TECHNICAL NOTE

IXTHUS Instrumentation

Kaman KD2300 inductive eddy current displacement measurement systems are tuned for a higher level of perfection

Towcester – UK – July 2011: *As the exclusive UK distributor for Kaman Precision Products Inc. - the high-performance, precision non-contact position measuring systems manufacturer - Ixthus Instrumentation presents the following technical note on its KD2300 family of inductive eddy current displacement systems.*

Inductive / Eddy Current Technology

Inductive / Eddy Current Technology linear displacement sensors rely on inductive techniques to induce current flow in a conductive 'target' without physical contact. The term 'eddy current' refers to the fact that induced current flows in a circular pattern.

It's not just a prox sensor...

The KD2300 from Kaman Precision Products was one of the first inductive eddy current displacement measuring systems designed. The design dates back to the early '70's and after a redesign in the mid-`80's, it has endured at a viable choice for distance measurement to this day.

And it was time for another update.

Distance? Measurement? Most are familiar with the prox or proximity switch which gives you a contact closure or a output voltage level when metal comes within range. Most think it's something magnetic. Yes, it is and it isn't.

It's not the same magnetism that holds your kids' pictures to the refrigerator. The short explanation is this: An oscillating magnetic field (AC) induces circulating currents in a conductive material. These currents generate their own magnetic field that, in turn, affects the source of the field, the sensor. It is the same type of mutual inductance that is exploited to create transformers; however, in this case, the change in field strength with distance is harnessed to generate an output proportional to the distance. The change in the sensor manifests itself in the form of an impedance change, a change in inductance and AC resistance.

So, an inductive eddy-current measurement system can work with any conductive material whether it is magnetic or not. In fact, the most desirable target is aluminum. Nonmagnetic materials give greater changes in inductance per distance and aluminum is inexpensive and non-deadly. Beryllium is actually a better target than aluminum but comes with the problems of handling and machining a poisonous material.

So it sounds simple, but in practice, it rarely is. There is a 'black magic' aspect to eddy-current systems.

It's all in the tuning.

Take a look at all those 'off-the-shelf ' eddy current systems. You'll see specs that quote 3, 5, 10% non-linearity. You'll see a footnote saying that those specs won't apply if you extend the cable. You'll see a footnote saying that the specs are based on aluminum.

What's happening here?

It's all in the tuning.

For an eddy current displacement system, the target, the sensor, the sensor cable and the amplifier input and even the measurement distance are all part of a tuned system. If you want good results, you tune it for your conditions. If you want generic, you widen your specs and it becomes 'off the shelf and less than satisfying as indicated above.

From the start, the KD2300 took a different tact. The electronics and amplifier are generic. Then you add a sensor from a family of almost 50 different sensors (and even more with custom) with different ranges, sizes, and mounting. Finally the key to performance, the 'bridge' card is added.

The resulting calibrated system will deliver a non-linearity as low as 0.1% FSO; temperature coefficients down to 0.02% FSO/Deg C; resolutions down to 10 nm and speeds up to 120 KHz.

And, of course, you can't get all of the above at the same time. This is where the compromises occur that can create a product like the 'off the shelf items. To get better than average performance you must do your 'homework' and craft the sensor and system to the application.

That is the 'why' behind all the sensors and all the bridges. That's not all you need to know, but that's the basics.

END

Typical system set-up using the KD2300

High resolution image available for download from www.tacticalmarcomms.com under downloads for Ixthus.

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