INTRODUCTION

This document explains how to install the Furse ESP 415CD40 Protector on three phase mains supplies & power distribution boards (sub-distribution level)

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 électrotechnique.

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

2. Before installation

2.1 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 3.5).

2.2 Make sure that the supply voltage is suitable for the ESP Protector.

	Supply Rated Voltage (V_{RMS})	Unit Voltage Range (V_{RMS})
ESP415CD40	380/400/415	346 - 484

3. Installation

3.1 Location

The ESP Protector needs to be installed very close to the power supply to be protected. Usually the ESP Protector will be installed at a power distribution board, either inside or right next to it in an enclosure. The ESP Protector includes a DIN foot for mounting on to 35 mm top hat DIN rails.

3.2 Enclose the ESP Protector

The ESP Protector has exposed terminals. For electrical safety, the ESP Protector must be installed:

(a) within a power distribution board, if possible behind a suitable viewing window in the distribution board, or

(b) in a separate enclosure, as close as possible to the power distribution board (see 3.10 - Length of connecting leads)

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. Where installing in an enclosure, gland the enclosure on to the power distribution board to protect cabling and the IP rating of the enclosure. Suitable enclosures are available from Furse.

3.3 DIN installation

The ESP Protector includes an innovative DIN foot for connection to 35 mm DIN rails. This DIN foot, comprising spring loaded steel DIN mounts, enables rapid positioning on to the rail (see Figures 1a & 1b). Pull the spring loaded steel DIN mount down and out to lock into place ready for siting the ESP Protector. Position the ESP Protector at the preferred location on the DIN rail and press the protector back to release the springs. The protector locks into place.

3.4 Parallel connection

The ESP Protector is 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 need to be kept short in order to minimise additive inductive voltages.

3.5 Connection to phase, neutral and earth

Connections are made to each supply conductor including earth (see Figure 2). Terminals marked L1, L2, L3, N, ⏚ must be connected to phase/live, neutral and earth respectively. Under no circumstances must the ESP Protector be installed without connection to its neutral. Maximum torque is 4.5 Nm for power terminals, with cable stripping length 11 mm. The torque rating for the volt-free contacts is 0.25 Nm and cable stripping length 7 mm.

Where no neutral is present (eg delta supplies) the neutral (N) terminal on the ESP Protector must be connected to earth in addition to the earth (⏚) terminal. This will result in a greatly increased earth leakage current. On some delta supplies the voltage between phase and earth may exceed the rating of the ESP Protector.

Figure 1a & 1b:
Innovative spring loaded DIN foot shown open and locked in place.

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

We recommend that you consult Furse ESP before installing ESP Protectors on delta supplies.

3.6 Connection point

(a) Protecting supplies feeding equipment in the building

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

(i) on the load side of the incoming isolator (see Figure 3), or

(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).** See Figure 4.

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. **Fitting the protector in any other position could affect the protector's performance.**

(iii) directly to the busbars via suitable HRC fuses, switchfuses or MCCBs - See 3.8.

(b) Protecting supplies going out of the building

The connection methods 3.6a (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 (see Figure 5).

3.7 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.

3.8 Fuse connecting leads

The connecting leads to the phase/live terminals of the ESP Protector should be fused (see Figure 1).

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

The fuse to the ESP Protector (FSPD) should be lower than the upstream supply fuse FS 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 protector required is 125 Amps (if the supply fuse is 250 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 or type 'C' MCB

Where the ESP Protector is installed via an outgoing way (3.6(ii) earlier), this should incorporate a 125 Amp (as appropriate) HRC fuse, MCCB or type 'C' MCB.

3.9 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 (stranded copper).

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

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

(i) Two sets of 6 mm² cable are used (ie two sets of live, neutral & earth conductors). Each set of conductors 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. The two sets of bound conductors should be separated in their routeing. 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

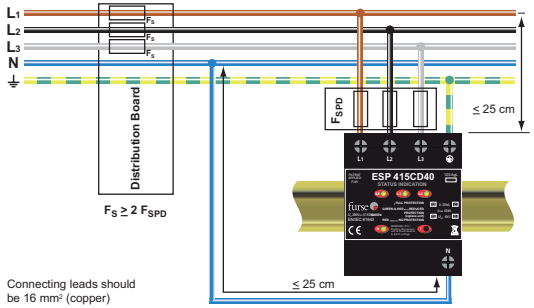

Figure 2:
Parallel connection for three phase star (4 wire and earth) supplies.

... continued overleaf

separated (as above) conductors to make that connection.

(iii) For metal distribution panels, 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 Protector to the earth bar.

(b) A second short and direct connection, again using 6 mm² cable, should be taken from the ESP Protector to the metalwork of the distribution board.

(c) Bond the earth bar to the metalwork of the distribution panel.

3.11 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

4.1 The ESP Protector should now be correctly installed. Switch the power supply on. Check that a green LED per phase and neutral is lit. If lit, the unit is now fully operational.

Watch the WARNING light for 30 seconds. If it is flashing or lit there is a problem with your installation.

If the WARNING light is illuminated there is an excessive voltage present between neutral and earth. **The WARNING light should never be illuminated.**

(a) Illumination at time of installation

If the WARNING light flashes as soon as the mains supply to the ESP unit is turned on, one of the phase/live cables may have been connected to neutral and the neutral to phase/live. **Isolate or disconnect the ESP Protector immediately.** Check the phase/live and neutral connections and if a mistake has been made, correct it.

If all the phase/live and neutral connections are correct, there is a fault with the mains supply (see (b) - below). **Note: The ESP Protector may have suffered damage - check the status indication (see Section 5).**

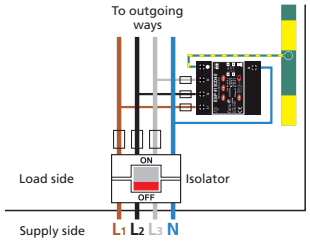

Figure 3:
ESP Protector mounted within a distribution board connected to the incoming supply on the load side (ie downstream) of the isolator.

(b) Illumination at any time

The WARNING light will flash when the neutral to earth voltage exceeds 30 Volts. The faster the flashing, the higher the voltage between neutral and earth (at very high voltages the WARNING light may appear to be permanently illuminated). **Disconnect the ESP protector immediately and check the mains supply.** The ESP protector should not be reconnected until the cause of the fault has been identified and rectified. **Note: The ESP Protector may have suffered damage - check the status indication (see Section 5).**

5. Status indication

5.1 The ESP Protector gives a continuous visual display of its status. It has a two colour LED indicator light, for each phase and neutral:

Green only	=	Full protection, power on.
Green + Red	=	WARNING. Reduced protection, replace as soon as possible.
Red only	=	NO PROTECTION. Replace immediately.
No lights	=	No power connection or system fault. Check external fuses and connections.

6. Remote indication

6.1 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.

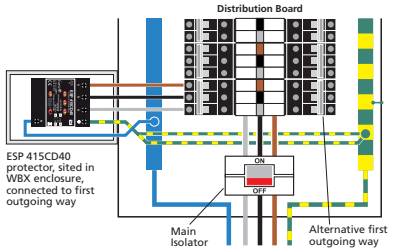

Figure 4:
ESP Protector connected to nearest available outgoing way to the incoming supply. The MCB also provides the means of isolation. Since there is insufficient space within the distribution board the ESP Protector has been mounted within a separate enclosure, directly alongside the board.

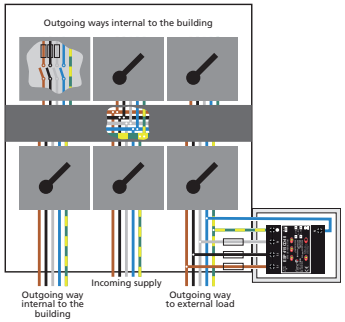

Figure 5:
Connection for supplies continuing external to the building.

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

The terminal for the volt free contact accepts 2.5 mm² cable (solid or stranded conductor) and is located on the bottom of the ESP Protector.

It has three terminals, marked:

NO = Normally Open
NC = Normally Closed
C = Common

The normally open (NO) contact is open when the ESP Protector is healthy and power is present.

The normally closed (**NC**) contact is closed when the unit is healthy and power is present. As well as providing warning of the reduced protection state, the normally closed volt free contact can also be used to signal power loss on one or more phases, eliminating the need for special relays. See Figure 6.

	Unit Healthy		Reduced or No protection	
	NO	NC	NO	NC
Power Present	OPEN	CLOSED	CLOSED	OPEN
Power Absent	CLOSED	OPEN	CLOSED	OPEN

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

7. Maintenance

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

Visually check:

– Visual status indication lights (see 6. Status indication for interpretation)

– Condition of connecting leads and terminations

8. Application notes

8.1 ESP coordination

The ESP Protector is designed to fully coordinate with upstream/downstream ESP Protectors of equivalent system voltage. For example an ESP 415 M4 or ESP 415 M2 located at the main distribution board would coordinate effectively with the ESP 415CD40 Protector 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 protectors 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 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.

ESP 415CD40

for mains wire-in protectors

INSTALLATION INSTRUCTIONS

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