Ground-loops

A DEFINITION OF EARTHING SYSTEM

For residential buildings the main protection system is the earthing system. Earthing an equipment **means establishing an electric connection between the equipment itself and the ground at a zero potential**. The main purpose of this connection is to avoid that such equipments represent in case of failure an extremely dangerous potential for people that get in contact with them, and to trigger protection systems (placed upstream) that immediately block electric supply. The earthing system must therefore easily disperse electric current in order to decrease contact voltage value.
Security is not of course guaranteed only by the earthing system (in fact, there are other valid protection systems against electric dangers*) but a good earthing system together with a correct use of equipotential connections is the most common solution to achieve highest security levels.

*Due to the extremely technical subject, the case is not thoroughly dealt with in this article. Please refer to CEI 11-1 and CEI 64-8 standards..

EARTHING SYSTEM AND 46/90 LAW

Since the introduction of the 46/90 law, and in particular of the decree of the Italian President D.P.R. 6.12.1991 n. 447, the question **if it is compulsory or not to establish a earthing system** is still doubtful. It is generally easier to say when a earthing system is not compulsory: earthing system is optional for residential buildings whose electric systems were built before March 1990. The earthing system is compulsory for all other cases.

GROUND-LOOPS

Although good quality materials have been used and all that has been explained in the tutorial Advantages of Video Signal Amplification (regarding coaxial cable attenuation and path length) has been followed, **the final result could not still be as good as expected**. Despite the use of high performance cameras and high definition monitors the image may still be disturbed, not clear and may show more or less evident stripes, both vertical and horizontal, as well as lines (dark bands) that slowly move on the monitor screen. **Such interferences are not dependant on the type of materials** used but most of the time on a current circulation along the coaxial cable shield. These interferences are mainly due to:

- Electromagnetic Induction (e.g. between a A.T. or M.T. feeder line subject to major charge variations and the coaxial cable running along a parallel tube/channel);

- Ground Loops.

As for Electromagnetic Induction, **even though the coaxial cable shield is earthed only at the control video level** (e.g. monitor) in order to obtain a theoretical direct block of the earthing circuit, the result is to increase the risk that the shield may be subject to high induced surges because **it works as a highly receptive antenna**, thus increasing the risk of damage to objects and/or individuals.
Note: for this specific subject, please refer to the tutorial Risks of induced surges.

As for Ground Loops, it is necessary to consider that in case both camera and the receiving equipment are earthed but at different grounding points, **a potential difference between these two different grounding points will generate a current circulation** along the coax cable shield. In theory, these two grounding points should have the same potential but in practice this will never be the case **due to inevitable differences in their grounding nature**.
The use of specific equipments for these disturbances (optoisolators) basically blocks the circuit along which the disturbance current is running.

HOW DOES AN IPTOISOLATOR WORKS

The idea behind an optoisolator is to establish a **galvanic isolation** between a video source (camera, dome, etc.) and the receiving equipment (monitor, matrix, digital equipment, etc.). In this way all **interferences due to different potentials between different grounding points** (Video Hum*, Ground Loops and all those factors that interfere with image quality) **are definitely eliminated**.
Note: in order to obtain an isolation between video source and video equipment it is also possible to use an isolation transformer. The advantage is the fact of not having to supply the transformer in order to operate it. Compared to an active optoisolator, the disadvantages are: 1) lower bandwidth, 2) high video signal attenuation, 3) phase and frequency distortions.

*Video hum is a low frequency noise which is in most cases generated by induced surges.

EVO1/1 OPTOISOLATOR

On the basis of what previously described, SERINN has designed an EVO1/1 **active optoisolator** which is very small, extremely easy to install and guarantees a perfect galvanic isolation between video source and receiving equipment. EVO1/1 is supplied through two separate TX and RX systems indicated by specific LEDs. **High quality circuitry and electronics guarantee a perfectly linear output together with an extremely large bandwidth (17MHz) with no distorsions at all**. The EVO1/1 board can be used in cases of different dimensions to meet all requirements. The 19"-2U rack version can be used in video boxes/consoles. For this purpose, a PSM24/2M power supply board (23Vac/24Vac-800mA, two occupied slots) which is able to supply up to 8 EVO1/1 boards (and/or EVD1/3 boards), has been specifically created.
Note: please be aware that for rack version a maximum of 10 boards (1 slot each) can be inserted for a total of 10 occupied slots. It is possible to use both optoisolators boards (EVO1/1) and video distributor boards (EVD1/3) at the same time. In this way if the optoisolator VIDEO OUT is connected to the video distributor
VIDEO IN, it is possible to have 3 optoisolated VIDEO OUT (referred to source).