

AN014



Protection of photovoltaic (PV) systems

Application Note AN014 for PV system power line protection



Protection of photovoltaic (PV) systems

Increasingly considered as a viable and cost-effective source of renewable energy, PV systems now range from commercial and residential supplementary energy solutions, to large-scale power generation at solar parks etc.

Installation of PV arrays at roof level, and the siting of solar parks in open, exposed locations, makes PV systems highly susceptible to damage from partial lightning currents.

Partial lightning currents can enter the PV system following a direct lightning strike to the external lightning protection system (LPS), or via transient overvoltages from the wider electrical network.

Protecting the PV system

Effective protection against partial lightning currents can be achieved through installation of Surge Protective Devices (SPDs), on both the DC and AC sides of the DC-AC inverter.

The mains power SPDs selected should conform to BS EN 61643-11, and be installed in line with the guidance provided in Technical Specification DD CLC/TS 50539-12:2010.

The appropriate SPD to protect each side of the inverter is dependent on whether the PV array is protected by an external LPS, and if so, whether the minimum separation distance (to BS EN 62305-3) between the LPS and the metallic parts of the PV array has been kept.

Installation on the DC side of the inverter

An SPD specifically designed for use on the DC side of a PV system (location **1** in Figures 1 & 2) should be installed.

The number of SPDs required is based on the distance between the PV array and inverter:

- If the distance between the PV array and inverter is less than 10 m, a single SPD installed as close as possible to the inverter, should suffice
- If the distance between PV array and inverter is greater than 10 m, two SPDs should be installed, one close to the inverter and the other close to the PV array

The minimum Type of SPD is defined in Table 1.

The Furse ESP combined Type 1+2 SPDs for PV systems - ESP DC550/12.5/PV and ESP DC1000/12.5/PV - are suitable for this purpose, providing protection against partial lightning currents, for Lightning Protection Zone (LPZ) boundaries LPZ_A to LPZ 2.

Installation on the AC side of the inverter

A lightning current SPD for protecting AC mains power supplies should be installed on the AC side of the inverter, dependent of the state of the external LPS (see Table 1).

The SPD should be positioned as close as possible to the origin of the AC supply (location **3**), usually the mains distribution board (MDB), unless the distance between inverter and MDB is greater than 10 m.

Where this is the case, two SPDs should be installed - one close to the inverter (location **2**) and the other close to the MDB (location **3**).

A Furse ESP combined mains power protector such as the ESP D1 Series or ESP M1 Series, is suitable at locations **2** & **3**. As combined Type 1+2+3 SPDs, these units deliver low let-through voltage with full mode protection between all sets of conductors, for optimum surge protective performance.

The Class of LPS (i.e. the Lightning Protection Level (LPL) offered), and the metallic services connected to the structure further determine the appropriate Furse SPD to be installed (see Table 2).

External LPS status	Minimum SPD Type required*		
	DC side, distance PV array to inverter		AC side of inverter
	< 10 m	> 10 m	
No external LPS	Type 2 SPD (PV)	Type 2 SPD (PV)	Type 2 SPD (mains)
External LPS (separation distance kept)	Type 2 SPD (PV)	Type 2 SPD (PV)	Type 2 SPD (mains) 2 Type 1 SPD (mains) 3
External LPS (separation distance not kept)	Type 2 SPD (PV)	Type 1 SPD (PV)	Type 1 SPD (mains)

* Furse ESP combined Type 1+2 SPDs for PV systems and Type 1+2+3 mains voltage SPDs are suitable for installation at applicable locations in the PV system and offer enhanced performance over and above Type 1 or Type 2 SPDs.

Table 1: SPD Type according to external LPS configuration - see also Figures 1 and 2

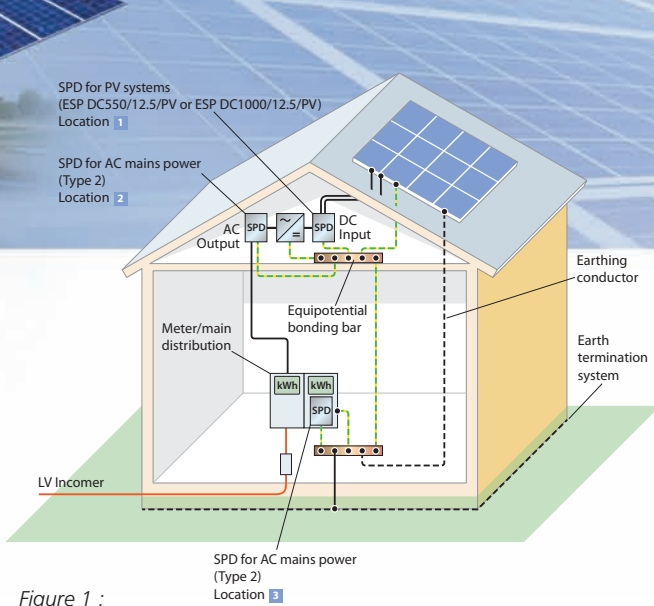


Figure 1 :
Roof mounted PV array,
no external LPS

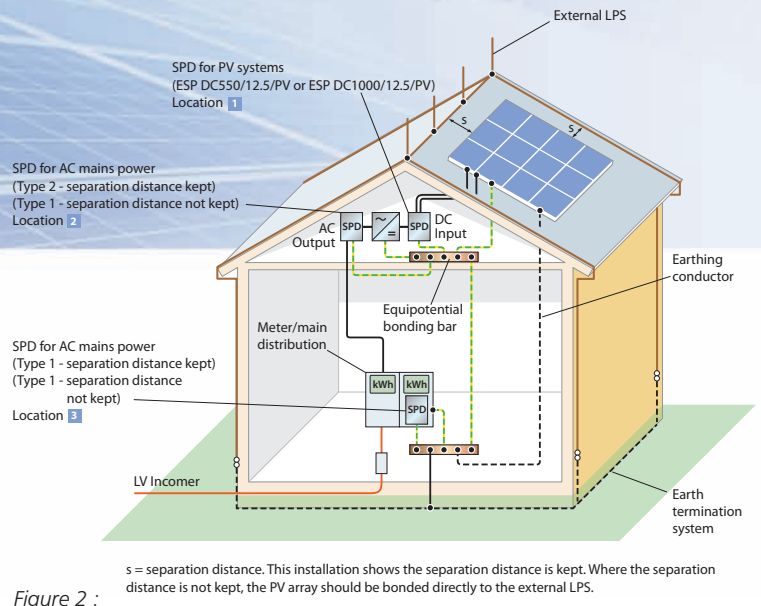
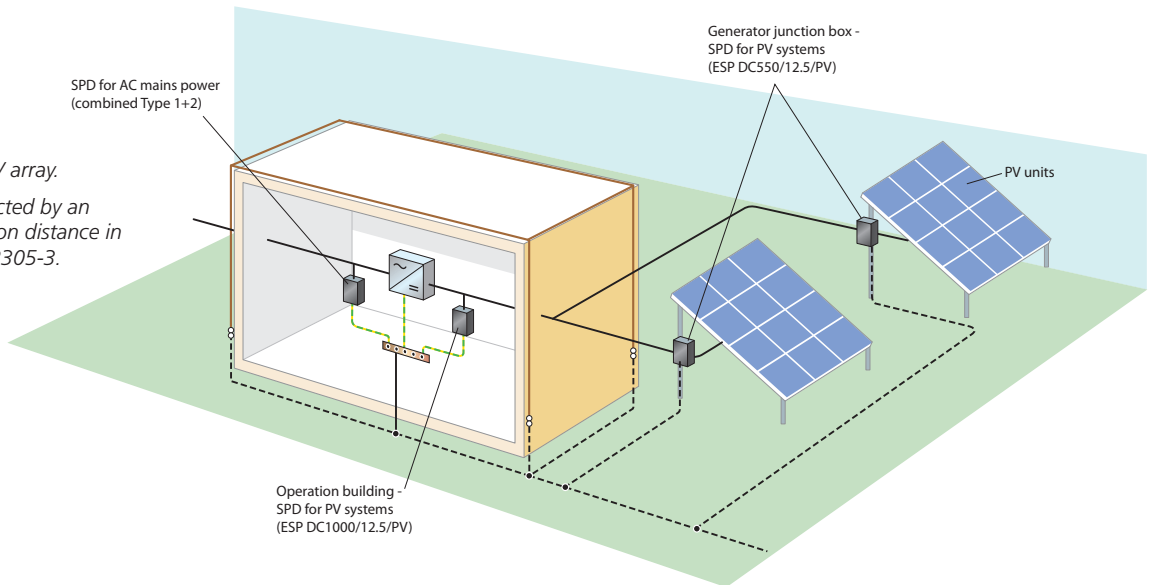


Figure 2 :
Roof mounted PV array,
external LPS

Figure 3 :
Protection of solar park/PV array.
PV arrays should be protected by an
external LPS with separation distance in
accordance with BS EN 62305-3.



Installation configuration	SPD (for 3 Phase 415 Vac supplies)
No external LPS, underground mains supply	ESP 415 D1 or ESP 415 M1
No external LPS, exposed overhead mains supply	ESP 415/III/TNS or ESP 415 M2
External LPS, multiple connected metallic services	ESP 415 D1 or ESP 415 M1
External LPS, unknown connected metallic services	ESP 415 /ITNS or ESP 415 M4 for LPS to LPL I & II ESP 415 /III/TNS or ESP 415 M2 for LPS to LPL III & IV

Note: All the Furse ESP Protectors stated above provide at least combined Type 1+2 protection against partial lightning currents (LPZ boundaries LPZ 0_B to LPZ 2 minimum), suitable for installation on the AC side of a PV inverter.

Table 2: AC protector requirement based on Class of LPS/connected metallic services

Important

This Application Note refers only to protecting PV systems from partial lightning currents.

For full protection of electronic systems, installation of SPDs to protect all incoming and outgoing services (mains power and data/telecoms lines) needs to be assessed in line with BS EN 62305. Please contact us for further information.

Full specifications of all of the products in the Furse ESP range of transient overvoltage protectors can be found in the Total Solution Product Catalogue.



To request a copy, contact Furse Sales at the address opposite.

Full product data can be downloaded in PDF form from our website at www.furse.com. Copies of the Total Solution Product Catalogue can also be requested from our website.

UK OFFICE

Thomas & Betts Limited
Furse
Wilford Road
Nottingham
NG2 1EB
United Kingdom

Switchboard +44 (0)115 964 3700
Fax +44 (0)115 986 0538
Sales tel +44 (0)115 964 3800
Sales fax +44 (0)115 986 0071

Email: enquiry@furse.com
www.furse.com

EUROPEAN HEADQUARTERS

Thomas & Betts
European Centre SA
200 Chaussée de Waterloo
B-1640 Rhode-St-Genèse
Belgium

Tel +32 (0)2 359 8200
Fax +32 (0)2 359 8201

www.tnb-europe.com

MIDDLE EAST OFFICE

Thomas & Betts Ltd. Br.
Office 724 6WA West Wing
Dubai Airport Free Zone
PO Box 54567
Dubai
United Arab Emirates

Tel +971 (0)4 609 1635
Fax +971 (0)4 609 1636

Email: furseenquiry@tnb.com

SOUTH EAST ASIA OFFICE

Thomas & Betts
Asia (Singapore) Pte Ltd
10 Ang Mo Kio Street 65
#06-07 Techpoint
Singapore 569059

Tel +65 6720 8828
Fax +65 6720 8780

Email: asia.inquiry@tnb.com

The content of this Thomas & Betts publication has been carefully checked for accuracy at the time of print. However, Thomas & Betts doesn't give any warranty of any kind, express or implied, in this respect and shall not be liable for any loss or damage that may result from any use or as a consequence of any inaccuracies in or any omissions from the information which it may contain. E&OE.

Copyright Thomas & Betts Corp. 2011. Copyright in these pages is owned by Thomas & Betts except where otherwise indicated. No part of this publication may be reproduced, copied or transmitted in any form or by any means, without our prior written permission. Images, trade marks, brands, designs and technology are also protected by other intellectual property rights and may not be reproduced or appropriated in any manner without written permission of their respective owners. Thomas & Betts reserves the right to change and improve any product specifications or other mentions in the publication at its own discretion and at any time. These conditions of use are governed by the laws of the Netherlands and the courts of Amsterdam shall have exclusive jurisdiction in any dispute.

Thomas & Betts