CONTACTUM DEFENDER

SURGE PROTECTION DEVICES

LAUNCH – JAN 2019

Surge Protection Technical Overview

- Definition of a surge
- How do surges happen?
- Benefits of surge protection
- BS7671:2018 Requirements
- Contactum Offer

Definition of a surge

A surge is a fast short duration electrical transient in current or voltage within an electrical circuit.

Typically caused by an oversupply in voltage either from a switching event, or from an external source such as lightning.

Mains sources of Surges

1. Transient Voltages

These occur during switching events which release stored energy from established magnetic fields.

External examples of these are power stations, distribution transformers and generators.

Transient voltages can also occur locally within installations by the switching of appliances such as welders and air-con units.

These by their nature will be smaller in magnitude

Mains sources of Surges

2. Lightning Strikes

These can be extremely detrimental to electrical Installations and attached equipment, as the current contained within a strike can be up to 200kA.

Buildings with a Lightning Protection System (LPS) will be more susceptible to a direct lightning strike.

Ground lightning strikes can cause surges within installations up to 2km away as this energy can find its way into buried electrical cables

Benefits of surge protection

A correctly specified and installed surge protection device **will safely disperse over voltages to earth** – minimising damage to the installation wiring and any connected equipment.

BS 7671:2018 Requirements

- **Two sections**

1. **Section 443** – Requirements for the provision of overvoltage protection

2. **Section 534** – Devices for Protection against Overvoltage

BS 7671:2018 Requirements

- **Section 443** – Requirements for the provision of overvoltage protection

- This section deals with protection against:
  - transient overvoltages of atmospheric origin transmitted by the supply distribution system,
  - Switching overvoltages generated by the equipment within the installation

When do you need Surge Protection?

443.4 Overvoltage Control

Protection against overvoltages **shall be provided** where the consequence caused by overvoltage could result in:

(i) Serious injury to, or loss of human life

(ii) Interruption of public services and/or damage to cultural heritage

(iii) Interruption of commercial or industrial activity

(iv) A large number of co-located individuals being affected.

For all other cases, a risk assessment according to 443.5 **shall be performed** in order to determine if protection against overvoltages is required.

When do you need Surge Protection?

……….except for single dwelling units where the total value of the installation and equipment therein does not justify such protection

Simply add up the cost of the Surge Arrestor and the Sparky's labour cost, and if the value of my assets don't justify the cost then I can forget it!!!!!!!

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Risk Assessment Calculation

Calculated Risk Level - CRL

$$\mathbf{CRL = f_{env}/(L_p \; X \; N_g)}$$

Where:

F_{env}	is an environmental factor selected from table 443.1
L_p	is the risk assessment length in kilometres
N_g	is the lightning ground flash density (flashes per km2 per year) relevant to the location of the powerline structure

IF CRL ≥ 1000 then SP is not needed

Risk Assessment Calculation

- Table 443.1, calculation of F_{env}

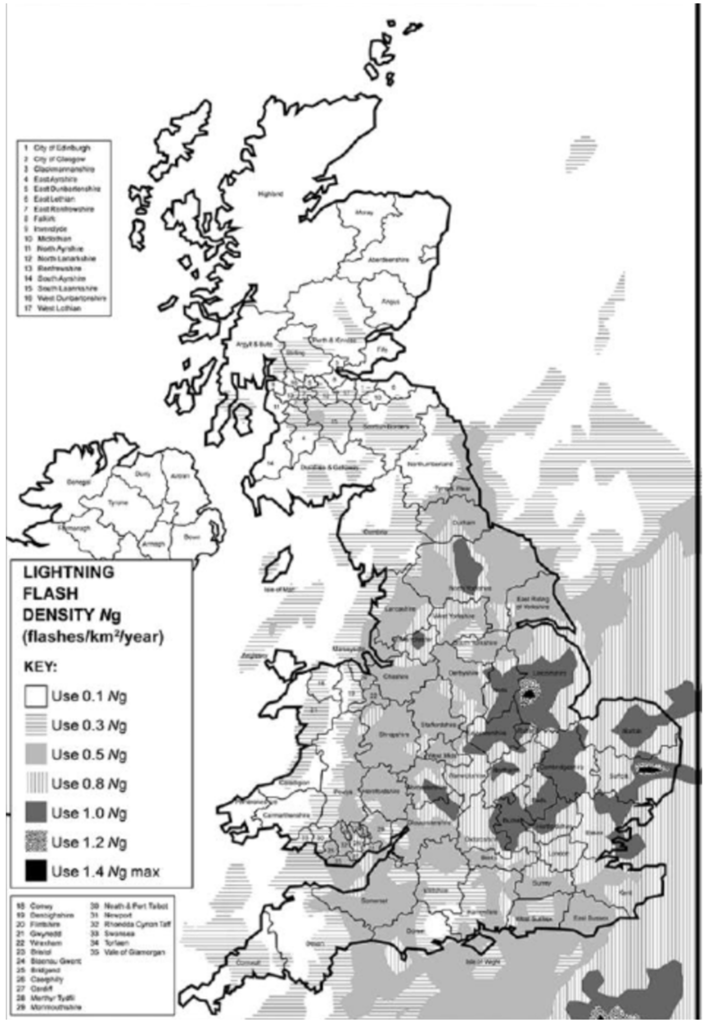
Environment	F_{env}
Rural and suburban environment	85
Urban environment	850

So, $CRL = \mathbf{850}/(L_p \times N_g)$

Risk Assessment Calculation

- Fig 44.2 - Lightning Flash Density – N_g
- For London use $0.8N_g$

So, CRL = **850**/(L_p X **0.8**)



Risk Assessment Calculation

- Risk Assessment length in km – L_p

$$L_P = 2L_{PAL} + L_{PCL} + 0.4L_{PAH} + 0.2L_{PCH} \text{ (km)}$$

Where:

L_{PAL} is the length of LV overhead line

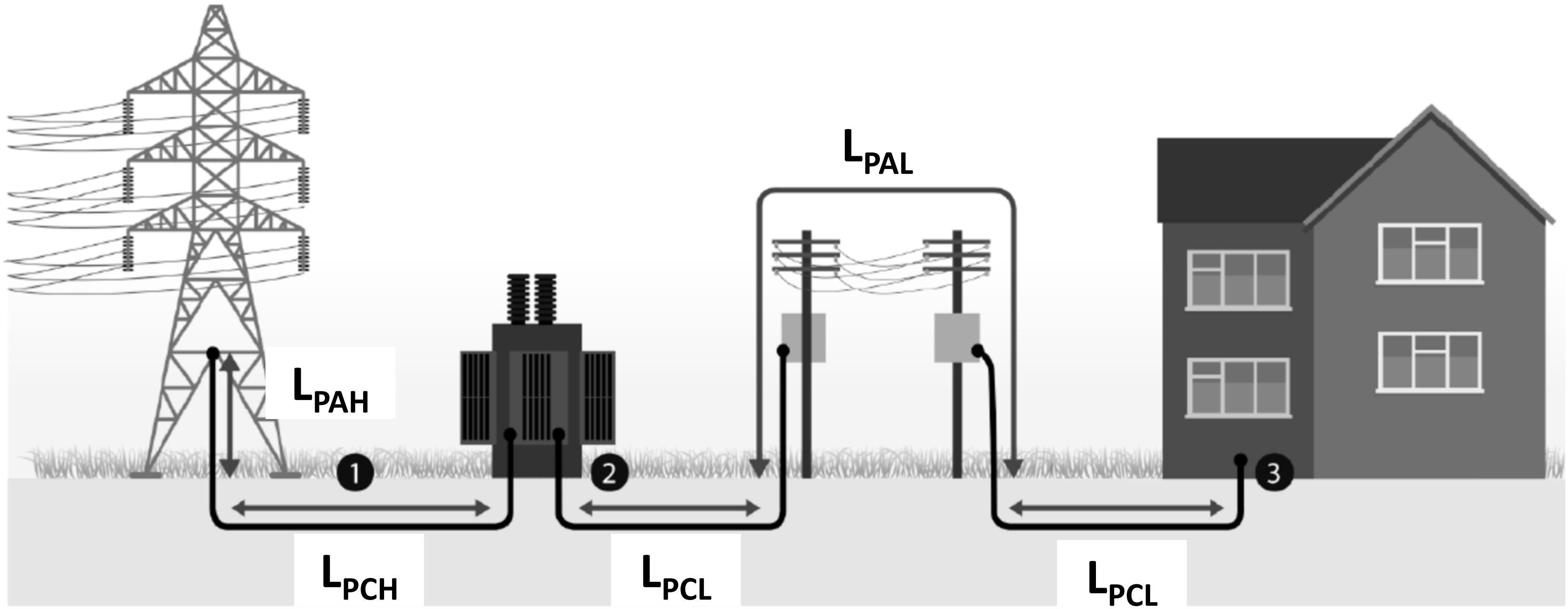
L_{PCL} is the length of LV underground cable

L_{PAH} is the length of HV overhead line

L_{PCH} is the length of HV underground cable

Risk Assessment Calculation

- Risk Assessment length in km – L_P



Risk Assessment Calculation

Assuming first 1km is all underground

$L_P = 2L_{PAL} + L_{PCL} + 0.4L_{PAH} + 0.2L_{PCH}$ (km)

LP = 1

Therefore, CRL = 850/(1 X 0.8) = 1062

Assuming first 100m underground to Transformer and 900m HV underground

$L_P = 2L_{PAL} + L_{PCL}(0.1) + 0.4L_{PAH} + 0.2L_{PCH}(0.2 \times .9)$ (km)

LP = 0.28

Therefore, CRL = 850/(0.28 X 0.8) = 3,886

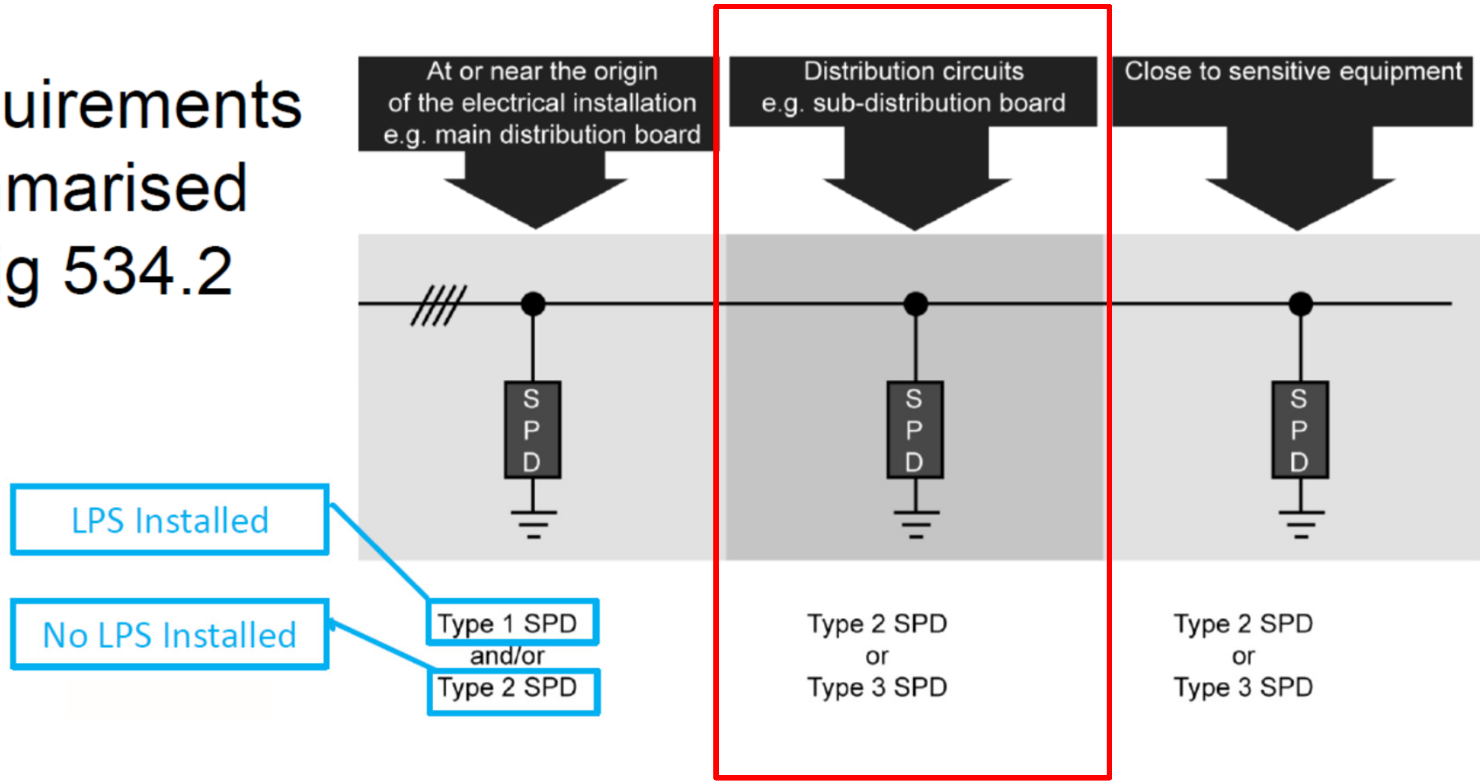
BS 7671:2018 Requirements

- **Section 534** – Devices for Protection Against Overvoltage
- **534.1** This section focusses mainly on the requirements for the selection and erection of SPD's for protection against transient overvoltages where required by Section 443.

Type & Location of SPD's

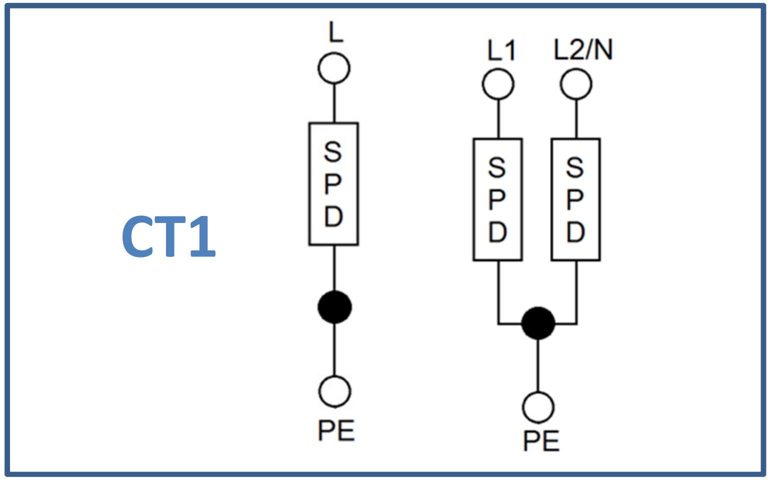
- Section 534.4.1 Selection and erection of SPD's

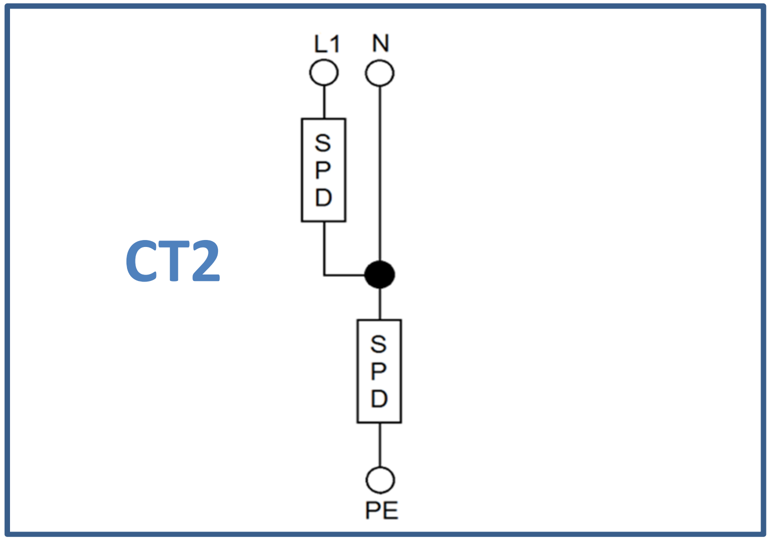
Requirements summarised in Fig 534.2



Connection Types

- Section 534.4.3
  Connection Mode Type
  - CT1 – Common mode
  - CT2 – Differential mode





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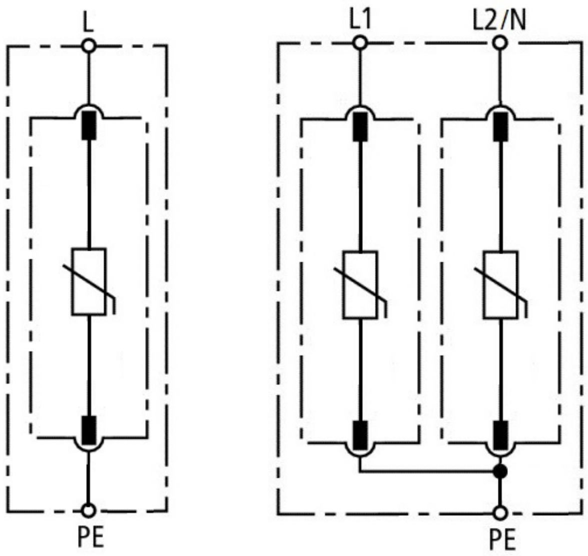
Types of SPD's – Common mode

Providing Protection from Phase(s) to Protective Earth



1+0 **2+0**

Phase to PE via Metal oxide Varistor (MOV) With each device in its own Cartridge

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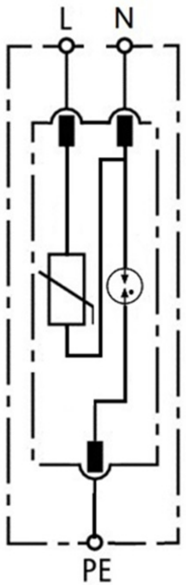
Types of SPD's – Differential mode

Providing Protection from Phase To Neutral & Phase/Neutral to Protective Earth in 1 Module width



1+1

L to N via Metal oxide Varistor (MOV) & L/N to PE via Gas discharge Tube (GDT) With each device in its own Cartridge

SPD's & Earthing systems

Earthing system	Single Phase Common Mode	Single Phase Differential Mode
TN-S	2+0	1+1
TN-C	1+0*	
TN-C-S	1+0*	
TT	2+0	1+1

* 2+0 & 1+1 can be substituted for 1+0 operation

Type 2 SPD Key characteristics

Imax – Maximum Discharge Current
The peak current the device will be able to discharge with an 8/20µs current waveshape. (20kA & 40kA)

In – Nominal Discharge Current
The nominal peak current value with an 8/20µs current waveshape. (10kA & 20kA)

Uc – Continuous Operating Voltage
The maximum continuous RMS voltage that may be applied to the SPD before it starts to discharge. (275V L-E, L-N and 255V N-E)

Up – Voltage Protection Level
The maximum voltage during a peak current (In) waveform (min<1.2kV)

Other key Considerations

- **534.4.5 – Protection against overcurrent** – Designed to protect the SPD and allow for local isolation, but **not to** operate within SPD's operating parameters

Contactum provide a 1 module Width SPD to allow for the inclusion of a MCB for overcurrent protection. This provides superior protection over the HRC Main Incoming fuse if the device is damaged due to the occurrence of a large overvoltage. It also provides a method to isolate the SPD during Installation Testing (the device becomes s/c after 275V!)

Contactum Kits contain a 32A 10kA, type C MCB

Other key Considerations

- **534.4.7 – Co-ordinating SPD’s on load side of RCD’s**
  Wherever possible to be installed upstream of RCD’s, or RCD Sensitivity needs to be reviewed and Time Delay RCD’s may be required

Contactum SPD Kits come complete with all of the cabling required to install the SPD before any outgoing circuits within the Consumer Unit which are protected by an RCD.

Other key Considerations

- **534.4.8 – Connection of SPD’s**
  Minimum Cable sizes for Type 2 SPD to be $4mm^2$ Maximum
  Recommended Cable Lengths – Max 1M

Contactum cables are all $6mm^2$ cables with ferruled ends

0.7M Total Cable Length (Live and Earth Cables combined)

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SP SPD's for Defender CU's

Common mode offer – 1+0 & 2+0

Differential mode offer – 1+1

- Type 2
- Single module width
- Available in Kit form or pre-installed
- into a Defender CU
- Plug in replacement cartridges available
- Remote Communication contacts available
- **Green** "Operational" – **Red** "Blown/Replace" Indicator

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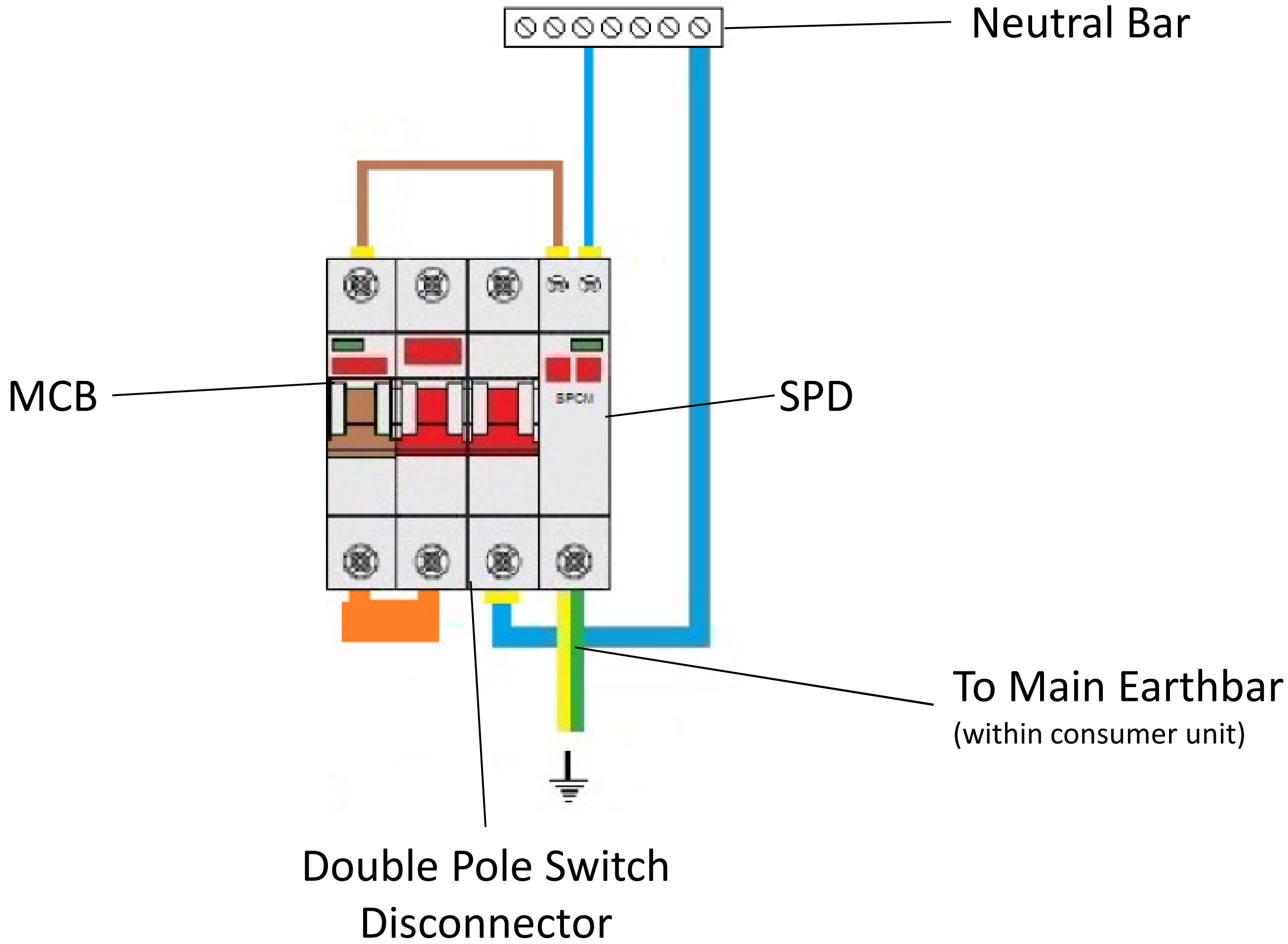
Defender SPD Kit wiring diagram



Defender Range SPD Kit’s

- Kits include 32A C Class MCB plus L, N & E Cabling)
  - T2S4010KIT – Common mode 1+0, Imax 40kA
  - T2C4020KIT* – Common mode 2+0, Imax 40kA
  - T2C4011KIT* – Differential Mode 1+1, Imax 40kA

* A Class Products

Defender CU’s with SPD’s

- Available in:
- DD Range – 100A Switch Isolator CU’s
- DDS Range – 100A Isolator plus 2 x 80A RCD’s
- Selected Populated DDS CU’s

Note: The product description and part numbering remains consistent with the current range. Therefore, if these indicate a 10 Way CU there are 10 usable ways, which means that the for a CU fitted with SPD kit, the Enclosure size is 2 modules wider than the corresponding standard CU

For example a DD101MS is a 12 Module enclosure with 10 usable ways, the DD101SPMS is a 14 Module Enclosure with 10 usable ways

Defender CU’s with SPD’s

- DD 100A Switch Isolator CU’s
  - Available in 4, 8, 10, 12, 16 & 18 Way (USABLE WAYS)
  - DD041SPMS*
  - DD081SPMS*
  - DD101SPMS*
  - DD121SPMS
  - DD141SPMS
  - DD161SPMS
  - DD181SPMS

* A Class Products

Defender CU's with SPD's

- DDS high Integrity CU's
  - Available in 6, 8, 10, 12, & 14 Way (USABLE WAYS)
  - Available with 100A Isolator & 2 x 80A RCD's
  - DDS06188SPMS
  - DDS08188SPMS
  - DDS10188SPMS*
  - DDS12188SPMS*
  - DDS14188SPMS*

* A Class Products, also available in Populated versions (suffix – P01), populated with MCB's as per the corresponding Populated DDS CU without SPD

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