



# Installation instructions for mains wire-in protectors

ESP D1, D1R, D1/LCD and D1R/LCD variants

## Introduction

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

Single phase ESP 120 D1 | Single phase ESP 240 D1 | Single phase ESP 277 D1 | Three phase ESP 208 D1, D1R, D1/LCD & D1R/LCD | Three phase ESP 415 D1, D1R, D1/LCD & D1R/LCD | Three phase ESP 480 D1, D1R, D1/LCD & D1R/LCD

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*.

**WARNING:** Incorrect installation will impair the effectiveness of the ESP units

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## Key points of installation

- 1 Install protectors very close to the power supply to be protected, either within the distribution panel or directly alongside it.
- 2 Mount units within a panel or WBX enclosure.
- 3 ESP D1 units can be installed in parallel or, for power supplies  $\leq 125\text{A}$ , in-line (series) with the power supply.
- 4 Connect to phase(s), neutral and earth.

NOTE: Units must have a neutral connection.

- 5 Units installed at 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
- 6 Provide a means of isolation for the ESP unit.
- 7 The connecting leads to phase/live terminals should be suitably fused (125A maximum) ensuring full discrimination with the immediate upstream supply fuse.

- 8** Connecting leads should be 10 mm<sup>2</sup> multi stranded cable for parallel/shunt installation. For series installation, refer to section 6.
- 9** For parallel/shunt installation, keep the connecting leads as short as possible and ideally less than 25 cm (10 inches) in length. For series installation, keep earth lead as short as possible.
- This may be better achieved with the equivalent D1R or D1R/LCD unit with remote display mounting flexibility.
- 10** Bind the connecting leads tightly over their entire length.

## Before installation

- 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 page 13).
- 2** Make sure that the supply voltage is suitable for the unit.

	Supply Rated Voltage (V <sub>RMS</sub> )	Unit Voltage Range (V <sub>RMS</sub> )
<b>ESP 120 D1</b> <i>Phase to Neutral/Earth</i>	110/120/127	90-150
<b>ESP 208 D1 Series</b> <i>Phase to Phase</i>	190/208/220	156-260
<b>ESP 240 D1</b> <i>Phase to Neutral/Earth</i>	220/230/240	200-280
<b>ESP 415 D1 Series</b> <i>Phase to Phase</i>	380/400/415	346-484
<b>ESP 277 D1</b> <i>Phase to Neutral/Earth</i>	240/254/277	232-350
<b>ESP 480 D1 Series</b> <i>Phase to Phase</i>	415/440/480	402-600

## Installation

### 1 Location

Protectors need to be installed very close to the power supply to be protected. Usually the protector will be installed at a power distribution panel either inside it (*Figure 1*) or right next to it (*Figure 2*).

ESP D1 protectors have been designed to fit onto a standard 35mm DIN rail (see 3 - *DIN Installation*) or within a Furse WBX D enclosure.

### 2 Enclose the ESP unit

The ESP unit has exposed terminals. For electrical safety, the unit must be installed within a panel or enclosure. For standard single and three phase units, where possible, install the unit within the power distribution panel behind a suitable viewing window.



*Figure 1 - ESP 415 D1/LCD installed on a DIN rail within a power distribution panel.*



*Figure 2 - ESP 415 D1/LCD installed next to a power distribution panel in a suitable WBX D enclosure.*

Alternatively, for three phase units, a remote display option is available. Units can be installed within the power distribution panel with the remote display mounted on the front of the panel (see 4 - *remote display*).

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 distribution panel it should be mounted in a separate enclosure, see *Figure 2*, as close as possible to the distribution panel (see 12 & 13 - *Length of connecting leads*). Gland the enclosure onto the power distribution panel. Suitable enclosures are available from Furse.

### 3 DIN Installation

ESP D1 Series protectors have been designed with an innovative DIN foot for connection to standard 35mm DIN rails. This DIN foot, comprising spring loaded steel DIN mounts, enables rapid positioning of D1 protectors onto the rail.



*Figure 3 - Reverse of 3 phase protector showing innovative spring loaded DIN foot.*

The spring loaded steel DIN mounts pull down and out to lock into place ready for siting the protector. Position the D1 protector at the preferred location on the DIN rail and press the protector back to release the springs. The protector locks into place.



*Figure 4 - Reverse of 3 phase protector showing spring loaded DIN foot locked onto DIN rail.*

### 4 Remote display

Three phase ESP D1R and D1R/LCD units include a remote mounting display to ensure optimum positioning of the unit along with quick and easy status checking.

The remote display should be mounted in a clearly visible position, typically on the front of the distribution panel (see Figure 5).

For remote display connection, ensure the cable is of sufficient length, and is unimpeded within the cabinet. Allow a minimum of 60 mm behind the front panel for the interconnection cable.

ESP D1R and D1R/LCD units are supplied with 1 m interconnection cable as standard, with a 4 m cable available as an option (contact Furse).



*Figure 5 - ESP 415 D1R/LCD remote display installed on the front of a power distribution panel.*

Care should be taken against static discharge when handling the remote display unit - avoid contact with the exposed connector.

### 5 Parallel connection

ESP D1 protectors can be connected in parallel with the supply to be protected, or connected in-line (series), for power supplies  $\leq 125A$  (see 6).

For parallel connection, the connecting leads do not carry the load current of the supply, only the current associated with suppressing the transient overvoltage.

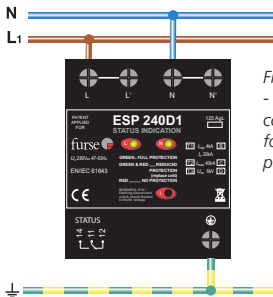


Figure 6  
- Parallel  
connection  
for single  
phase supplies.

Figures 6 & 7 show connection diagrams for single phase and three phase star power supplies.

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

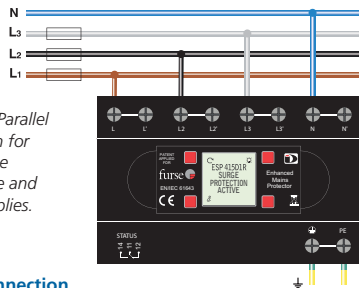


Figure 7 - Parallel  
connection for  
three phase  
star (4 wire and  
earth) supplies.

### 6 Series connection

The twin terminal design of ESP D1 units enables installation in-line (series) with the power supply (for power supplies  $\leq 125A$ ). The supply cables should be suitably rated for the specific load current. The terminals of the ESP unit can receive up to 35 mm<sup>2</sup> stranded cable.

Any type of protector installed in parallel (shunt) with the supply will have additive inductive voltage on the connecting leads. This resultant voltage let-through the protector is hence seen by the equipment to be protected (see 5 and 12). Series installation eliminates the additive voltage associated with connecting leads on parallel installations.

Ensure the power supply does not exceed 125A for series installations. The connecting leads to phase/live terminals should be suitably fused (125A maximum) ensuring full discrimination with the immediate upstream supply fuse.

Figure 8 shows the connection diagram for three phase star power supplies.

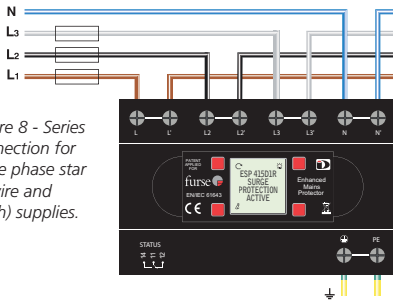


Figure 8 - Series connection for three phase star (4 wire and earth) supplies.

## 7 Connection to phase, neutral and earth

Connections are made to each supply conductor including earth. Terminals marked L, N,  $\downarrow$  (single phase units) or L1, L2, L3, N,  $\downarrow$  (three phase units) must be connected to phase/live, neutral and earth respectively.

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

Where no neutral is present (eg delta supplies) the neutral (N) terminal on the ESP unit must be connected to earth in addition to the earth ( $\downarrow$ ) terminal. This will result in a greatly increased earth leakage current.

On some delta supplies the voltage between phase and earth/neutral may exceed the rating of the ESP unit.

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

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

## 8 Connection point

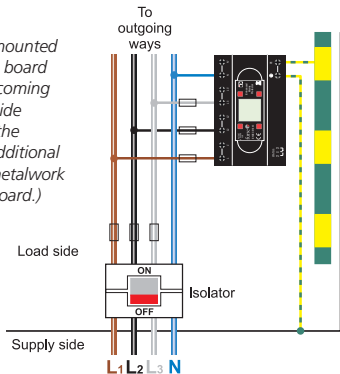
### (a) Protecting supplies feeding equipment in the building

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 (Figure 9).
- (ii) on the closest available outgoing way to the incoming supply (ie the incoming isolator).

Figure 9 - ESP unit mounted within a distribution board connected to the incoming supply on the load side (ie downstream) of the isolator. (Note the additional earth bond to the metalwork of the distribution board.)

This technique is explained in 12(iii)



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).** See Figure 10.

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

- (iii) directly to the busbars via suitable HRC fuses, switch fuses or MCCBs - see Section 10.

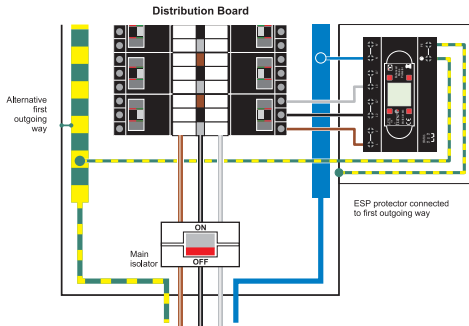


Figure 10 - Three phase ESP protector connected to the nearest available outgoing (MCB) way to the incoming supply. The MCB also provides the means of isolation. Since there is insufficient space within the distribution board the ESP unit has been mounted within a separate enclosure, directly alongside the board. Note the double connection to earth, in order to compensate for the long connecting leads. (See 12 Length of connecting leads - this also gives an alternative technique in 12(iii).)



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

The connection methods 8a (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 (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 11.

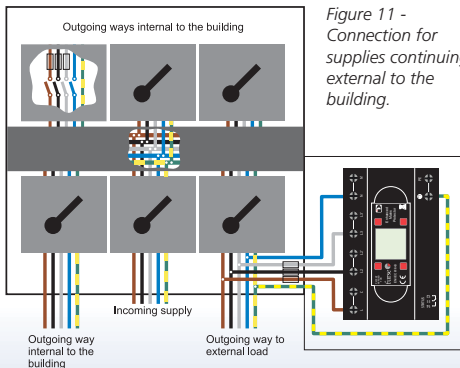


Figure 11 - Connection for supplies continuing external to the building.

### 9 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 12 & 13 show example connection schematics. Where it is also necessary to fuse the connection to the ESP unit (see 10 - Fuse connecting leads) this can be achieved through use of a switchfuse, MCCB or type 'C' MCB.

Figure 12 - ESP unit installed on incoming side of distribution board.

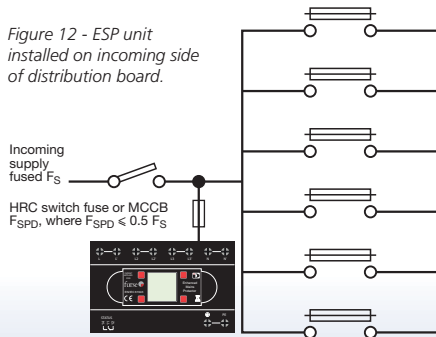
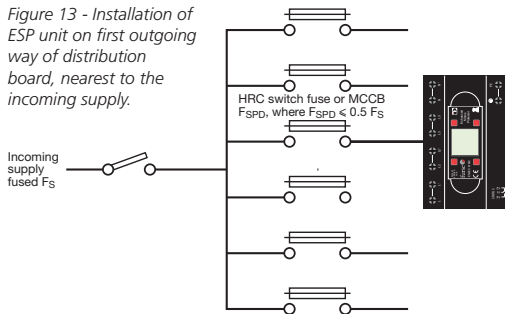


Figure 13 - Installation of ESP unit on first outgoing way of distribution board, nearest to the incoming supply.



#### 10 Fuse connecting leads

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

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 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:

- installing high rupture capacity (HRC) fuses or switch fuses in the connecting leads at the supply end of the lead (See Figure 14), or
- installing up to a 125 amp circuit breaker (MCCB or type 'C' MCB). Where the ESP unit is installed via an outgoing way (8b earlier) this should incorporate up to a 125 amp HRC fuse or circuit breaker.

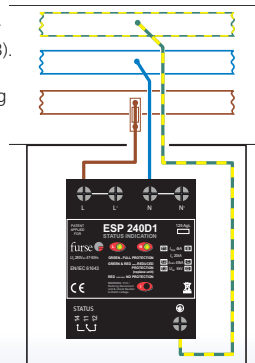


Figure 14 - Busbar mounted HRC fuse at the end of the live connecting lead.

### 11 Size of connecting leads

For parallel connection, the connecting leads between the terminals of the ESP unit and the power supply should be 10 mm<sup>2</sup> multi stranded conductor (copper). If required, the terminals on the ESP unit will accept connecting leads of up to 35 mm<sup>2</sup>. (For series connection, see 6).

### 12 Length of connecting leads – parallel connection

For ESP units installed in parallel, 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.

ESP D1/LCD units include a rotating display function for improved legibility when units are mounted sideways or upside down (see page 31).

ESP protectors with remote display units (D1R variants) allow the protector to be mounted with short connecting leads whilst allowing the display to be positioned independently (eg conveniently on the front of the panel).

The display is connected to the protector via the supplied 1 m cable (4 m cable optional). The remote display cut-out template, which can be found at the back of these instructions, conforms to the standard DIN 72x36 format.

**WARNING:** The longer the connecting leads (between the mains cable or busbars and the terminals of the ESP unit), the greater the 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 up to 50 cm (20 inches) can be used when:

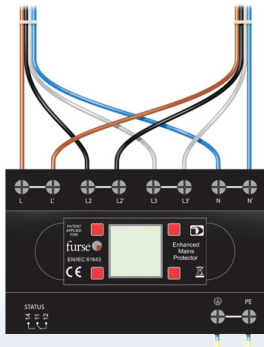
- (i) Two sets of 6 mm<sup>2</sup> cables are used (ie two sets of live, neutral and earth conductors). Each set of conductors is tightly bound together, using Ty-Raps®, tape or spiral wrap.

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. See Figure 15.

- (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. See Figure 10.
- (iii) For metal distribution boards, if only the earth connection needs to be longer than 25 cm, the following procedure is suggested (see Figure 10):

- (a) Using 6 mm<sup>2</sup> cable make one connection from the ESP unit to the earth bar.
- (b) A second short and direct connection, again using 6 mm<sup>2</sup> 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.



*Figure 15 - For connecting leads of up to 50 cm use two sets of conductors (L1, L2, L3, N, PE). Each set of conductors has been tightly bound and separated in their routing.*

### 13 Length of connecting leads – series connection

For ESP units installed in series (for power supplies  $\leq 125\text{A}$ ), the connecting lead to earth needs to 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.**

Three phase ESP D1 protectors are available with rotating LCD display (ESP D1/LCD variants) and remote mounting display (ESP D1R and ESP D1R/LCD variants) for optimum positioning of the unit whilst enabling easy ongoing status checking.

### 14 Bind connecting leads – parallel connection

Connecting leads should be tightly bound together using Ty-Raps<sup>®</sup>, tape or spiral wrap. This should be done for the entire length of the cable or as far as is possible. See Figure 15.

## Installation check (LED units)

The ESP unit should now be correctly installed. Switch the power supply on. Check that a green LED per phase and neutral is lit. See Figure 16. 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 (see opposite).

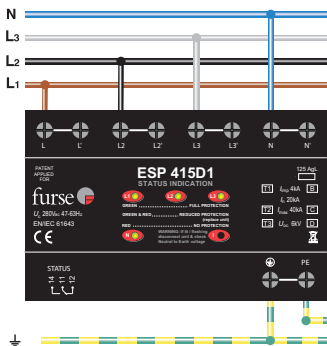


Figure 16 - Status indication lights showing full protection on all phases and neutral. On D1R units, status indication is shown on the remote display unit.

## Neutral-earth warning light (LED units)

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 unit 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 unit may have suffered damage - check the status indication (see page 26).

### (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 unit may have suffered damage - check the status indication (see page 26).

## Status indication (LED units)

ESP units give a continuous visual display of their status. They have a two colour indicator light for each phase and neutral:

- 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.

## Status indication (LCD units)

Following installation, switch the power supply on. The LCD display will illuminate for 15 seconds and show the introductory status screen for correct performance. The introductory screen alternates to show protector status every 2-3 seconds (ESP 415D1R example shown).

	Introductory screen	Protector status
Normal operation:	<p>ESP 415D1R SURGE PROTECTION ACTIVE</p>	<p>L1 = ✓ L2 = ✓ L3 = ✓ N = ✓ N/E &lt; 30V RLY ACTIVE</p>

The unit is now fully operational. These display messages will be visible and alternate at all times the protector is connected and is functioning correctly.

Where a fault or power supply issue is detected by the protector, the LCD message will change, the backlight will flash, and the protector will sound an alert. Several types of fault will trigger a response from the ESP protector.

### Line fault – no connection or system fault

Live (including neutral) connections will register a '✓' if protected and functioning properly. If any of the live connections is lost, the LCD screen will query this with 'OFF?'. The example below shows a power supply issue for L1.

	Warning screen	Alternates with
L1 Fault (no power) [BACK-LIT DISPLAY ON - FAST FLASHING] [AUDIBLE ALERT]	<p>WARNING! DISCONNECT AND INVESTIGATE</p>	<p>L1 = OFF? L2 = ✓ L3 = ✓ N = ✓ N/E &lt; 30V RLY DISABLED</p>

Disconnect the unit and check external fuses and connections.

### Line fault – protection impaired

Live connections (including neutral) will register a '✓' if protected and functioning properly. Where protection to a live connection is impaired, the LCD screen will query this with '✗', the backlight will flash and an audible alert will sound.

The examples below show L1 has reduced or no protection.

	Warning screen	Alternates with
L1 Fault (reduced protection) [BACK-LIT DISPLAY ON - SLOW FLASHING] [AUDIBLE ALERT]		
L1 Fault (no protection) [BACK-LIT DISPLAY ON - FAST FLASHING] [AUDIBLE ALERT]		

Reduced protection – replace unit as soon as possible.

No protection – replace unit immediately.

### Neutral-earth warning

The Neutral-earth warning screen will display if there is an excessive voltage present between neutral and earth, or if there is no protection on the N-E connection. The backlight will flash and an audible alert will sound.

	Warning screen	Alternates with
N – E Fault (over 30 volts detected) [BACK-LIT DISPLAY ON - FAST FLASHING] [AUDIBLE ALERT]		

#### (a) Illumination at time of installation

If the WARNING message and backlight 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 unit 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 unit may have suffered damage - check the status indication.

### (b) Illumination at any time

The WARNING message and backlight will flash when the neutral to earth voltage exceeds 30 volts.

### 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 unit may have suffered damage - check the status indication.

## LCD display settings

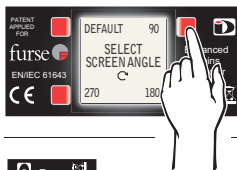
The LCD display has enhanced functionality to improve legibility of status information. The display functions are controlled through the 4 buttons, located near each corner of the screen, where control icons are displayed. Display functions include:

### Rotate display function

For rotate display, start with introductory screen (shown below)



Press and hold the rotate display button for a couple of seconds to call up the screen angle selection screen.



The display rotates clockwise in 90° steps.



By selecting 90, the screen rotates 90° clockwise as shown left, enabling the D1/LCD protector or D1R/LCD remote display to be positioned vertically.



## Activate backlight

Press and hold the activate backlight button for a couple of seconds to illuminate the display screen.

The backlight will activate for approximately 15 seconds.

## Silence buzzer

ESP D1/LCD and D1R/LCD protectors include a buzzer alert which activates when a unit has reduced or no protection, or when there is a supply fault (phase loss, excessive N-E voltage).

To deactivate the buzzer, firmly press the silence buzzer button (buzzer deactivates for 1 hour).

## Protector information

For Protector Information, start with the introductory screen (shown left). Press and hold the information button for a couple of seconds to call up the information menu.

The information menu provides a link to the software version (1) and build date of the protector (2).

1. VERSION

Press and hold the top left button to select software version (1. VERSION).

Press and hold the top right button to review protector' build date (2. BUILD).

2. BUILD (Format: wyyy)

To exit the information screens and return to the introductory screen, press and hold the bottom right button, (EXIT).

## 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, powered by an 'active' relay.

The terminal for the volt free contact accepts 1.5 mm<sup>2</sup> cable and is located on the bottom of the ESP unit. It has three terminals, marked:

- 14 = NO = Normally Open
- 12 = NC = Normally Closed
- 11 = 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.

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 17*.

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

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

*Figure 17. Operation of normally closed (NC) and normally open (NO) volt free contact.*

While the relay is active and functioning correctly the LCD display will show the 'normal operation' screens - RLY ACTIVE.

## Maintenance

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

- (i) Visual status indication lights/LCD display (see *Status indication for interpretation*).
- (ii) Condition of connecting leads and terminations.

## Application notes

### 1 ESP coordination

ESP D1, D1R, D1/LCD and D1R/LCD units are designed to fully coordinate with ESP units of equivalent system voltage on the same installation.

For example the ESP 415 M2 located at the main distribution panel would coordinate effectively with the ESP 415 D1 unit typically located at sub-distribution panels. No additional de-coupling elements such as inductors are needed to ensure ESP units achieve coordination.

Always ensure ESP units are used on the same installation to ensure coordination. Mixing ESP units with alternative manufacturers' units could result in damage to both protection units and connected equipment through poor coordination.

### 2 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.

### 3 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.

### 4 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

#### 5 Installing three phase units on single phase supplies

If a three phase unit is installed on a single phase mains supply (or a supply in which one or two phases are not in use), the ESP units spare (or unused) live terminal(s) should be connected to live, otherwise its indication lights and volt free contact will not work correctly.

The preferred approach is to take a connecting lead from each spare terminal to the supply live. However, it is also possible to connect the ESP units spare terminal(s) to whichever live terminal is in use at the unit.

#### 6 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 4.5 Nm for these terminals).

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[www.furse.com](http://www.furse.com)



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