Technicle White Paper

Zettlex
Precision in the Extreme

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Custom versus Standard Sensors

Why do some engineers choose custom sensors and others choose standard 'off-the-shelf' sensors? Often the right choice is not straightforward. Darran Kreit from Zettlex Ltd. examines the pros & cons of custom versus standard position sensors and explains why new technology is changing the rules.

Why would an engineer choose anything other than a standard 'off-the shelf' sensor? After all, there is a huge selection, no shortage of manufacturers and the internet provides a quick and easy way to compare price, performance and availability. Well, there must be a reason because there is plenty of bespoke and customised sensors across all sorts of sectors and seemingly no end to the demand.

The first – and most obvious - reason to choose a custom sensor is that there is not a standard 'off-the-shelf' sensor that meets all, or enough, of your requirements. The second -less obvious - reason is that standard, **off-the-shelf sensors can be more expensive than a bespoke or customised sensor**. Yes, you might want to read that last sentence again. One reason to choose a bespoke or customized sensor is to minimize costs. Let me explain…….

First, let's deal with some terminology. I will use the term 'bespoke' to refer to a sensor which has been designed and engineered to meet a specific customer's requirements. The term 'customised' refers to a sensor which is based on a standard product but whose software or hardware has been modified so it meets a specific customer's requirements. For example, a customised sensor might be a standard unit but fitted

with a mil-spec connector, high temperature electronics or a specific comms protocol. A standard or commercial off-the-shelf sensor ('COTS') sensor refers to a sensor whose specification or build standard remains unchanged.

Fig. 1 – Example of standard 'COTS' angle sensors

To illustrate the different types of sensor, it is tempting to use a parallel with tailor made or off-the-peg clothing. If you are 6'10" with one leg shorter than the other, then a bespoke, made to measure suit is probably a smart choice. If you are 5'10" and 12 stone then off the peg is probably the smart choice. But this analogy does not give the full picture because bespoke and custom sensors are not necessarily just for unusual one offs – instead they are just as frequently the right choice for higher volume, mainstream applications.

Most sensors – by both volume and value - are COTS sensors. Typically, sensor manufacturers group together a similar set of market requirements then develop and make a range of products to suit that group. If you are buying a small number of fairly run-of-the-mill, low to medium specification sensors then such standard ranges are ideal and you can probably buy what you need straight from the internet. Although you will pay a premium price for low volumes, the economics are still in your favour since any

further effort (and hence cost) you might expend in searching and negotiating for the very best deal may well incur more cost than you save.

At the other end of the spectrum, we can consider higher volume, higher specification sensors – for example, those sensors found in robotics, CNC machinery, military or aerospace equipment. Even if you are lucky enough to find a standard COTS sensor that fits a demanding specification, it is likely that such a sensor will have a mechanical form, electrical interface, functionality etc. that has been designed for a group of applications rather than your specific one. As such, you will be paying for hardware and functionality that you may not need. Similarly, you may have to modify the design of your host equipment to accommodate a standard unit. Such changes might include a power supply specifically for the sensor, special cabling, cable routing, different connectors, couplings or mechanical mounts. By Sod's Law your *overall* unit costs will increase.

In higher volume, higher specification areas, bespoke or customised sensor are more likely to be the smart choice. In these cases the initial costs that the sensor manufacturer will charge to engineer a bespoke or customized solution can provide a rapid pay-back. You are likely to save money because you will get (and only pay for) exactly what you need, nothing more, and you will minimize the costs associated with the sensor's mechanical and electrical interface because you can specify exactly what best suits the host equipment.

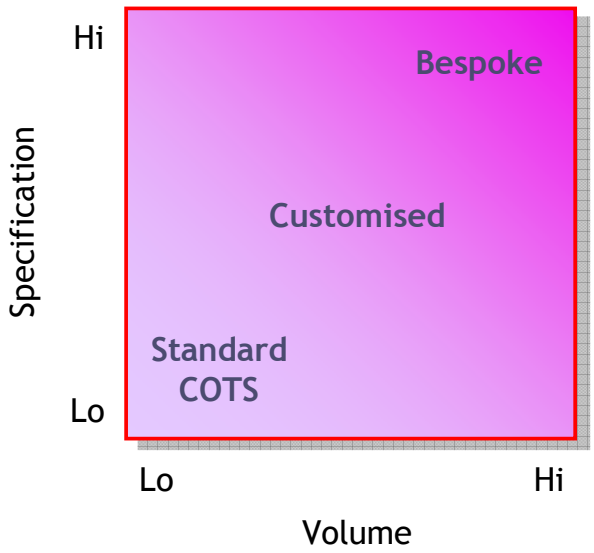

Fig. 2. – Decision grid for sensor selection.

The decision in favour of a bespoke or customised sensor therefore turns on the non-recurring engineering/tooling cost versus the unit cost savings. For traditional sensor technologies, such costs may include significant mechanical design, tooling and re-engineering costs. These high costs for engineering and tooling can be prohibitive for many, mainstream applications and this means that, in many instances, a standard sensor has to be ‘shoe-horned ‘ in to the host equipment and made to work as best it can.

Zettlex technology is changing the decision point between standard and custom sensors by reducing or eradicating much of the engineering & tooling costs needed for a customized or bespoke sensor. Zettlex’s inductive devices are based on printed circuit boards (PCBs) and so a custom or tailored device can be engineered by simply relaying out a new PCB to match the specific mechanical and electrical requirements. The fundamental physics behind these new generation inductive sensors is similar to those of resolvers and linear transformers and it is this fundamental physics that enables measurement stability even in harsh environments. Similarly, Zettlex sensors do not need precision alignment or installation for precision measurements. This means that the mechanical components required to seal, protect and orient the sensor components are simply no longer needed. Instead, the main sensor parts can be mounted directly to

the host machinery. The net effect is that the costs required to engineer a customized or bespoke sensor solution are massively reduced. The sensor unit costs are also reduced since there is no need for a sensor housing, seals, bearings or couplings. The sensor is simply a printed circuit board assembly mounted and housed within the host equipment.

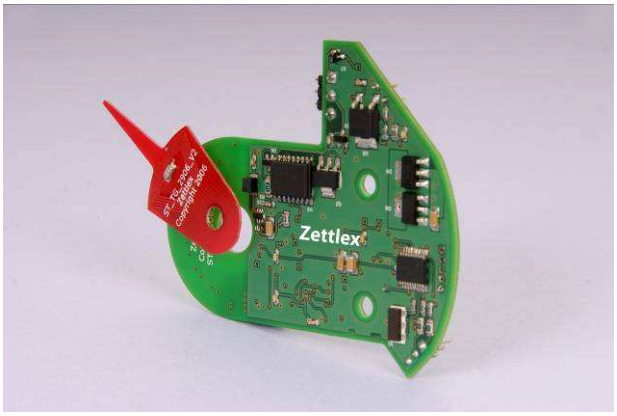

Fig. 3. – Next generation inductive sensor used by Flow-Mon.

The sensor's circuit boards can simply be encapsulated or conformally coated to provide protection against even the harshest of environments; sensors can be powered from 3,3VDC - 240VAC; any connector can be used and the mechanical mounting points chosen to suit the host's own mechanical parts. Shapes include rotary, linear, curvi-linear, 2D & 3D and measurement ranges span from 0,1mm to 10m.

We can illustrate with an example:- Flow-Mon Ltd. of Harrogate make flow meters. Christian Freeman, Flow-Mon's Commercial Director comments "Originally, we used a standard potentiometer to produce a 4…20mA signal of flow. The solution worked well but needed a lot of labour to set up. Then we found that we could swop to a Zettlex sensor which gave us better accuracy and radically simplified installation. The move to a non-contact sensor was also perceived by our customers as a more reliable, long-life solution. We specified the new sensor so that fitting just needed 2 screws; we could program the sensor with a PC and the moving part of the sensor also acted as a pointer

to give visual indication of flow against a scale. The unit cost of the Zettlex sensor was about the same as the potentiometer solution but the big savings on labour and simplification of the production process meant a rapid payback on the engineering cost. Our customers love the solution and now we also use an ATEX variant of the sensor."

For more information on Zettlex inductive position sensors, please contact Zettlex UK Ltd on 01223 874 444 or visit the website at www.zettlex.com or email info@zettlex.com.

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Editor's Notes:

About Zettlex UK Ltd:

Zettlex is a sensors company. The company's range of sensors measure position or speed accurately and reliably, even in harsh conditions.

Zettlex designs and manufactures sensors; supplies sensor components and integrated circuits. The company offers bespoke sensor design and development for specific customer applications.

Unique technology and laminar, printed designs, enables Zettlex to manufacture sensors that have no contacts, no bearings, no delicate parts and zero maintenance.

Zettlex sells directly to OEMs and system integrators across a broad range of industry sectors. Applications include position measurement, servos, motor controls, and user interfaces. Around 50 per cent of the company's business is safety-related or safety-critical.

Zettlex is ISO 9001 and BS EN 13980 certified for the manufacture of electromagnetic sensors, including sensors for intrinsically safe (ATEX) environments.

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