PROTECTION AND CONTROL

EV Charger Protection Solutions

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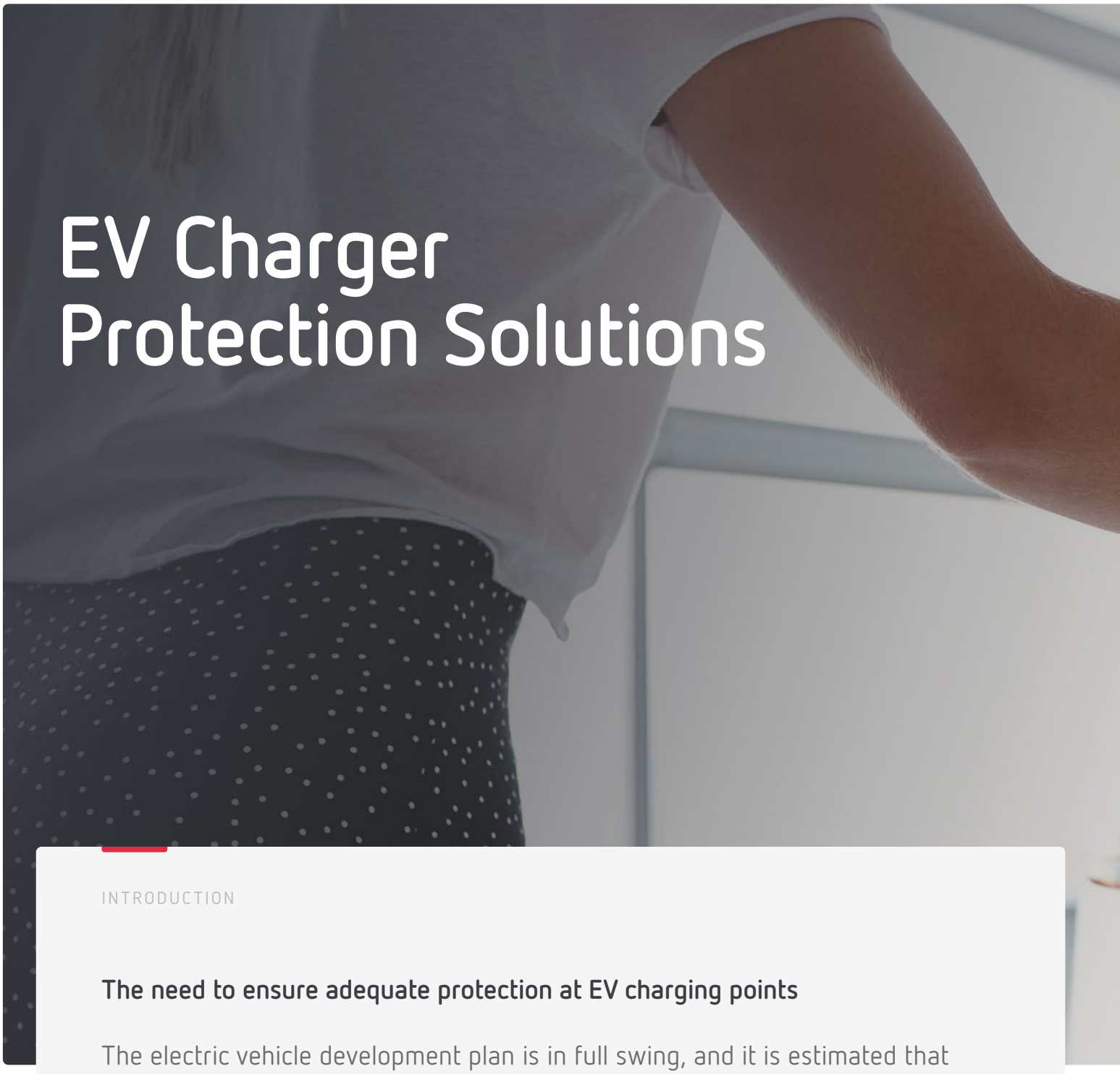


EV Charger Protection Solutions

INTRODUCTION

The need to ensure adequate protection at EV charging points

The electric vehicle development plan is in full swing, and it is estimated that these vehicles will be fully integrated in coming years, leading to the phasing out of combustion engine vehicles.

The higher the number of electric vehicles and, as a result, the number of charging points, the more of these points non-specialised personnel will be exposed to in public spaces. This requires installing suitable residual current protection devices for installations and people.

This will result in better service at charging points, the kind that is currently available with fuel pumps.

CONTENT

Residual Current Protection for AC Chargers

AC CHARGERS

How can AC EV chargers be protected?

For years, residual current protection has focused on the safety of people and property, guaranteeing continuity of service in electrical installations.

In the wake of the appearance of this new type of installation, CIRCUTOR has developed a specific range of RCCBs. This range includes both type A+6 mA_{DC} and type B breakers, without and with reclosing systems to ensure continuity of supply. They allow consumers to use these points safely, in compliance with the applicable standards.

IDA-EV
Type A + 6 mA_{DC} current detection RCCB

Type A

REC4-EV-C
Type A + 6 mA_{DC} current detection RCCB with reclosing system and status output

Type A

IDB-4
Type B RCCB

Type B

RECB-EV-C
Reclosing type B RCCB with status output

Type B

Where should these protection devices be installed?

These types of devices are designed to provide residual current protection with or without reclosing, for any electric vehicle charging station. The solution chosen will depend on the type of installation where the charging points are located.

Domestic use

Public car parks

Private car parks

Corporate fleets

Public chargers

Type A

IDA-EV

Type A RCCB with 6 mA$_{DC}$ current detection

Fault currents in excess of 6 mA$_{DC}$ can be present while charging electric vehicles. Given this possibility, a conventional type AC or A RCCB would not be able to operate correctly, as it could lead to untimely trips or, in the worst case, stop protecting altogether.

IDA-EV guarantees adequate protection for EV charging facilities and satisfies the new **IEC 62955** standard. Since it is a type A RCCB with current detection above to 6 mA$_{DC}$, it guarantees the correct selectivity of the RCCBs installed upstream, avoiding having to replace them.

Type AC protection
Sinusoidal alternating current

Type A protection
Sinusoidal alternating current
Pulsating alternating current

- 40 A and 63 A rated current
- Three-phase or single-phase connection.
- Avoids replacing the RCCB installed upstream, ensuring correct vertical selectivity.

KEY BENEFITS

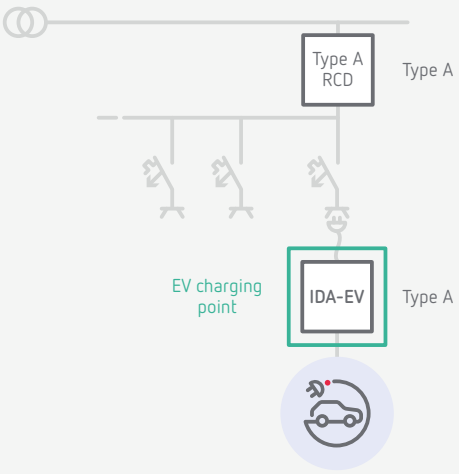
- Preserves the type of residual current protection upstream
- Residual current protection for EV chargers approved as a single device as per **IEC 62955**
- Easy installation on DIN rail
- For any type of layout allowed in **IEC 60364-7-722** for EV charging installations
- Withstands extreme weather conditions. Expanded operating temperature range -25...65 °C.

References

Type	Code	Idif. (AC)	Idif. (DC)	In	Icc
IDA-EV-40-30	P17321.	30 mA	6 mA	40 A	10 kA
IDA-EV-63-30	P17322.	30 mA	6 mA	63 A	10 kA

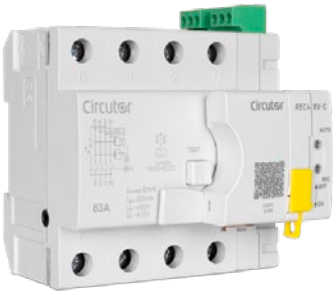
Types of facilities

If the charging unit is connected through an existing socket protected with a type A RCCB, the RCCB for the charging point must be Type A+6 mADC (as per **IEC 60364-7-722**). This allows preserving the residual current protection upstream, since a type A with currents in excess of 6 mADC does not guarantee its proper operation. →



If the charging unit is directly connected, **IDA-EV** provides the correct protection (as per **IEC 60364-7-722**). →

Type A



REC4-EV-C

Reclosing type A RCCB with 6 mA$_{DC}$ current detection and status output

REC4-EV-C incorporates type A RCCB with 6 mAdc current detection for single-phase or three-phase installations, associated with a reclosing motor, which lets the RCCB safely reclose if it tripped as the result of an unwanted trip, so that we can quickly restore the recharge of the connected vehicle.

The reclosing mode or system on this device it's done by a remote input, as per **IEC 61851-1** requirements, and it has an additional input for a remote trip, as well as an output indicating the status of the switch.

Type AC protection
Sinusoidal alternating current

Type A protection
Sinusoidal alternating current
Pulsating alternating current

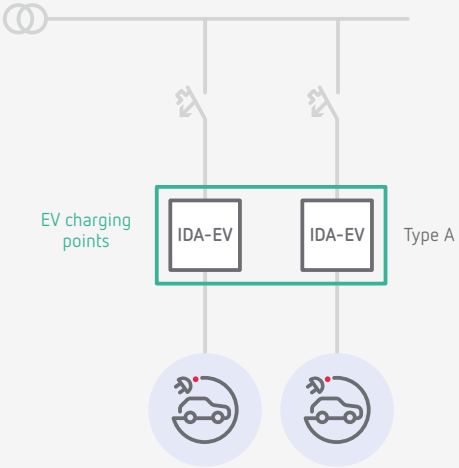
- 40 A and 63 A rated current
- Three-phase or single-phase connection.
- Avoids replacing the RCCB installed upstream, ensuring correct vertical selectivity.
- Avoids unnecessary travel to restore the supply. Guaranteed service continuity.

KEY BENEFITS

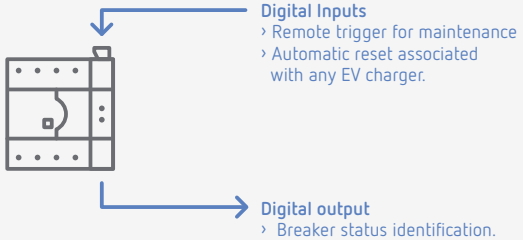
- Type A + 6 mA$_{DC}$ residual current protection
- Compact device
- Easy installation on DIN rail
- Remote reclosing and trip
- Breaker status via digital output

References

Type	Code	Idif. (AC)	Idif. (DC)	In	Icc	Dig. inputs	Dig.output
REC4-EV-C-4P-40-30	P26L00.	30 mA	6 mA	40 A	10 kA	2	1
REC4-EV-C-4P-63-30	P26L01.	30 mA	6 mA	63 A	10 kA	2	1



Functions of the inputs and outputs



Type B

IDB-4

Type B RCCB

Designed for EV charging installations that require the use of a type B RCCB (according to standards or regulations), or in cases where required by the project design. The **IDB-4** is a compact RCCB designed for DIN rail installation. It guarantees adequate type B protection for EV charging facilities and satisfies the new **IEC 62423** standard.

IDB-4 is an RCCB designed to protect EV charging points in situations where the laws or regulations of the country in question, require the use of type B.

Type B protection
Sinusoidal alternating current
Pulsating alternating current
Direct current

- 40 A and 63 A rated current
- Three-phase or single-phase connection.
- For installations that require type B protection

KEY BENEFITS

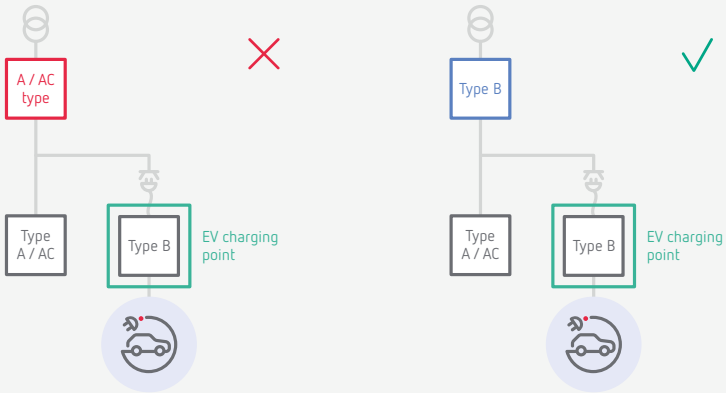
- Easy installation on DIN rail
- Provides protection as per ITC-52 and IEC 60364-7-722 for electric vehicle charging stations
- Withstands extreme weather conditions. Expanded operating temperature range -25...65 °C.

References

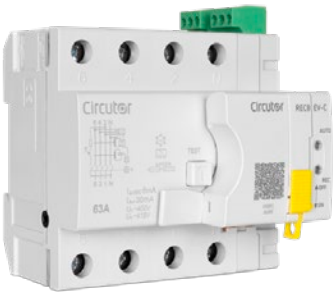
Type	Code	Idif. (AC)	Idif. (DC)	In	Icc
IDB-4 4P-40A-30mA	P17221.	30 mA	30 mA	40 A	10 kA
IDB-4 4P-40A-300mA	P17222.	300 mA	300 mA	40 A	10 kA
IDB-4 4P-63A-30mA	P17231.	30 mA	30 mA	63 A	10 kA
IDB-4 4P-63A-300mA	P17232.	300 mA	300 mA	63 A	10 kA

Type of installation for type B residual current protection

If the charging unit is connected to a direct socket on the line or via a type B RCCB upstream, the RCCB for the charging point must be Type B (as per **IEC 60364-5-53**). →



Type B



RECB-EV-C

Reclosing type B RCCB with status output

RECB-EV-C features a type-B RCCB for single-or three-phase installations linked to a reclosing motor.

The reclosing system on this device it's done by a remote input, as per **IEC 61851-1** requirements, and it has an additional input for a remote trip, as well as an output indicating the status of the switch.

Type B protection
Sinusoidal alternating current
Pulsating alternating current
Direct current

- 40 A and 63 A rated current
- Three-phase or single-phase connection.
- For installations that require Type B protection.
- Avoids unnecessary travel to restore the supply. Guaranteed service continuity.

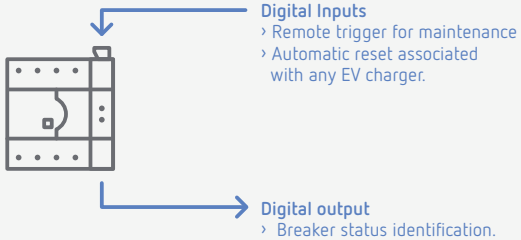
KEY BENEFITS

- Type B residual current protection
- Compact device Easy installation on DIN rail
- Remote reclosing and trip
- Breaker status via digital output

References

Type	Code	/dif. (AC)	/dif. (DC)	/n	/cc	Dig. inputs	Dig. output
RECB-EV-C-4P-40-30	P26M00.	30 mA	30 mA	40 A	10 kA	2	1
RECB-EV-C-4P-63-30	P26M10.	30 mA	30 mA	63 A	10 kA	2	1

Functions of the inputs and outputs



Residual Current Protection for AC/DC Chargers

How can Fast-DC EV chargers be protected?

Quick charging stations use power electronics inside the charger with AC/DC converters. In order to adequately protect the EV charger, the ideal solution is to install type B residual current protection, capable of monitoring and acting when a leakage appears in the AC or DC circuit coming from the converter.

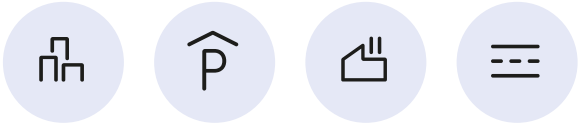
CIRCUTOR has residual current protection solutions with inputs/outputs to provide status information to the charger, with one or several measurement channels in the same enclosure all with Modbus RS-485 communications to control the vehicle and charger status.

RGU-100B
Type B residual current relay.

CBS-400B
4 type B channels residual current relay.

Where should these protection devices be installed?

These types of devices are designed to provide residual current protection for any outdoor AC/DC electric vehicle charging station. The solution chosen will depend on the charger internal construction, the circuits to protect and the charger location.



Public car parks

Private car parks

Corporate fleets

Public chargers

Type B

RGU-100B

Type B residual current relay

Designed for EV charging installations that require the use of a type B MRCD (according to standards or regulations), or in cases where required by the project design. The **RGU-100B** is a compact RCCB designed for DIN rail installation. It guarantees adequate type B protection for EV charging facilities and satisfies the new **IEC 60947-2-M** standard.

Non-B type residual current protection devices become more sensitive and could even lock up when a pulsating residual current is coupled with a direct current. Those devices can be triggered unexpectedly or be blocked, affecting the service continuity and creating a serious risk to the installation and/or people.

Type B protection
Sinusoidal alternating current
Pulsating alternating current
Direct current

- Sensitivity from 30 mA to 3 A
- Instantaneous trip (INS)
- Delay up to 10s (SEL)
- RS-485 (Modbus RTU)
- 2 relay outputs (pre-alarm and trip status)

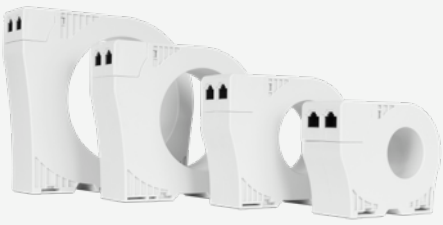
Check the residual current from your EV charger (AC + DC leakages)

KEY BENEFITS

- ☑ Versatility for all types of installations
- ☑ Preventive maintenance by means of alarms
- ☑ Real-time display and monitoring
- ☑ Simple to install
- ☑ RS-485 communications (Modbus-RTU)

References

Type	Code	Nr. of relays	/dif.	Delay	Communications	Power supply
RGU-100B	P11961.	1	0.03... 3 A	0.1 ... 10 s, INS, SEL	RS-485	230 Vac



WGB

Residual current transformers for type-B relays

Type	Code	Usefull diam.(mm)	IΔn (A)	In (A)
WGB-35	[C] P11B52.	35.5	0.03 ... 3 A	80
WGB-55	[C] P11B53.	55.5	0.03 ... 3 A	160
WGB-80	[C] P11B54.	80.5	0.03 ... 3 A	250
WGB-110	[C] P11B55.	110.5	0.03 ... 3 A	400

Only for relays type RGU-100B and CBS-400B

Type B

CBS-400B

4 type B channels residual current relay

Designed for EV charging installations that require the use of a type B MRCD (according to standards or regulations), or in cases where required by the project design. The **CBS-400B** is a compact RCCB designed for DIN rail installation. It guarantees adequate type B protection for EV charging facilities and satisfies the new **IEC 60947-2-M** standard to protect the control supply line, the power converters and the AC supply.

The **CBS-400B** relay, together with the WGB transformers, protects and monitors all electrical installations where, due to the type of load, the applicable law or manufacturer's requirement, it is necessary to install type B residual current protection.

Type B protection
Sinusoidal alternating current
Pulsating alternating current
Direct current

- Sensitivity from 30 mA to 3 A
- Instantaneous trip (INS)
- Delay up to 10s (SEL)
- RS-485 (Modbus RTU)
- 4 relay outputs (trip status alarm)
- 1 relay output (Pre-alarm)

Check the residual current from your EV charger (AC + DC leakages) in only one device (3 DIN modules).

KEY BENEFITS

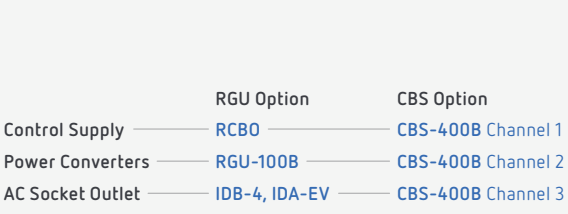
- ☑ Versatility for all types of installations
- ☑ Preventive maintenance by means of alarms
- ☑ Real-time display and monitoring
- ☑ Simple to install
- ☑ RS-485 communications (Modbus-RTU)

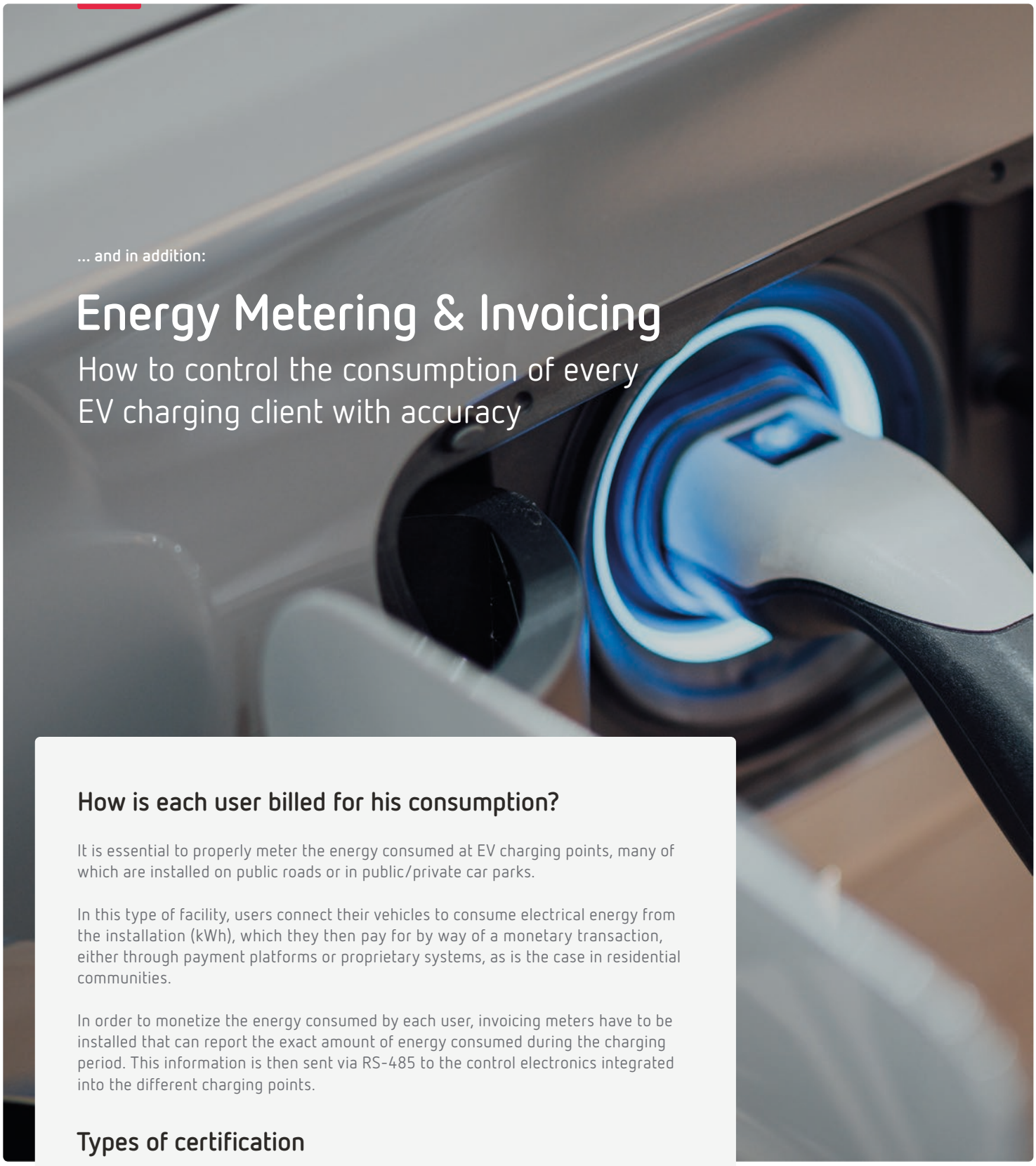
References

Type	Code	Nr. of relays	IΔn (A)	*Delay*	*Communications*	*Power supply*
CBS-400B	P12721.	4	0.03... 3 A	0,1 ... 10 s, INS, SEL	RS-485	230 Vac

Simplified installation with RJ connections.

Installing options depending on the device





... and in addition:

Energy Metering & Invoicing

How to control the consumption of every EV charging client with accuracy

How is each user billed for his consumption?

It is essential to properly meter the energy consumed at EV charging points, many of which are installed on public roads or in public/private car parks.

In this type of facility, users connect their vehicles to consume electrical energy from the installation (kWh), which they then pay for by way of a monetary transaction, either through payment platforms or proprietary systems, as is the case in residential communities.

In order to monetize the energy consumed by each user, invoicing meters have to be installed that can report the exact amount of energy consumed during the charging period. This information is then sent via RS-485 to the control electronics integrated into the different charging points.

Types of certification

Invoicing meters have to comply with **IEC 62053-21** (Class 1 for active energy) internationally or, in Europe, with the MID certification by means of the **EN 50470** (Class B for active energy) standard. The MID certification includes the **IEC 62053-21** standard, which is currently the most suitable option if the country where the chargers will be used is unspecified.

The MID certification (**EN 50470**) is essential for those meters used to invoice energy use, as they ensure the reliability of the consumption logs used to bill the end user.

CEM-C12c

Single-phase electricity meter with **direct** measurement

Where can be installed?

Single-phase chargers (230 V_{AC})

Chargers with type 1, type 2 or Schuko connectors (for single-phase connection)

Main features

Direct connection up to 100 A

1 DIN rail module

Save costs by avoiding having to install external current transformers.

CEM-C21

Three-phase electricity meter with **direct** measurement

Where can be installed?

Three-phase chargers (400 V_{AC})

Charging power up to 45 kW

Chargers with type 2, Combo CCS or CHAdeMO connectors (before the AC/DC converter).

Main features

Voltage:
3x127/220 V_{AC}... 3x230/400 V_{AC}

Direct connection up to 65 A

Operating time measurement for preventive maintenance

4 DIN rail module

Save costs by avoiding having to install external current transformers.

CEM-C31

Three-phase electricity meter with **indirect** measurement

Where can be installed?

Three-phase chargers (400 V_{AC})

Charging power up to 45 kW

Combo CCS or CHAdeMO connectors (before AC/DC converter).

Main features

Voltage:
3x57/100 V...3x230/400 V

Indirect connection.../5 A

Operating time measurement for preventive maintenance

4 DIN rail module

Adaptable to any power by means of current transformers.

COMMON FEATURES

Sealable and easy installation on DIN Rail

Class B/1 in active energy
Class 2 in reactive energy

IEC or MID certification

Communications RS-485 (Modbus RTU)

Power analyzer (voltage, current, power, energy and frequency)

References

Type	Code	Measurement range (V)	Nominal current	Certification	Digital output	Communications	Protocol
CEM-C12c	Q27211.	1x230 V	100 A	IEC	-	RS-485	Modbus RTU
CEM-C6-MID	Q27212.	1x230 V	100 A	MID	-	RS-485	Modbus RTU
CEM-C21-485-T1	Q22421.	3 x 127/220...3 x 230/400	65 A	IEC	1	RS-485	Modbus RTU
CEM-C21-485-T1-MID	Q22422.	3 x 127/220...3 x 230/400	65 A	MID	1	RS-485	Modbus RTU
CEM-C31-485-T1	Q23521.	3 x 57/100...3 x 230/400	.../5A	IEC	1	RS-485	Modbus RTU
CEM-C31-485-T1-MID	Q23522.	3 x 57/100...3 x 230/400	.../5A	MID	1	RS-485	Modbus RTU

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