INTROTEK®

Excellence In Ultrasonic Technology SM

Non-Invasive Ultrasonic Air Bubble Detection

Liquid Level Sensors & Electronics

Introtek Sensors: When Performance Matters

Introtek International designs, manufactures and markets non-invasive ultrasonic air bubble and liquid level detection systems.

Beginning operations in 1982, we became a wholly-owned subsidiary of Magnetrol International—a worldwide leader in industrial level and flow instrumentation—in 1986. Since then, the companies have engaged in collaborative R&D efforts for the enrichment of both firm's product lines.

Introtek's Edgewood, NY plant and offices.

Core Competencies

Though Introtek sensors and electronics serve a wide range of industrial applications, our company's primary market is supplying sensing systems for patient-connected medical devices. These sensors aid in the detection of air bubbles flowing through tubing, and thus prevent air embolism in arteries and veins during medical procedures. Introtek's liquid level sensors assure that liquids are maintained at optimum levels during various processes.

Our products lead the way in meeting O.E.M. customers' needs for sensors and electronics that are compact, accurate, highly reliable and reasonably priced. Introtek's standard sensors attach at the desired point of detection to the outside of stainless steel, glass, or rigid and flexible plastic tubing with diameters as small as 1/16" or in vessels as wide as four feet. When O.E.M. devices pose sensor or electronics requirements not met by our standard products, we can custom design and produce them for your special needs.

We manufacture our products in Edgewood, NY (50 miles east of New York City) and at Magnetrol's world headquarters in Downers Grove, IL (20 miles west of Chicago).

Magnetrol®

Introtek is a subsidiary of Magnetrol International. An innovator in liquid level and flow technologies since 1932, Magnetrol's customer base today extends to over 100 countries.

Advanced Technology

Introtek's sensors utilize a patented pulse-type ultrasound, an advanced technology that detects air, air bubbles, or liquid level with the highest degree of accuracy and reliability. Pulse ultrasound—which is not susceptible to the limitations exhibited by continuous wave ultrasound or by optical detection systems—forms the heart of Introtek's products.

Quality Assured

Introtek's production operations represent the leading-edge in manufacturing. Our manufacturing practices conform to the identical standards as those of medical device manufacturers. An ISO-certified company, our quality system is also TUV certified to meet the established requirements for the development, production and distribution of ultrasonic air bubble detectors. Introtek stands behind the quality of every product with a three-year product warranty.

INTROTEK's CERTIFICATIONS

ISO 13485: 2003
ISO 9001: 2000
EN 60601-1
DIN VDE 0750

TUV PRODUCT SERVICE

Whether you require standard or custom-designed sensors and electronics, our comprehensive design and manufacturing capabilities—along with our solid record of O.E.M. service proficiency—will provide you with the most reliable ultrasonic-based detection products available today. n

Industries Served

Primary Industry: **Medical Devices**

Apheresis: Introtek sensors and electronics perform a critical safety role in Apheresis Blood Component Collection Systems in which blood is collected, separated into its basic constituents, specific blood components are removed, and the remaining blood is returned to the donor.

Auto Transfusion: In autologous transfusion procedures where a patient's blood is removed for subsequent reinfusion, Introtek sensor products are an integral part of Continuous Autologous Transfusion Systems (CATS).

Blood Processing: Processing equipment relying on our sensors is used for a variety of treatments; some treat blood and return it to the patient while others remove unwanted pathogens in blood being stored for future use.

Hemodialysis: Introtek products enable safe dialysis procedures where an "Artificial Kidney" machine removes wastes and fluid from blood with a dialyzer system and then returns the cleansed blood back to the patient.

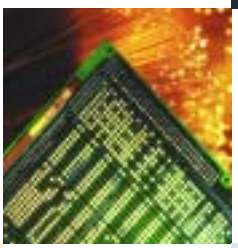
Liquid Chromatography: High Performance Liquid Chromatography (HPLC) and other methods which identify, separate, purify, and quantify a variety of compounds utilize Introtek sensors.

Infusion and Syringe Pump Devices: Introtek's products are used in devices that administer intravenous medications and solutions in neonatal, aesthesia, epidural and critical care units.

Cardio-Pulmonary Systems: Organ transplants and surgical procedures that require an extracorporeal bypass circuit to take over a patient's heart and lung functions employ heart-lung machines with Introtek sensors and electronics for embolism protection.

Dispensing: Biotechnology, medical device and other life science manufacturers credit Introtek's sensing products with improving efficient dispensing of drugs, coatings, therapeutic agents and hot melt adhesives.

Biotechnology



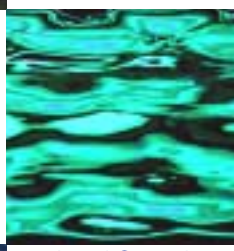
Semiconductor

Pharmaceutical

Chemical Control

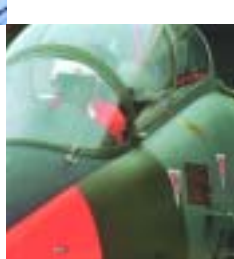
Fluid Treatment

Diagnostic Industries



Level Control

Analytical Industries



Military Applications

Introtek's Non-Invasive Approach to Ultrasonic Sensing

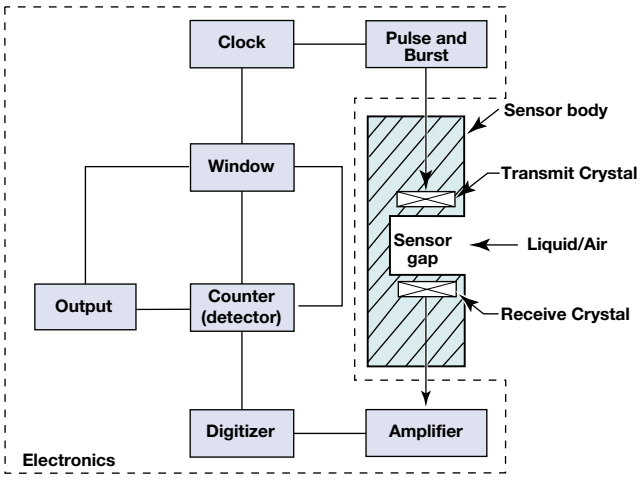
Introtek's pulsed ultrasonic technology for air detection was developed and patented to overcome many of the difficulties and limitations associated with other types of air-detection technologies.

Operating Principle:

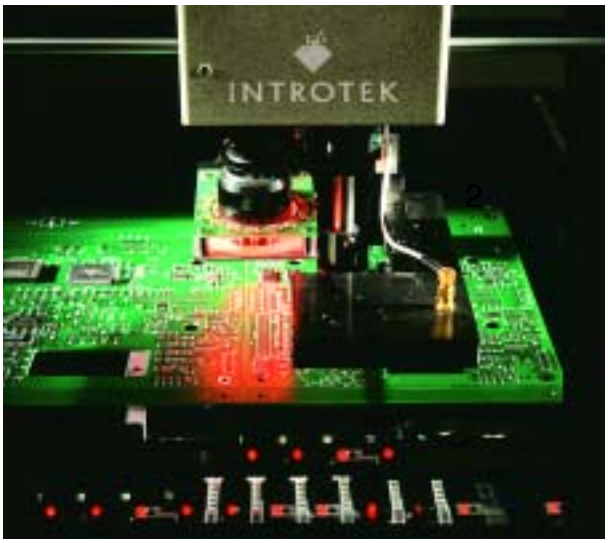
Pulse-type ultrasound detects the presence of air or liquid based on the velocity or transit time of the receive signal. Introtek sensors contain integral piezoelectric crystals which utilize high frequency acoustic energy. These crystals send and receive pulses of ultrasonic energy which detect the presence of air, air bubbles and fluids.

The transmit signal of Introtek's pulse ultrasound consists of short bursts or pulses of ultrasonic energy. Following each pulse, the electronics "looks" for a return signal within a specific window of time, which corresponds to the time it takes for the energy to pass through the liquid-filled tubing. Only signals received within this temporal window will indicate fluid. Signals which have been interrupted by air will not be received within this window, thus causing the electronics to send out the appropriate air warning indication to the operator.

Introtek's Pulse System Ultrasound



Above: The transmit piezoelectric crystal converts electrical energy into ultrasonic energy. The receive piezoelectric crystal converts the ultrasonic energy that is transmitted across the gap when liquid is present, back into electrical energy



Introtek's ultrasonic circuit boards are manufactured with state-of-the-art laser guided systems which are capable of selecting and placing many thousands of integrated circuit components an hour.

Advantages of Pulse Ultrasound:

- **Applications Flexibility.** Pulse wave technology is unaffected by optical, dielectric, or physical properties of the tubing or fluid.
- **Non-Invasive Design.** Because there is no physical contact between Introtek sensors and the fluid, liquid compatibility and sterility concerns are eliminated. Compared to invasive technologies, pulse ultrasound dramatically reduces system maintenance.
- **Solid State Design.** With no moving parts in its design, mechanical failure is eliminated.
- **No Calibration Required.** The high-efficiency system design provides optimum performance while eliminating the need for intricate and tedious field calibration.
- **High Noise Immunity.** Introtek's pulse technology greatly reduces the effect effects of EMI and RFI noise to its air detection components.
- **Design Flexibility.** A variety of standard designs are available, from single stand-alone systems to low cost, high volume modular designs for O.E.M. applications. Introtek also develops custom sensors and electronics from concept to completion. n

INTROTEK® SENSORS

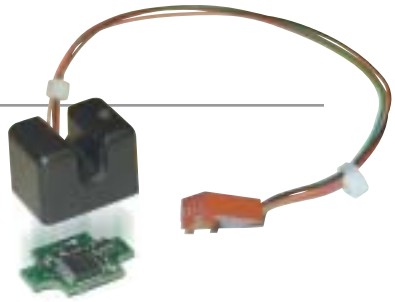
Introtek's non-invasive air detection systems are ideal for critical applications where air, air bubbles or foam require detection through rigid and flexible tubing. Sensors can also perform as a liquid level detector in larger tubing or vessels. Applications include patient-connected medical devices, chromatography, dispensing and other industrial applications.

Integral Sensors

AD8
Rigid Tubing

AD9
Flexible Tubing

AD8 / AD9 air bubble detection sensors incorporate Introtek's latest generation "MEC" pulse-type ultrasonic circuitry. The micro-controller based circuitry is located integrally in the sensor assembly. Custom algorithms for functionality control (such as those for response times, time delays, etc.) can be designed to meet specific customer requirements.



AD8/AD9 Integral Sensors

BD8
Rigid Tubing

BD9
Flexible Tubing

The **BD8 Integral** combines BD3 electronics with a BDP, free-entry sensor head. Constructed of soft polyurethane, BD8 is recommended for rigid tubing.

The **BD9 Integral** combines BD3 electronics with a BDF sensor head. Constructed of rigid epoxy or ABS plastic, BD9 is recommended for flexible tubing.

BD9 Integral Sensor
for flexible tubing

Free-Entry Sensors

BDP
Rigid Tubing

BDP Free-Entry Sensors are recommended for applications requiring detection in rigid tubing. The BDP sensor is constructed of soft polyurethane and is available with or without a mounting base.

BDP Free-Entry Sensor
shown with a mounting base

BDF
Flexible Tubing

BDF Free-Entry Sensors are recommended for applications requiring detection through soft, flexible plastic or rubber tubing. The BDF sensor is constructed of either rigid epoxy or ABS plastic for use with flexible tubing and is available with or without a mounting base.

BDF Free-Entry Sensor
shown without a mounting base

Strap-On Sensor

BDS

Air Bubble, Liquid Level Detection

BDS Sensors are designed to work well with a wide range of tubing materials and sizes. When utilized with Introtek's circuitry they provide the most reliable strap-on bubble detection. BDS sensors are typically used on tubing larger than one inch and can detect point level on containers up to four feet in diameter.

BDS Strap-On Sensor

Clamp-On Sensors

BDR

Non-Mounting Base Style; Rigid Tubing

BDR Round Clamp-On Sensors consist of a sensor and electronics and are designed to work with a wide range of tubing materials and sizes. When utilized with Introtek's circuitry they provide the most reliable clamp-on bubble detection. Designed for rigid tubing, BDR is recommended for applications where a mounting base is not a requirement.

BDR Clamp-On Sensor

BDC

Mounting Base Style; Rigid Tubing

BDC Clamp-On Sensors are recommended for applications that are similar to the BDR sensor (above) except that it has a mounting base to meet that requirement. The BDC sensor is also designed to work best with rigid tubing.

BDC Clamp-On Sensors

Drip Chamber Level Sensor

Drip Chamber Level Sensor

Drip Chamber Level Sensors are designed for soft drip chambers and tubing of various diameters and tapers. Featuring simple unibody construction with no moving parts, the sensor is not affected by fluid color or tubing discoloration. Designed to resist the effects of chamber relaxation, slippage or vibration, the sensor allows for constant visual confirmation of fluid level.

Drip Chamber Level Sensor

Optical Blood Leak / Blood Component Detector

Blood Leak Detector

Introtek's **Blood Leak Detector** is a non-Invasive, compact, free-entry design with integral micro-controller based circuitry. Detection threshold of blood is AAMI compliant for Dialysis applications. The detector features temperature-compensated operation and adjusted sensitivity and output logic for colorimetry applications.

Blood Leak Detector

Custom Designed Sensors

Custom Designed Sensors will fulfill your particular applications needs when standard sensors do not. Custom sensors are developed within our state-of-the-art design and manufacturing system to meet each customer's unique requirements. Contact us for full details on our custom design and development services.

INTROTEK® ELECTRONICS

Introtek's Pulsed Ultrasonic Electronics generate the transmit signal and process the return signal. Introtek's patented technology allows for greater applications flexibility. Its accuracy is unaffected by optical, dielectric, or physical properties of either the tubing or the fluid.

MEC

MEC Electronics feature pulse-type ultrasound in conjunction with sensor assemblies to detect air, bubbles, foam or liquid level in tubing and vessels. A programmable micro-controller allows for custom tailored functionality specific to your application. The MEC circuitry is small enough to be located within sensor heads of various designs for a compact, integral sensory assembly.

BD2

BD2 Electronics provide open collector output. This board is recommended for applications which require unique input/output features or when specialized factory calibrations are necessary. The BD2 electronics work particularly well with stainless steel applications and with BDS strap-on sensors.

BD3

BD3 Electronics are designed for high volume O.E.M. applications which require surface mount technology, compact size and economical price. The BD3 board provides the user with a TTL/CMOS output.

Custom Pulsed Electronics

A Custom Designed Electronic Circuit can be produced for you when standard electronics will not meet your project requirements. Custom electronics are developed within our state-of-the-art design and manufacturing system to meet your exacting requirements. Contact us for full information on our custom capabilities.

When performance matters, rely on the people whose mission is to provide you with the most reliable non-invaisive fluid detection products available.

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