

# Solar & Wind Farms Grounding

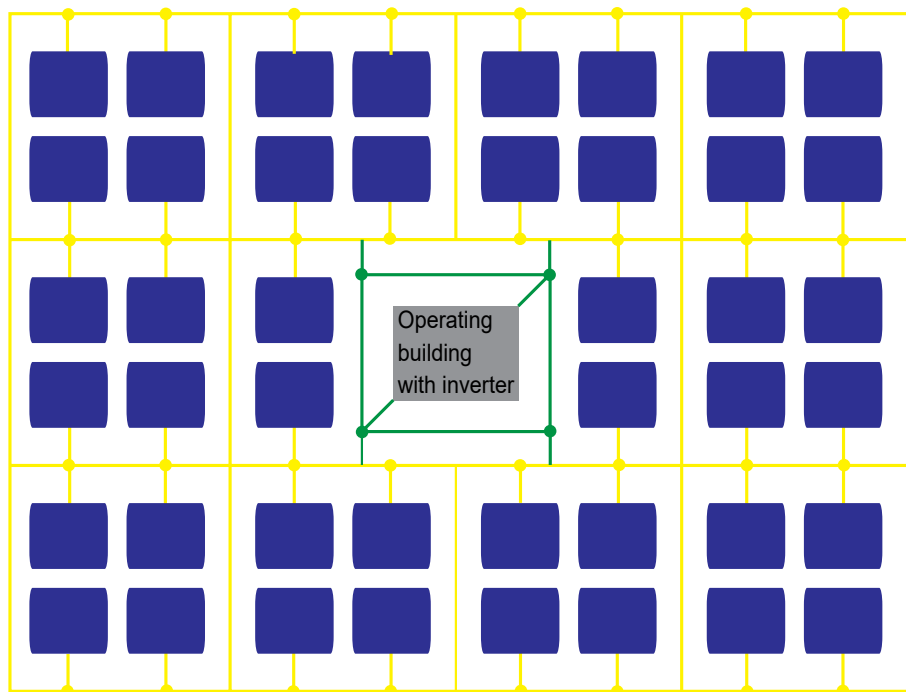


Overvoltage Protection Systems

## ENSURING SAFETY & PROTECTION ALWAYS

With over 30 years of experience, our ability to meet our clients expectations has always been key. CBM Technology offers the solutions enabling safe and reliable functioning of solar farms. The first solution we offer is a unique grounding system with over 30 years of non-corrosion status, a solution which does not cause an accelerated corrosion of the underground steel structure of solar panels. Conforms to IEC/EN 62651-2. The second solution is the protection of PV systems with generator connection boxes. Our solutions allow you to reduce your overall maintenance costs and ensure safety at the same time. In the case of the grounding system our solution also reduces the investment costs.

Layout of a solar park with PV rows and operation building



Yellow color – underground mesh for the PV area in the form of a 20 m x 20 m or 40 m x 40 m.

Green color – grounding for the operating building with Inverter.

## Grounding system: Security

For the safety of personnel, electrical equipment and discharge of atmospheric discharges, it is necessary to make a proper grounding system and equalize the potentials between the panels and rows of modules.

Grounding for PV – it is copper/tin bonded steel round conductor (St/Cu/Sn) placed underground within the PV area in the form of 20 m x 20 m or 40 m x 40 m mesh (yellow color).

Grounding for the operating building with inverter – a copper/tin bonded steel round conductor (St/Cu/Sn) or copper/tin bonded steel tape (St/Cu/Sn) placed underground around building (green color).



# Grounding system: Corrosion resistance, personnel safety

## Corrosion Resistance

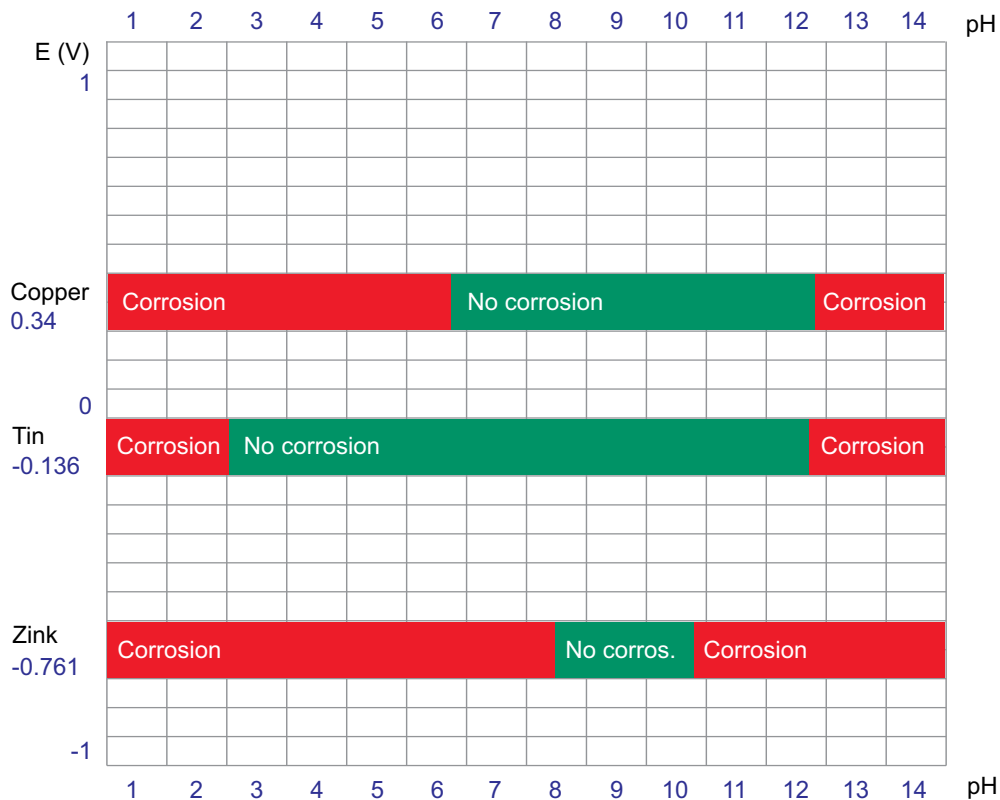
The grounding system is a copper-tin bonded steel wire or tape. The tin layer protects the grounding system against earth corrosion in the soil with a pH range from 1.5 to 12.5. Also allows for the connecting of the earthing system with steel hot-dip galvanized, aluminum and stainless-steel constructions without the need for bi-metal separators.

The attached image is a clear comparison of corrosion resistance areas for three metals based on Pourbaix charts. On the vertical axis there are values of the normal potential for copper, tin and zinc.

On the horizontal axis you can see the pH range of the soil in which there is no corrosion of copper, tin and zinc. The green color for tin shows that the tin has the largest range of corrosion resistance in the soil.

In addition, the hot-dip galvanized steel structure of solar panels placed underground is not exposed to electrochemical corrosion after connecting the earthing system to the Cu/Sn coating. Electrochemical corrosion occurs when using a grounding system made of copper and is created due to the flow of corrosive current.

Corrosive current occurs when the potential difference between two metals placed in the ground is greater than 0.6 V and accelerates the corrosion of the underground solar panel mechanical structures.



# Graphical Comparison

The graphical comparison of corrosion phenomena in two different examples

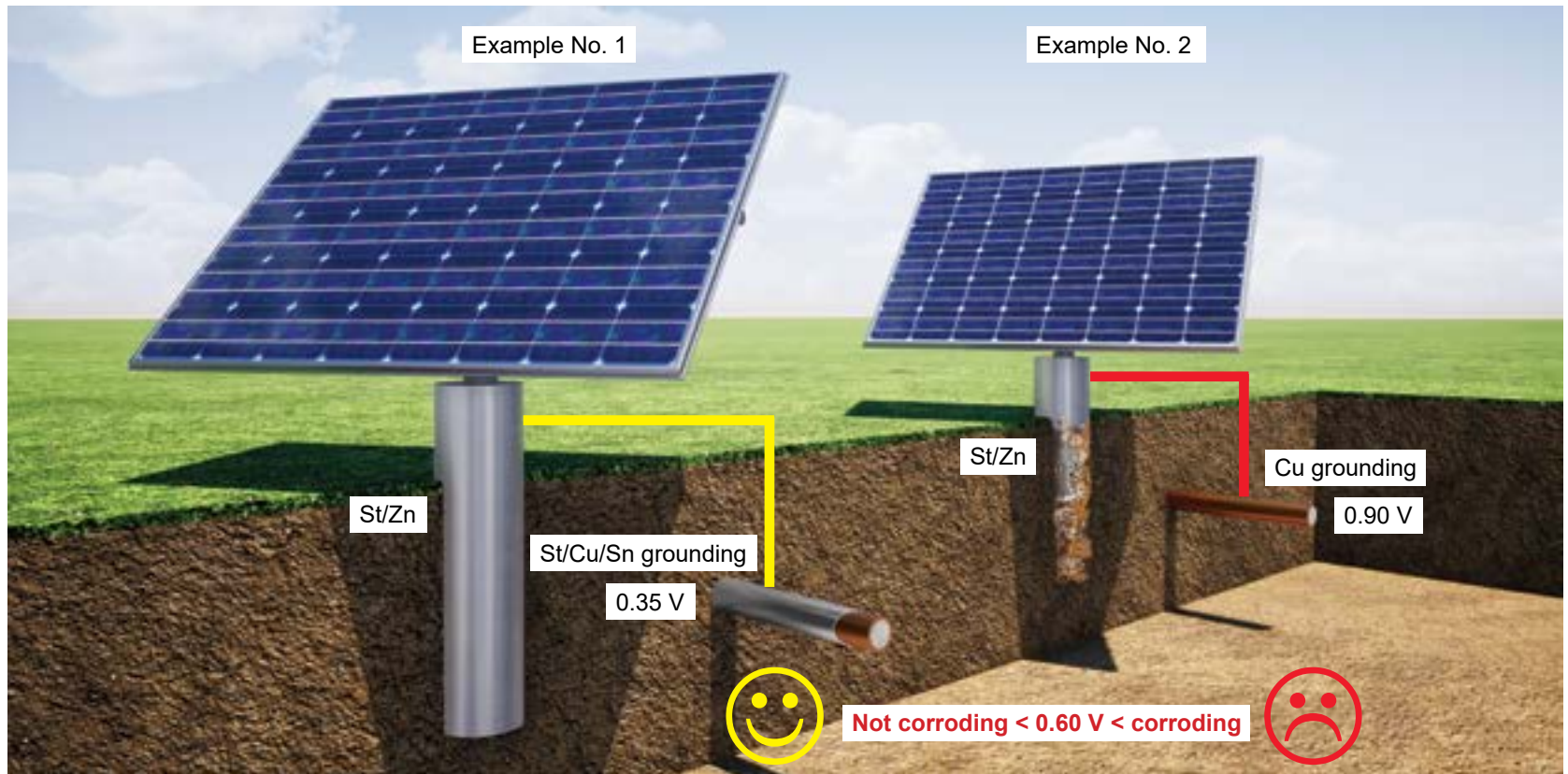
**Example No. 1** Copper/tin bonded steel conductor (St/Cu/Sn)

Connected to a solar panel on a frame made from steel with a hot dip zinc coating (St/Zn).



**Example No. 2** Copper conductor (Cu)

Connected to a solar panel on the frame made from steel with a hot-dip zinc coating (St/Zn).



In the future no problem arises from electrochemical corrosion due to galvanic currents.



# Function of metals in the earthing conductor

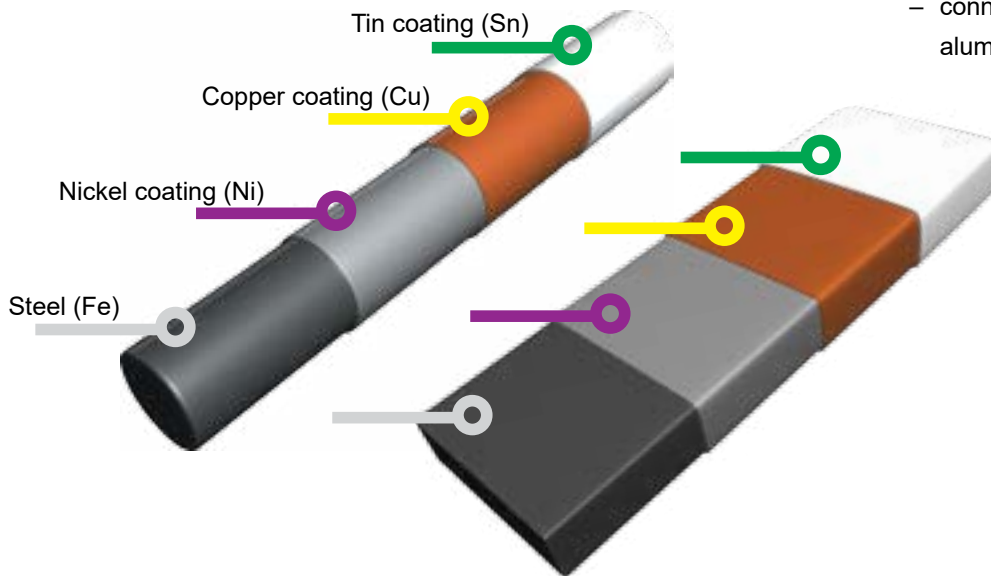


## Steel (Fe) is responsible for:

- conduction current,
- making the product unprofitable for thieves,
- easy verification by the thief with the help of a magnet.

## Nickel coating (Ni) is responsible for:

- copper adhesion to steel.



## Tin coating (Sn) is responsible for:

- theft protection because suggesting the color of zinc,
- protection against corrosion in the soil environment regardless of the pH value. The tin is resistant to earth corrosion at a pH in the range of 1.5 to 13.5,
- to eliminate the corrosion current in the ground between the solar construction and the grounding system,
- connection of a grounding system with other metals such as zinc, aluminum or stainless steel without a bimetallic spacer.

## Copper coating (Cu) is responsible for:

- increasing the conductivity of grounding wire and tape,
- providing corrosion resistance of wire and tape for over 30 years .



# Overvoltage protection

## Protection of PV system with generator connection boxes from CBM GALMAR

### Generator connection boxes with surge protection

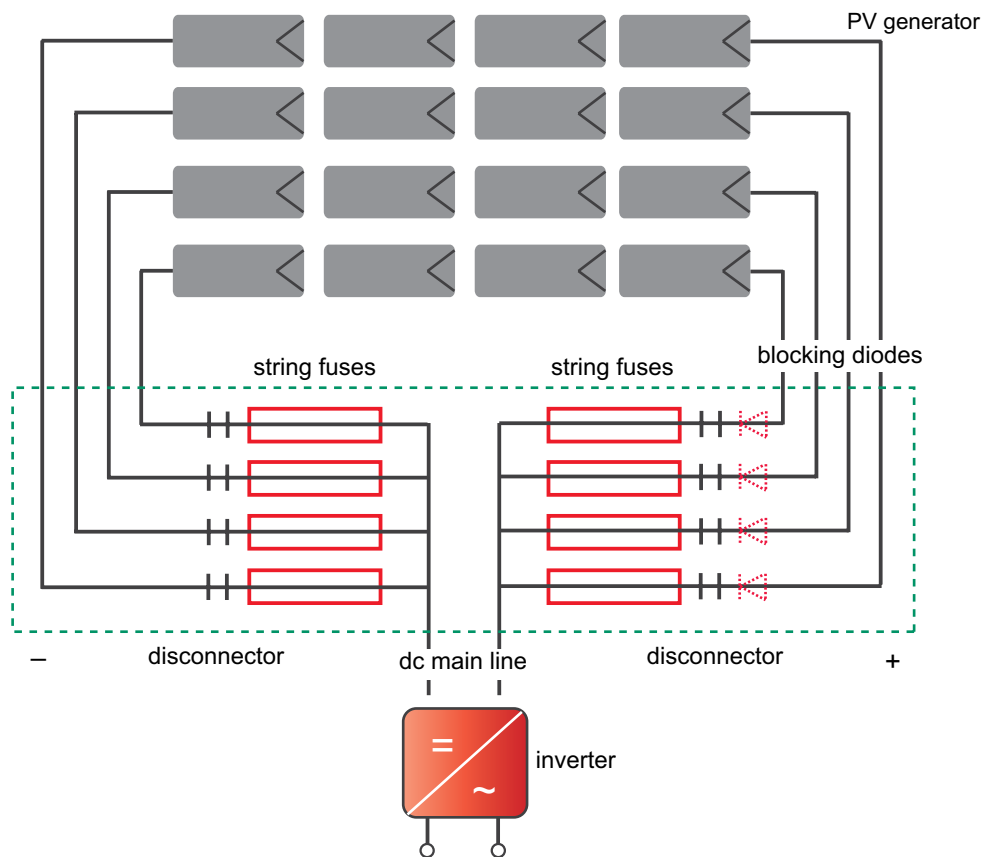
With the development of more powerful inverters, CBM GALMAR designed a new generation of generator connection boxes, which complies to the requirements of PV installations.

The new generator connection boxes allow for a very efficient installation by collecting several strings of the PV installation at one single point.

This type of installation reduces the process of cabling to a minimum.

All terminals of the generator connection boxes are accredited to 1000 V. Up to 12 strings can be combined and protected with a single generator connection box. Every generator connection box has two output terminals for plus and minus poles, which allows for several generator connection boxes to be connected in parallel.

By this, installation may be expanded to any number of strings. Installation and mounting of the CBM GALMAR generator connection boxes is an easy and fast process due to their preassembled brid-



Example of a generator connection box equipped with blocking diodes and string fuses

ges, busbars and screw connections and dummy plugs. Generator connection boxes from CBM GALMAR contain no dc switch-disconnector, because the

manufacturers of inverters place them in their units, String fuses are not part of the delivery.

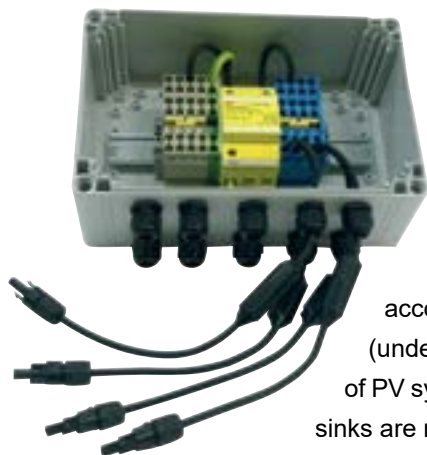
They can be ordered separately.

## Generator connection boxes, blocking diodes and string fuses

In case that several strings of the PV generator should be connected together, a generator connection box is often used.

It also includes, if necessary, blocking diodes, string fuses and surge protection devices besides the connection terminals for the PV string cables.

The string currents are transferred by combining two main generator lines in the PV generator. These lines have to be dimensioned according to the total string current. To protect generator lines also in case for a double earth fault, both lines (+ and -) have to be protected with string fuses. Kick fuses, suitable for DC application and with low power dissipation, are often used in this case.



The rated current of the PV modules ensures a failure-free operation. The generator connection box can also be equipped with disconnect and measurement terminals to enable the control and monitoring of the string currents.

The generator connection box has according to DIN VDE 0100-712, to be tagged with an appropriate warning label. To decouple the single module strings from each other, blocking diodes can be used in each string. If a short circuit condition or shadowing effect occurs in one of the strings, all other strings can continue working without disturbances.

Without the blocking diodes current would flow in load direction (back current). If blocking diodes are used, according to VDE 010 part 712, the reverse voltage must be dimensioned for double voltage of the PV modules (under STC = Standard Test Conditions). Blocking diodes are applied in conducting direction during normal operation of PV system. Therefore, the full current flows over the blocking diodes (often heat sinks are necessary).

The breakdown of blocking diodes is problematic because the whole PV string break down. This is often detected and fixed, so that today most of the grid-connected photovoltaic systems do not use blocking diodes. The technical conditions of connecting are to be noted, details are given from the manufacturer of inverters.

Please see the manufacturer's requirement about the maximum reverse current in any parallel connection of solar panels.





**CBM Technology Sp. z o.o.**

ul. Kasztanowa 2, 64-320 Niepruszewo, Poland

tel. +48/61 650 30 40

e-mail: [office@cbm-technology.eu](mailto:office@cbm-technology.eu); [www.cbm-technology.eu](http://www.cbm-technology.eu)

