

**INTRODUCTION**

This document explains how to install Furse ESP Protectors for use on 110 V and 140 V power supplies on the Railtrack Solid State Interlocking (SSI) System:

**ESP SSI/120AC**  
for 110 V supplies (formerly ESP 120X)

**ESP SSI/140AC**  
for 140 V supplies (formerly ESP S065)

For any other application contact Furse.

Railtrack approves the above protectors in conjunction with these installation instructions for use as stipulated on certificate number PA05/471 Issue 3.



**1. Safety note:**

Warning! Installation by person with electrotechnical expertise only.

Warnung! Installation nur durch elektrotechnische Fachkraft.

Avvertenza! Fare installare solo da un elettricista qualificato.

Avertissement! Installation uniquement par des personnes qualifiées en électricité.

Advertencia! La instalación deberá ser realizada únicamente por electricistas especializados.

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.

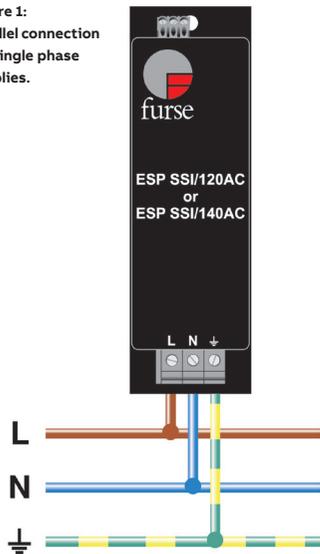
**2. Key points of installation**

**2.1** Install protectors very close to the power supply to be protected.

**2.2** Mount units within a location cabinet or equipment room.

**2.3** Units are installed in parallel with the supply being protected.

**Figure 1: Parallel connection for single phase supplies.**



**2.4** Connections are required to L, N and E (BX, NX/CNX and Earth).

**2.5** Units are installed on the secondary windings of 110 V and 140 V transformers.

**2.6** Provide a means of isolation for the ESP unit.

**2.7** On power supplies rated over 100 Amps, contact Furse.

**2.8** Connecting leads should be 10 mm<sup>2</sup> multi-stranded cable.

**2.9** Keep the connecting leads as short as possible.

**2.10** Bind the connecting leads tightly over their entire length.

**3. Before installation**

**3.1** A 'section E disconnection' must be made to the equipment that will be affected and this must be agreed with the signaller before any work starts.

**3.2** The supply to be protected must be earth tested in accordance with the Signalling Maintenance Testing Handbook (SMTH) and its voltage should be recorded.

**3.3** If the readings taken above indicate the presence of an earth fault, this must be rectified before proceeding with the installation.

**3.4** If the readings above are not within the specified tolerance of the supply, this should be rectified before proceeding with the installation.

**3.5** Make sure that the supply voltage is suitable for the unit.

	Nominal Voltage	Working Voltage
ESP SSI/120AC	120 VRMS	90-150 VRMS
ESP SSI/140AC	140 VRMS	90-165 VRMS

(ESP SSI/140AC may also be used on 110 VRMS supplies. ESP SSI/120AC must not be used on 140 VRMS supplies)

**3.6** The supply to the busbars etc where the protection will be connected must be isolated by appropriate means such as the removal of fuses etc.

Measures should be taken to ensure the supply cannot inadvertently be reconnected during the installation procedure, for example dummy fuses may be installed in fuse holders.

**4. Installation**

**4.1 Location**

Protectors need to be installed very close to the power supply to be protected. Usually the protector will be installed within a location cabinet for a trackside application or within an equipment room.

Suitable plates, brackets and hardware should be used to mount the unit in the desired position.

**4.2 Enclose the ESP unit**

The ESP unit has exposed terminals. For electrical safety, the unit must be installed within a panel or enclosure. A location cabinet or equipment room serves this.

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.

**4.3 Parallel connection**

The 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.

**4.4 Connection to phase, neutral and earth**

Connections are made to each supply conductor including earth. **Connections should be hand tightened - do NOT use powered screwdrivers.**

Terminals marked L, N and ⊕ must be connected to the supply. The terminal marked L connects to the BX of the supply. The terminal marked N connects to the NX or CNX of the supply. The terminal marked ⊕ connects to the earth of the location cabinet or equipment room.

**Under no circumstances must the ESP unit be installed without all three of its terminals connected to the appropriate points.**

Maximum torque is 2.3 Nm power terminals, with cable stripping length 16 mm. The torque rating for the volt-free contacts is 0.25 Nm and cable stripping length 7 mm.

Suitable pin crimps, ferrules, ring crimps etc should be used when terminating wires to ensure a high integrity connection.

**4.5 Connection point**

Protectors are used to protect the supply to TFM/DLM/LDT SSI modules etc.

The supply for these is derived from the secondary 110 V or 140 V winding of a step down transformer.

The protector is typically connected to the transformers' secondary winding, after its supply fuse.

The connection is usually made via the busbars that then feed the TFM/DLM/LDT.

One protector is required per transformer winding. If a common busbar feeds other locations with SSI modules, then those locations must also fit protection.

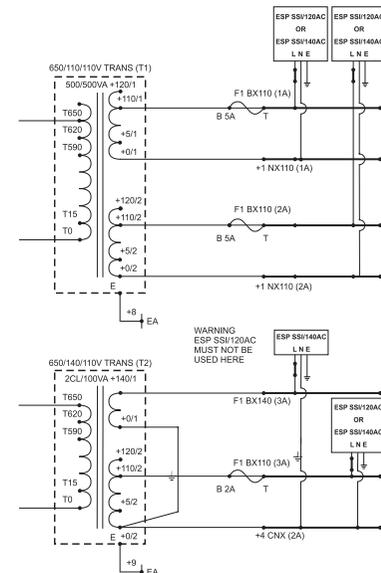
Figure 2 shows some examples of how a protector is connected.

**4.6 Isolation**

It is good practice to be able to isolate or disconnect the ESP unit from the supply. Using an isolating link in both the BX & NX lead to the protector or, more ideally, a two pole isolator provides complete isolation. As a minimum, an isolating link should be placed in the BX feed to the unit.

**4.7 Fuse connecting leads on supplies over 100 Amps**

If the ESP unit is to be connected to a power supply rated over 100 Amps the connecting lead to the live terminal of the ESP unit should be fused. However, such large supplies are not encountered in the SSI system. For further information on fusing for supplies greater than 100 Amps, please contact Furse.



**Figure 2: Example of a typical installation of ESP SSI/120AC and ESP SSI/140AC. Parallel connection for single phase supplies.**

**4.8 Size of connecting leads**

The connecting leads between the terminals of the ESP unit and the power supply should be between 4 mm<sup>2</sup> and 10 mm<sup>2</sup> multi-stranded conductor.

**4.9 Length of connecting leads**

Connecting leads should be kept as short as possible.

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

In order to avoid the possibility of electro-magnetic coupling to other circuits, the protector's connecting leads should be segregated from other wiring, especially low voltage signal and data wiring.

The following recommendations in Section 4.9 apply generally to the use of protectors. However the maximum lengths given may be exceeded with no adverse effects for 110 V & 140 V supplies, where the supply transformer is located within the location cabinet or equipment room where the protector is fitted.

Hence, the recommendations are only included for reference.

The leads to protectors should be kept as short as possible and ideally should not exceed 25 cm (10 inches) from the busbars to the unit's terminals. Use 10 mm<sup>2</sup> cable.

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

- (a) Two sets of 4 mm<sup>2</sup> cables are used (ie two sets of live, neutral and earth conductors).

Each set of conductors is tightly bound together, using Ty-Rap®, 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 (see Figure 3).

- (b) 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.

- (c) For metal distribution boards and panels, if only the earth connection needs to be longer than 25 cm, the following procedure is suggested:

- (i) Using 4 mm<sup>2</sup> cable make one connection from the ESP unit to the earth bar
- (ii) A second short and direct connection, again using 4 mm<sup>2</sup> cable, should be taken from the ESP unit to the metalwork of the distribution board
- (iii) Bond the earth bar to the metalwork of the distribution board

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

**4.10 Bind connecting leads**

Connecting leads should be tightly bound together using Ty-Rap®, tape or spiral wrap. This should be done for the entire length of the cable or as far as is possible (see Figure 3).

**5. Installation check**

**5.1** After installation the wiring should be visually checked to ensure it is correct.

**5.2** The supply should be reinstated by refitting fuses etc.

**5.3** The indications on the TFM/DLM/LDT SSI modules must be checked to see if they are working correctly after power up.

**5.4** The signalling equipment affected must be tested for correct operation.

**5.5** The status indication on the protector should be checked to ensure it is showing only a green light.

**5.6** The protected supply must be earth tested in accordance with the Signalling Maintenance Testing Handbook (SMTH) and its voltage should be recorded. Results should be supplied for each supply fitted with a protector.

**5.7** Documentation & diagrams showing where the units are installed should be completed and forwarded to the relevant parties.

**5.8** The earth test in Section 5.6 should be repeated one month after installation.

**6. Status indication**

**6.1** 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.

**7. Remote indication**

**7.1** A remote indication of the reduced protection state or no protection 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 2.5 mm<sup>2</sup> cable & 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 and power is present. The normally closed (NC) contact is closed when the unit is healthy and power is present.

**7.2** The ESP units remote indication is rated at 0.2 A, 250 Vac.

**8. Maintenance**

**8.1** Maintenance should be conducted at least once a year and also following lightning activity.

Visually check:  
(a) Visual status indication lights (see Status indication, Section 6, for interpretation).

(b) Condition of connecting leads and terminations.

(c) The protected supply must be earth tested in accordance with the Signalling

Maintenance Testing Handbook (SMTH) and its voltage should be recorded. Results should be recorded on the locations' record card.

**9. Application notes**

**9.1 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.

**9.2 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.**

**Environment**  
Consider the protection of the environment!  
Used electrical and electronic equipment must NOT be disposed of with domestic waste. The device contains valuable raw materials which can be recycled. Therefore, contact ABB for disposal of this equipment.



**For SSI mains power supplies**  
INSTALLATION INSTRUCTIONS



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**Figure 3:**  
For connecting leads up to 50 cm, use two sets of conductors (L, N, E). Each set of conductors has been tightly bound and separated in their routing.