## Introduction

This document explains how to install Furse ESP 240/XXX Protectors for Type 1 equipotential bonding on single phase mains supplies and power distribution boards:

**ESP 240/I/TNS I ESP 240/I/TNC I ESP 240/I/TT**
For Class I or Class II Lightning Protection Systems (LPS) for TN-S, TN-C or TT supplies.

**ESP 240/III/TNS I ESP 240/III/TNC I ESP 240/III/TT**
For Class III or Class IV LPS for TN-S, TN-C or TT supplies, or exposed overhead power lines where no LPS is fitted.

## 1. Safety Note

**1.1** ESP Protector installation should be conducted by a qualified competent person and comply with all relevant Regulations and Legislation (including BS 7671 Wiring Regulations and Building Regulations).

**1.2** Incorrect installation will impair the effectiveness of the ESP Protector.

**1.3** Always handle cables by their insulation.

**1.4** Never work on ESP Protectors, earthing or their cables during a storm.

## 2. Application

**2.1** Furse ESP 240/XXX Type 1 equipotential bonding Surge Protection Devices (SPDs) are suitable for use on 1-phase mains supplies and power distribution boards, primarily to prevent flashover as a result of lightning, which may present a risk to life through dangerous sparking causing fire and/or electric shock.

Following BS/EN/IEC 62305, installing Type 1 equipotential bonding SPDs alone does not protect sensitive electronic equipment from transient overvoltage damage. Type 1 SPDs should be used as part of a coordinated set of SPDs, with downstream Type 2 + 3 Full Mode SPDs typically installed at sub-distribution boards feeding electronic equipment.

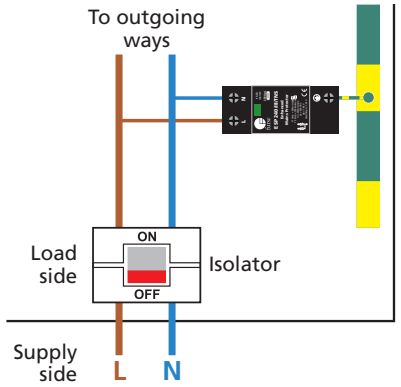


*Figure 1: ESP 240/XXX mounted within a distribution board connected to the incoming supply on the load side (ie downstream) of the isolator.*

Contact Furse for further information about Full Mode SPDs, such as our ESP D1 and ESP M1 Series protectors.

## 3. Before installation

**3.1** Check that the voltage between neutral and earth does not exceed 10 Volts. If this voltage does exceed 10 Volts, the installation is unsafe. Find and rectify the cause of this fault before proceeding (for delta supplies with no neutral, *see Section 4.4*).

**3.2** Make sure that the supply voltage is suitable for the ESP protector.

| | Supply Rated Voltage (VRMS) | Unit Voltage Range (VRMS) |
|---|---|---|
| ESP 240/XXX Protectors | 220/230/240 | 200-280 |

## 4. Installation

### 4.1 Location

ESP 240/XXX Protectors need to be installed very close to the power supply to be protected.

The ESP 240/XXX Protector will be installed at a main power distribution board, either inside it *(Figure 1)* or right next to it in an enclosure *(Figure 2)*.

The ESP Protector includes a DIN foot for mounting onto 35 mm top hat DIN rails.

### 4.2 Enclose the ESP Protector

The ESP Protector has exposed terminals. For electrical safety, the protector must be installed within a distribution board or enclosure.

Where possible, install the ESP Protector in the main distribution board behind a suitable viewing window.

If it is not possible to install the ESP Protector within the distribution board, it should be mounted in a separate enclosure, as close as possible to the distribution board *(see 4.9 - Length of connecting leads)*.

Gland the enclosure onto the power distribution board. Suitable enclosures are available from Furse.

When mounting in an existing metal panel or enclosure, ensure that the enclosure is securely bonded to the earth bar to which the ESP Protector will be connected.

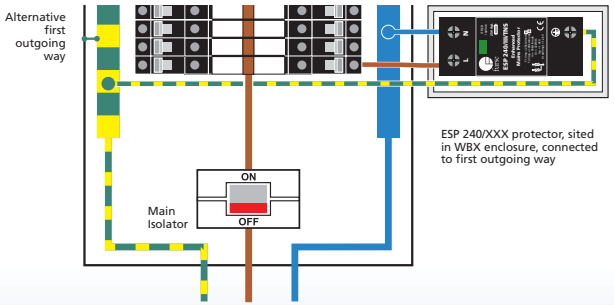


*Figure 2: ESP 240/XXX Protector connected to the nearest available outgoing (MCB) way to the incoming supply. Since there is insufficient space within the distribution board the ESP Protector has been mounted within a separate enclosure, directly alongside the board.*

### 4.3 Parallel connection

ESP 240/XXX Protectors are connected in parallel with the supply to be protected.

**The connecting leads do not carry the load current of the supply,** only the current associated with suppressing the transient overvoltage.

Connecting leads to the ESP Protector need to be kept short in order to minimise additive inductive voltages.

### 4.4 Connection to phase, neutral and earth

Connections are made to each supply conductor including earth.

Terminals marked **L**, **N**, ⏚ must be connected to phase/live, neutral and earth respectively. See *Figures 3 & 4* for connection per system type (TN-S, TN-C or TT).

**For TN-S or TT electrical installations, under no circumstances must the ESP Protector be installed without connection to its neutral.**

Where no neutral is present (eg delta supplies), the neutral (**N**) terminal on the ESP Protector must connected to earth (⏚) in addition to the earth terminal. On some delta supplies the voltage between phase and earth may exceed the rating of the ESP Protector.

Consequently, the supply's phase to earth voltage must be checked before installing the ESP Protector.

**We recommend that you consult Furse before installing ESP Protectors on delta supplies - the TN-C version of the protector may be more suitable for your application.**

### 4.5 Connection point

#### (a) Protecting supplies feeding equipment in the building

The ESP Protector is typically connected to the power supply at the main power distribution board, either:

(i) on the load side of the incoming isolator *(Figure 1)*.

(ii) on the closest available outgoing way to the incoming supply (ie the incoming isolator).

The ESP Protector can be connected via one of the distribution board's outgoing fuseways or circuit breakers.

**Ideally, the ESP Protector should be connected to the outgoing way which is nearest to the incoming supply (or isolator).**

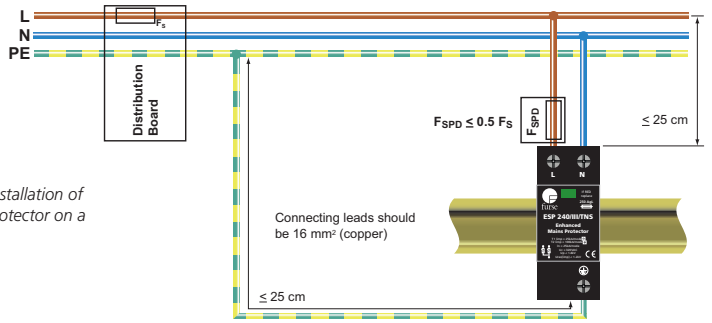


*Figure 3: Parallel installation of an ESP 240/XXX Protector on a TN-S or TT supply*

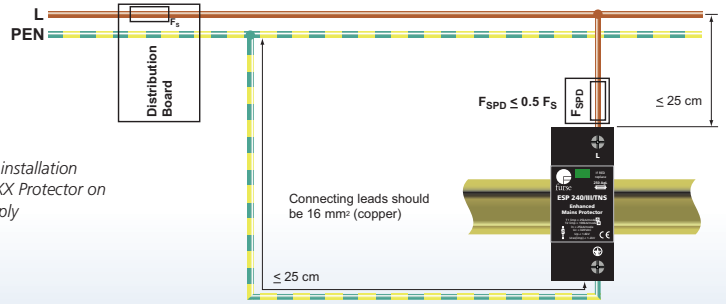


*Figure 4: Parallel installation of an ESP 240/XXX Protector on a TN-C or TT supply*

...continued overleaf

On small, compact, metal cased distribution boards, (such as small MCCB boards) the first way is preferable, although any outgoing way is suitable.

On a large board (eg cubicle switchboard), it is better to install the ESP Protector on the load side of the incoming isolator (eg in the metering section) for optimal protection.

(iii) directly to the busbars via suitable HRC fuses, switchfuses or MCCBs - *See 4.7.*

**(b) Protecting supplies going out of the building**

The connection methods 4.5a (i to iii) are not suitable for protecting a distribution board which provides a supply to outside the building either to a separate building or some other external load (eg site lighting).

To protect the equipment inside the building from transient overvoltages entering the board on the outgoing feed, protection should be installed close to the external load.

**4.6 Isolation**

It is good practice to be able to isolate or disconnect the ESP Protector from the supply.

The supply to the entire distribution board should not be switched off on many computer power supplies and other critical loads.

The means of isolation should therefore be installed in the connection to the ESP Protector (*see 4.7 - Fuse connecting leads*).

**4.7 Fuse connecting leads**

The connecting leads to the phase/live terminals of the ESP Protector should be fused.

This is to protect the connecting leads in the event of a short circuit.

The fuse to the ESP Protector ($F_{SPD}$) should be lower than the upstream supply fuse $F_S$ by a sufficient enough factor to ensure fuse discrimination.

As a general guide a factor of at least 2 could be used ($F_{SPD} \leq 0.5\ F_S$), where the maximum fuse to the ESP Protector required is 250 Amps (if the supply fuse is 500 Amps or greater).

Refer to the fuse manufacturer's operating characteristics to ensure discrimination, particularly where an installation includes a mixture of types of fuse, or of fuses and circuit breakers.

Live/phase connecting leads can be fused by either:

(a) installing appropriate high rupture capacity (HRC) fuses or switchfuses in the connecting leads at the supply end of the lead, or

(b) installing an appropriate MCCB

Where the ESP Protector is installed via an outgoing way (4.5b earlier), this should incorporate a 250 Amp (as appropriate) HRC fuse or MCCB.

**4.8 Size of connecting leads**

The connecting leads between the terminals of the ESP Protector and the power supply, should be multi stranded conductor no less than 16 mm² (copper). If required, the terminals on the ESP Protector will accept connecting leads of up to 25 mm².

**4.9 Length of connecting leads**

The connecting leads should be kept as short as possible and ideally should not exceed 25 cm (10 inches) from the busbars to the ESP Protector's terminals.

**ESP Protectors can be mounted upside down or on their side if this facilitates shorter connecting leads.**

**WARNING:** The longer the connecting leads (between the mains cable or busbars and the terminals of the ESP Protector) the greater the additive voltage let-through by the installed protector. High additive voltages will place greater strain on coordinated downstream Type 2 or Type 3 ESP Protectors and impair their performance or lower the lifespan of these protectors.

**4.10 Bind connecting leads**

Connecting leads should be tightly bound together using Ty-Raps®, tape or spiral wrap. This should be done for the entire length of the cable or as far as is possible.

## 5. Protector operation/status indication

**5.1** The ESP Protector includes an internal thermal supervision device which continually monitors its operation.

Status is displayed via the front facing window. During normal operation the status display is clear.

Should a fault occur, the supervision device disconnects the ESP Protector from the mains supply and displays a red indicator in the status window.

**Note: After the supervision device has disconnected surge protection, the ESP Protector should be replaced to prevent the risk of flashover causing dangerous sparking and equipment damage.**

## 6. Remote indication

**6.1** A remote indication facility is provided for linking the ESP 240/XXX Protector to a management system/remote alarm.

A volt free contact on the ESP Protector allows a remote alarm to be tripped if a fault develops within the ESP Protector. When a fault occurs terminals 11-14 (14 is NC) break contact and terminals 11-12 (12 is NO) make contact.

**Note: Unless further specific surge protection is in place the signalling wires for the remote alarm contact should only be routed inside the building, otherwise the overall surge protection may be affected.**

**6.2** The terminal for the volt free contact accepts 1.5 mm² cable and is located on the bottom of the ESP Protector.

The ESP Protector's remote indication is rated at 0.5 Amp, 250 V AC.

Note: For reliable contact operation, the minimum permissible load is 10 mA, 5 V DC.

## 7. Maintenance

**7.1** Maintenance should be conducted at least once a year and also following lightning activity. Visually check:

- Status indication window (clear = ok, red = fault/disconnected)
- Condition of connecting leads and terminations

## 8. Application notes

**8.1 ESP coordination**

ESP 240/XXX Protectors are designed to fully coordinate with downstream ESP Protectors of equivalent system voltage.

For example the ESP 240/I/TNS located at the main distribution board would coordinate effectively with an ESP 240 M1 or ESP 415 D1 Protector typically located at sub-distribution boards. No additional decoupling elements such as inductors are needed to ensure ESP Protectors achieve coordination.

Always ensure ESP Protectors are used on the same installation to ensure coordination.

Mixing ESP Protectors with alternative manufacturers' units could result in damage to both protection units and connected equipment through poor coordination.

**8.2 RCD units**

ESP Protectors should ideally be installed before (or upstream of) residual current devices (RCDs) and not on the load side. ESP Protectors should only be installed on the load side of the RCDs if the load in question is external to the building.

This should help to reduce any spurious tripping of such devices due to transient overvoltages. Special transient hardened RCDs (type 'S') can be obtained from a number of manufacturers.

**8.3 Insulation tests (flash testing)**

The ESP Protector should be fully disconnected from the circuit before testing. Otherwise the ESP Protector will treat the insulation test as a transient overvoltage and control the voltage to a low level - thereby defeating the object of the test.

**8.4 Use of powered screwdrivers**

The use of powered screwdrivers is not recommended. Hand tighten connections only (maximum torque value is 4.5 Nm for these terminals).

Thomas&Betts

ESP 240/I/XXX Series, ESP 240/III/XXX Series

Installation instructions for mains wire-in protectors


furse

furse

**Technical Help**
is available from:

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

Tel: +44 (0)115 964 3700
Fax: +44 (0)115 986 0538

www.furse.com



240XXXii-1212

Thomas&Betts