

TECHNOLOGY HANDBOOK

SENSORS

A LOOK INTO THE PRODUCTS, TECHNOLOGIES
AND SOLUTIONS SHAPING THE MARKET

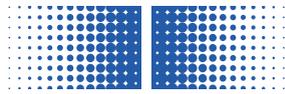
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DIGITAL
SUPPLEMENT TO

MANUFACTURING 
AUTOMATION

MACHINE DESIGN • SYSTEMS • TECHNOLOGY



Baumer

Your Sensor Supplier Doesn't Want You To Read This Ad...

...especially if you are a food or beverage producer concerned with food safety.

That's because our sensors are easy to clean and can thrive in harsh wash-down conditions. You do not have to cover our sensors with a bag or glove or remove them during a wash cycle. This saves you valuable production time and also ensures your machinery can be completely cleaned, including the sensor, without worrying about sensor fogging or leak induced failures. Baumer sensors also survive well in many aggressive environments where other sensors get 'eaten up'. One poultry producer's maintenance department has even dubbed our sensor the 'Super Sensor' since it has survived in applications where the competitors' sensors previously were replaced monthly.

Along with the extremely well sealed and hygienic housing designs, our customers also appreciate our superior sensor performance. From our extended sensing range proximity sensors, to our background suppression and SmartReflect™ photoelectric sensors, to several high precision measurement technologies, tough applications are just plain easier to solve.

For example, Baumer offers the UNAR 18 series of ultrasonic sensors in digital and analog versions. Both versions feature stainless steel housing and a special Parylene coating on the sensing face. The digital version reliably detects the presence of many objects, including clear cups, bottles, or even liquids. The measuring version of the UNAR 18 is particularly well-suited for the contactless level control in filling machines.

For volume measurement, such as used in meat and cheese processing, Baumer provides the OADR 20 series of laser sensors. The OADR 20 uses laser triangulation to provide a high degree of accuracy and a resolution down to 5µm. Baumer laser distance sensors are designed to provide 4-20mA or 0-10v signal directly from the sensor - no separate amplifier; just a single housing with IP69K rating.



The IFBR and IFRR series of inductive sensors are available in both hygienic and wash-down designs. These products feature smooth, continuous or sealed surfaces, corrosion-resistant materials as well as flush and hygienic connections. The sensor is able to withstand frequent and intense (100deg C) cleaning and disinfection cycles. The Eco-lab-tested and EHEDG-certified inductive sensors are particularly well-suited for presence detection in food processing machinery.

Series 14 photoelectric sensors, which are used to detect food or packages on conveyor belts, feature the hygienic and wash-down designs as well. This feature is also present in a version of the SmartReflect™, an award-winning light barrier without a reflector that has a sensing distance of 800 mm. The photoelectric sensors feature an anti-fog lense to increase reliability in high humidity and varying temperatures.

Baumer is already well known in many industries for offering high performance sensors with high quality standards. We have seen the needs of the food and beverage industries and have incorporated our proven technologies into these products. We have designed our sensors to live up to the industry's IP68 and IP69K standards, even after many wash-down and high temperature cycles.

Baumer products are designed and manufactured in Switzerland, with Canadian sales and service support in Burlington, Ontario. Please contact us for more information or a product demonstration.



Baumer

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www.baumer.ca/food-beverage-industry/



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Passion for Sensors

A new member of the family.

O300 – The latest addition to the new performance class for optical sensors.



While the O500 is perfect for long ranges, the O300 is the new member of the family in the 1-inch class, ideal for confined spaces. Baumer gives you safety, ease-of-use and reduced operating costs in all performance classes.

To learn more about
all the advantages of this series, visit
www.baumer.com/O300



Another
Baumer
INNOVATION

SENSOR SELECTION FOR PRESENCE-ABSENCE APPLICATIONS

Knowing where to start when choosing a sensor for your application can be a daunting task. We will discuss the pros and cons of 3 major sensor types to help you get started. The worksheet on the next page can help you make your selection.



Inductive Proximity

How they work:

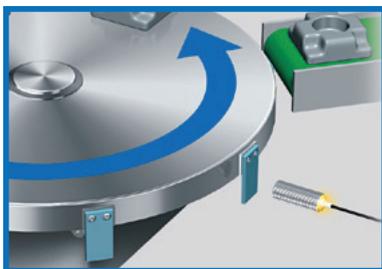
Inductive proximity sensors utilize a magnetic field to detect the presence or absence of ferrous materials when they are in close range to the sensing face.

Pros:

- Unaffected by the target color, texture, or surface.
- Less affected by debris build-up in the environment.
- Able to detect ferrous metal inside an object and not physically visible to the eye or a photoelectric sensor.

Cons:

- Detects only ferrous metal targets.
- Detection range decreases as the percentage of ferrous metal in the target is reduced.
- Detection range typically is limited to 30 mm or less.



Part positioning on an index table

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Omron Automation & Safety is the leading global provider of machine safety and automation solutions, with the know-how to recommend and apply unbiased solutions for our customers whenever and wherever they need us.



Photoelectric

How they work:

Photoelectric sensors utilize a light emitter and receiver to determine "how much" light the sensor receives. This allows the sensor to detect presence or absence of a target.

Pros:

- Much longer sensing distances available compared to proximity sensors. Diffuse reflective sensors typically detect out to 1 meter, while through-beam and retro-reflective sensors have several meter ranges.
- Able to detect a wide range of objects – not limited to ferrous metals.

Cons:

- With diffuse reflective sensors, detection performance is affected by target variation: color, opacity, and surface finish.
- Through-beam and retro-reflective style photoelectric sensors offer more stable detection with target variation; however, two units are required for these sensing set-ups.
- Environmental factors such as a dirt and debris build-up can affect sensing performance.



Clear bottle detection



Fiber-Optic

How they work:

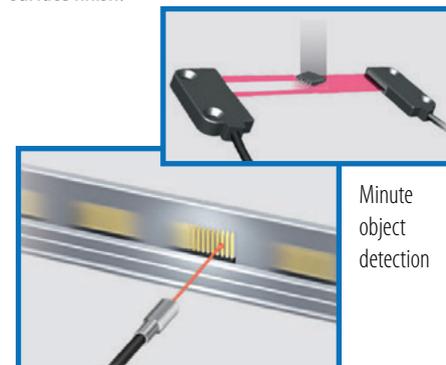
Fiber-optic sensors use the same basic method as photoelectric sensors. The big difference is that fiber-optic sensors utilize fiber-optic cable to provide pathways for the emitted and received light to travel in and out of the amplifier. This gains the user a higher functioning amplifier located on a DIN rail, with a small fiber-optic sensing head.

Pros:

- Improved detection stability compared to standard photoelectric sensors and the ability to fine tune sensor calibration.
- Fiber heads are very small and available in a wide range of sizes and shapes making them great for compact or challenging mounting conditions.
- Separate fiber amplifiers allow for advanced functionality not available on other sensors, such as built-in timers, modes to combat debris build-up, sensor misalignment, and the ability to change power and response time.

Cons:

- Two units are required: an amplifier and fiber head(s).
- With diffuse reflective fibers, detection performance is affected by target variation: color, opacity, and surface finish.



Minute object detection



SENSOR APPLICATION WORKSHEET

The below guidelines are intended to be used as a self-help guide in assessing the scope of sensor applications. The information can be cross-checked with sensor specifications to determine the best sensor for the application.

1. Target Object

2. Target Material

- Metal (Ferrous or Non-ferrous)
- Non-metal Opaque
- Transparent Translucent

3. Target Description and Dimensions

Target finish (shiny, dull, matte, etc.): _____

Target color: _____

Target texture (smooth, various imperfections, etc.): _____

How many different colors, finishes or textures? _____

4. Target Orientation/Spacing

Describe position of target relative to sensing face:

Size of target: _____

Spacing between targets: _____

Number of targets nested together: _____

5. Target Movement/Speed/Velocity

Describe how the target approaches the sensing area (axial/lateral):

Target speed: _____

Cycles per second/minute/etc.: _____

6. Maximum & Minimum Sensing Distance

From target to sensor: Max _____ Min _____

From target to background: Max _____ Min _____

7. Background Description

Describe the area behind the target object relative to the sensor's perspective:

8. Physical/Mounting Criteria

Is target accessible from more than one side? _____

Space available to install sensor: _____

Sensor orientation possibilities: _____

Are mounting brackets required? _____

9. Environment

- Clean Oily Dusty
- Humid Outdoor Indoor
- Submersion Washdown

Temperature: _____

Temperature Variation: _____

10. Control Voltage Supply

_____ VDC, _____ VAC

11. Output Requirements

Number of wires: _____

Number of output/inputs: _____

Describe the load: _____

Inductive: Inrush _____, Sealed _____

- NPN Light-ON Normally open
- PNP Dark-ON Normally closed
- Relay

12. Connection Preference

Connector style sensor with separate cordset required

Pre-wired sensor
(what cable length is required? _____)

MOD-TRONIC

INSTRUMENTS LIMITED

Temperature Sensors for Optimal Performance

Mod-Tronic offers the perfect fit for any temperature and humidity sensing application. From miniature detectors to 100 foot aver-aging thermometer and heavy duty probe assemblies, our selection lets you choose the best model for your needs.

Sensing technology options provide flexibility

Mod-Tronic can supply sensors to work with nearly any type of instrument.

- Resistance Temperature Detectors (RTDs)
- Platinum RTDs with wide range of TCRs
- Range from 0.00375 to 0.003927
- 0.00385 (Minco element "PD") is most popular
- Nickel, copper, and nickel-iron RTD elements
- Non-standard resistance-temperature curves
- Base resistances up to thousands of ohms
- Thin film or wire wound constructions
- Thermistor temperature sensors
- Thermocouple temperature sensors
- Integrated Circuit temperature sensors
- High accuracy humidity sensors and transmitters
- Signal conditioning
- Linearizing transmitters with 4 to 20 mA, 1 to 5 VDC, or other voltage/current outputs
- Explosion-proof temperature and humidity sensor and transmitter assemblies
- Controllers, monitors and alarms for optimal compatibility with sensors

From simple elements to complex assemblies

Mod-Tronic can configure a sensor style to best fit your application and capabilities:

- Basic sensing elements for assembly into your own housing or protective sheath
- Addition of leadwires and terminations to elements
- Packaging into protective sheaths, laminates, custom housings, cabling
- Bendable case designs or preformed to your specifications
- Assembly with fittings, connection heads, thermowells, connectors, feedthroughs
- Assembly with signal conditioning electronics, standard or customized
- Certified measurement and test in our metrology lab
- Certified designs for hazardous locations



Machining and materials

A sensor's construction has a large impact on its thermal time response and resistance to corrosive media. Minco has an advanced machine shop with CAD/CAM capability for economic production of cases and fittings.

We have extensive machining capabilities in a variety of materials:

- Stainless steel in various grades
- Brass
- Copper
- Monel
- Hastelloy
- Titanium
- Rubber, PTFE, plastics

We can plate with nickel, gold, and other metals. Additional services include electro-polishing, passivating, and pressure testing.

Leadwires

Sensors may be furnished with many different types of leadwire and cables to meet application parameters:

- PTFE, silicone rubber, polyimide, Tefzel, PVC, mica/glass, and glass braid insulation over silver or nickel plated copper wire are common selections or specify your own leadwire or cable requirements
- Stainless steel overbraid or flexible armor
- Flat ribbon leads or sensor/flex circuit hybrids

MOD-TRONIC
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Minco designs and manufactures critical components for critical applications. Components that precisely fit your needs and deliver extremely high performance to ensure the highest level of reliability. Minco's products have proven themselves in thousands of applications worldwide. Minco manufactures temperature sensors and transmitters, humidity sensors and transmitters, and flexible heaters with total cost of ownership (TCO) in mind to ensure ease of installation, the highest level of quality and reliability, compatibility to a variety of larger control systems and value-added opportunities for integration and assembly.



Flexible Heaters

Humidity Transmitters

Temperature Sensors & Transmitters

Temperature Controllers

Temperature Monitors

High Performance

- Innovative designs and match calibration drive unmatched accuracy, repeatability and time response
- Custom engineered products available to address unique application requirements

Reliability You Can Count On

- 56 years of MINCO product quality backed by a 3 year warranty with over 30 million sensors sold
- Comprehensive testing and industry certifications including ATEX, FM, UL/CSA and NIST - IECEx coming soon

Cost-Effective

- Dramatically lower cost than comparable competitive products from the industry leaders
- Supports new installations, or as a direct mechanical and electrical replacement for competitive products

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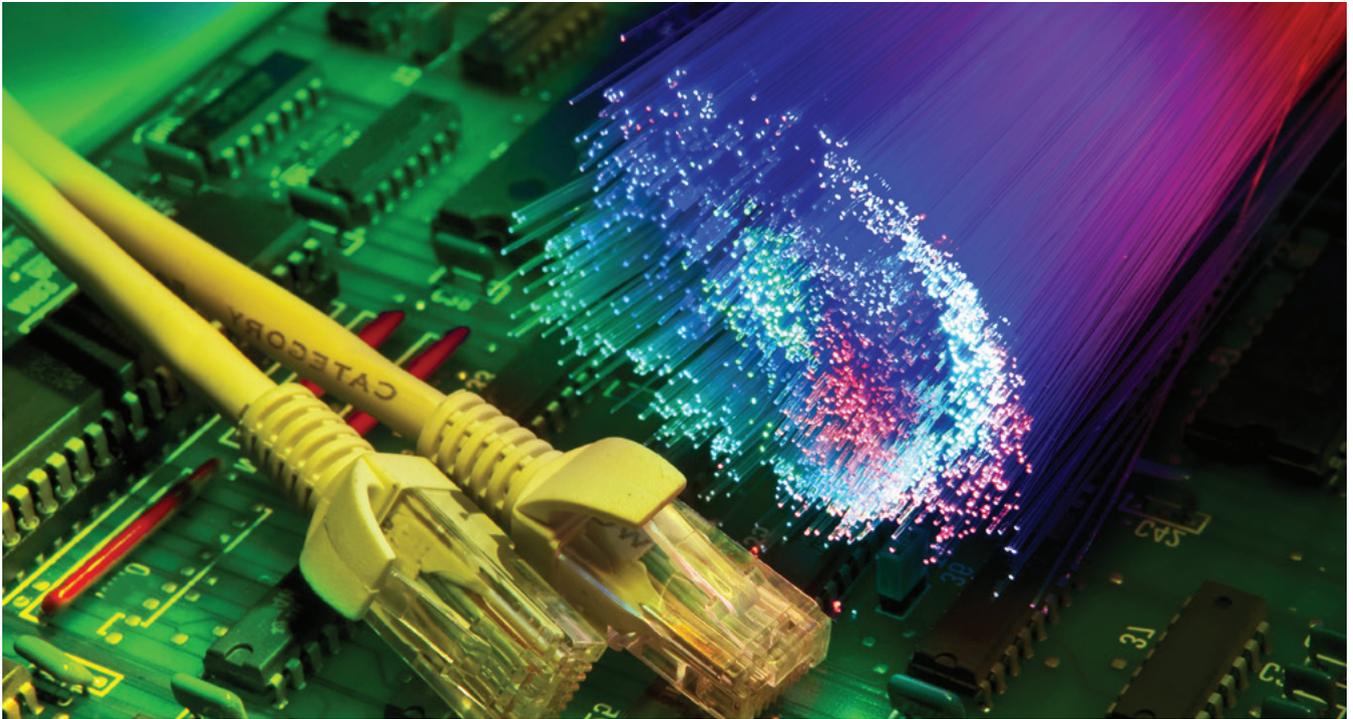
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Can the **INTERNET OF THINGS** drive the adoption of energy harvesters?

BY RAGHU DAS



The Internet of Things adds connectivity to things. It is a broad term referring to applications as diverse as Internet-connected vehicles to consumer electronics such as smartphones. However, the edge of the Internet of Things network will consist of simpler sensors and wireless devices that provide, among other things, the identification of objects, sensing, control and automation.

The simplest, passive RF devices, with relatively short range, will potentially be the highest volume of all devices and come in at the lowest price points. Adding power to these devices enables more functionality such as sensing, mesh networking and automated control. However, the return on investment of many wireless sensors in different applications is dependent in part on the lifetime of the device, which is most usually a function of the battery lifetime. A device lasting 10 years versus two has a dramatic change on the ROI calculation, particularly if these sensors are embedded in devices adding significant labour cost for battery replenishment.

This is where energy harvesters can help. However, there are several challenges moving these to market. The first is buyers buying on cost for the short term. The cost of a primary battery is less than that of an energy harvester and associated interfacing electronics. Over

the life of the energy-harvested powered device, the energy harvester version may be cheaper, but buyers may be incentivised by low upfront cost without taking into account the long-term costs. Then there are batteries that last for longer periods of time, particularly as the energy requirements of circuitry falls. However, these batteries usually command a premium price.

What is needed?

Some of these issues can be addressed in a few ways. Lack of end-user knowledge about the capabilities of energy harvesting technologies and cost over time have to be addressed. There is a need for clear case studies of energy-harvesting powered wireless sensors showing payback versus others. End users are more likely to adopt the technology if it is proven.

The widespread publicity of the Internet of Things will help to gain recognition for wireless sensors and how they can add value. Wireless sensors, forming part of the fabric of the Internet of Things, will increasingly use energy harvesting as a power source.

IDTechEx sees the energy harvesting market by component reaching US \$596 million in 2018, up from US \$163 million in 2014.

Raghu Das is the CEO of IDTechEx.

WEARABLE ELECTRONICS

Motion Engine invests in the market with Montréal International

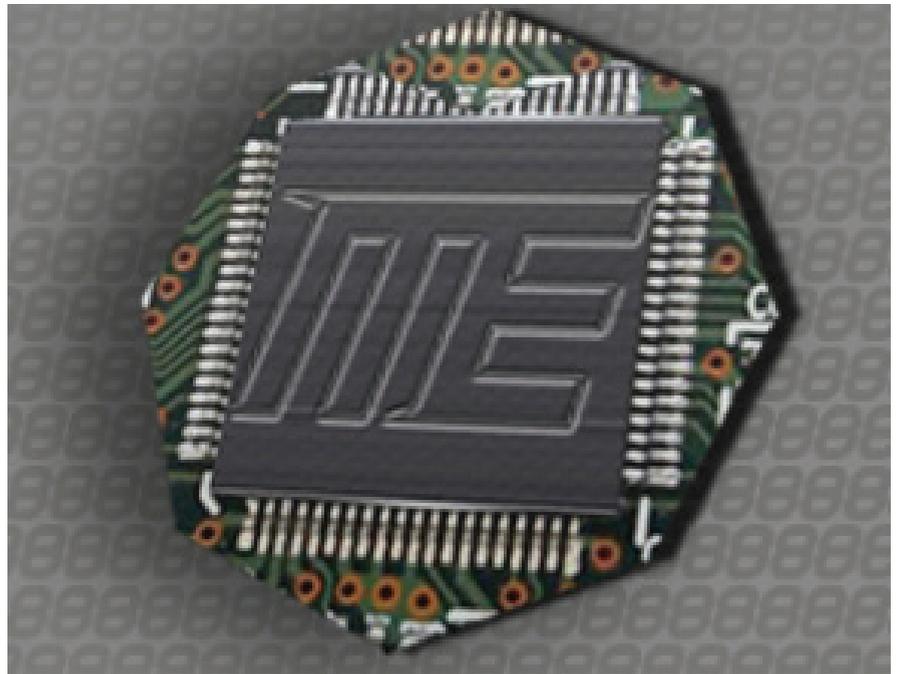
Motion Engine is investing in Greater Montréal to develop its technology and take on the North American and international markets.

The company specializes in next-generation micro-electro-mechanical systems (MEMS) motion sensing systems.

“Greater Montréal is an ideal location to develop our technology and business. Over the past two years, the market for MEMS motion sensing in smartphones and tablets alone breached the \$1 billion mark and by 2018 it is expected to increase at least three fold. The wearable electronics trend will boost the rate of growth exponentially over the next five years — particularly in areas like gaming, health care/medical, fitness and sports,” said Louis J. Ross, CEO of Motion Engine.

The Montréal region maintains leading industrial clusters with internationally competitive large anchor companies for several of these market sectors. For example, the region did an excellent job nurturing a world-class game software development industry. As a result, there is also a great deal of talent to draw from here and from the surrounding areas, including Ontario and the U.S. northeast,” added Ross.

Motion Engine plans to develop new cutting-edge systems for increasingly ubiquitous mainstream wearable and quantified self-oriented electronic devices, including activity trackers that are more and more functional and fashionable. MEMS motion sensors for such applications must provide greater performance, lower cost and higher integration. The ability to produce high-grade inertial sensor systems at low cost is also advantageous for industries that demand greater reliability and higher performance specifications that are standard for the consumer electronics industry. These indus-



“I am delighted that Motion Engine has chosen Greater Montréal to develop their expertise even further.”

Minister of International Relations,
La Francophonie and External Trade,
Jean-François Lisée.

tries include health care/medical (patient monitoring and rehabilitation), industrial (robotics, logistics), automotive (next-generation electronic stability control system or ESC, which are now mandated in most countries) and “self-balancing” transportation vehicles.

The company is also partnered with the MiQro Innovation Collaborative Centre, a \$218-million MEMS/microsystems R&D facility located right outside of Montréal. The centre maintains a world-class facility that is expected to greatly contribute to the

region’s economic growth. The centre’s founding member companies include IBM and Teledyne Dalsa, the world’s second-largest “open” MEMS foundry and an international leader in high-performance digital imaging and semiconductors.

“I am delighted that Motion Engine has chosen Greater Montréal to develop their expertise even further,” said Minister of International Relations, La Francophonie and External Trade, Jean-François Lisée.

Montréal International, which has the mandate to attract foreign direct investment, supported Motion Engine in setting up in the region.

“Success attracts success! We welcome Motion Engine as it joins a solid ecosystem that is focused on innovation and collaboration and brings its expertise in enriching Greater Montréal’s value chain in the highly sought-after Information and Communications Technology sector,” said Dominique Anglade, president and CEO of Montréal International.

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