CONSIDERATIONS TO BE ADDRESSED WHEN SELECTING FIRE ALARM, INTRUDER ALARM, PUBLIC ADDRESS AND DATA CIRCUITS FOR USE ON SHIELDED INSTALLATIONS

These notes relate to equipment intended for use on shielded installations but apply equally to any other installation where interconnecting wiring needs to pass through filters. Filters are the only electrical point of entry into a shielded installation. They service all equipment within the protected area and are essential to maintain the integrity of the shield.

If a fire alarm, intruder alarm, public address, or data circuit has to pass through a shield, it will inevitably have to pass through a filter, in the same way as all other electrical services.

RFI filters work by shunting unwanted RFI to ground via capacitors and also impeding RFI with series inductors. Generally, the higher the filter performance, the larger the capacitance and inductance values it will contain. The filter performance and hence its component values are largely determined by the shield specification and the line impedance required.

This means that if one of the above items of equipment is specified to operate through a shield, then by inference, it must be capable of tolerating a certain amount of capacitance, inductance and resistance on the line. These filter component values, being determined by the shield attenuation specification and line impedance are effectively predefined and are not arbitrary values introduced by the filter manufacturer.

When selecting a piece of equipment for use on a shield, the specifier must ensure that the equipment is tolerant of capacitance, inductance, and resistance, on the line. It is not good practise to wait until the equipment is installed and find that there is a problem and then claim that the equipment works ok without filters. The application for the equipment requires that it must work with filters to be fit for purpose.

Most pieces of electrical equipment with interconnecting cables will be susceptible to some extent to extra capacitance, inductance, or resistance inserted into the line. Some types of equipment are very tolerant, whereas others are very susceptible depending on the type of circuitry used. It is our experience that capacitance on the line is the parameter most likely to cause problems, although with some circuits, inductance and resistance can also be problematical. Because of filter component values, any compatibility problems are likely to be more pronounced with higher performance filters.

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It is imperative that the question of susceptibility of the equipment circuitry to capacitance and other parameters is addressed when specifying equipment to be used. Only the equipment manufacturer is capable of knowing the susceptibility of his equipment to line parameters so he must advise the suitability of his equipment for use on a shield. e.g. If the equipment is not tolerant of the necessary level of capacitance on the line, then it is not fit for purpose for use in an application on a shield.

MPE are usually able to provide a free loan filter, where practical, and/or full filter circuit details to enable the equipment manufacturer or the user to confirm compatibility of the equipment with the filter. As the filter component values are determined by the shield specification, the equipment has to be made compatible with the filter (and hence the shield specification) and not the other way round.

If an item of equipment is found not to be compatible with a filter once installed, it is unlikely that an alternative (lower performance but more compatible) filter can be substituted without compromising the shield attenuation specification.

It should be remembered that if the signal has to pass through more than one filter in series then effects of line capacitance, inductance and resistance will be additive.

Additional Considerations for Data Lines

For digital data lines, there is often a conflict of interests between the shield attenuation specification, and the bandwidth required to allow data to pass. In this case, specifications normally require that filters of the minimum bandwidth possible which allows data to pass, shall be used.

It is generally accepted that, for reliable transmission of digital data, a bandwidth of ten times the data rate is required. This is therefore the criterion used for the filter design.

Despite this, it is our experience that some older data interface circuits need a higher bandwidth than this to operate correctly, whereas many newer types will work with a much lower bandwidth, often as low as twice the data rate. Some circuits are also more susceptible to line impedance than others, and some are particularly susceptible to capacitance on the line. The requirements of individual data interface circuits can again only be defined by their manufacturer. These requirements are fundamental to the equipment being fit for purpose for use with filters on a shielded installation.

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SUMMARY

1. For equipment to be used on a shielded installation, it must be tolerant of capacitance, inductance and resistance on the line.

2. Because filter parameters are governed by the shield attenuation specification, to be fit for purpose, equipment must be selected to be compatible with the filter, not the other way round.

3. Compatibility of circuits with filters should be checked (preferably by testing) prior to installation, taking account of any filters connected in series.

4. Use of equipment on a shielded application is a very special case, not a general commercial application, and must be treated appropriately. If commercial equipment is to be used then it must be evaluated carefully for fitness for purpose in this application.

5. For data circuits, bandwidth and impedance need consideration as well as capacitance, inductance and resistance, making compatibility checks even more imperative.

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