HOW TO FIND ELECTRICAL INTERFERENCE

(Generally called EMI or Electro Magnetic Interference)

Richard McKinley – Contacta, Inc July 1, 2012

What is Hearing Loop interference or background noise – First of all, hearing loop systems use a small coil as the component that detects a changing **magnetic field**. It **rarely picks up radio waves or something that is transmitted by an antenna**. The magnetic field we produce in a hearing loop does not radiate out from an antenna, like a two way communication system or a radio station. The interference we are trying to get rid of is the result of an electrical current flowing in a loop (not to be confused with a hearing loop) of some sort, often called a ground loop. In AC electrical power distribution systems wherever current flows out through the HOT (often back or red) wires, an equal and opposite current flows right next to it through the neutral/return wire (usually white). When the current in the neutral wire is equal to the current flowing in its adjacent hot wire it will cancel out any potential magnetic field.

Interference that affects a large area is NOT caused by – a dimmer, light switch, light bulb, individual light, motor, appliance, computer, TV, radio, saw, air conditioner etc. It is possible to detect some EMI off of devices like a dimmer but it will fall off to a negligible amount a foot or so away from the device.

In almost all cases it is either –

- An electrical circuit that has been mis-wired often due to a change of a circuit or a remodel
- A device or sub-panel where the return power is misdirected to the ground or earth
- A circuit fed off of one phase and has its return in another panel possibly even on a different phase
- There are multiple earths and ground points throughout a facility
- A broken conduit was not acting as the ground
- A corroded neutral connection so the return ends up going through the ground
- The same lighting circuit was fed off of two different sub panels

Examples of EMI that we've found include:

- A chandelier with all of the light bulbs run in series, they use low voltage lamps
- A malfunctioning copier was sending half or more of its return current down through the ground wire and ultimately to an old water pipe.

- In one facility, three electrical panels were mounted side by side. After we turned off the feed to the problem panel, we discovered over 20 amps on its neutral due to a breaker having been fed from a separate panel on a different phase
- In one facility, we found all the electrical panels grounded to old water pipes
- In another we found a 208 V three phase power feed had been run directly through a theater. The three phases were not in balance with the return and a lot of current (7 to 10A) was flowing through the earth ground. To solve this, the feed line was rerouted so that it did not run near the theater.

Notes before you begin – If the noise covers a large area (more than a 2 – 3 ft area around a light or dimmer) you would follow the steps listed below. I recommend you follow this procedure with the assistance of a licensed electrician.

Step 1 – Turn **off all** electrical power to your facility or home. This can usually be accomplished by turning off a main switch. If not available, generally your power company will send out a truck to turn their main service off to your facility. Preferably this is the first main switch where the power from the company enters your facility or home. If the interference either goes away or lowers to an insignificant level then proceed to step 2. If the interference is still there and at an annoying level proceed to step 3

Step 2 – Starting at your main electrical panel turn on one circuit breaker at a time until you find the breaker or breakers that cause this issue. **Note: it is often more than one breaker** but there is usually some common characteristic between them. As an example: in one facility, four breakers caused 99% of the background noise. No one knew where one of them went to and it has now been disconnected. The other three all went to one room below the sanctuary. Due to the way these three circuits had been wired and mis-grounded we found over 20 amps of current when we put our amp meter around one of the **water pipes**. Once isolated and reworked, all background noise went away.

If you have multiple subpanels turn them on **one at a time** to see if you can determine which panels do not cause the interference. Then work your way down the breakers in the remaining problem panel until you find the breakers that cause the issue.

Time saving note: Whenever a hearing loop receiver is held directly over the source of the interference the noise will go away in your headset. When you hold the meter directly in line with one of the two wires or conduits causing the interference you will hear a null. See the photo below where we discovered two conduits 8 to 10 ft apart that caused our meters/loop receivers to null or be quiet. The electrician discovered that a neutral in a lighting panel had been accidently mis-wired and the 15 amps going out through one conduit was mistakenly returning on the neutral in another conduit and also through an additional sub panel.

The meter nulled when held right under this conduit. There had to be two conduits in order to cause the problem and they ended up being about 8ft apart.

Step 3 – If tuning the power off to your facility or home does not get rid of the interference do not give up hope until you talk to your power company. You are probably on a system that has a large level of distortion and much of the power is going through the earth and not on the power lines. Sadly this is lost power that is wasted in all of the wall plug in power supplies that we use today. In one case the power company rerouted the power fed to a large group of homes and the worship facility interference went completely away.

I am very willing to talk with the electrician prior to your on site visit.

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