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12.1 About this Guide to SSI Earthing and Bonding

Electronic systems are prone to damage when lightning strikes, either because the strike is close to the lineside equipment and the immense discharge of energy through the ground causes failure or, as is often the case, a strike close to a Data Link or power feeder causes the temporary shutdown of the equipment.

The following highlights common deficiencies found on site with earthing and bonding, and advises on the course of action to reduce lightning-related failures as well as immunising against other sources of electromagnetic interference (EMI).

This section of the SSI Technicians Manual is based upon information contained in SSI8503 – Earthing and Bonding of Solid State Interlocking Equipment, from the SSI Applications Manual (the contents of which are stated in RT/E/S/17002 [\[Ref 1\]](#)). Should there be any disagreement between this document and the SSI Applications Manual, the information in SSI8503 shall be taken as definitive.

12.2 Lightning Effects

12.2.1 Direct Hits

Direct lightning strikes result in large discharges of electrical energy passing through equipment. The only defence is to have a good earthing system to encourage the energy to pass through the equipment location case or building straight to earth without passing through the sensitive equipment. Surge arrestors, if positioned and wired up correctly, will protect the equipment from severe damage although it is likely that the system will fail due to fuse rupture or equipment shut-down.

However, severe damage to equipment is likely if the earthing and bonding arrangements are deficient.

12.2.2 Indirect Hits

It is more likely that high ground currents cause high-voltage transients to enter the system through lineside cabling, either via the TDL cables, power distribution cables, or tail cables.

12.2.3 Data Link Surge Protection

Older Data Links are fitted with a Gas Discharge tube in a housing with a black plastic cover. The internal components are standard items, clip mounted for ease of replacement.



Older Type of Data Link Surge Protection

Modern Data Links are fitted with Surge Protection Units (SPUs) capable of preventing failures by diverting surges to earth. These devices are effective provided that they are correctly fitted and have an effective earthing system.



GS/ES 1937 SPU made by Furse

Both Furse- and Clipit-made Surge Protection Units (SPU) are specified to provide protection from surge voltages of 4 kV and 2 kV common-mode and differential-mode respectively and surge currents of 2 kA and 1 kA common-mode and differential-mode respectively. However, repeated operation of the gas discharge tube within these devices is known to cause a progressive reduction of the voltage at which these devices strikeover; this will eventually cause reliability issues. Therefore,

in areas known to be subject to frequent lightning strikes, if TDL problems are being experienced, testing of the SPUs is advised.

A Furse SPU tester is now available to simplify site testing of SPUs. It carries out six tests against specified operating parameters.

12.2.4 Tail Cable Surge Protection

Transients entering through the tail cables can also cause failures, and some protection is provided by the TFMs. MK3 and MkIIIA modules provide greater protection than MkII modules, although such internal protection will degrade with time. To fully protect the TFM, external surge protection is being developed. Currently, a Phoenix Contact device is available for the protection of signal head tail cables.



Phoenix Contact signal tail cable protection

In the above picture, the topmost surge protection position shows the empty black base unit below the grey DIN rail end stop. The second to fourth base units from the top show the configuration plug (red for this type) in position. This device is inserted when the plug-in portion is first fitted and then remains captive to ensure correct subsequent replacement. The fifth base unit has the plug-in unit fitted (shown with its label just visible in the bottom of the picture). The Phoenix Contact surge protection plug-in modules may be unplugged without interruption to the protected circuit, though of course surge protection will be lost, for testing in the Checkmaster tester.

Shorter tail cables and MK3, MkIIIA or Mk4 TFMs can reduce the risk of damage where no surge protection is fitted.

12.2.5 Power Supply Surge Protection

Power supply perturbations are probably the most common reason for failure of SSI systems. These can result from a lightning strike at or near the power feeder or sub-station and can cause power dips and surges