Guidelines – Electrical Switching Considerations

NOTE:
This document mainly provides guidance on wiring in relation to mains (domestic electricity supply) switching applications. The guidelines are based on UK electrical fittings and UK electrical regulations. Installers in other countries will recognise similar basic principles but must consult and adapt to their own regulations

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Introduction

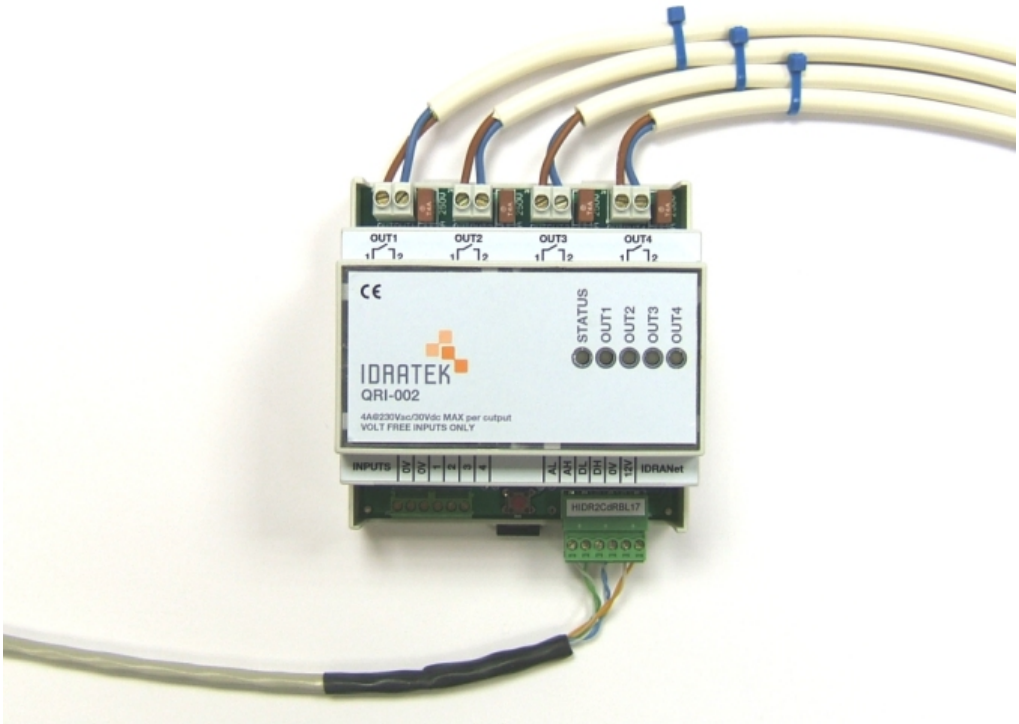
A number of IDRANet compatible modules have switching capabilities via 250Vac rated relays and can therefore be used in applications where mains (domestic electricity supply) switching is required. Examples of these include the DRB-001 (Dual 4A Fused Relay) and QRH001 (Quad 13A Non Fused DIN Mounted). As these require connection to both mains wiring (LV) and Extra low voltage (ELV) IDRANet wiring, it is paramount to ensure that the installation makes every effort to prevent any possibility of inadvertent connection between LV and ELV signals. It is also important to bear in mind that relay switching can generate a high degree of electrical noise, particularly when poorly suppressed highly inductive loads are switched. Such noise, if great enough, can adversely affect the relatively sensitive digital electronics. So precautions need to be taken both to ensure wide enough separation between noise bearing conductors and the module electronics and/or to fit additional suppression components where necessary.

This document provides guidelines which cover both these considerations.

Isolation and Insulation

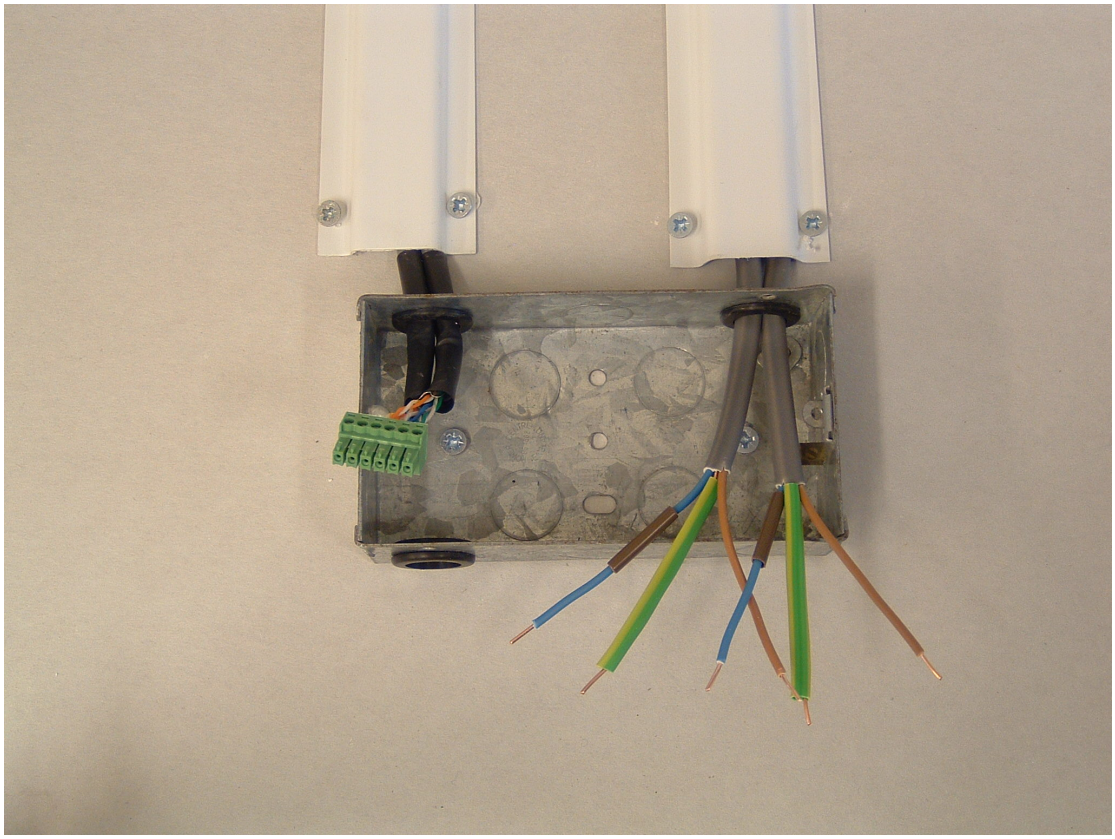
It is a requirement in numerous regulations that mains (LV) and extra low voltage (ELV) cables are adequately isolated from each other such that there is no risk of electric shock or damage to the ELV side due to the two coming into contact. Within those modules that provide a mains rated switching capability this is normally inherent in the physical design. However wiring outside the module is under the control of the installer and good wiring practices should be adhered to including the advice listed here.

In a typical installation using small electrical pattresses and housings, internal separation is provided by the use of physical barriers which have been fully tested and provide sufficient insulation. These are supplied with IDRATEKs range of small modules e.g. DRB, DRH, SLD and SRH units. For the range of DIN mounted units, such separation is inherently provided partly by the physical bulk of the module and partly by the approach route of the wiring. It is nevertheless the responsibility of the installer to ensure adequate separation is maintained by mounting and wiring such units sensibly and also in an enclosure which prevents the LV wires from coming into contact with users. Good practice includes securing the mains cables to the enclosure and wiring them from the top as intended, while the ELV IDRANet cabling is kept at the bottom and secured. Metal enclosures should be earthed.



Cable Run Separation

In addition to the above, it is necessary to consider how cables are routed through the walls and floors of an installation. In order to minimise the effect of mains borne noise, e.g. switching spikes caused by inductive loads and equipment such as fluorescent lighting, a minimum distance between the IDRANet cabling and mains cabling is recommended. For parallel cable runs this should preferably be **at least 100mm** and be implemented throughout an installation (except within a pattress itself where it is not possible). This is illustrated in the photograph below where the wiring is physically held apart by the conduits.



Switching Noise and Suppression

As mentioned in the introduction, relay switching can cause short lived but high energy electromagnetic radiation spikes due to the sudden interruption of a flowing current (particularly from an inductive load) or due to transitory high current surges (switching on a powerful halogen lamp from cold). This can also be exacerbated by appliance manufacturers who fail to fit suitable suppression components on their products.

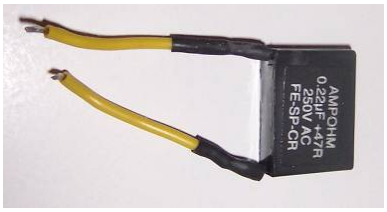
All electronic equipment is susceptible to such electromagnetic spikes to one degree or another, and whilst IDRATEK products are all designed and tested to exceed stringent European immunity standards it is nevertheless possible for the power of such emissions to be locally exaggerated far above such standards. For example by placing a switched conductor very close to the digital electronics. Such issues are rarely encountered with DIN format modules since the cabling usually approaches the module at a near right angle and is unlikely to be passing in close proximity underneath or above the module. However with wall mounting modules it is possible for the cabling inside the pattress box to get much closer to the electronics and it is also possible for the cabling outside to pass in close proximity to the back or side of the wall box. In particular plastic wall boxes (as compared to metal) do not offer any shielding properties.

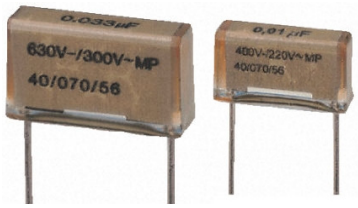
For the range of small modules such as DRB, SRH, SLD and DRH, separation within the module enclosure is maintained by ensuring that the cables enter from opposite sides of the pattress, and within the pattress a physical isolation barrier is provided. Nonetheless it is also important to ensure that the mains cabling within the pattress box and outside it is kept as far away from the electronics as is possible.

Though such adverse cabling is typically unusual, it is better to ensure that these separation precautions are kept in mind during the installation phase rather than having to deal with such issues when access to cabling becomes more difficult.

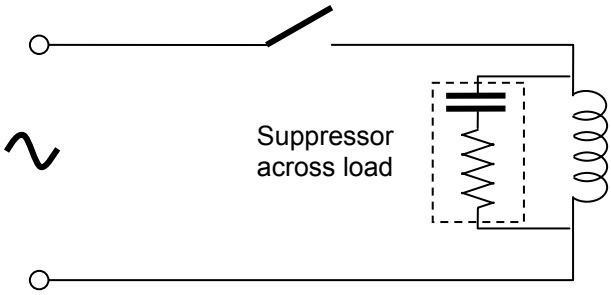
Transient Suppressors (Snubbers)

It is also a good idea to consider fitting suppressors commonly known as 'snubbers' across potentially problem loads such as motors or incandescent lights (if not already fitted by manufacturer). Such suppressors typically consist of a high voltage rated flame resistant capacitor integrated with a low value resistance. Typically 0.1-0.22uF in series with 47R is sufficient. It is important that devices specifically rated for use across the electricity supply are used – not ordinary capacitors (even if these are rated to a high voltage). Example devices are shown below:

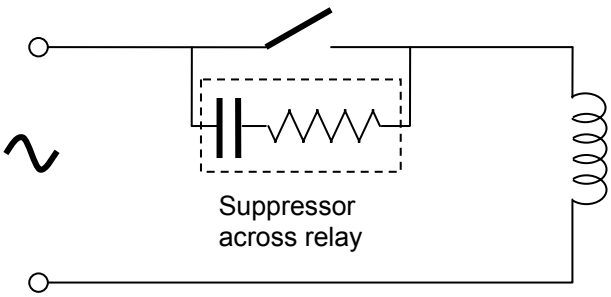




It is best to fit suppressors at the load side rather than at the relay terminals:



But this may not always be possible, in which case fitting at the relay terminals may still offer some level of protection:



However it should be noted that a capacitive suppressor connected across a relay terminal (rather than load) will allow a small leakage current to flow to the load even when the relay contacts are open.

When suppressors are supplied without sleeves over the legs, a suitable sleeve or insulating sheath should be fitted, ensuring there is sufficient bare copper to make connection to the terminal block.

An additional benefit of suppressors is that they can reduce the amount of arcing across relay contacts during switching operations and may thus help extend relay life,