CCTV VIDEO GROUND LOOP PROBLEM SOLVING

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This article will discuss video ground loop problems in CCTV installations. The cause and how it effects picture quality with solutions to eliminate the problem.

When Video Ground Loop problems or 60 cycle Bars occur, they are easy to see on a video monitor. They look like a horizontal band or bar across the video monitor that slowly moves up the video screen. These bars can be barely noticeable, or can be so bad that the video monitor loses lock and breaks up the picture. If the video camera is Line-Locked to the 60 cycle main power, the bars may stand still in the picture, but they still obscure picture definition and create customer complaints.

The source of the 60 cycle bar originates from the power industries use of local grounds to balance their power grid. Everywhere 60 cycle power is used, a local ground is attached to the power grid to return all unbalanced current flow to ground. As an example, you will notice that every main power breaker box will have a ground wire or conduit going to a ground rod or similar device connected to an earth ground. Every correctly installed power outlet will have a connection to this ground.

Not all grounds are created equal. In fact the earth ground in one building is most likely to have a different voltage potential relative to any other building, even grounds inside the same building will have different voltages between them, based on the uneven current flow of the power load.

Here is how the 60 cycle bar gets into your video picture. If you connect a coaxial cable to a monitor or other equipment that plugs into the 60 cycle main power and the other end of the coaxial cable becomes grounded locally for any reason a Ground Loop is created. Any difference in the 60 cycle voltage between these two ground points will create a current flow in the shield of the coax that induces the 60 cycle AC voltage into your video signal.

It is easy to measure these differential voltages, simply disconnect the video cables at the monitor point and using your voltmeter on AC volts, measure between any two shields of the incoming video cables, you will be amazed at the difference.

The solution is to never connect both ends of a video cable to local grounds. Any cable can be grounded at one end without inducing the ground loop current. When you run coax cable from one building to another, it is acceptable to install through connection points, but do not allow the shields to come into contact with one another or the local ground. A coaxial connector laying in a cable tray or conduit box can accidentally contact ground, don't let this happen. Use tape on the connector to prevent accidental grounding. Also try not to attach the camera to any structure that is likely to be grounded. Remember that the camera is already grounded at the opposite end of the coaxial cable by the monitor equipment.

At the monitor station you may have many pieces of equipment connected together, like a (Quad, Tape Recorder, Monitor) all of which plug into the main 60 cycle power. This will not present a problem if you plug all of the equipment into the same power line at the monitor point. Making sure that all the equipment share the same ground point at the monitor station. Also try to keep the video cables between equipment, (the service loops) as short as possible.

If you already have an installation that has 60 cycle bars, there are some steps you can take to solve the problem. If coaxial cable shields are connected together anywhere in the system, separate them if possible. Similarly remove all but one ground connection on each coaxial cable if possible. The ground is usually at the monitor end of the coaxial cable because the monitor equipment plugs into the 60 cycle main power supply which is grounded.

Sometimes a ground loop problem can be reduced by reversing the AC plug on the power transformer used to power the camera, or reverse the 24 VAC power connection to the camera. This technique will not work on DC powered cameras.

If the problem still persists, video isolation transformers can be installed at one end of the coaxial cable to block the shield current flow and eliminate the 60 cycle bars.

These transformers must be installed at the coaxial cable that is originating the 60 cycle bar problem. Isolation transformers only work when they can block the current flow in the shield. Once 60 cycle bars become part of the video signal, no economical down stream solution will remove the bars. Use a portable monitor to find the origin of the ground loop problem, start at the camera and move down the coaxial cable until you see the bars appear on the portable monitor. This then is the coaxial cable with the current in the shield. Clear the ground connection or install an isolation transformer at this point.

The type of AC power transformers you use to power your cameras can contribute to Ground Loop problems. A ground can be introduced to your camera "Capacitively" through the power transformer windings depending on the type and construction technique used to build the AC transformer. Some transformers are built by winding a primary (the 110 VAC side) on a metal core, then simply winding the secondary coil (24VAC) directly over the primary coil. This puts the primary and the secondary in direct capacitive contact. This type can cause Ground Loop problems.

Other manufacturers build their AC transformers with a split bobbin. That is each winding is separately mounted on the metal core. The separation of primary and secondary coils are greatly increased, reducing the capacitive coupling and removing the unwanted second ground in your system. This type of transformer usually does not cost any more, and may prevent the 60 cycle ground loop from occurring. It would help if you determine which transformers are built to minimize capacitive coupling between windings and purchase that type only.

With an understanding of Ground Loop problems and the use of good single ended grounding techniques, you should be able to keep the 60 cycle bars out of your CCTV installations.