# Monitor shielding to control magnetic interference

**Only certain proprietary ferromagnetic alloys provide effective shielding against H-fields.**

**BRAD FRIESTEDT**
Magnetic Shield Corporation*
Bensenville, IL

Whatever the instrument or control system—a complex multiple network, a touch-screen control center, or a single CRT monitor—an invisible ambience factor can sometimes produce major problems. Such problems frequently stem from magnetic interference, a phenomenon often overlooked in system design. Of course, every electronic or electrical engineer has sat through a lecture or two on the subject of magnetism. But in many cases, magnetic interference is the unsuspected source of malfunctions in instruments or control systems.

These malfunctions manifest themselves in several ways. A CRT screen may suddenly develop vagaries variously described as shimmy, hula, jitter or undulation. Colors may change, producing deceptive information. A screen may go blank at a critical moment. Touch-screen controls may suddenly become unresponsive—losing the essential assets of real-time response to operator commands. Or, possibly even worse from the operator's personal viewpoint, screen images may be so distorted that operator fatigue or severe migraine-type headaches result.

## THE BASICS

Magnetic fields (also called H fields) are created by current flow—AC or DC. As current increases, so does the strength of the H field. This magnetic force travels unabated through construction materials like drywall or concrete and may even be conducted by steel beams or through the typical steel-frame-and-metal-skin building.

Magnetic field strength is measured in milligauss (0.001 G). Typical of the magnetic fields found in industry are those in steel mills, where magnetic forces as high as 1200 mG are not unusual 20 feet from a 37-kA ladle metallurgical furnace. Such a field is likely to saturate magnetically sensitive components of control systems. Since some components (color CRT monitors, for example) are affected by H fields as low as 10 mG, the adverse effects described above are likely to occur.

Often the source of these effects is difficult to identify or simply cannot be eliminated. For example, in today's mini steel mills, induction furnaces frequently use power in the 30-50 kA range. They perform their primary function well—heating the melts in process. But they may also create a most difficult side effect: generating magnetic fields which prevent effective operation of instrumentation and control systems. When heating elements of the furnace are not operating—or operating at less-than-maximum power—the control system tests and functions properly. But when the operator calls for full power—the time when precise control is most essential—the CRT screen may, in the words of one operator, go crazy. This


*See advertisement on page 69

| Ambient Magnetic Field | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Field without Shielding | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Field with Shielding | 0.020 | 0.036 | 0.052 | 0.067 | 0.082 | 0.097 | 0.111 | 0.125 | 0.140 | 0.155 |
| Attenuation Ratio | 50 to 1 | 55 to 1 | 58 to 1 | 60 to 1 | 61 to 1 | 62 to 1 | 63 to 1 | 64 to 1 | 64 to 1 | 65 to 1 |

***Table 1. Magnetic field in gauss before and after shielding. Testing performed per ASTM A698 using a Helmholtz coil and an AC pickup probe. Shield tested was a dual-layer CRT shield, 0.062" thick per layer, designed for use in a steel mill.***

adverse effect of H fields is not confined to the steel industry. Similar magnetic interference problems may occur wherever high electrical currents are utilized.

## MAGNETIC CONTROL

For the control engineer facing what seems to be a problem of magnetic interference, one possible solution is provided by an off-the-shelf magnetic shield enclosing the CRT monitor (Figure 1). Properly designed and installed, such a shield will protect monitors and other shielded devices both mechanically and electronically. In so doing, the shield will help prevent erasures, crashes and glitches. Working with a properly shielded monitor, operators will receive reliable, readable data, and by reducing eyestrain and fatigue caused by jittering images, the shield will reduce annoyance and enhance operator productivity.

Figure 2 shows the strengths of a magnetic field before and after shielding. The shield used for this study was a 2-layer CRT shield, each layer 0.062" thick, designed for use in a steel mill or near an MRI. Table 1 shows the performance of this 2-layer CRT shield, expressed as attenuation level.

In selecting a shield, it should be understood that H fields are quite different from radio frequency interference, which can be shielded with beryllium copper composites, silver, tin, lead, solder or aluminum products. Although these materials may handle RFI effectively, they are completely ineffective as magnetic shields. Only certain proprietary ferromagnetic alloys provide effective shielding against H fields. Formulated for high magnetic permeability, these alloys divert the radiated magnetic field away from sensitive electronic components such as computer and control monitors. A five-sided enclosure built of such an alloy will protect the monitor and provide a clear view of the monitor face for the operator.

Another possible course of action is a field study to provide a detailed analysis of magnetic phenomena at the plant site. This can best be performed by engineers who specialize in magnetic interference problems and who identify sources of interference and the paths through which it travels to the control center. After such a study, either a manufactured shield or a custom-built shield may be recommended. Other steps, such as modifying or relocating power-using equipment or control centers may be indicated. Because such modifications are costly in terms of expense and plant down-time, many engineers recommend the try-and-see approach provided by an off-the-shelf shield.

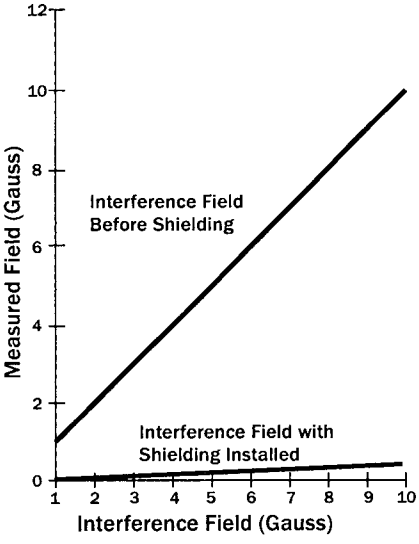


***Figure 2. Effect of magnetic shielding.***

As in many situations involving instrument or control systems, the first step in solving H-field problems is recognizing magnetic interference as the probable cause. Then experience-based solutions can provide efficient performance, assuring satisfaction for both operators and management.

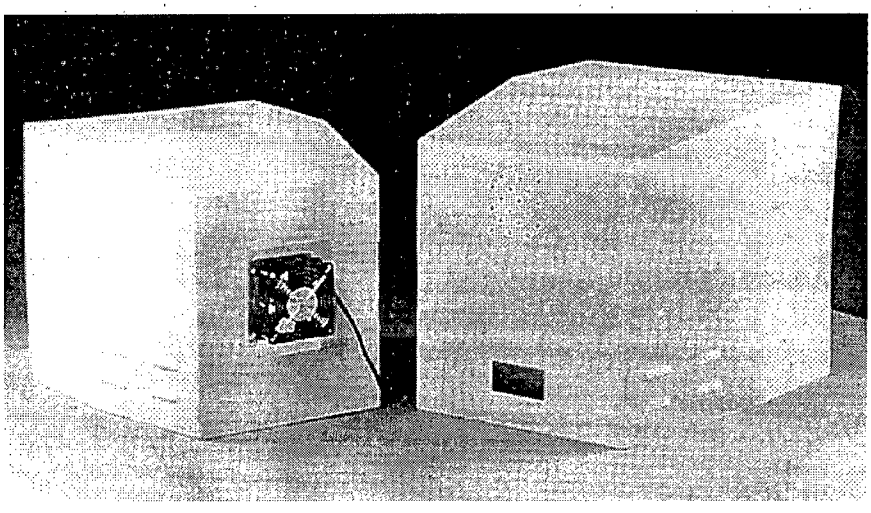

***Figure 1. Magnetic shield for enclosing CRT monitor.***

***BRAD FRIESTEDT*** *is regional sales manager at Magnetic Shield Corporation. He holds a degree in environmental science from Bradley University, and has 18 years experience in the electronics industry. (630) 766-7800. admin@magnetic-shield.com.*