Technical Bulletin

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TOPIC: FERROMAGNETIC MATERIALS NEAR LKP OR LKB CURRENT SENSORS

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INTRODUCTION

The Model LKP and LKB high current measurement sensor systems perform measurements by producing a nulling, magnetic flux in a closed core path, encompassing the primary bus. The close presence of significantly large ferromagnetic structures may cause the magnetic field at some locations in the core to be significantly changed in strength and orientation. Ferromagnetic materials such as steel and iron are used throughout industrial plants. These materials may exist in hidden reinforcing bars in the concrete or in obvious structural components supporting the sensor, the bus or objects near the bus. This technical note provides some guidelines to assure the user that their DynAmp high current measurement systems are not adversely affected by nearby ferromagnetic structures.

DISCUSSION

For more than 20 years, some version of the following statement has appeared in the instruction manuals. “All DynAmp measuring heads should be mounted or supported with non-ferrous materials such as aluminum, wood or phenolic. Use of ferrous mounting materials may cause error in some installations due to adverse magnetic effects”. In today’s competitive environment, where the area of a process line is minimized, more specific guidelines have been requested.

What are the effects of the presence of ferromagnetic masses? How significant is the issue? There are about 10,000 installations of these sensors and their predecessors installed around the globe. In numerous cases, the advice to avoid ferromagnetic materials has been overlooked. Almost all of these installations are operating properly and only in a few have ferromagnetic problems actually been identified. In these few installations, field service people have been called to the site because of suspicions of malfunction only to find massive ferromagnetic structures very near or even supporting the sensors. In extreme cases, very near, massive ferromagnetic masses might result in local saturation in a channel, showing up as a measurement error. In less severe arrangements, large electromagnetic masses can cause shifts in the feedback currents for various channels, shifting the channel voltages and the thermal load sharing of the channels making up the system. However, in general, the effects are local to a channel and do not cause measurement errors because the effects cancel out when summed around the entire closed core path.

Presently there is no practical way to precisely and theoretically evaluate specific cases involving large nearby ferromagnetic masses to issue a performance guarantee, so following are some general distance guidelines. The present Bus Analysis program does not evaluate the impact of nearby ferromagnetic materials. The theoretical evaluation of specific ferromagnetic structures is complex, involving non-linear effects and numerous parameters. Important considerations involve the mass of the ferromagnetic structure, the type of material, its shape, how well joined are the ferromagnetic components, the location and the orientation of the ferromagnetic elements with respect to the channels of the sensor, the size of the sensor and the current in the bus. There is an infinite number of structure combinations that are conceivable. In the future, it may become practical to evaluate specific cases, but for now, DynAmp can only issue a general guarantee based upon the following conservative guidelines. In a given installation, if these admittedly conservative guidelines are not acceptable, please contact DynAmp’s High Current Metering Product Applications Manager to search for a better solution. DynAmp guarantees there will be no adverse effects if the following guidelines are followed.

GUIDELINES

The following statements apply to all sizes of sensors:

1. There shall be no ferromagnetic structures within 500 mm of any surface of the measuring head.

2. There shall be at least 1000 mm spacing to ferromagnetic structures of up to 10 kg.

3. There shall be at least 2000 mm spacing to ferromagnetic structures of greater than 10 kg.

FUTURE WORK

DynAmp recognizes the desirability of providing less restrictive guidelines and will advise when these are available.