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Good EMC design principles for panel & system builders

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9 Bracken View, Brocton, Stafford ST17 0TF T:+44 (0) 1785 660247 E:info@emcstandards.co.uk

Good EMC design principles for panel & system builders

Keith Armstrong resumes his coverage of good EMC engineering practices with yet more RF bonding techniques for cabinets

Before I digressed to cover Risk Assessment, this column was describing good EMC engineering practices for shielded cabinets. This edition carries on from the January 2009 column, with yet more details on techniques for 'RF-bonding' cable shields. As I said before, following these good practices for shielded cabinets also helps get the best EMC performance out of unshielded metal cabinets.

Figures 1 and 2 show two examples of mass-termination techniques for cable shields, that you can easily design and make yourself at low-cost, and surpass the performance of most commercial product offerings.

For unshielded cabinets, it is important to RF-bond the shields (screens) of all cables, RF-bond the filters for all unshielded cables, and RF-bond all conductive items - at the edge of the RF Reference (usually the backplate, see PSB July 2007) at the place where they enter it. It is also important to keep all interconnections to just one edge of the RF Reference.

For shielded cabinets (see PSB July 2008) it is important to RF-bond shields, filters and all other conductors at the point where they enter the shielded enclosure, and to keep all interconnections to that one side. This column discussed some suitable bonding methods for shielded cabinets in PSB January 2009, but the methods shown in Figures 1 and 2 are shown as for unshielded cabinets.

Cherry Clough Consultants was started by Keith Armstrong in 1990 to help manufacturers reduce costs, time-scales and warranty costs whilst complying with the EMC Directive and other regulations.

Keith has a great deal of experience with the EMC of control panels, systems and installations, of all types and sizes, and with Tim Williams, wrote the only textbook on the subject: "EMC for Systems and Installations" (Newnes, 2000, ISBN 0-7506-4167-3, www.bh.com/newnes, RS Components P/No. 377-6463).

The 'Publications & Downloads' pages at www.cherryclough.com contain a great deal of helpful and practical information on EMC.

Figure 1 sketches a backplate on which has been stuck a strip of conductive gasket. Gasket strips are available with conductive glue, for which it is important first to clean the mounting area of backplate with solvent, and avoid getting fingerprints on it. But gaskets with a strip on non-conductive glue are acceptable if the strip of glue only covers about 50% of the gasket, leaving the rest of it to make contact with the backplate.

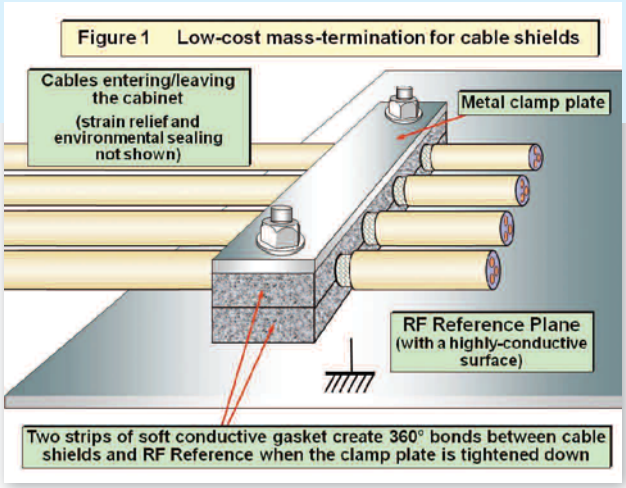
The shielded cables that are to have their shields RF-bonded have a portion of their outer jackets removed, to expose the conductive screen underneath. If they are foil shielded cables, this method will only work if the foil is metallised on the outer surface.

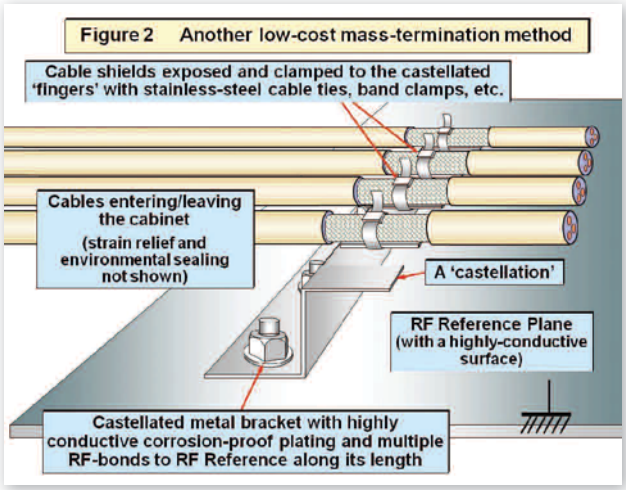
The cables are retained (not shown on Figure 1) so that their exposed portions of screen lie on top of the gasket strip, and then the clamping plate is tightened down on top. The clamping plate has an identical gasket strip fixed to it, so that the cable screens are surrounded by flexible conductive gasket that makes contact with the backplate as shown in Figure 1.

Figure 2 shows a similar technique, this time using a castellated bracket with multi-point bonding to the backplate. The exposed portions of cable shield are RF-bonded to the castellations using stainless-steel cable ties or the like, as shown in the Figure. Like Figure 1, this technique only works for foil shields if their foil is metallised on the outer surface.

For both techniques, it is vital that all the items make a good conductive connection with each other, so polymer passivation must not be used on any metal items (use Alochrome, Iridite-NCP or other conductive finish instead). If your gasket supplier cannot produce test evidence for the long-term compatibility and lack or corrosion of their gaskets when used with the metal plating you are using, find a different supplier who can.

Many wiring accessory manufacturers offer fixings for terminating the shields of cables, but all the ones that I have seen use green/yellow wires somewhere, so are only really any use





below about 100kHz. The techniques shown in Figures 1 and 2 can be effective to about 100MHz with unshielded cabinets, and to any frequency if used with shielded cabinets. But to achieve the benefit at frequencies above about 10MHz means fitting the shield termination as close to the point where the cables enter the metal cabinet as possible.

To get the very best performance with a shielded cabinet, the method of Figure 1 should be used with the gasket making a good conductive contact with the shield wall all around the perimeter of the aperture where the cables (or other conductors) enter the enclosure. Roxtec (http://www.roxtec.com/the-roxtec-solution) offer a range of products designed for just this purpose, which can also be used to prevent water ingress or in hazardous areas.

Earlier columns in this series are posted at: www.psbonthenet.net/company.aspx?CompanyID=12242.

For more about good EMC engineering practices, download the free REO Guide: "Good EMC Engineering Practices in the Design and Construction of Industrial Cabinets" from http://www.reo.co.uk/knowledgebase.

For more technical background read: "EMC for Systems and Installations" (Newnes, 2000, ISBN 0-7506-4167-3, www.bh.com/newnes, RS Components P/No. 377-6463).

The REO Guide "Good EMC Engineering Practices in the Design and Construction of Fixed Installations" is now available from http://www.reo.co.uk/knowledgebase.

If errors or malfunctions in the electronics or software of your project could increase safety risks, complying with the EMC Directive will not be enough to show 'due diligence' in ensuring tolerable safety risks despite the possibilities for electromagnetic interference. For a suitable EMC methodology, download the IET's new free guide on "EMC for Functional Safety" from www.theiet.org/factfiles/emc/index.cfm.

Some useful EMC references....

- The EMC Directive, 2004/108/EC: http://eur-lex.europa.eu/LexUriServ/site/en/oj/2004/l_390/ l_39020041231en00240037.pdf
- The EC's official Guide to 2004/108/EC: http://ec.europa.eu/enterprise/electr_equipment/emc/directiv/dir2004_108.htm#guide
- The UK's EMC Regulations 2006, Statutory Instrument 2006 No. 3418: http://www.opsi.gov.uk/si/si2006/uksi_20063418_en.pdf
- The UK's official guide to the 2006 EMC Regulations is posted under 'Related Documents' at: http://www.berr.gov.uk/whatwedo/sectors/sustainability/regulations/ecdirect/page12469.html