



The Introtek Advantage provides products of unsurpassed quality, functionality and dependability that are manufactured to the highest medical device standards and backed by a three-year warranty.

BD2 Pulsed Ultrasonic Electronics

The BD2 pulse-type ultrasonic circuit board is used in conjunction with Introtek sensors for air bubble, air-in-line and liquid level sensing applications.



Introtek's 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 in stainless steel applications and with the BDS strap-on sensor.

TECHNOLOGY

Introtek's air bubble detectors and liquid level sensors utilize high-frequency acoustic energy to monitor tubing or vessels for the presence of air, air bubbles, foam or liquid. The sensor's piezoelectric crystals are placed in direct contact with the desired point of detection. Air detection sensors and electronics emit pulses of ultrasonic energy which are sent through tubing and returned within a specified "window" of time. If air is present, the ultrasonic signal does not arrive within this "window" of time and a warning or dry signal is immediately transmitted.

HIGHLIGHTS

- ◆ Non-invasive technology does not contact the fluid or require a break in the tubing.
- ◆ Fastest air bubble detection circuitry available.
- ◆ Works with a variety of sensor configurations to meet many applications.
- ◆ Self-test (optional) and fail-safe logic.
- ◆ High EMI and RFI noise immunity.
- ◆ Low cost, premium performance.
- ◆ Low power consumption.
- ◆ Not affected by fluid color or changes in tubing material.
- ◆ Air detection threshold or bubble size can be user-specified.
- ◆ Custom manufactured systems for OEM applications available.
- ◆ 5, 12 or 24 VDC operation.

INTROTEK'S CERTIFICATIONS



APPLICATIONS

- ◆ Air bubble, air-in-line and liquid level sensing
- ◆ Patient-connected medical devices, including:
 - Apheresis
 - Auto-transfusion
 - Infusion pumps
 - Perfusion-based "life support" devices
 - Heart-lung bypass
 - Dialysis
 - Cardiac assist pumps
- ◆ Immunoassay and diagnostic equipment
- ◆ Liquid and chemical dispensing
- ◆ Blood processing equipment

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FUNCTIONAL SPECIFICATIONS

Response Time:

Wet to Dry (liquid to air) 450 microseconds maximum;
Dry to Wet (air to liquid) 60 milliseconds minimum

Output Pulse Width:

The output will continue to indicate the presence of air for 60 milliseconds after the bubble has passed through the sensor to allow fast moving bubbles to be detected.

Liquid:

Bubbles will be detected in almost any liquid; however, groups of micro-bubbles or foam will also be detected as bubbles.

Temperature Limits:

Operating: +41° to +140° F (+5° to +60° C)
Storage: -4° to +185° F (-20° to +85° C)

Humidity:

0% to 95% Non-Condensing

ELECTRICAL SPECIFICATIONS

Input Voltage:

5 VDC, 12 VDC, 24 VDC ($\pm 10\%$)

Current Consumption:

30 mA maximum

Output:

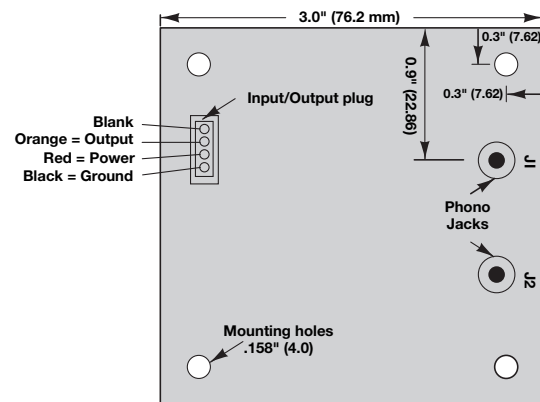
Open collector, 28 VDC, 150 mA maximum sinking
Fluid indication = Ground closure
Air indication = Open circuit

Self-Test (optional):

Connect the test lead to ground to activate self-test.
Self-test will disable the internal transmitter, resulting in an output indication of air.

Calibration:

Pre-calibrated at the factory



BD2 Electronics

Dimensions shown in parentheses are millimeters.

VALIDATION TESTING

The BD2 Series Pulsed Electronics was designed to be tested in conjunction with the following specifications;

Electrical Fast Transients:

IEC 61000-4-4:2004

Radiated Emissions, Group 1, Class B:

CISPR 11

Electrostatic Discharge:

IEC 61000-4-2:2002

Radiated Immunity:

IEC 61000-4-3:2002

Power Frequency Magnetic Fields:

Performed per IEC 60601-1-2:2004

General Safety Requirements:

IEC 60601-1:1988

THREE YEAR WARRANTY

All Introtek systems are warranted free of defects in materials or workmanship for three full years from the date of original factory shipment.

If returned within the warranty period; and, upon factory inspection of the unit, the cause of the malfunction is determined to be defective material or workmanship; then, Introtek will repair or replace the system at no cost to the purchaser (or owner) other than transportation.

Introtek shall not be liable for misapplication, labor claims, direct or consequential damage or expense arising from the installation or use of the equipment. There are no other warranties expressed or implied, except special written warranties covering some Introtek products.

