SOLAR FARMS & BATTERY STORAGE

Lightning Protection of Solar Farms and Battery Storage

Effective lightning protection of solar farms and battery storage facilities requires a systematic approach to be implemented within the normal project phases of Design, Construct and Commission.

LPI recommends a systematic 4-step approach to protecting solar farms / battery storage, namely:

1. Protect equipment and arrays against direct strikes, as indicated in a risk assessment;
2. Design and install appropriate Earthing and Bonding;
3. Protect power lines and equipment; and
4. Protect signal lines and equipment.

Step 2 is particularly important for solar farms. In order to design appropriate earthing, it is recommended that a soil resistivity survey is carried out. Soil resistivity data are then used to generate a soil resistivity profile for the site. This model is a key input parameter into the earthing design stage. A professional engineering software package (like CDEGS) is used to design the earthing system to meet all required criteria associated with power, lightning and personnel safety.

Protection of Solar Farm

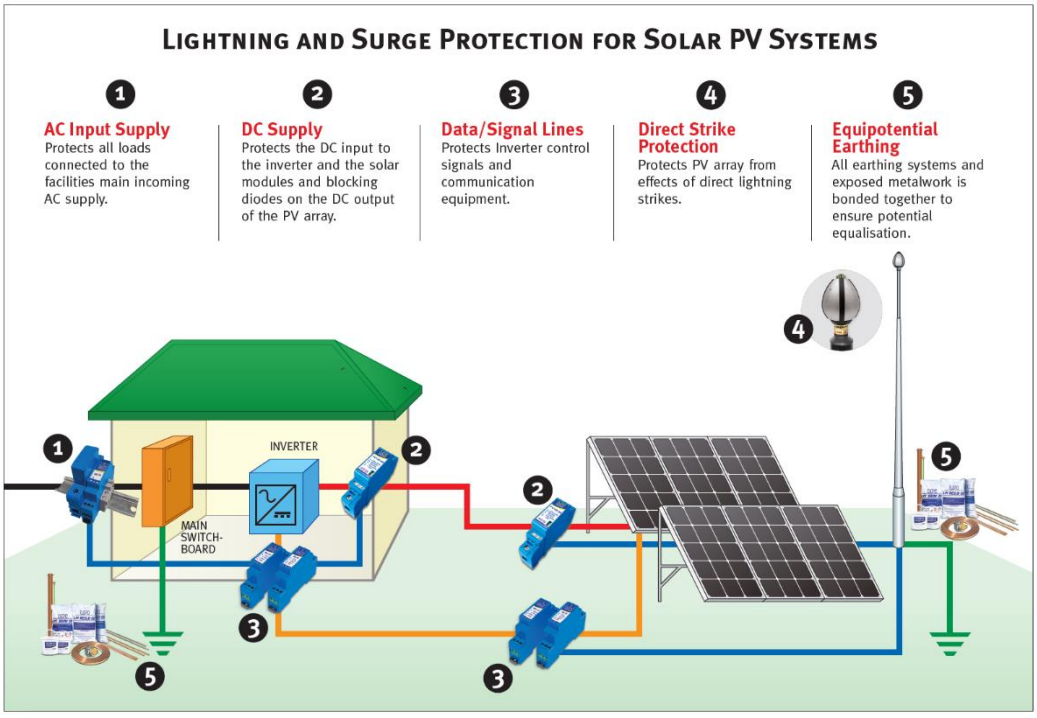


Figure 1: Key parts of a solar farm and the types of products that are required for each part.

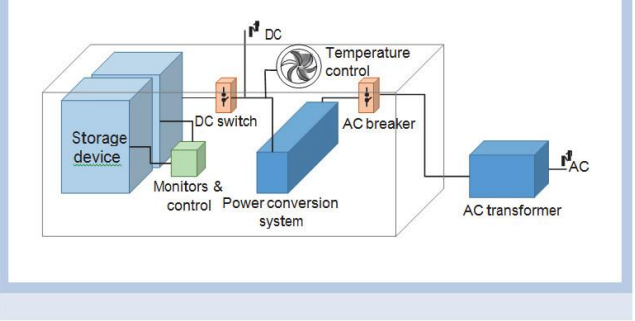
Why Earthing Is Important

Earthing helps mitigate hazards to personnel and damage to equipment. Hence, a well-engineered earthing solution and installation is an integral part of any electrical system as it is directly related to the safety of human life as well as the equipment.

Good earthing practices provide the following:

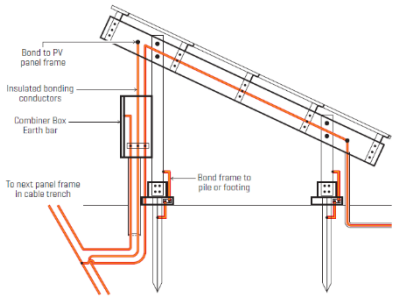
- Personal safety from step, touch and transfer voltages – hence maintaining a safe working environment;
- Equalisation of potential differences under fault current conditions, such as from nearby power generation earth faults or cloud-to-ground lightning strikes;
- Elimination of noise that may affect precision equipment from operating within optimum operating parameters.

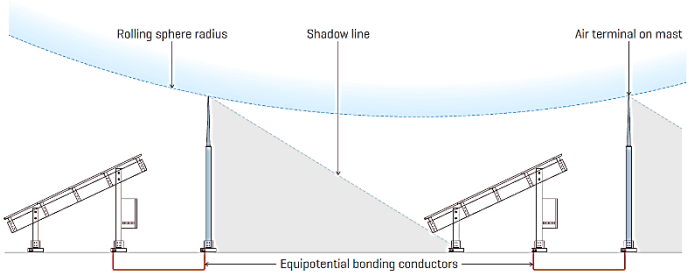
Figure 1: Battery Energy Storage System and Primary Power Components

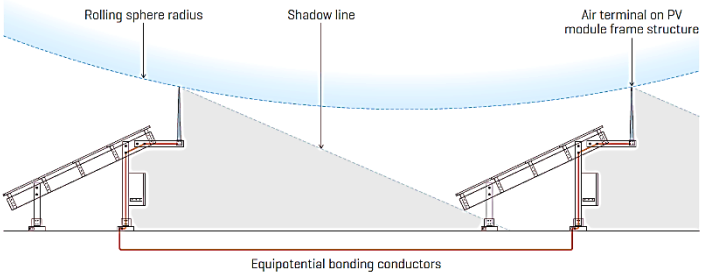


In harsh soil conditions, earth enhancing compounds (EECs) can help to reduce earth potential rise and hence personnel and equipment hazards.

Typical examples of earthing and bonding used on solar farms are shown below:





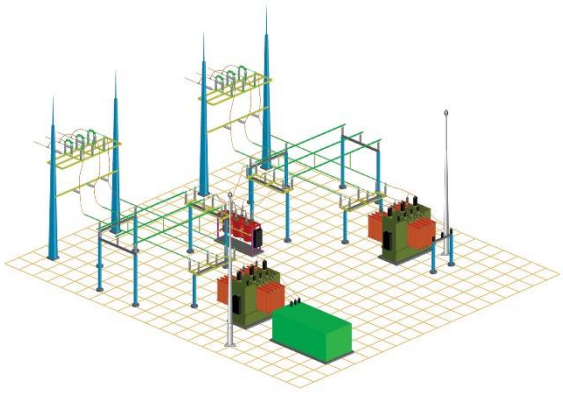


LPI offers a full suite of earthing products, including:

- Copper-bonded and stainless-steel earth rods
- Mechanical clamps and C Crimps
- Earth enhancing compounds
- Poly concrete and plastic earth pits

Type and Positioning of Lightning Protection System

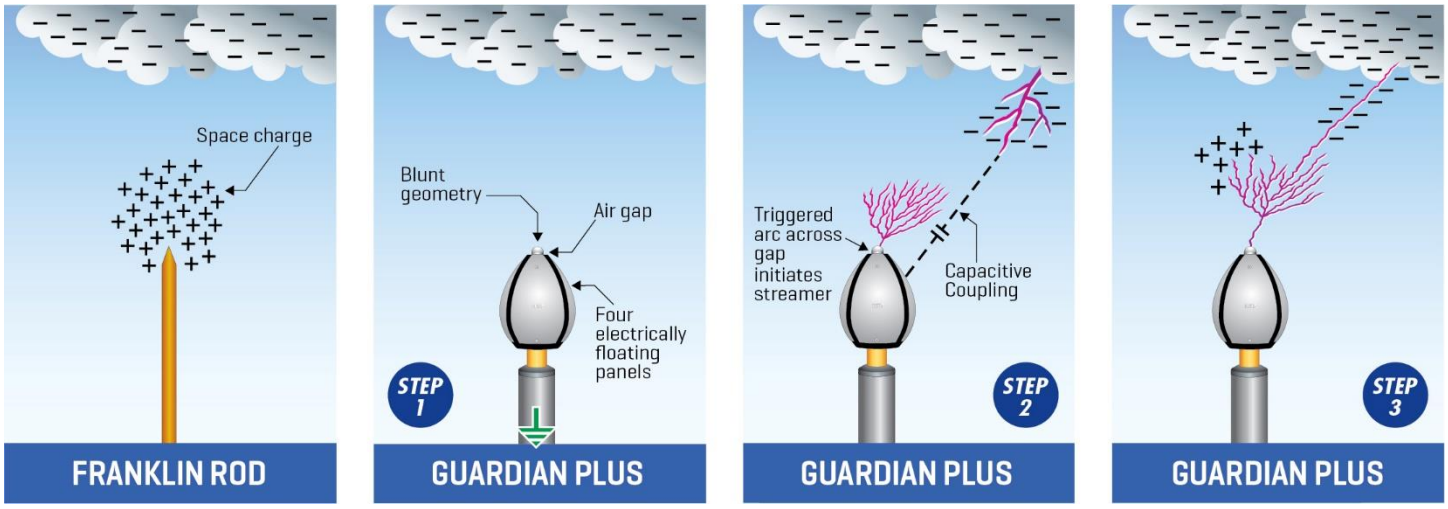
The use of Rolling Sphere Method (RSM) has been used for lightning protection designs for more than half a century. However, with the installation of Solar Farms and Battery Storage facilities, the RSM method has reached it limits in design protection capability. Over recent years, scientific advancements have improved the overall understanding of the lightning interception process and how to safely control and dissipate lightning strikes, especially in open areas like solar farms.



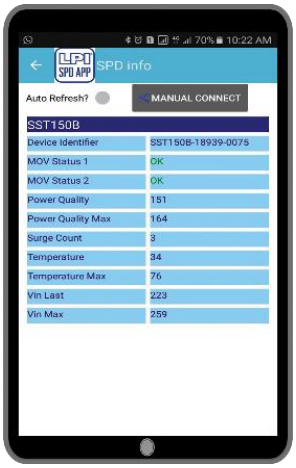
Specialised standards such as IEEE Std. 998 focus on lightning protection for substations. They use RSM but also understand the need to utilise other methods for protection such as Leader Inception Theory (LIT). The latter not only considers size, shape and BIL of the installation, but also environmental parameters, making it far more effective and efficient in providing protection from the effects of lightning strikes on an open site facility.

LPI "Guardian Plus" Lightning Protection System:

- Air terminals designed to achieve optimum corona performance
- Air terminal initiates upward leader via capacitive coupling from the downward leader electric field
- Placement of Guardian Plus air terminals via LIT method as per IEEE Std. 998
- Family of stainless steel air terminals
- Easy to install
- Manufactured to a design achieving compliance with IEC 62651-2 and UL96



Why do I need Surge Protection?



With the fast-changing pace of technology, more and more equipment is designed and built for smarter connectivity and fast processing power, all operating at lower voltage. This means that today's modern equipment is far more susceptible to electrical disturbances, either from grid disruptions or transients within the facility, and lightning strikes, either direct or indirect.
A well-coordinated surge protection scheme can add years to the successful running of these sites, leading to high reliability and a greater return on investment.

LPI's latest surge protection range not only offers the latest in surge protection design specification, but every power protection module is Bluetooth enabled. This feature enables contactless communication, for fast and easy assessment of surge status, surge count and much more.

Consultancy and Design Capabilities

LPI provides specialised engineering consulting and design services in lightning protection, surge and transient protection and earthing. LPI's expertise is broad, with many years' of experience serving customers throughout the world, especially in some of the most lightning prone regions.

- Team of qualified electrical and mechanical engineers
- Direct strike lightning protection in compliance with international standards
- Earthing in compliance with international standards
- Risk analysis in compliance with international standards
- Site evaluation, surveys and audits
- Review of existing designs and drawings
- Design and drafting capabilities ulilising AutoCAD software
- Solutions based engineering

Head Office | 49 Patriarch Drive, Huntingfield Tasmania, Australia 7055
Postal | PO Box 379 Kingston, Tasmania, Australia 7051
Web | www.lpi.com.au
Phone | + 61 3 6281 2475
Facsimile | + 61 3 6229 1900
Email | info@lpi.com.au