



Installation instructions for mains wire-in protectors

ESP 12 DC, ESP 24 DC, ESP 36 DC, ESP 48 DC

Introduction

This document explains how to install Furse Electronic Systems Protectors for mains power supplies:

ESP 12 DC | ESP 24 DC | ESP 36 DC | ESP 48 DC

These instructions are prefaced by a summary of the *Key points of installation*.

Each key point is explained in detail in the section entitled *Installation*.

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SAFETY NOTE: 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). Incorrect installation will impair the effectiveness of ESP protectors.

Always handle cables by their insulation. Never work on ESP protectors, earthing or their cables during a storm.

1. Key points of installation

- 1.1 Install protectors very close to the equipment to be protected, either within the equipment panel or directly alongside it.
- 1.2 Mount units within a panel or WBX3 enclosure.
- 1.3 Units are installed in parallel.
- 1.4 Connect to positive, negative and earth.

NOTE: Units must have a negative connection (see 3.4).

- 1.5 Units installed at DC power distribution boards can be installed either:
 - on the load side of the incoming isolator, or
 - on the closest available outgoing way to the incoming supply

- 1.6 Provide a means of isolation for the ESP unit.
- 1.7 The connecting leads to phase/live terminals should be suitably fused (up to 63 A) ensuring full discrimination with the immediate upstream supply fuse.
- 1.8 Connecting leads should be 10 mm² multi stranded copper conductor (terminals can accept up to 16 mm²).
- 1.9 Keep the connecting leads as short as possible and ideally less than 25 cm (10 inches) in length.
- 1.10 Bind the connecting leads tightly over their entire length.

2. Before installation

- 2.1 Make sure that the supply voltage is suitable for the unit.

	Supply Rated Voltage (V _{DC})	Unit Voltage Range (V _{DC})
ESP 12 DC	12	9-15
ESP 24 DC	24	18-30
ESP 36 DC	36	27-45
ESP 48 DC	48	36-60

3. Installation

3.1 Location

Protectors need to be installed very close to the equipment to be protected.

Usually the protector will be installed at a power distribution panel either inside it or right next to it.

3.2 Enclose the ESP unit

The ESP unit has exposed terminals. For electrical safety, the unit must be installed within a panel or enclosure.

Where possible, install the unit within the power distribution panel behind a suitable viewing window.

When mounting the units in existing metal panels or enclosures, ensure that the enclosure is securely bonded to the earth bar to which the ESP unit will be connected.

If it is not possible to install the unit within the panel it should be mounted in a separate enclosure, WBX3, as close as possible to the distribution panel (*see 3.9 - Length of connecting leads*).

Gland the WBX3 enclosure onto the power distribution panel.

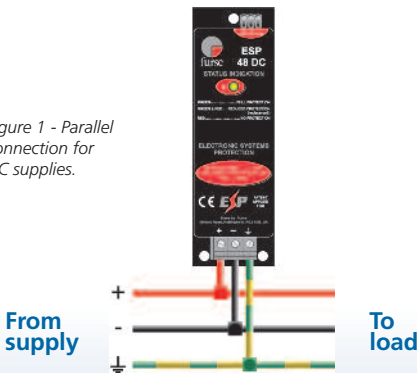
3.3 Parallel connection

ESP mains wire-in protectors are connected in parallel with the supply to be protected. See *Figure 1*.

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 unit need to be kept short in order to minimise additive inductive voltages.

Figure 1 - Parallel connection for DC supplies.



3.4 Connection to positive, negative and earth

Connections are made to each supply conductor including earth. Terminals marked +, -, \perp must be connected to positive, negative and earth respectively.

Under no circumstances must the ESP unit be installed without connection to its negative.

Where no negative is present (eg 2-wire supplies) the negative (-) terminal on the ESP unit must be connected to earth in addition to the earth (\perp) terminal.

This will result in a greatly increased earth leakage current.

3.5 Connection point

(a) Protecting supplies feeding equipment in the building

The ESP unit is typically connected to the power supply at a power distribution board/panel, either:

- (i) on the load side of the incoming isolator.
- (ii) on the closest available outgoing way to the incoming supply (ie the incoming isolator).

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

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

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

On a large board such as a cubicle switchboard, it is better to install the 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, switch fuses or MCCBs - see *Section 3.7*.

(b) Protecting supplies going out of the building

The connection methods 3.5a (i to iii) are not suitable for protecting a power distribution board which provides a supply to outside the building - either to a separate building or some other external load.

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.

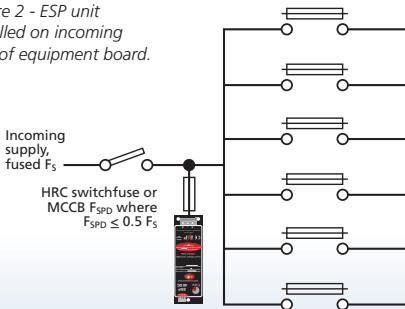
3.6 Isolation

It is good practice to be able to isolate or disconnect the ESP unit 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 unit.

Figures 2 & 3 show example connection schematics. Where it is also necessary to fuse the connection to the ESP unit (see 3.7 - Fuse connecting leads) this can be achieved through use of a switchfuse, MCCB or type 'C' MCB.

Figure 2 - ESP unit installed on incoming side of equipment board.



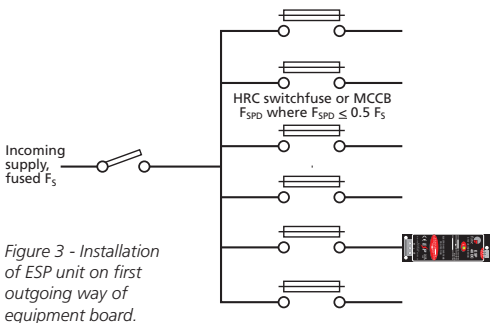


Figure 3 - Installation of ESP unit on first outgoing way of equipment board.

3.7 Fuse connecting leads

The connecting leads to both positive(+) and negative (-) terminals of the ESP units should be fused, unless positive or negative is directly connected to earth (2-wire systems).

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

The fuse to the ESP unit (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 unit required is 63 Amps (if the supply fuse is 125 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.

Connecting leads can be fused by either:

- (a) installing high rupture capacity (HRC) fuses or switch fuses in the connecting leads at the supply end of the lead, or
- (b) installing up to a 63 Amp circuit breaker (MCCB or type 'C' MCB).

Where the ESP unit is installed via an outgoing way (*3.5b earlier*) this should incorporate up to a 63 Amp HRC fuse or circuit breaker.

3.8 Size of connecting leads

The connecting leads between the terminals of the ESP unit and the power supply, should be 10 mm² multi stranded conductor (copper).

If required, the terminals on the ESP unit will accept connecting leads of up to 16 mm².

3.9 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 unit's terminals.

ESP units 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 unit) the greater the additive voltage let-through by the installed protector.

If the resultant let-through voltage is higher than the susceptibility level of the equipment to be protected, damage will result.

Connecting leads up to 50 cm (20 inches) can be used when:

- (i) two sets of 6 mm² cables are used (ie two sets of live, neutral and earth conductors).

Each set of conductors is 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.

The two sets of bound conductors should be separated in their routing. Ideally a distance of 10 cm (4 inches) should be maintained between the two sets of conductors as far as possible.

- (ii) alternatively, if only one conductor needs to be longer than 25 cm then use a pair of separated (as above) conductors to make that connection.
- (iii) for metal distribution boards, if only the earth connection needs to be longer than 25 cm, the following procedure is suggested:
 - (a) using 6 mm² cable make one connection from the ESP unit to the earth bar.
 - (b) a second short and direct connection, again using 6 mm² cable, should be taken from the ESP unit to the metalwork of the distribution board.
 - (c) bond the earth bar to the metalwork of the distribution board.

The techniques outlined above (i-iii) are designed to minimise the inductance associated with the connecting leads.

3.10 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.

4. Installation check

The ESP unit should now be correctly installed. Switch the power supply on.

Check that the green LED is lit. *See Figure 4.* The unit is now fully operational.

5. Status indication

ESP units give a continuous visual display of their status.

They have a two colour indicator light:

Green only = Full protection, power on.

Green + Red = WARNING. Reduced protection, replace unit as soon as possible.

Red only = NO PROTECTION. Replace ESP unit immediately.

No lights = No power connection or system fault. Check external fuses and connections.



Figure 4 - Status indication lights showing full protection.

6. Remote indication

A remote indication of the reduced protection state is provided for linking the protector to a building management system, remote telemetry, PLC or directly to an indication light or buzzer.

The unit has both a normally open and a normally closed volt free contact.

The terminal for the volt free contact accepts 1.5 mm² cable (solid or stranded conductor) and is located on the top of the ESP unit.

It has three terminals, marked:

NO = Normally Open

NC = Normally Closed

C = Common

The normally open (NO) contact is open when the ESP unit is healthy. The normally closed (NC) contact is closed when the unit is healthy (*see Figure 5*).

The ESP units remote indication is rated at 1 Amp, 250 V AC. A minimum load of 10 mA, 5 V DC is required to ensure reliable contact operation.

Unit Healthy		Reduced or No protection	
NO	NC	NO	NC
OPEN	CLOSED	CLOSED	OPEN

Figure 5. Operation of normally closed (NC) and normally open (NO) volt free contact.

7. Maintenance

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

- Visual status indication lights
(see *Status indication for interpretation*).
- Condition of connecting leads and terminations.

8. Application notes

8.1 RCD units

ESP units should ideally be installed before (or upstream of) residual current devices (RCDs) and not on the load side. ESP units 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.

8.2 Insulation tests (flash testing)

The ESP unit should be fully disconnected from the circuit before testing.

Otherwise the ESP unit will treat the insulation test as a transient overvoltage and control the voltage to a low level - thereby defeating the object of the test.

8.3 Duplex configuration

For systems demanding extremely high reliability, ESP units can be connected in duplex format.

The use of two units will achieve an improvement in performance and increased lifetime over a single ESP unit at high discharge current levels.

Each unit should have its own (separate) wiring and its own isolation.

If possible the two units should be connected to the power supply a short distance apart either:

- (a) onto the first two outgoing ways
- (b) up to a metre apart on the incoming power supply

8.4 Use of powered screwdrivers

The use of powered screwdrivers is not recommended unless measures are taken to ensure screws are tightened correctly and not damaged (maximum torque value is 1.5 Nm for these terminals).

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