Technical Bulletin

NO. 9907

TOPIC: LKP & LKB SENSOR MOUNTING GUIDELINES AND RESTRICTIONS

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ABSTRACT

This bulletin covers installation location topics for the LKP and LKB families of products. Principal issues discussed include the selection of mounting locations with respect to busses and ferromagnetic structures. Other issues examined include water protection, outdoor cover guidelines, ambient temperatures, safety, sunlight, mounting orientation, centering and support methods.

INTRODUCTION

Installation circumstances can either support or degrade the safety, reliability and accuracy of a Model LKP or LKB system. The ideal location is indoors, in a clean, cool, unpolluted environment, on a long, straight section of bus, at a perfect height above the floor, far from other bus currents and large pieces of iron. Because economics dictates the total bus path will be as short as possible, there are few perfect places found in the typical plants so it is necessary to identify the most practical mounting location. This technical bulletin discusses restriction issues and will help the user identify practical locations, select the best, approve it, then provide any necessary support mechanisms.

INSTALLATION ISSUES

THEORY OF OPERATION: The measurement system works by feeding back enough amperes through feedback coils to create a net magnetic flux null balance in a closed path surrounding the bus. The currents required to maintain a null in one section, called a “channel”, of the closed path may be higher than in any other section of the path, creating the hottest local temperature. A major goal is to minimize the hot-spot temperature. A general guideline is that the components reliable life is doubled for every 10 °C it is possible to lower the hot-spot temperature. The hot spot temperature is minimum when the feedback current is evenly balanced around the entire closed path. This condition also allows the system to have the greatest short-term overcurrent operating range.

This technical bulletin generally covers over 30 versions of LKP, LKB and related models. While the structures are similar, there are differences from one model to another so that the general comments of this technical note need to be compared to the specific model to determine its suitability. Customers are encouraged to obtain an advanced copy of the instruction manual covering the model of interest for more specific information. Also, this bulletin refers to other Technical Bulletins but does not cover these issues in detail. You are encouraged to obtain the entire referenced Technical Bulletin from DynAmp.

Throughout this document, the instruction manuals and the specification sheets, the terms “sensor”, “head” and “measuring head” are used interchangeably.

LOCATION SELECTION: To find practical locations, first look for long, straight sections of bus, far from other bus currents and large iron pieces. The choices are limited because the total bus path is designed to be as short as possible. How long is long enough? It is as easy as 1-2-3:

1. DynAmp's application and sales people are available to provide suggestions.

2. DynAmp has general guidelines for locating measuring heads in the instruction manuals and also described in Technical Bulletin 748. These guidelines apply to simple, single cases where there is only one bend or bus nearby.

3. DynAmp has developed a computer program and service to evaluate installations where there are more than one bus or bend to simultaneously consider. More information is available from DynAmp's Technical Bulletin 749, which describes the analysis process and Technical Bulletin 941, which concisely details the information needed to apply for this service. This service is free for situations where a system purchase is under consideration and available at a small cost for relocation of an older system. DynAmp will guarantee proper operation at locations approved by the computer evaluation process.

FERROMAGNETIC STRUCTURES: In general, avoid use of ferromagnetic materials in the support and do not install the sensor near large iron structures. If any part of the LKP or LKB sensor is within 2000 mm of a large iron object, the magnetic field at the closed path core can be changed in strength and direction. In severe cases, this could significantly change the operating point of a channel. More information about ferromagnetic structures is available in Technical Bulletin 987.

AMBIENT TEMPERATURES: One way to minimize the hot spot temperature is to assure free air circulation. Ambient air temperatures in the range of -20 to +55 °C (-4 to +130 °F) are acceptable. The sensor needs to be protected from temperatures above the maximums to avoid permanent damage.

SUNLIGHT: Sunlight falling on the sensor will increase the operating temperature. Sunshade protection is usually necessary. This is one reason why an indoor mounting location or a shelter is desired.

CAUTION: **PROTECT PERSONNEL AND THE SYSTEM FROM ELECTRICAL SHOCK** There may be electrical shock potential between the chassis of the sensor and the bus passing through the aperture. The sensor chassis may be at earth potential because, when shipped from the factory, the head structure may be connected to the meter unit ground connection via the interconnecting cables. There may exist a firm connection from the Meter Unit to earth ground. Contact the factory if sensor has to be isolated from ground.

DIRECT AND INDIRECT WATER

The standard head has been designed for indoor use. The LKP and LKB sensor head designs rated 15 kA and higher meet IP Classification 4 when manufactured, indicating protection from splashing water from any direction. However, users are cautioned that this rating is not a blanket approval for simply installing it outdoors without additional water protection. The measuring heads are splash proof but are not waterproof. The head must be protected from water. The IP Classification 4 acknowledges that some water may penetrate the seal. Water that invades the sensor is likely to cause long term destruction including, but not limited to, swelling of the iron core from rust, undesirable new electrical paths being created, electromachining of metallic materials and corrosion in general. Consequently, it is necessary to provide some rain and snow protective covering if the equipment is to be mounted outdoors or in the vicinity of a sprinkler system. If you must mount the sensor outdoors, here are some shelter design guidelines:

1. Provide top and side covers extending below the sensor such that even horizontal rain does not impinge upon the sensor.
2. Leave the shelter bottom open to allow cooling air to enter the structure from the bottom.
3. Allow enough space on the sides for convection air to rise over the cooling fins of the sensor.
4. Allow hotter air to exit from the top of the structure through baffles or louvers.
5. Use electrically non-conductive materials for the cover structure. Avoid the use of ferromagnetic elements. Avoid contact with the bus and avoid contact with the head.
6. Do not encircle the cross section of a leg with a conductive path as it will act like a short-circuited current transformer winding to any ac ripple or transients.
7. Design the cover structure to allow the head to be shifted off the geometric centered condition with respect to the bus. For voltage isolation, keep an airspace of 25 mm or greater from the inside of the window insulation.
8. It is best to make the shelter in two structures. One to cover the bottom and side legs, the other to cover the top and overlap protection on the side legs.
9. Portions of the structure should be removable so that maintenance may be performed if necessary. An annual maintenance checkpoint is to visually inspect the sensor for evidence of possible leaks in the rubber seal around the aperture.

MECHANICAL SUPPORT METHODS FOR THE SENSOR

Provisions for water and sunlight protection are strongly tied to the mechanical support considerations. Design and installation may be expensive. Before a support method can be established it is necessary to determine where the sensor is to be installed and how it is likely to be oriented and centered. Before finalizing the design, it is recommended you use the free location evaluation service to get DynAmp's comments and guarantee the system will operate well at the anticipated location.

CENTERING: The initial tendency is to geometrically center the bus within the sensor aperture. Seldom will this lead to a minimized "hot-spot" temperature and other performance characteristics may also be less than optimal. The position or orientation

of the bus through the sensor does not affect the accuracy of the measurement except in very severe cases. DynAmp recommends that the mounting mechanism be designed to allow "electrical centering" as described in the instruction manual for the system. This optimizes the installation by slightly repositioning the sensor after start-up. Information about this procedure can be found in the instruction manual specific to the model of your interest. The free bus analysis service will predict the likely mechanical offsets. However, even when an analysis has been accomplished, it is best to create a mounting design which permits mechanical adjustment to the sensor on the bus at start-up. This is particularly true when the drawings supplied for the computer evaluation are preliminary or incomplete. Differences may exist between the simplified initial plans and the final installation.

SENSOR MODEL VARIATIONS

1. SHAPES of the sensors vary from one size to another. Smaller units are either square or rectangular and larger sizes are octagonal. Some octagonal sizes are optionally available in two versions. One is a regular octagon and the other is a stretched version where the sides are not all equal lengths. The computer evaluation will tell which version is best for your particular installation. Consult the specification sheet for the models of interest to you.
2. THE HEADS ARE DESIGNED TO SPLIT APART so they can be installed on a bus without disconnecting the bus. All of the heads are in at least two sections and the largest sizes are shipped in 4 sections.
3. The WEIGHTS of the smallest sensor is only 5 kg while the weight of the largest sensor is 2200 kg. There are significant differences in the mounting details.
4. MOUNTING FEET: Mounting feet are supplied in the standard design for the larger systems because these sensors usually are used to monitor the total bus current. In these cases, the usual bus layout is mostly horizontal except for short vertical transitions. Conversely, mounting feet are not usually supplied in the smaller systems because these are generally used to monitor individual rectifier bus currents. Here the bus layout usually has longer vertical paths, which often are the most suitable mounting locations. Mounting feet, as well as mounting bar kits, are available as options for the smaller systems. See the data sheets for the individual systems for more information.
5. POLARITY: To get an output from the LKP sensors, it is necessary to install the head with the conventional current passing through the head in a specific direction. The sensor drawing shows the conventional current flow direction arrow.
6. INTERCONNECTING CABLE CONSIDERATIONS: The sensor and the metering unit are interconnected by 1, 2 or 4 multi-conductor cables. See the data sheets for details pertinent to the system under consideration. Some installers run the cable(s) in conduit. See the specification sheet for the standard length of interconnecting cable and the lengths permitted without special approvals. Depending on factory approval, sometime even longer cables can be used. From cost and operation standpoints, it may be better to stay with the standard cable length and use a simple two-conductor connection to supply only the feedback current signal to a shunt at a remote point of use.

7. Methods of attachment to heads: See the instruction manual drawings for attachment points on sensors. Generally, these are at flanges and some through bolt holes. For smaller sizes, each of these head halves is made of two large, cast aluminum shell pieces that might be described as the front and back quarter section. The front and back sections are bolted together along the outer spine ridge of the casting. Either or both of the molded front and back pieces may have been molded with a slight warp. During manufacture, these are sealed together with liquid silicon rubber gasket material and the spine ridge bolts are drawn tight, to create an IP -4 rated housing. Once the gasket material has solidified, loosening or removal of the spine bolts can break the seal, destroying the 4 rating. For this reason it is generally forbidden to loosen these spine bolts to move the mounting feet unless special precautions are taken.

ORIENTATION, GENERAL: It is necessary to determine if the mounting plane of the sensor will be vertical, horizontal or other. DynAmp's computer based application service can easily evaluate the intended location before the installation design is created.

VERTICAL MOUNTING METHODS:

- Vertical Mounting Method "A": Support the sensor from below, using mounting feet. The top half of the head can be supported by the bottom half. Some installations set the feet directly upon a pedestal. Lighter weight sensors can be installed upon a shelf that is suspended from above or even from the bus.

- Vertical Mounting Method "B" (Applies only to smaller systems) : Use the optional bus bar mounting kit for these sizes to support the head directly from the bus bar. The busbar mounting kit has to be ordered before manufacturing because extra holes are drilled and tapped in the aluminum head structure and additional pieces are attached to the head. These optional mounting rails and insulating bars mount to the front and back faces of the head to secure it to the bus. After the head is mounted and electrical centering has been performed, there can be holes drilled through the insulator bars and the bus can be drilled and tapped for a set of screws to make the installation permanent.

- TEMPORARY Vertical Mounting Method "C": (Applies only to smaller systems) Hang the sensor on the bus with an intermediate, weight distributing support, made of insulating material. This is feasible with the 30 kA and smaller heads but it is considered desirable only on a temporary installation, for example when the customer wants to check a rectifier. The lower half of a 30 kA head may be supported by the upper half. Therefore, the head may be suspended from the busbar, provided the busbar can accept the extra load. If handled carefully, the aperture isolation plates are strong enough to accept the weight of the -15 and -30 kA head.

- Vertical Mounting Method "D": (Without optional mounting feet) Support the sensor from the sides. It is recommended to attach to four points per head section.

- General comments:
    - Unless the mounting feet are adequately bolted to the base, safety braces are necessary to keep a vertically mounted sensor from falling over in an accident or earthquake.
    - In some unusual installations the result of a computer evaluation results in advice to the customer calling for rotation of the head at some angle with respect to the vertical side of the bus. Mounting in such orientations requires special design.

NON-ORTHOGONAL MOUNTING:
In some unusual installations, the result of a computer evaluation results in advice to the customer calling for rotation of the head at some angle with respect to the bus. Usually, this is for thermal purposes to more equally distribute the heat load among channels. There are three axis of orientation that are easily considered using the computer analysis. These may be termed Yaw (twist), Pitch (lean) & Roll (rotate). Mounting in such orientations requires special design and this is best devised with knowledge of the particular circumstances. These unusual mounting arrangements are only used when no acceptable simple vertical or horizontal position can be found. This may save the customer from the increased cost of using a larger sized system.

HORIZONTAL MOUNTING:
- Space the sensor 25 mm or more above the horizontal mounting platform to allow circulation under the sensor.
- There is a flange that protrudes from the side of the head at the partline between head half A and head half B. Block the head up from the (non-magnetic) platform to allow clearance so the flange does not bear the sensor weight.
- Bolt or block the head in place to prevent unintended movement.
- Do not encircle the cross section of a leg with a conductive path, as it will act like a short-circuited current transformer winding to any ac ripple or transients.

----------SUMMARY----------

This bulletin addresses installation issues in a general way for many models. You are advised to obtain a copy of the instruction manual and technical bulletins to read about the specific model of interest and the issues. DynAmp's application and service associates welcome the chance to discuss any of these topics. Our goal is to supply current metering products of superior accuracy and reliability.