meter Modbus port is connected to the PLC via an EGX100 Ethernet gateway.

Recommendations for the PLC

Overview

The PLC installed in the cluster cabinet is a Modicon M340.

- The PLC can manage several types of EV•1S••••• EVlink Parking Standard charging stations: wall mounted or floor standing, with 1 or 2 socket-outlets.
- The PLC supports a maximum of 16 socket-outlets.

To control more than 16 socket-outlets with the Modicon M340 PLC, contact the Schneider Electric EVlink Customer Care Center.

Hardware

To control and monitor the charging station socket-outlets, install a Modicon M340 PLC with the following components mounted in a BMX XBP 0600 rack with 6 slots:

Slot Number	Reference	Description
–	BMX CPS 2010	24 Vdc isolated power supply module
00	BMX P34 2000	Processor (CPU) module with: <ul style="list-style-type: none"> • 1 memory card (NCA 84000: EVlink MS Cluster Management Software, NCA 82000: EVlink MS Energy & Cluster Management Software) • 1 integrated communication port (not used)
01	BMX NOE 0110	Communication module with Ethernet port used for: <ul style="list-style-type: none"> • EV•1S••••• EVlink Parking Standard charging stations • energy meters (EVlink MS Energy Management option)
02	BMX DDM 16025	16-channel mixed I/O module dedicated to main supply protection and optional devices
03	BMX DDI 1602	Input module dedicated to the control circuit breakers of the charging stations
04	BMX DDI 1602	Input module dedicated to the power circuit breakers of the charging station socket-outlets
05	–	Reserved

24 Vdc Power Supply

A 24 Vdc power supply is used to supply the following devices on the installation:

- the PLC I/O modules
- the optional PLC backup batteries:
 - ABL8REM24050 Phaseo power supply output 24 Vdc 5 A
 - ABL8BBU24200 Phaseo battery control module 24 Vdc 20 A
 - ABL8BPK24A03 Phaseo battery module 24 Vdc 3.2 Ah for the battery control module
- 1 or more Ethernet switches
- 1 PowerLogic EGX100 Ethernet gateway for 8 socket-outlets (EVlink MS Energy Management option)
- the modem (EVlink MS Supervision option)

The following table shows the 24 Vdc consumption of the elements in the cluster cabinet installation:

Hardware	Consumption
Modicon M340	20 W
TCSESU083FN0 8-port Ethernet TCP/IP switch	9.4 W
EGX100 Ethernet gateway (EVlink MS Energy Management option)	4 W
Modem (EVlink MS Supervision option)	< 15 W

Incoming Line Components Connected to the BMX DDM 16025 I/O Module

The following incoming line components are connected to the PLC inputs:

- switch disconnecter
- surge arrester
- backup batteries
- emergency stop (optional)

PLC Input	Component Connected to the PLC	Description
1	Switch disconnecter	Position of the switch disconnecter contact
2	Surge arrester	State of the surge arrester
3	Uninterruptible Power Supply (UPS)	UPS presence detected in input (optional)
4	Battery power supply	Power supply of battery in backup mode (optional)
5	Battery	Alarm when less than 80% of battery is discharged or battery is disconnected (optional)
6	Spare circuit breaker	Spare circuit breaker MN coil supply
7	Emergency stop	Contact of emergency stop
8	Door contact	Contact of the charging station door for intrusion detection

The following incoming line components are controlled by the PLC outputs:

- modem (EVlink MS Supervision option)
- indication lights (EVlink MS Energy Management option)

PLC Output	Component Connected to the PLC	Description
1	Modem (EVlink MS Supervision option)	Modem ON/OFF
2	Modem (EVlink MS Supervision option)	Authentication request
3	Illuminated indicator bank (EVlink MS Energy Management option)	Energy management indication (green indicator light)
4	Illuminated indicator bank (EVlink option)	Energy management indication (orange indicator light)
5	Illuminated indicator bank (EVlink MS Energy Management option)	Energy management indication (red indicator light)

Outgoing Line Components Connected to the BMX DDI 1602 Input Modules

In the architecture of charging stations for electric vehicles, the charging stations and available socket-outlets are set following a specific order.

The wiring of the PLC inputs in the input module in PLC slot 3 defines the order of the charging stations, therefore the number of their respective socket-outlet in the input module in PLC slot 4.

2 to 3 inputs of PLC are connected to the outgoing line components:

- 1 control circuit breaker per charging station
- 1 power circuit breaker per charging station socket-outlet, that is, 1 or 2 inputs for each power circuit breaker per charging station, following the charging station order

The following table shows the outgoing line components connected to the PLC inputs.

Module Reference	PLC Input	Component Connected to the PLC	Description
BMX DDI 1602 in slot 3	0...15	Control circuit breaker of charging station no. 1...16	Position of the circuit breaker contact
BMX DDI 1602 in slot 4	0...15	Power circuit breaker of charging station socket-outlet no. 1...16	Power circuit breaker of each socket-outlet following the charging station order

Wiring Rules of Charging Station Circuit Breakers

The example described in the following procedure refers to the charging stations used in the wiring diagram of the cluster cabinet example shown at the end of this guide (*see page 29*).

Step	Action	Example
1	<p>Connect the OF contacts of the control circuit breaker in the PLC slot 3 input module in the following order:</p> <ol style="list-style-type: none"> 1 Connect the EVlink Parking Standard EV•1S••••• charging stations with 2 socket-outlets to the inputs 0 to i. 2 Connect the EVlink Parking Standard EV•1S••••• charging stations with 1 socket-outlet to the inputs i+1 to j. 	<ul style="list-style-type: none"> ● %I0.3.0: control circuit breaker EVW1S22P33 charging station ● %I0.3.1: control circuit breaker EVF1S22P33 charging station ● %I0.3.2: control circuit breaker EVW1S22P03 charging station
2	<p>Connect the OF contacts of the socket-outlet power circuit breaker on the PLC slot 4 input module:</p> <ul style="list-style-type: none"> ● Follow the same order of wiring of the control circuit breakers. ● Connect the socket-outlets of charging stations with 2 socket-outlets as follows: <ul style="list-style-type: none"> ● first, connect the right socket-outlet, ● then connect the left socket-outlet. 	<ul style="list-style-type: none"> ● %I0.4.0: power circuit breaker EVW1S22P33 charging station right socket-outlet ● %I0.4.1: power circuit breaker EVW1S22P33 charging station left socket-outlet ● %I0.4.2: power circuit breaker EVF1S22P33 charging station right socket-outlet ● %I0.4.3: power circuit breaker EVF1S22P33 charging station left socket-outlet ● %I0.4.4: power circuit breaker EVW1S22P03 charging station right socket-outlet
3	<p>If the EVlink MS Energy Management option is available, configure the Modbus address of the iEM3155 energy meters, respecting the connection order of the corresponding socket-outlet power circuit breaker input.</p>	<ul style="list-style-type: none"> ● Modbus address = 1 for iEM3155 corresponding to the power circuit breaker connected to %I0.4.0 (EVW1S22P33 charging station right socket-outlet) ● Modbus address = 2 for iEM3155 corresponding to the power circuit breaker connected to %I0.4.1 (EVW1S22P33 charging station left socket-outlet) ● Modbus address = 3 for iEM3155 corresponding to the power circuit breaker connected to %I0.4.2 (EVF1S22P33 charging station right socket-outlet) ● Modbus address = 4 for iEM3155 corresponding to the power circuit breaker connected to %I0.4.3 (EVF1S22P33 charging station left socket-outlet) ● Modbus address = 5 for iEM3155 corresponding to the power circuit breaker connected to %I0.4.4 (EVW1S22P03 charging station right socket-outlet)

Communication Protocol

Ethernet is the communication protocol used by the Modicon M340 PLC for EVlink Parking Standard EV•1S••••• charging stations.

Illuminated Indicator Bank (EVlink MS Energy Management Option)

The illuminated indicator bank is used in the energy management solution to indicate the capacity of the cluster cabinet to meet energy needs to charge the electric vehicles.

The following table shows the meaning when the indicator light is lit.

Indicator Light	Description
Green	Power modulation is not active: all the energy required by the electric vehicles is being supplied
Orange	Power modulation is active: the energy being supplied is less than that required by the electric vehicles
Red	Load shedding is active or power is not available: no energy is supplied to some or all electric vehicles

The following table shows the components of the illuminated indicator bank.

Catalog Number	Description
XVB C2B3	Green steady, illuminated lens unit
XVB C2B4	Red steady, illuminated lens unit
XVB C2B5	Orange steady, illuminated lens unit
XVB C21A	AS-Interface base unit and top cover
XVB Z02	Mounting base with 25 mm aluminum support tube

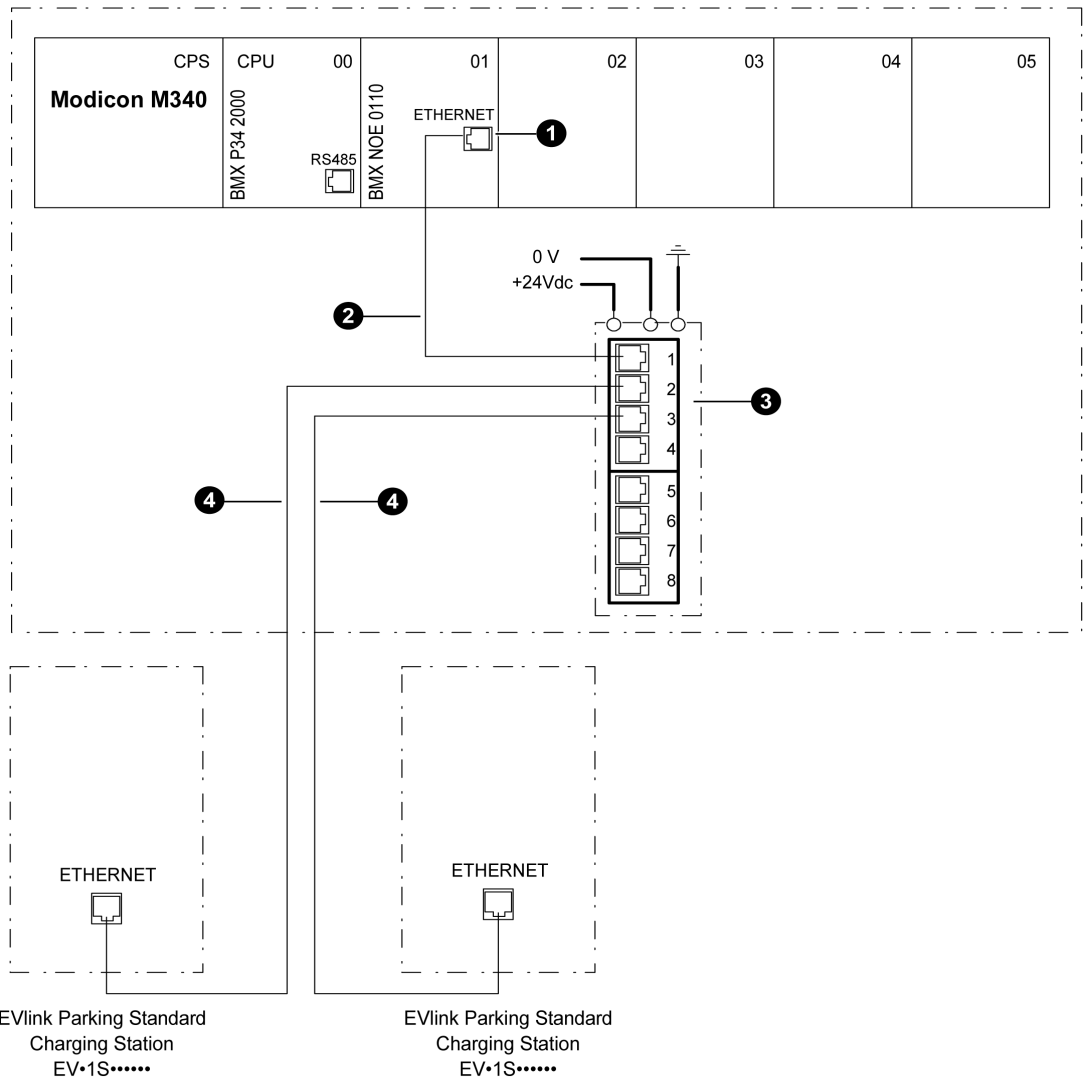
Ethernet Communication With the EVlink Parking Standard EV•1S•••••• Charging Stations

Overview

The Ethernet port integrated in the BMX NOE 0110 communication module of the Modicon M340 PLC is used to communicate with EVlink Parking Standard EV•1S•••••• charging stations.

Connection Diagram

The following diagram shows how to connect the Modicon M340 PLC to EVlink Parking Standard EV•1S••••~ charging stations on the Ethernet network:



- 1 RJ45 connector for Ethernet on BMX NOE 0110 communication module
- 2 490NTW00002 shielded twisted pair straight cable with RJ45 connectors
- 3 TCSESU083FN0 8-port or TCSESM163F23F0 16-port Ethernet TCP/IP switch depending on the number of socket-outlets
- 4 Shielded twisted pair straight cable with RJ45 shielded connectors

Wiring Recommendations

To design an Ethernet network longer than 100 m, contact the Schneider Electric EVlink Customer Care Center.

Communication With Energy Meters Dedicated to the EVlink MS Energy Management Option

Overview

The required energy meters depend on the mode used in the EVlink MS Energy Management option:

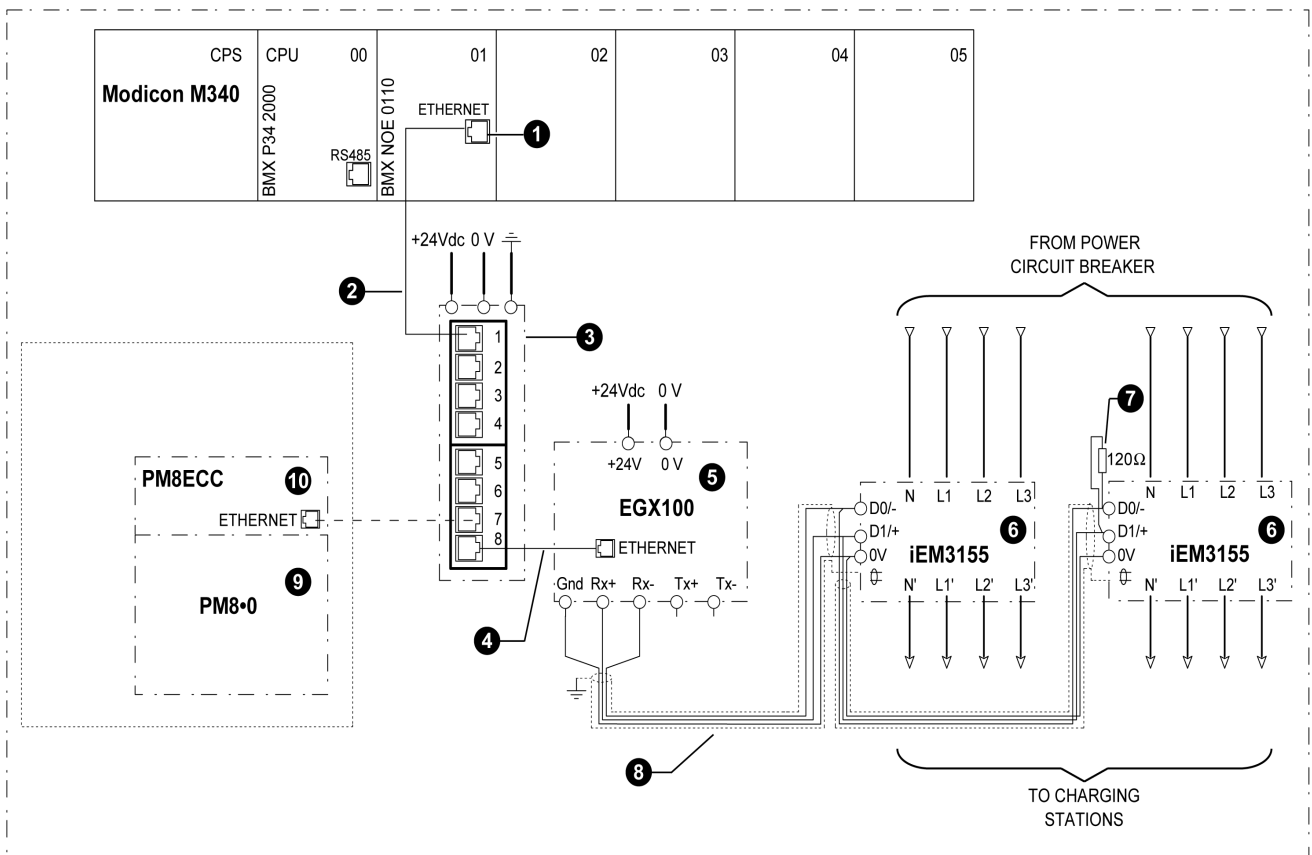
- in dynamic mode: iEM3155 energy meters on each outgoing line and a PM8•0 power meter on the customer main incoming line
- in static mode: iEM3155 energy meters on each outgoing line

With the EVlink MS Energy Management option, the Ethernet port integrated in the BMX NOE 0110 communication module of the Modicon M340 PLC is used to communicate with energy meters via an EGX100 Ethernet gateway.

Connection Diagram

The following diagram shows the connection on the Ethernet network of:

- the iEM3155 energy meters on each outgoing line and the associated EGX100 Ethernet gateway
- the PM8•0 power meter with a PM8ECC Ethernet communication card on the customer main incoming line.



- 1 RJ45 connector for Ethernet on BMX NOE 0110 communication module
- 2 490NTW00002 shielded twisted pair straight cable with RJ45 connectors
- 3 TCSESU083FN0 8-port Ethernet TCP/IP switch
- 4 490NTW00002 shielded twisted pair straight cable with RJ45 connectors
- 5 PowerLogic EGX100 Ethernet gateway
- 6 Acti 9 iEM3155 energy meter
- 7 VW3 A8 306RC line terminator
- 8 RS 485 shielded twisted pair cable
- 9 PowerLogic PM8•0 power meter on the incoming line
- 10 PowerLogic PM8ECC Ethernet communication card for PM8•• power meters

Wiring Recommendations

- It is mandatory to connect a maximum of 8 Acti 9 iEM3155 energy meters per PowerLogic EGX100 Ethernet gateway.
- A line termination is necessary at the extremity of the Modbus cable on the Acti 9 iEM3155 line.

Additional Information

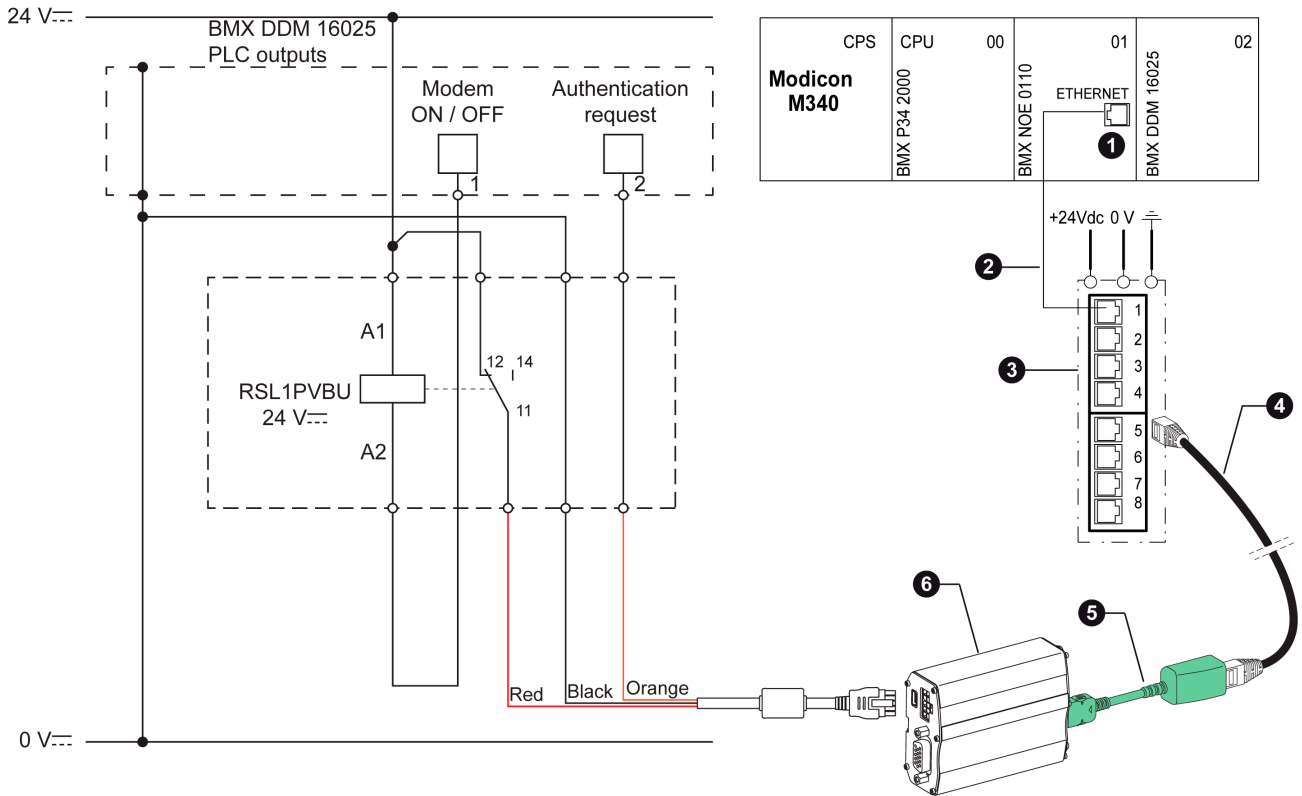
- For detailed information about the Ethernet gateway, refer to the following guides:
 - *PowerLogic Ethernet Gateway EGX100 Installation Guide*
 - *PowerLogic Ethernet Gateway EGX100 User Guide*
- For more information about the energy meter, refer to the *iEM3155 Instruction Sheet*.
- For detailed information about the power meter, refer to the following guides:
 - *PowerLogic Series 800 Power Meter Installation Guide*
 - *PowerLogic Series 800 Power Meter User Guide*

Communication With Modem Dedicated to the EVlink MS Supervision Option

Overview

The dedicated Schneider Electric EVlink NCA91000 GPRS modem is used to connect the cluster cabinet to a supervision system through the Modicon M340 PLC.

Connection Diagram



- 1 RJ45 connector for Ethernet on BMX NOE 0110 communication module
- 2 490NTW00002 shielded twisted pair straight cable with RJ45 connectors
- 3 TCSESU083FN0 8-port Ethernet TCP/IP switch
- 4 Shielded twisted pair straight Ethernet cable
- 5 RJ45 interface cable (delivered with the EVlink NCA91000 GPRS modem)
- 6 EVlink NCA91000 GPRS modem

The control relay KA1 (reference RSL1PVBU) is not provided with the modem. It must be ordered separately.

NOTE: It is recommended to install this relay in the cluster cabinet. This reduces the amount of wiring if any upgrade with EVlink MS supervision option is implemented.

Additional Information

For more information about the modem and the EVlink MS Supervision option, refer to the *EVlink NCA91000 GPRS Modem Instruction Sheet* and *EVlink NCA91000 GPRS Modem Installation Guide*.

Pre-Commissioning in Factory

Pre-Commissioning Checks in Factory

A visual check in factory must be carried out on the electrical equipment connected in the cluster cabinet. The following check-list covers all components of the cluster cabinet, including the EVlink MS Energy Management and EVlink MS Supervision options:


- Check the circuit breakers are in the OFF position.
- Check the earth leakage protection devices and cable size are in accordance with the recommendation guide.
- Check tightness of electrical components and their proper terminations. Refer to the relevant hardware documentation for tightening torque values.
- Check all the required modules are installed in the Modicon M340 PLC.
- Check all the PLC modules are properly fixed in the rack slots.
- Check the wiring of the PLC to the Ethernet switch.
- Check the wiring of the EGX100 Ethernet gateway to the Ethernet switch and to the iEM3155 energy meter connected to the charging station number 1 in the architecture (EVlink MS Energy Management option).
- Check the wiring of the iEM3155 energy meters including the line terminator (EVlink MS Energy Management option).
- Check the communication parameters of the EGX100 Ethernet gateway and iEM3155 energy meters comply with the installation (EVlink MS Energy Management option).
- When a PM8•0 power meter with the PM8ECC communication module is connected to the incoming line (optional), check the correct wiring.
- Check the cluster cabinet wiring diagram is available in the cluster cabinet.

For more information, refer to the specific device documentation.

Pre-Commissioning On-Site

Safety Instructions

Read and make sure that you understand the safety instructions below. You must follow them exactly as described before commissioning a cluster cabinet.

 DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. For markets where NEMA standards are applicable, see NFPA 70E.
- This equipment must be installed and serviced by qualified electrical personnel.
- Disconnect all power sources before performing commissioning operations.
Assume that all circuits are live until they are completely de-energized, tested, grounded, and tagged. Consider all sources of power, including the possibility of backfeeding and control power.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Overview

Install on-site the cluster cabinet and the EVlink charging stations following the cluster cabinet wiring diagram and the corresponding architecture.

Before commissioning the PLC and energizing the charging stations, check the wiring of the charging stations:

- Check the power wiring at the PLC and charging stations.
In particular, check the phase and neutral cables are connected to the correct wiring terminals. When connecting several charging stations to a 3-phase supply network, it is recommended to balance the single-phase power outgoing lines between the 3 phases.
- Check the wiring of the emergency stop and the associated tripping auxiliary (MX shunt trip coil or MN voltage release).
- Check the wiring of the MNx voltage releases in the charging stations. The wiring must comply with the appropriate instruction sheet of each charging station.
- Regarding the Modicon M340 PLC installed in the cluster cabinet:
 - Check the wiring of the EVlink Parking Standard EV•1S••••• charging stations to the Ethernet switch.
 - Check the order of the charging stations and the corresponding socket-outlets in the architecture comply with the connection to the PLC input modules following the wiring rules.
 - Check the wiring of the illuminated indicator bank (EVlink MS Energy Management option).
- Check the modem wiring (EVlink MS Supervision option).

For more information, refer to the specific device documentation.

NOTE: The commissioning of the PLC and the EVlink MS Energy Management option are described in the EVlink Commissioning Guide. The commissioning of the EVlink MS Supervision option is described in the EVlink Modem Installation Guide.

Circuit Breakers Referenced in the Pre-Commissioning Procedures

The circuit breakers referenced in the pre-commissioning procedures below correspond to those used in the wiring diagram of the cluster cabinet example in this guide (*see page 29*).

Pre-Commissioning Process

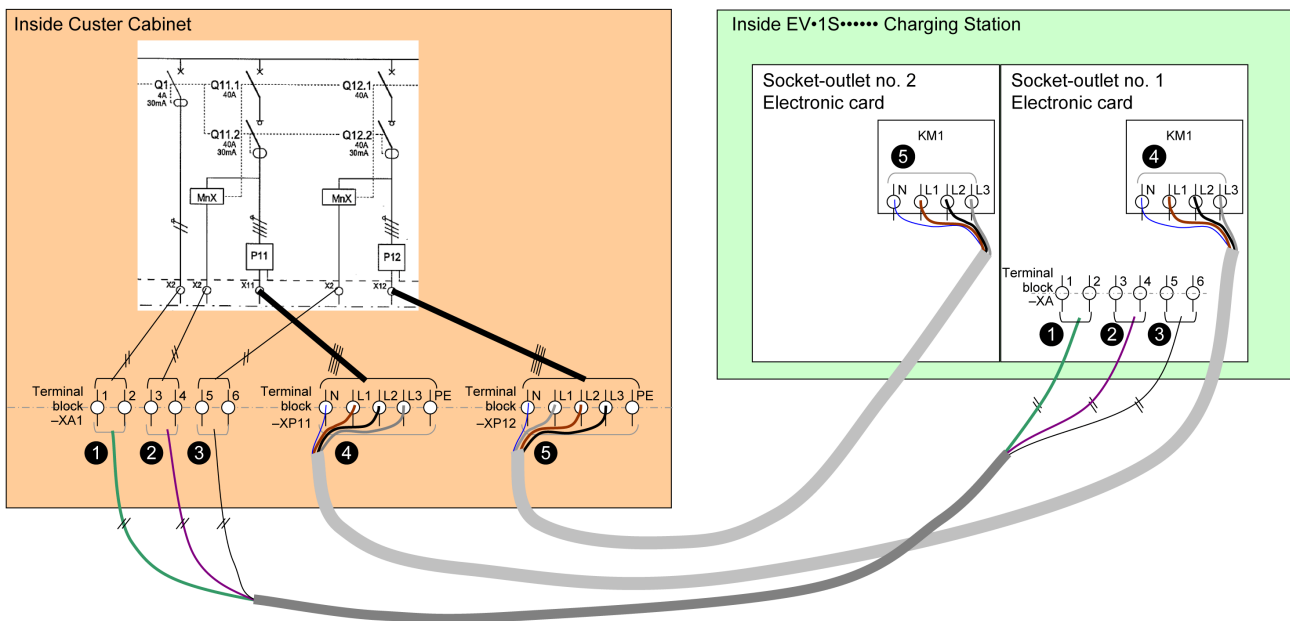
The pre-commissioning process for a cluster cabinet with a PLC includes the following stages:

Stage	Description
1	Verifying the phase order on 400 V power supply
2	Verifying the 4-pole circuit breakers of socket-outlets on 400 V power supply
3	Verifying the 2-pole circuit breaker of charging stations on 230 V auxiliary power supply
4	Verifying the MNx wiring
5	Checking order of the PM8•0 power meter phases in the cluster cabinet (dynamic mode in EVlink MS Energy Management option)
6	Checking the PLC input wiring
7	Energizing the Parking Standard EV•1S••••• charging stations and configuring the iEM3155 energy meters
8	Configuring the EGX100 Ethernet gateways

Each stage is detailed after the diagram that shows the wiring between cluster cabinet and charging stations.

Wiring Between Cluster Cabinet and Each Charging Station

The wiring between the cluster cabinet and a charging station is similar for all the charging stations in the application. The following diagram shows the wiring between the cluster cabinet and charging station no. 1.



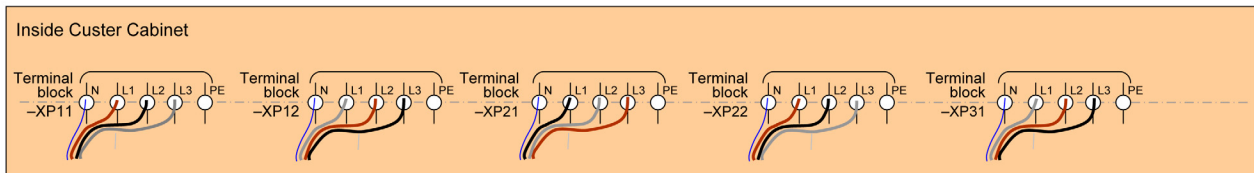
- 1 Auxiliary power supply (230 V) of the charging station
- 2 MNx coil on electronic card no. 1 (corresponding to the right socket-outlet)
- 3 MNx coil on electronic card no. 2 (corresponding to the left socket-outlet)
- 4 Power supply (400 V) of the charging station socket-outlet no. 1 (right socket-outlet)
- 5 Power supply (400 V) of the charging station socket-outlet no. 2 (left socket-outlet)

400 V Power Supply: Verifying Phase Order

Verify the phase order for each charging station:

Step	Action
1	Disconnect all power sources.
2	In the cluster cabinet, verify that phase order is correct on XP** terminal blocks as described below.
3	For each charging station, verify that wiring is correct as described below.

The diagram below shows the order of phases of the 400 V power supply in the cluster cabinet, using the XP** terminals blocks. Wiring is identical for all EV•1S***** charging stations. There must be a circular rotation of the wire colors in the XP** terminals blocks in the cluster cabinet; for example, brown, black, gray; gray, brown, black; black, gray, brown; brown, black, gray; gray, brown, black, and so on.



In an EV•1S***** charging station with 2 socket-outlets, wiring must be identical for the 2 electronic cards.

400 V Power Supply: Verifying 4-Pole Circuit Breakers of Socket-Outlets

For each charging station, verify the 4-pole circuit breakers protect the corresponding socket-outlets. These circuit breakers are Q11.1, Q11.2, Q12.1, Q12.2, Q21.1, Q21.2, Q22.1, Q22.2, Q31.1, Q31.2, that is, Q_{mn} power circuit breakers (where m is the number of the charging station in the application, and n is the socket-outlet).


Step	Action
1	In the cluster cabinet, switch off all the Q _{mn} socket-outlet circuit breakers and all the Q _m control circuit breakers.
2	Energize the cluster cabinet.
3	Switch on the Q _m control circuit breaker of the charging station to be checked.
4	For charging stations with 2 socket-outlets, always begin verifying the right socket-outlet.
5	In the cluster cabinet, switch on the two 4-pole circuit breakers corresponding to the right socket-outlet, that is, Q _m 1.1 and Q _m 1.2 (where i is the number of the charging station in the application).
6	Connect the electric vehicle simulation tool NCA93100 to the right socket-outlet, and then start charging the charging station.
7	Using the simulation tool, check the simulation tool indicates the socket-outlet is powered.
8	Switch off Q _m 1.1 circuit breaker and check the simulation tool indicates the socket-outlet is not powered.
9	Switch on Q _m 1.1 circuit breaker.
10	Switch off Q _m 1.2 circuit breaker and check the simulation tool indicates the socket-outlet is not powered.
11	Switch on Q _m 1.2 circuit breaker.
12	In the cluster cabinet, switch off the two 4-pole circuit breakers corresponding to the left socket-outlet of the charging station.
13	For charging stations with 2 socket-outlets, check the left socket-outlet.
14	Connect the electric vehicle simulation tool NCA93100 to the left socket-outlet, and then start charging the charging station.
15	In the cluster cabinet, switch on the two 4-pole circuit breakers corresponding to the left socket-outlet, that is, Q _m 2.1 and Q _m 2.2.
16	Check the simulation tool indicates the socket-outlet is powered.
17	Switch off Q _m 2.1 circuit breaker and check the simulation tool indicates the socket-outlet is not powered.
18	Switch on Q _m 2.1 circuit breaker.
19	Switch off Q _m 2.2 circuit breaker and check the simulation tool indicates the socket-outlet is not powered.
20	Switch on Q _m 2.2 circuit breaker.
21	In the cluster cabinet, switch off the two 4-pole circuit breakers corresponding to the left socket-outlet of the charging station.
22	Switch off the Q _m control circuit breaker of the checked charging station.
23	Repeat steps 3 to 22 to check another charging station in the application.

230 V Auxiliary Power Supply: Verifying 2-Pole Circuit Breaker of Charging Stations

For each charging station, verify the 2-pole circuit breaker (Q1, Q2, Q3, that is, Qm), protects it.

Step	Action
1	Switch off the Qm control circuit breaker (where i is the number of the charging station in the application).
2	Energize the cluster cabinet.
3	In the cluster cabinet, switch on the 2-pole circuit breaker corresponding to the charging station.
4	Check the charging station is powered with the corresponding indicator light that lights on.
5	If not, check the green and red LEDs on 1 of the charging station electronic boards are on.
6	In the cluster cabinet, switch off the Qm control circuit breaker.

Verifying MNx Wiring

 **DANGER**

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. For markets where NEMA standards are applicable, see NFPA 70E.
- This equipment must be commissioned by qualified electrical personnel.

Failure to follow these instructions will result in death or serious injury.

For each charging station, verify that the MNx of a power circuit is associated to the corresponding charging station plate. The MNx are associated to the circuit breakers Q11.2, Q12.2, Q21.2, Q22.2, Q31.2.

Step	Action
1	Switch on the 4-pole socket-outlet circuit breakers, that is, Qmn (where m is the number of the charging station in the application and n is the socket-outlet).
2	Switch on the Qm control circuit breakers.
3	Energize the cluster cabinet.
4	For charging station with 2 socket-outlets, always begin verifying the right plate.
5	In the charging station, manually switch on the KM1 contactor of the right plate by pressing the central mechanism using an appropriate tool.
6	In the cluster cabinet, check that the 4-pole circuit breaker (Qm1.2) corresponding to the right plate switched off, triggered by the MNx.
7	For charging stations with 2 socket-outlets, check the left plate.
8	In the charging station, manually switch on the KM1 contactor of the left plate by pressing the central mechanism using an appropriate tool.
9	In the cluster cabinet, check that the 4-pole circuit breaker (Qm2.2) corresponding to the right plate switched off, triggered by the MNx.

Checking Order of PM8•0 Power Meter Phases in the Cluster Cabinet (Dynamic Mode in EVlink MS Energy Management Option)

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. For markets where NEMA standards are applicable, see NFPA 70E.
- This equipment must be commissioned by qualified electrical personnel.

Failure to follow these instructions will result in death or serious injury.

When using the dynamic mode of the EVlink MS Energy Management option, verify the phases:

- phases measured by the power meter on the customer main incoming line and phases of main supply
- phases of the main installation and phases of the cluster cabinet power supply

Verify that the number of the phases measured by the power meter on the customer main incoming line correspond to the phases of the main supply:

Step	Action
1	In the cluster cabinet, switch on the switch disconnecter.
2	On the switch disconnecter, measure the power consumption on the cable of phase 1 using a current meter.
3	On the power meter, check the current value measured on phase 1.
4	Check the 2 measures are identical.
5	Repeat steps 2 to 4 for phases 2 and 3.

Verify that the number of the phases of the main supply correspond to the phases of the cluster cabinet power supply:

Step	Action
1	In the cluster cabinet, switch off the switch disconnecter.
2	Check continuity of wiring between phase 1 of the switch disconnecter and phase 1 of the cluster cabinet circuit breaker.
3	Check that the phases correspond.
4	Repeat steps 2 to 3 for phases 2 and 3.

Checking the PLC Input Wiring

The circuit breakers referenced in the procedure below correspond to those used in the wiring diagram of the cluster cabinet example in this guide (*see page 29*).

Step	Action
1	<p>Check that the order of the control circuit breakers of the charging stations in the installation follows the wiring rules for the input module in PLC slot 3.</p> <p>For example:</p> <ul style="list-style-type: none"> • The Parking Standard EVW1S22P33 charging station with 2 socket-outlets is connected to input %I0.3.0. • The Parking Standard EVF1S22P33 charging station with 2 socket-outlets is connected to input %I0.3.1. • The Parking Standard EVW1S22P03 charging station with 1 socket-outlet is connected to input %I0.3.2.
2	<p>Check that the order of the power circuit breakers of the charging station socket-outlets in the installation follows the wiring rules for the input module in PLC slot 4.</p> <p>For example:</p> <ul style="list-style-type: none"> • The power circuit breaker of the right socket-outlet of the Parking Standard EVW1S22P33 charging station is connected to input %I0.4.0. • The power circuit breaker of the left socket-outlet of the Parking Standard EVW1S22P33 charging station is connected to input %I0.4.1. • The power circuit breaker of the right socket-outlet of the Parking Standard EVF1S22P33 charging station is connected to input %I0.4.2. • The power circuit breaker of the left socket-outlet of the Parking Standard EVF1S22P33 charging station is connected to input %I0.4.3. • The power circuit breaker of the socket-outlet of the Parking Standard EVF1S22P03 charging station is connected to input %I0.4.2.

NOTE: The light defect of the I/O card flashes because the PLC is not configured.

Energizing the Parking Standard EV•1S••••• Charging Stations and Configuring the iEM3155 Energy Meters

The circuit breakers referenced in the procedure below correspond to those used in the wiring diagram of the cluster cabinet example in this guide (see page 29).

Step	Action
1	Check that each iEM3155 energy meter is assigned to the dedicated socket-outlet according to the cluster cabinet wiring diagram.
2	For the Parking Standard EV•1S••••• charging station number 1, switch on the control circuit breaker (Q1), that is, the circuit breaker connected to input %I0.3.0 of the input module in PLC slot 3.
3	For the charging station number 1, switch on the power circuit breakers of each socket-outlet (Q11.1, Q11.2, Q12.1, Q12.2).
4	Configure the iEM3155 energy meters (refer to the <i>Acti 9 iEM3155 Instruction Sheet</i>). <ul style="list-style-type: none">• The address depends on the socket-outlet connected. The Modbus address of energy meters is defined by the input of the OF contact of the socket-outlet power circuit breaker (in PLC slot 4). For example:<ul style="list-style-type: none">• If the socket-outlet power circuit breaker is connected to input %I0.4.0, then iEM3155 address = 1• If the socket-outlet power circuit breaker is connected to input %I0.4.4, then iEM3155 address = 5• Modbus communication settings are the same as for the PowerLogic EGX100 gateway:<ul style="list-style-type: none">• speed: 38,400 Baud• parity: even
5	Repeat steps 2 to 4, for each Parking Standard EV•1S••••• charging station following the order defined by the input module in PLC slot 3.

Configuring the EGX100 Ethernet Gateways

Step	Action
1	Configure the EGX100 Ethernet gateways (refer to the <i>PowerLogic EGX100 User Guide</i>). <ul style="list-style-type: none">• Modbus communication settings:<ul style="list-style-type: none">• speed: 38,400 Baud• parity: even• response timeout: 0.5 s• Ethernet communication settings:<ul style="list-style-type: none">• IP address: 192.168.0.130 for the first EGX100 Ethernet gateway (charging station socket-outlets number 1 to 8) 192.168.0.131 for the second EGX100 Ethernet gateway (charging station socket-outlets number 11 to 16)• subnet mask: 255.255.255.0

Cluster Cabinet Example With EVlink MS Energy Management and EVlink MS Supervision Options

Overview

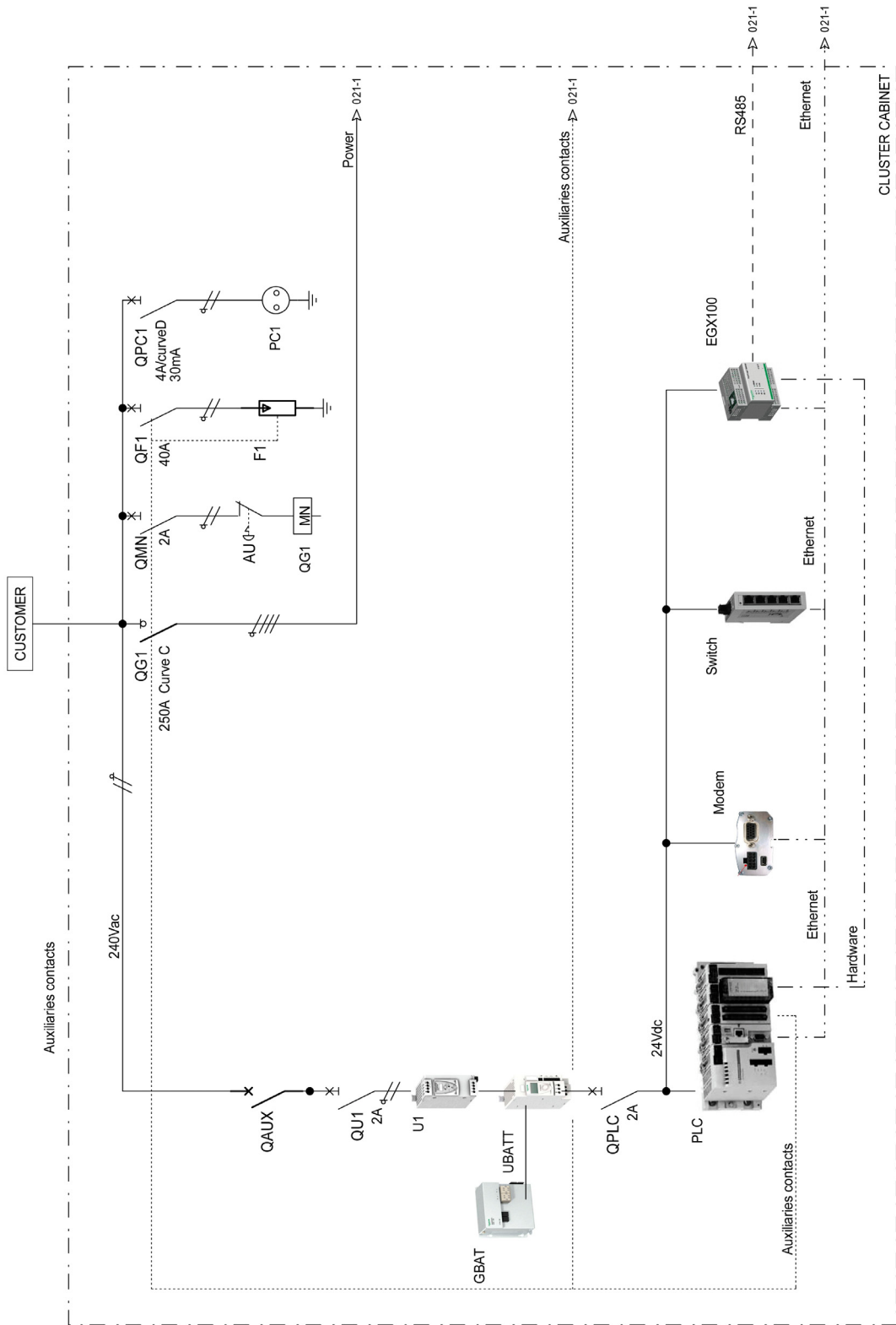
An example of a single-line wiring diagram of the cluster cabinet is presented to describe the function and the set-up of a cluster cabinet with a PLC including the EVlink MS Energy Management and EVlink MS Supervision options.

This example shows a cluster cabinet used to supply the 3 EVlink charging stations described in the table below.

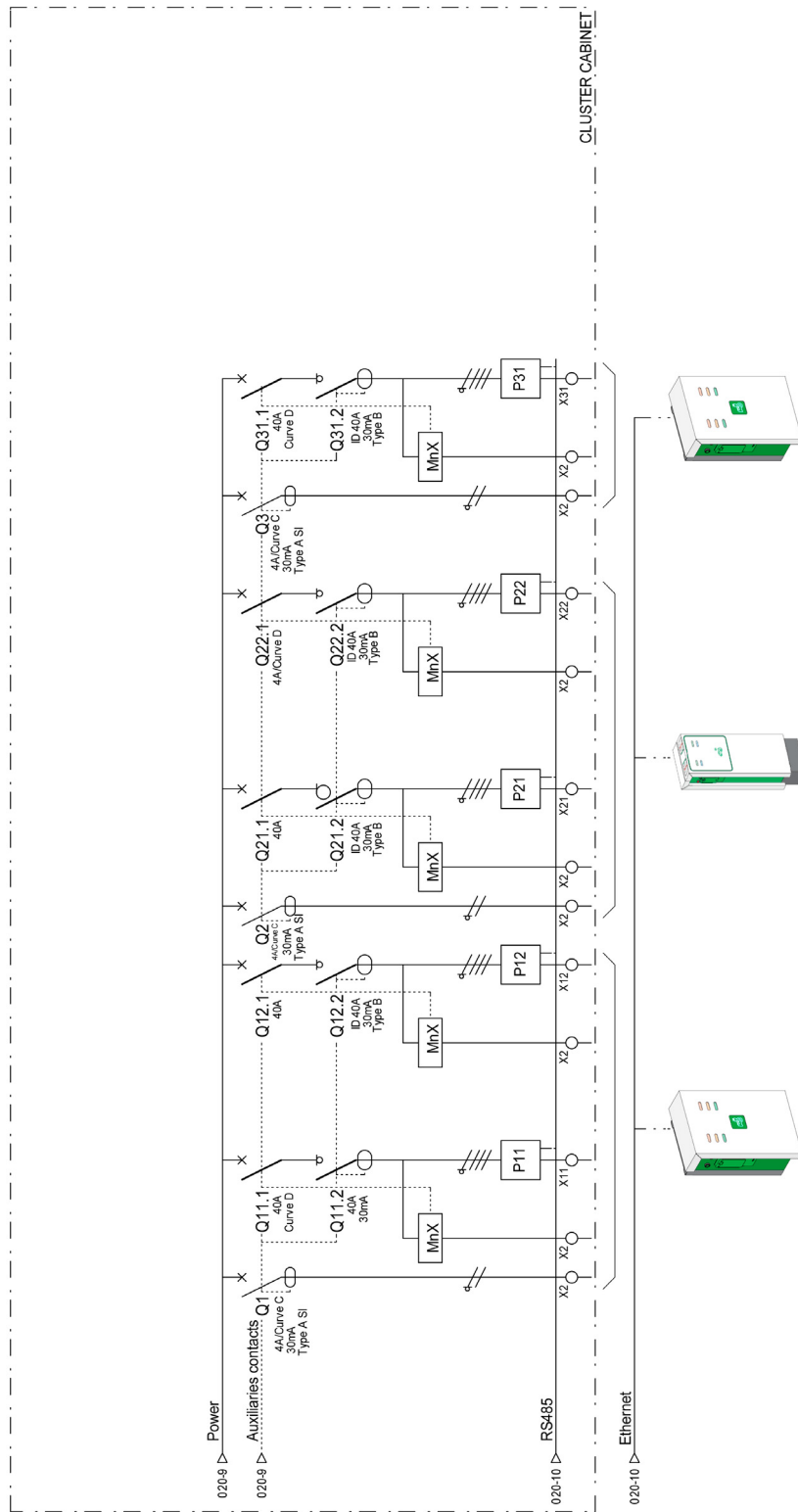
Catalog Number	Supply Type	Maximum Power	Charging Voltage	Maximum Charging Current	Available Socket-Outlet	Socket-Outlet Position on Charging Station
EVW1S22P33	Three-phase (3P+N)	22 kW	400 Vac	32 A	Type 3	Right
	Three-phase (3P+N)	22 kW	400 Vac	32 A	Type 3	Left
EVF1S22P33	Three-phase (3P+N)	22 kW	400 Vac	32 A	Type 3	Right
	Three-phase (3P+N)	22 kW	400 Vac	32 A	Type 3	Left
EVW1S22P03	Three-phase (3P+N)	22 kW	400 Vac	32 A	Type 3	Right

Single-Line Diagram

The following single-line diagram shows the cluster cabinet designed to feed the 3 EVlink charging stations and shows the communication network.



File:
Page:
20



EVlink Parking Standard Charging Station EWW1S2P33 2 x T3 - 22kW
 EVlink Parking Standard Charging Station EVF1S2P22 2 x T2 - 22kW
 EVlink Parking Standard Charging Station EWW1S7P03 1 x T3 - 7kW



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As standards, specifications and designs change from time to time, please ask for confirmation of the information given in this publication.

04/2013