
matt:e
Caring about your World

Why do I need an EV protection unit from matt:e ?

PME (TNCS) is the most common form of earthing provided at new installations and utilises a single conductor for the neutral and earthing functions (PEN) with an earth terminal derived from the neutral cable

The danger arises if there is an open PEN conductor within the network.

This can lead to an electric shock if any metallic parts, including gas pipework and any bonded appliance are touched by a person in simultaneous contact with general mass of Earth

Unfortunately, MCBS and RCDS currently used do not detect this fault and do not offer any protection

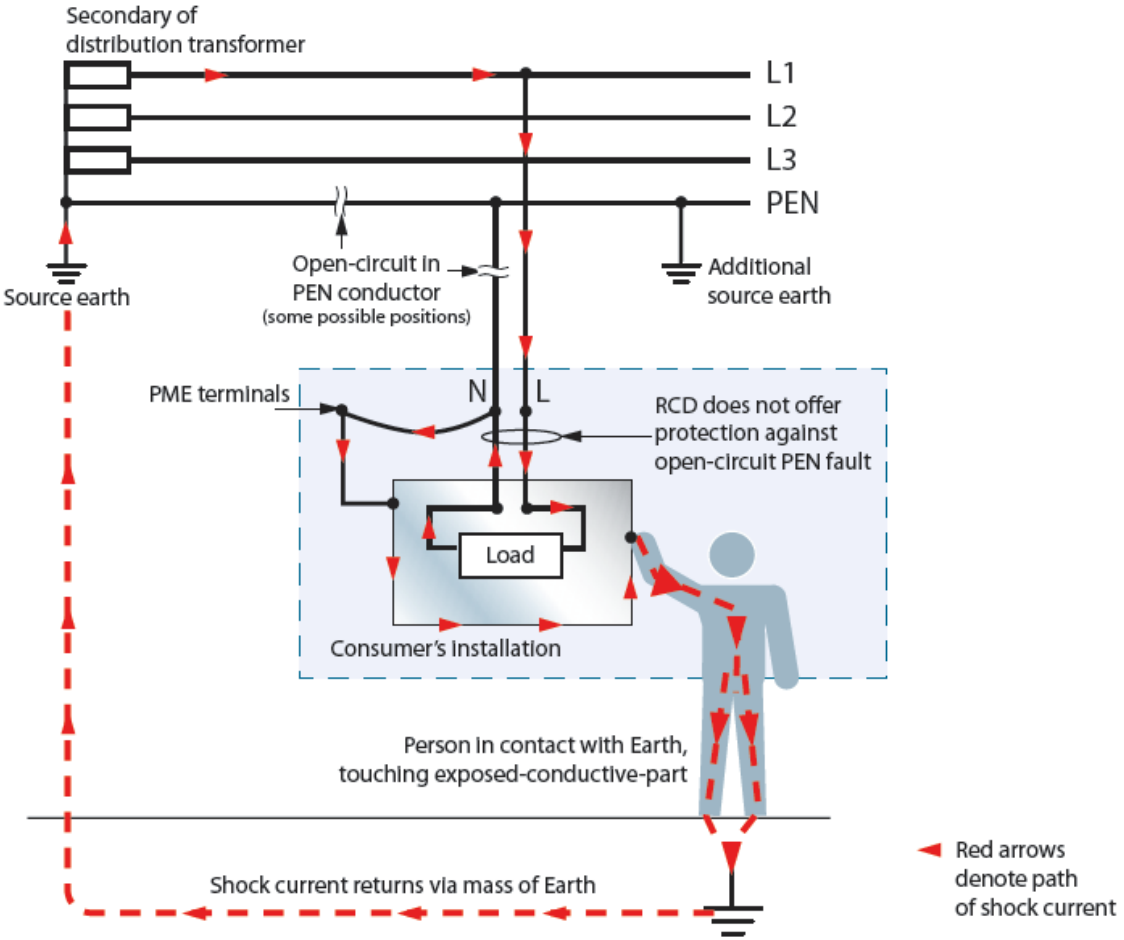


Fig 3 Electric shock risk due to open-circuit fault in the supply neutral PEN conductor

In accordance with the IET Wiring Regulations BS:7671 2018 Amendment 1: 2020, Regulation 722.411.4.1 a PME earthing facility shall not be used as means of earthing for the protective conductor contact of a charging point located outdoors or that might reasonably be expected to be used to charge a vehicle located outdoors.

Unless one of the following methods is used

- (i) The charge point forms part of a three-phase installation that also supplies loads other than for electric vehicle charging and, because of the characteristics of the load of the installation, the maximum voltage between the main earthing terminal of the installation and Earth in the event of an open-circuit fault in the PEN conductor of the low voltage network supplying the installation does not exceed 70 V rms.

- (ii) requires the installation of an earth electrodes of a suitably low earth electrode resistance

- (iii) a voltage operated device that operates when the voltage between the general mass of Earth and the protective conductor at the charging point exceeds 70 V rms.

- (iv) a voltage operated device for installations with single-phase supplies that operates when the line to neutral voltage at the charging point is out side a specified range.

- (v) a device for detecting open PEN conditions that provides no less a degree of safety than those described in (iii) and (iv)

Points to consider when installing Earth electrodes

TT charging circuits from PME supplies may not always be the safest option, due to simultaneous contact issues, along with the risks associated with interactions between earthing zones of the PME earthing system of the existing installation and the TT earth electrode provided for the charging point(s).

Before a TT system is installed, a risk assessment **MUST** be carried out so that risks of simultaneous contact with electrical installations, including other street furniture with PME earthing, are minimized and is only acceptable if all of the following conditions apply

(a) there is no possibility of simultaneous contact between exposed – and/ or extraneous-conductive – parts of the TT earthing system and exposed – and/or extraneous-conductive-parts of the TN-C-S (PME) earthing system of the main installation or any other earthing system of a nearby installation.

(b) The earth electrode zone of the TT system must not overlap the zone of any buried metalwork connected to the earthing system of the main installation. If it does the benefit of separating the earthing system will be lost.

(c) Buried metalwork connected to the PME system does not unduly influence the potential of the ground on which someone will be standing, adjacent to the vehicle, in the event of a fault in the supply PEN conductor. It is particularly important to assess this in small curtilage properties, such as in many dwellings.

The resistance of the earth electrode shall not exceed 200 ohms.

Where the installation is supplied from a three-phase distribution system, The EPR (earth potential rise) on the broken PME system can approach 253 V.

It is therefore extremely important to consider the risk of inadvertently returning the PME touch voltage we are trying to avoid by providing a separate TT system for a charging point.

- (iii) Protection of electric shock is provided by a device which electrically disconnects the vehicle from the live conductors of the supply and from protective earth in accordance with Regulation 543.3.3.101 (ii) within 5 s in the event of the voltage between the circuit protective conductor and Earth exceeding 70 V rms due to an open–circuit fault in the PEN conductor of the low voltage network. The device need not operate if the voltage exceeds 70 V rms for less than 4 s. The device shall provide isolation and be selected in accordance with table 537.4. Closing or resetting the device shall be possible only if the voltage between the circuit protective conductor and Earth does not exceed 70 V rms. Equivalent means of functionality could be provided within the car charging equipment.

Annex 722, item A 722.4 gives guidance on voltage monitoring device described in Regulation 722.411.4.1 (iii) and describes a device that measures the voltage between the circuit protective conductor of the electric vehicle charging equipment and Earth. During a PEN failure in the supply network, the neutral of a TN-C-S supply is no longer considered to be reliably connected to Earth, and a device that measures the voltages between the following points **WILL FAIL TO PROVIDE** equivalent safety to the device described in Regulation 722.411.4 (iii):

(i) The circuit protective conductor and neutral

(ii) The circuit protective conductor and the consumers main earthing terminal

Suitable arrangements include measurement of the voltage between either:

(a) The circuit protective conductor and a suitable measurement earth electrode, or

(b) The circuit protective conductor and a reference point derived from the line conductors of a three-phase systems, provided that suitable precautions are also taken to disconnect the device when the supply to one or more-line conductors is interrupted.

(iv) Protection against electric shock in a single phase installation is provided by a device which electrically disconnects the vehicle from the live conductors of the supply and from protective earth in accordance with regulation 543.3.3.101 (ii) within 5 s in the event of the utilisation voltage at the charging point, between the line and neutral conductors, being greater that 253 V rms or less than 207 V rms. The device shall provide isolation and be selected in accordance with Table 537.4. Equivalent means of functionality could be included within the charging equipment. Closing or resetting of the device shall be possible only if the voltage between line and neutral conductors is in the range 207 to 253 V rms.

Please note;

BS 7671 **DOES NOT** permit a protective device as described in indent (iv) of Regulation 722.411.4.1 to be used to protect single-phase charging equipment in three-phase installations.

Equally, BS 7671 **DOES NOT** permit charging equipment containing equivalent functionality to that described in indent (iv) of Regulation 722.411.4.1 to be installed in installations with three-phase supplies.

(v) Protection against electric shock is provided by the use of an alternative device to those in (iii) or (iv) which does not result in a lesser degree of safety than using (iii) or (iv).

" Does not result in a lesser degree of safety" is the key statement from (v) which any device currently on the market or that may be invented in the future must adhere to.

These key points are

(iii) Closing or resetting the device shall be possible only if the voltage between the circuit protective conductor and Earth does not exceed 70 V rms

(iv) within 5 s in the event of the utilisation voltage at the charging point, between the line and neutral conductors, being greater that 253 V rms or less than 207 V rms

For isolation from the supply during a fault condition; The device shall provide isolation and be selected in accordance with Table 537.4.

How do matt:e devices comply with the Regulation ?

All protection devices have been designed to comply with the operational parameters set out in BS:7671 2018 : Amendment 1:2020 Regulation 722.411.4.1 indents (iii) and (iv) offer isolation from the supply in line with table 537.4 and have been independently tested to conform with the relevant Union harmonisation legislation: Low Voltage Directive (2014/35/EU)

The following harmonised standards and technical specifications have been applied:

EN61439-2 : Low-voltage switchgear and control gear assemblies.
EN60947-4-1 Low-voltage switchgear and control gear
EN61009-1 Residual current operated circuit-breakers with integral overcurrent
EN60255-1 2010 Emissions standard for Measuring Relays and Protection Equipment
EN55011 Class A 2011 + A1:2017 Emissions Standard for ISM Equipment
EN60255-26 2013 Immunity standard for Measuring Relays and Protection Equipment,
EN61000-4-2 2009 ESD Requirements
EN61000-4-3 2006 + A1 + A2 Radiated Susceptibility
EN61000-4-4 2012 Electrical Fast Transient Burst Requirement
EN61000-4-5 2006 Surges Requirements
EN61000-4-6 2009 Conducted Susceptibility
EN61000-4-11 2004 Voltage Dips and Interruptions

Three-phase infrastructure

The O-PEN device is able to detect open PEN faults on three-phase PME infrastructures and safely isolates the electrical loads.

This helps prevent the risk of electric shock if dangerous touch voltages above 70V occur and is fully compliant with BS:7671: 2018 amendment 1: 2020 Regulation 722.411.4.1 (iii)

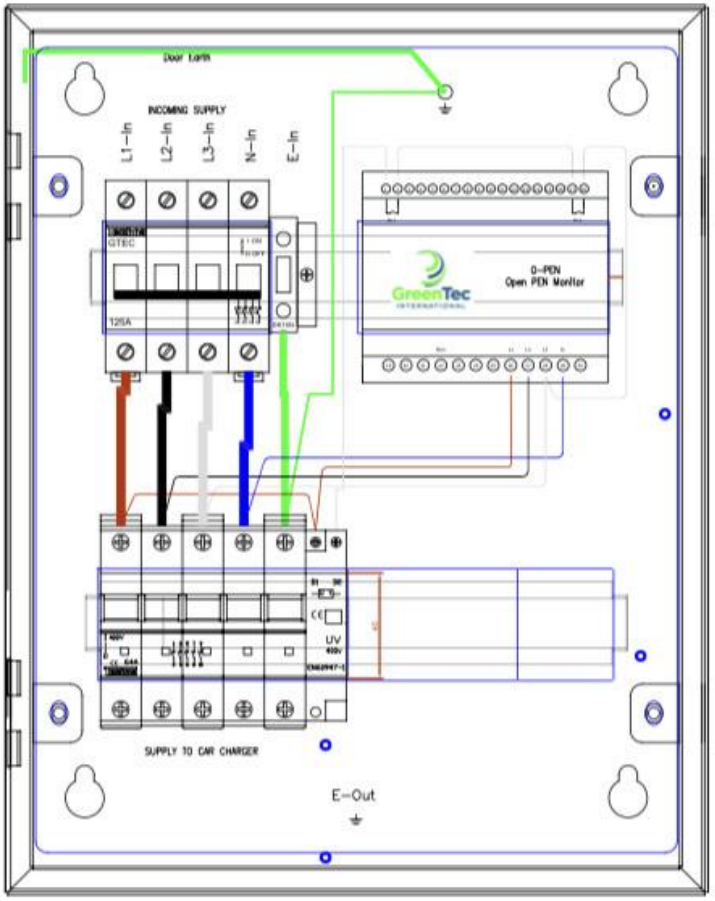
EV connection centres for three-phase infrastructures.

- Simple wire in wire our connection
- Multiple configurations to suit most installations

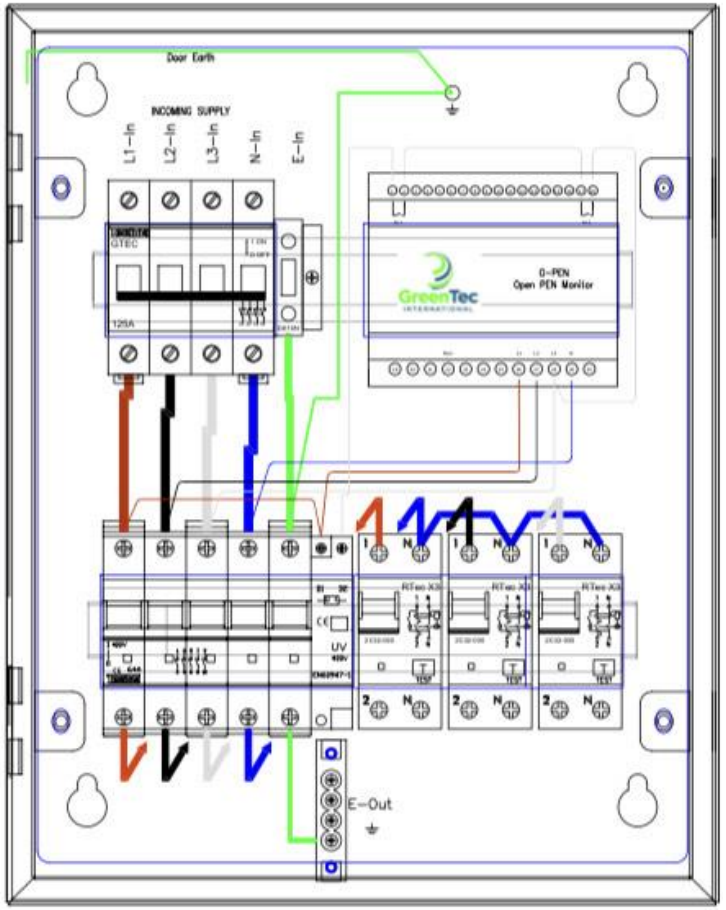
EVU-3-32-R

EVU-1-100-TP

Typical product layout



EVU-1-63-TP



EVU-3-32-R

Single-phase infrastructure

EV connection centres for single-phase infrastructures.

SP-EVCP-R

SP-EVCP-B

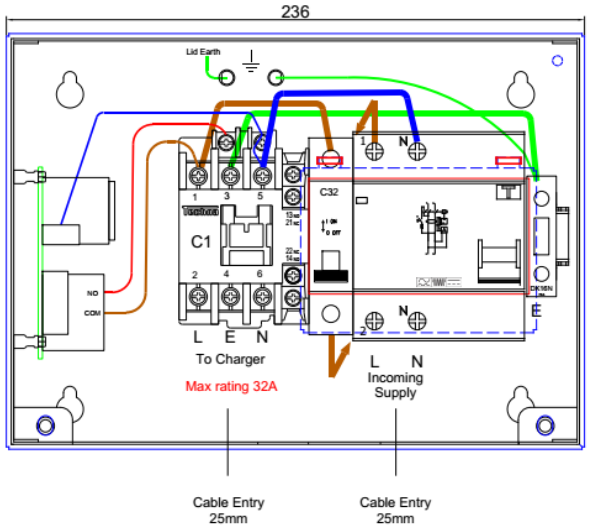
The units are available in multiple configurations to suit all domestic installations.
Options available include;

- Double pole MCB
- Type A RCBO
- Type B RCCB
- IP65 Enclosure
- Current limiting for maximum demand and diversity load curtailment in line with Regulation 722.311.201

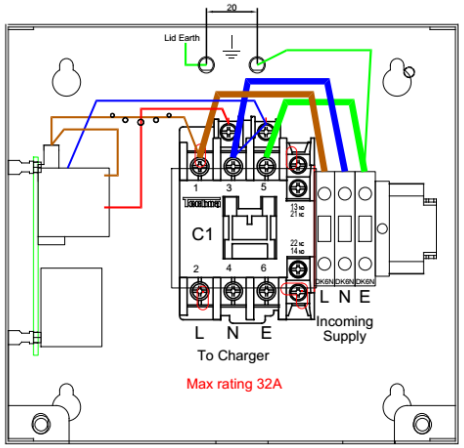
Connection diagrams

The single-phase protection devices have been designed to replace a garage board to reduce cost and simplify installation.

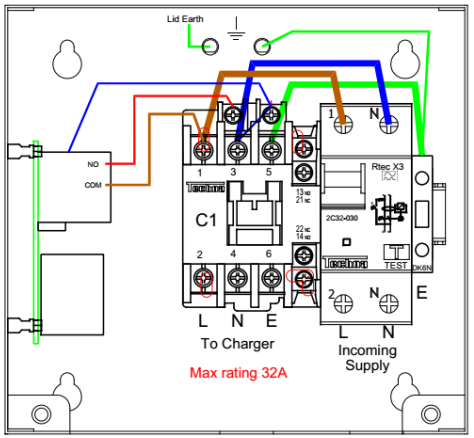
SP-EVCP-B



SP-EVCP-T



SP-EVCP-R



The matt:e SP-EVCP electronic device monitors the supply voltage and disconnects the live conductors of the supply and protective earth in accordance with regulation 543.3.3.101 (ii) within 5 s in the event of the utilisation voltage at the charging point, between the line and neutral conductors, being greater that 253 V rms or less than 207 V rms.

This helps prevent the risk of electric shock if dangerous touch voltages occur, fully compliant with BS:7671: 2018 amendment 1: 2020 Regulation 722.411.4.1 (iv)

All matt:e SP-EVCP units have the option to be supplied with the additional functionality for load curtailment in line with regulation 722.311.201

This function isolates the charge point once the house consumption rises above a pre-set limit and automatically restores power to the charge point when the load falls back within limits.

- Saves time during survey,
- Helps ensure house consumption remains within DNO limits
- Ideal for new build developments
- Factory set at 60, 80 or 100A
- Simple plug and play connection

Key Product Benefits

- Standardises installation
- No more scanning for buried services
- Minimises civil works
- Prevents danger posed by driving Earth electrodes into the ground
- Allows charge points to be mounted directly onto metal clad structures
- Safer earth connection as connected directly onto PME supply
- Guarantees that the earth resistances values are met and maintained all year round
- Designed and manufactured in Great Britain

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Simplifying EV connection