

FALSE ALARMS FROM ELECTROMAGNETIC EMISSIONS

1.0 Introduction

Control Logic Spark Detectors are designed and certified for an electromagnetic immunity level greater than required by CE norms (EMC directive). If other electrical equipment present in the plant have an electromagnetic emission level lower than required by CE norms, false alarms are not expected.

2.0 Main causes of false alarms

The electromagnetic emissions can enter inside the spark detector electronic circuit in two ways: by radiation and by conduction.

2.1 Electromagnetic radiation

The electromagnetic emissions are spread into space and enter inside spark detector both directly through metallic enclosure where openings are present, like optical windows and cable fittings, and indirectly through electrical cables. A metallic enclosure not well connected to the ground lets electromagnetic radiation pass through.

2.2 Electromagnetic conduction

Electromagnetic emissions create an electromagnetic field which produces disturbing currents inside metallic conduits, metallic tubing and electrical cables. Also, electrical cables can operate like electrical transformers, so that electromagnetic currents can pass from one conductor to others and go through all cables which are running together.

Fig. 1 - Electrical arc between two electrical contacts while they are opening

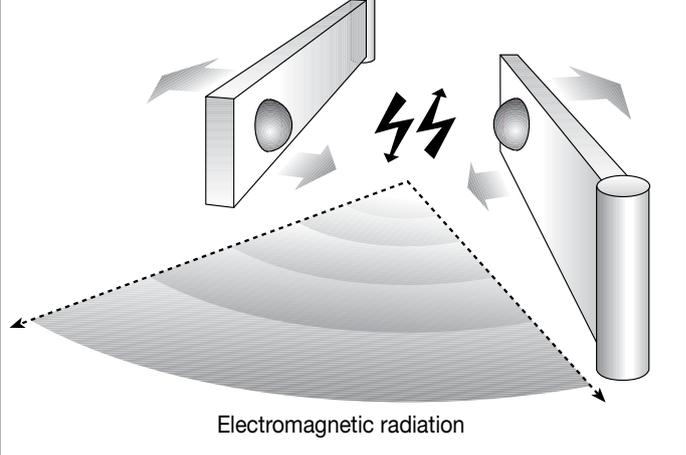


Fig. 2 - Current induced by electromagnetic radiation on sensor wiring

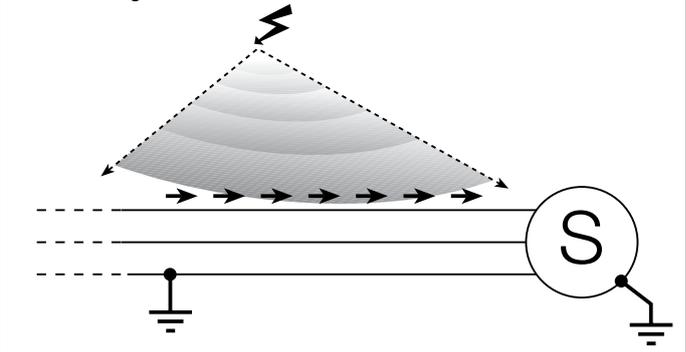
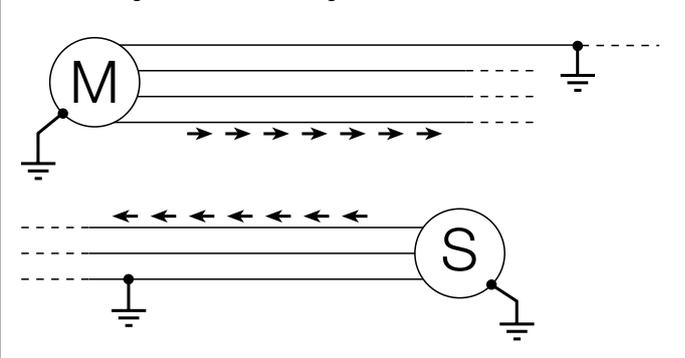


Fig. 3 - Noise current induced between motor wiring and sensor wiring which are close together



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3.0 Sources of electromagnetic emissions

There are lots of electrical equipment which can generate electromagnetic noise. Here is a short list of the main ones.

3.1 Radio and television transmitters

Their electromagnetic field is modulated by sound and image.

3.2 Radio-telephone transceivers

Their electromagnetic field is modulated by voice.

3.3 Mobile phone transceivers

Their electromagnetic field is intermitted and modulated both by connection impulses which keep mobile phone under control and by voice.

3.4 Frequency converters for variable speed electric motors

This electronic equipment control frequency and power by electrical pulse trains with variable time length and repetition frequency. The electrical pulses steep fronts generate electromagnetic noise.

3.5 Uninterruptible power supplies

Uninterruptible power supplies are built with electronic 50-60Hz frequency generators and are supplied by DC power supplies. Frequency is generated by electrical pulse trains with variable time length and repetition frequency. The electrical pulses steep fronts generate electromagnetic noise.

3.6 Switching power supplies

Switching power supplies are DC power supplies which control the level of voltage and current by electrical pulse trains with variable time length and repetition frequency. The electrical pulses steep fronts generate electromagnetic noise.

3.7 Industrial computers for production processes

Their connection to equipment and other electrical devices is done by electrical pulse trains of high intensity running through long cables.

3.8 High frequency generators for plastic welding machines

They behave like powerful radio transmitters built into industrial equipment, and are activated periodically for short periods during welding. The same high frequency generators are used in the woodworking industry to heat and bend the parts to be curved and shaped.

3.9 On-off switches for electrical motors

At the starting and stopping of the motors the switch contacts generate strong electrical arcs caused by inrush currents and its contact behavior on opening and closing. The opening arc is particularly strong because of high induction values in the motor. The related electromagnetic pulsing field covers all the surrounding environment and runs through all the electrical cables nearby.

3.10 Automatic electronic welding equipment for metallic parts

These generate frequent electrical arcs during operation, for example for point welding of metallic sheets. The electrical arcs are by nature unstable and intermitted, and they behave like high frequency generators, more or less the first generators used by Marconi in his first radio transmissions.

Fig. 4 - Electromagnetic noise generated by a motor current at the starting and stopping

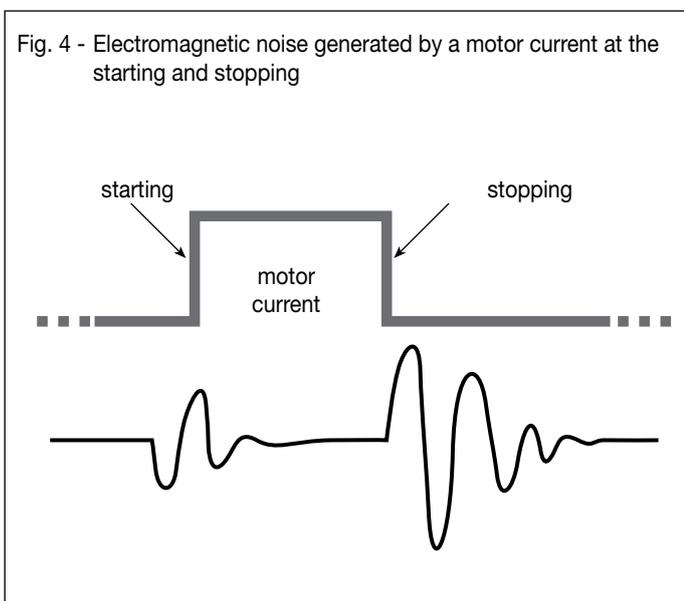
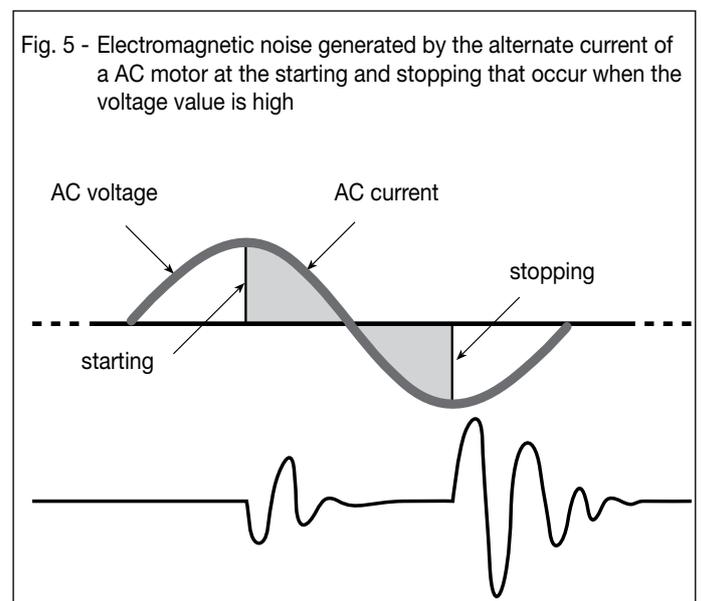


Fig. 5 - Electromagnetic noise generated by the alternate current of a AC motor at the starting and stopping that occur when the voltage value is high



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4.0 How to reduce the electromagnetic noise

In order to obtain good results and to eliminate or minimize the risk of false alarms, it is necessary to operate on two fronts: on the equipment that generate noise and on systems and wiring of spark detectors.

4.1 Stopping electromagnetic emission on source equipment

- Ground connection, verifying it is a good ground. Connect to ground all metallic parts of the equipment, metallic conduits, metallic tubing for cables, shields of shielded cables, so as to discharge to the ground the electromagnetic fields present or running by.
- Use shielded wiring, and keep it physically separate from other wiring. If possible run it through metallic tubing. Remember that nearby cables are influenced by induction caused by current variations.
- Insert stop inductors on connections to common power electrical lines so as to prevent electromagnetic noise from running towards other equipment and systems.

4.2 Stopping electromagnetic noise on spark detector systems

It is necessary to prevent noise from reaching the detector.

- Connect to ground all metallic parts of the system, the detector enclosure, the dust extraction conduits, metallic tubing for cables, shields for shielded cables. Verify that ground is good. Remember that a bad ground connection spreads the electromagnetic noise.
 - Use shielded wiring, and keep it physically separate from other wiring. If possible put it into a metallic tubing. Remember that nearby cables are influenced by induction caused by current variations.
- Keep separate 24Vdc wiring from higher voltage wiring (keeping in mind that 24Vdc wiring enters inside the detector electronic circuit).

GROUND CONNECTION AND WIRING SEPARATION

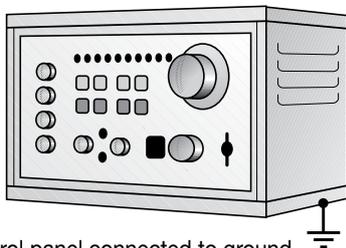


Fig. 6 - Control panel connected to ground

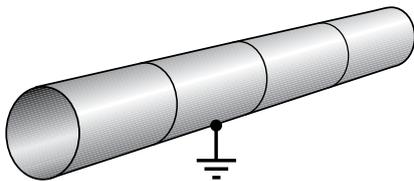


Fig. 8 - Dust extraction conduit connected to ground

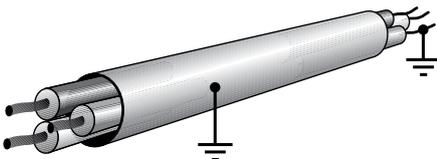


Fig. 9 - Metallic tubing for cables connected to ground

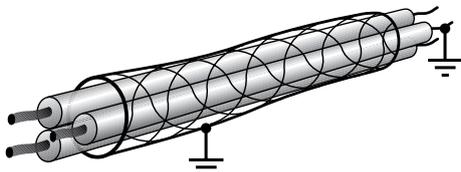


Fig. 10 - Shielded wiring connected to ground

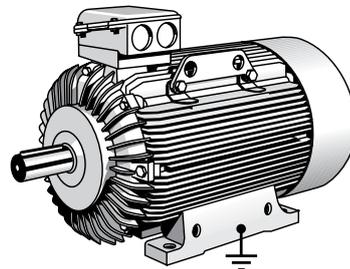


Fig. 7 - Electric motor connected to ground

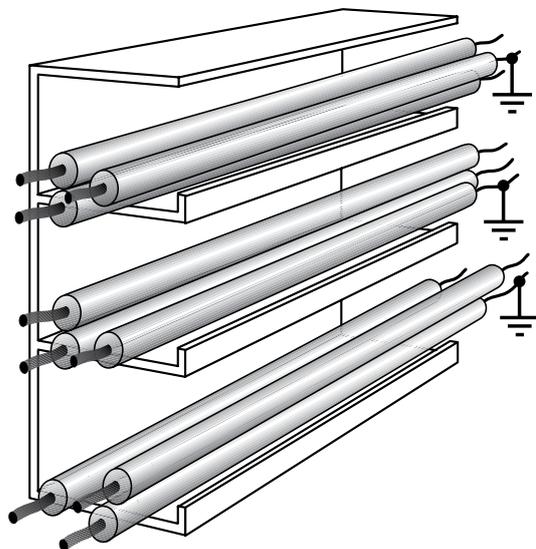
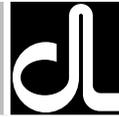


Fig. 11 - Plastic conduit with different levels to separate different cables (electronic signals, DC low power, AC power)



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5.0 Conclusions

Electromagnetic noise pulses, those that are only a fraction of a microsecond in length, are difficult to verify due to their fast, momentary and unpredictable nature. Yet they are the most treacherous ones since they are difficult to verify and can trigger spark detectors false alarms because detector response is very fast. Also, suitable instruments are not available, since those available can only measure average values and can not follow momentary pulses.

We then strongly suggest you to take every precaution, as detailed above, to minimize the probability of false alarms.

A simple instrument which can light a progressive series of LED signals and sound a progressive alarm BIP can be useful to detect electromagnetic noise even if impulsive and momentary.

Our technical staff is always available for any further information and suggestions.