



WHITE PAPER



Smart Solutions for Sensors

By Don Salladin, Tom Steucek, and Eric Traxler, *Engineering Sales Representatives - Ellsworth Adhesives*

Electronic sensors are the go-to data input device for many industries and tasks. From measuring the airspeed on military drones to the patient evaluations performed by medical testing equipment, sensors have become ubiquitous. They currently represent a \$22 billion market that is growing exponentially due to many developing applications such as self-driving cars and chemical sensing. Many sensors are part of mission-critical systems where they must be optimally protected from adverse operating conditions. Precision sensors are expensive and fragile, and shrinking component design demands that sensors become more intricate and delicate. Engineers are commonly challenged to find a low-cost, manufacturing-friendly method of incorporating sensors into a system that will function in a harsh environment while meeting demanding performance requirements.

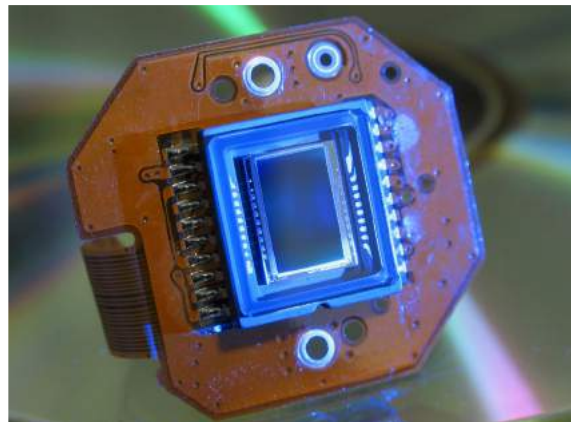
Experienced engineers have discovered that adhesives are critical to sensor assemblies, and they can be effective bonding sensors to almost any surface. Another important fact is that the right potting compound provides excellent protection without hindering sensing abilities. Ellsworth Adhesives offers customized product design solutions that are scalable and can be integrated into any sensor application. Standard dispensing equipment seamlessly assimilates into common processes, but Ellsworth Adhesives can also adapt equipment for unique applications.

"Countless other applications require a ruggedized sensor which can be facilitated by adhesive compounds, without affecting resolution and other qualities."

Protecting Vulnerable Sensors

Sensor-based systems are required to be both accurate and sensitive. Therefore, protecting a sensor is imperative to creating a reliable product with accurate readings, but must be accomplished without compromising instrument sensitivity. This narrow equilibrium is easily upset by poor assembly methods, mechanically constraining hardware, or a hostile environment. Consider tire pressure monitoring systems (TPMS), which utilize pressure sensors to measure the real-time air pressure within an automobile tire. A malfunctioning sensor cannot warn the driver if an unsafe tire condition exists, and as result puts the safety of the driver and other motorists at risk. Yet the same sensor, if encapsulated with an RF-permeable potting compound, is protected from vibration, moisture, and temperature changes while still permitting

communication with the rest of the TPMS. The right encapsulant is a simple and inexpensive key



technology for protecting valuable and potentially life-saving sensors that are otherwise vulnerable to environmental damage. Countless other applications require a ruggedized sensor which can be facilitated by adhesive compounds, without affecting resolution and other qualities.

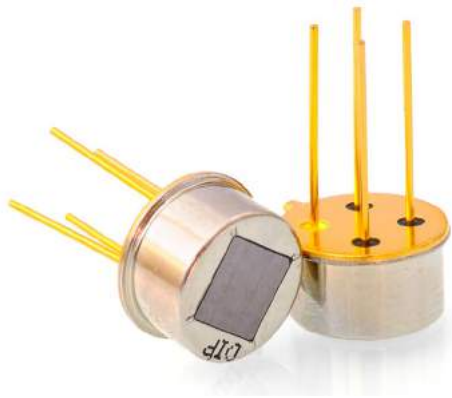
| Sensor type | Example application | Protection from | Properties needed |
|--|--|--|---|
| Ultrasonic, Electromagnetic Acoustic Transducer (EMAT) | Position detection in assembly line | Impacts; vibration; contaminants | Acoustically permeable |
| Load cell | Scales | Thermal expansion; overstrain | Deformation transfer to strain gauge |
| Turbidity | Water quality testing | Water ingress; oxidation | Optical transmission |
| Moisture/temperature (wireless) | Determining wet road conditions | Vibration/shock; compression; corrosives (road salt); weather; temperature | Thermally conductive; RF permeance |
| Inertial | Munitions | Shock; temperature | Disposable (low cost) |
| Myocardial | Monitor patient temperature changes during heart surgery | Contaminants; fluid ingress | Sterility (adhesive unaffected by biocides) |
| Airspeed | Aircraft speed | Extreme temperatures; weather | Instrument exposure to air flow |



Manufacturing Made Easy

Adhesives simplify assembly processes and in many applications can replace costly or vulnerable hardware. Adhesives commonly replace rivets and welding, and UV-curing or dual-curing compounds can conjoin components almost instantly—reducing assembly times and eliminating costly curing equipment. Replacing fasteners and hardware with a high-strength adhesive bond can increase throughput, decrease part count and material costs, and simplify product designs. Electrically conductive compounds can replace physical wires in some instances. Some manufacturers seek a single compound to meet all their adhesive needs, but there is usually a better-suited and more efficient solution specific to each application.

A common challenge faced by consumer electronics manufacturers is adhering sensors to polypropylene, polyethylene and polytetrafluoroethylene plastics. The application



of certain types of epoxies—typically preceded by a primer, corona treatment, or plasma surface-treating process creates reliable adhesion even on

low surface energy plastics where other compounds fail, especially when exposed to thermal variances. Ellsworth Adhesives can engineer a solution that works for any sensor application.

Sensor components which generate heat will benefit from a thermally conductive adhesive, which can route excess heat to an outer case or heat sink to protect sensitive equipment; in rare instances the adhesive itself can dissipate heat. Temperature sensors need a thermally conductive adhesive to ensure reliable readings. These types of compounds are filled with a material that matches the thermal expansion rates of the materials around it to prevent delamination from thermal stress.

Innovative and customizable solutions exist as well. Certain pastes with electrically conductive fillers can create a fuse-like compound to protect against over-currents in a circuit. Casting resins can be used instead of individual component and PCB housings. Compounds can be functionally graded or layered to create a laminated composite, with each material imparting its own mechanical, thermal, or electrical properties. For instance, a sensor can be encapsulated with a dielectric resin, upon which a shock-absorbing compound is then overlaid. An RF or EMI shielding adhesive can then be used to create a virtually incorruptible sensor. Similarly, an adhesive solution for RF applications must have a precise dielectric value or system performance may be compromised.

Learn how the industry-leading sensor solutions experts can empower your manufacturing by calling 800-888-0698 or visiting www.ellsworth.com.



Ellsworth Adhesives Solutions

Finding the right adhesives for your company's sensor applications doesn't need to be a dilemma. Ellsworth Adhesives has been finding individualized adhesive solutions for customers in every industry for more than 40 years. A global network of experienced engineers and representatives means Ellsworth Adhesives can serve any market, and can also evaluate their customer's requirements on-site.

Ellsworth Adhesives also maintains a network of equipment suppliers to help customers procure equipment and materials, as well as integrate the dispensing and application of adhesives into manufacturing and assembly processes. In most cases this standard processing and dispensing equipment can be used for different compounds, which helps keep costs down, but is also easily reconfigured. The Engineering Sales Representatives at Ellsworth Adhesives are available to help you assimilate machinery into operations and train personnel while also diminishing down times.

Ellsworth Adhesives is more than an adhesives supplier; they are product design specialists and collaborators who can optimize your product lines and maximize revenues. Enlist Ellsworth Adhesives as your complete adhesives solutions analysts by calling 800-888-0698 or visiting www.ellsworth.com.

Ask the Glue Doctor[®]

About Ellsworth Adhesives

Ellsworth Adhesives is a distributor of adhesive products and equipment. Ellsworth Adhesives is a value added supplier of adhesives, sealants, coatings, encapsulants, tapes, releases and lubricants from leading international manufacturers including 3M, Bostik, Dow Corning, Dymax, Emerson & Cuming, Fisnar, Henkel Loctite, Lord, Permabond, Techcon and many others and offers the most comprehensive level of technical expertise available. Ellsworth Adhesives operates sales offices and warehouses in the United States, Canada, Mexico, United Kingdom, France, Spain, Germany, Sweden, Finland, Denmark, Brazil, Australia, China, Malaysia, India, Vietnam, and Thailand. For more information, visit www.ellsworth.com.



Copyright © 2015 Ellsworth Corporation. All Rights Reserved.

