Internet Enabled Real-time Gas Detection Equipment And Instrumentation

iBall Instruments
Chloride Detector System
Description & Operation Manual

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1. OVERVIEW – IBALL INSTRUMENTS CHLORIDE DETECTOR SYSTEM

The iBall Instruments Chloride Detector System allows the user to easily and reliably detect the amount of chlorides found within the drilling fluid while drilling for natural resources of oil and gas.

The Chloride Detector System was developed using digital signal processing techniques and the very latest in high frequency and extreme low power detection techniques. Couple that with integrated WITS feed through interfaces, a robust power system, and iBall Instruments presents a system unique in the industry.

Further, when utilized with the iBall Instruments Bloodhound system that integrates 3G wireless technology, Ethernet connectivity with an embedded switch to provide real-time monitoring and charting via the Internet anywhere in the world.

The Chloride Detector system is composed of a detector head end system that is lowered into the free flowing drilling fluid (also known as “mud”) and will monitor the conductivity of the fluid in question utilizing high frequency technology developed for the military in the 1990’s. This detector interface section is connected to the sensor driver using 18 gauge two conductor wire. The sensor driver in turn is connected to the Bloodhound Gas Detector and Chromatograph system.

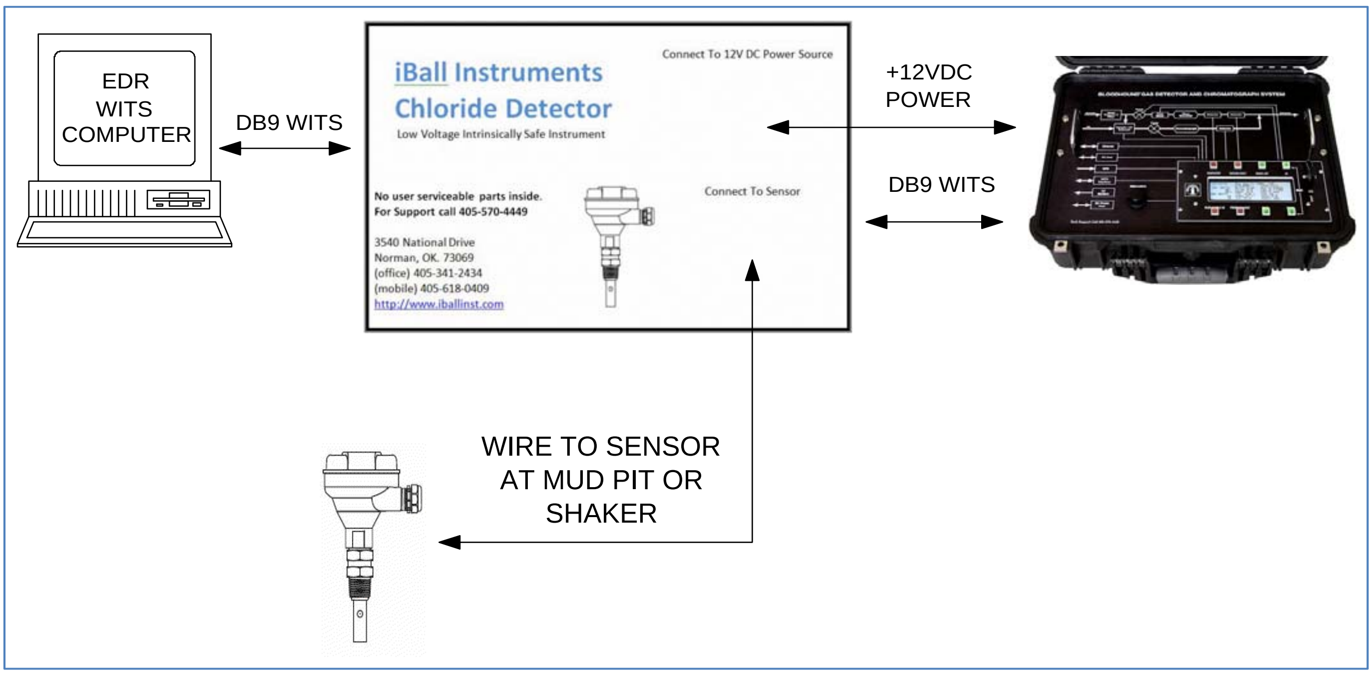

FIG 01. Hookup of Chloride Detector System

Conductivity is a measure of how well a solution conducts electricity. The amount of Chloride in a water based fluid can easily be calculated from this measured conductivity.

To carry a current a solution must contain charged electrons, or ions. Most conductivity measurements are made in aqueous (water based) solutions, and the ions responsible for the conductivity come from electrolytes or chemical salts or acids dissolved in the water.

Salts (like sodium chloride and magnesium sulfate), acids (like hydrochloric acid and acetic acid), and bases (like sodium hydroxide and ammonia) are all electrolytes which can conduce minute amounts of current at extremely low voltages. Although clean water itself is not an electrolyte, it does have a very small conductivity due to impurities, implying that at least some ions are present. The ions in pure water are hydrogen and hydroxide, and they originate from the dissociation of molecular water.

Conductivity is not specific. It measures the total concentration of ions in solution. It cannot distinguish one electrolyte or ion from another. Not all aqueous solutions have conductivity. Solutions of non-electrolytes, for example sugar or alcohol, have no conductivity because neither sugar nor alcohol contains free ions nor do they produce ions when dissolved in water.

The iBall Instruments Chloride Detector System consists of two metal electrodes made from titanium that is in contact with the electrolyte solution under test which is the drilling fluid. The detector system applies an alternating high frequency very low voltage to the electrodes.

The resulting electric field causes the ions to move back and forth producing a current in the same manner as a capacitor. Because the charge carriers are ions, the current is called an ionic current. The analyzer measures the current and uses Ohm's law to calculate the resistance of the solution (resistance = voltage/current). The conductance of the solution is the reciprocal of the resistance. The ultimate amount of calculated Chloride is based on this resistive or conductive measurement.

The amount of ionic current depends on the total concentration of free ions in solution, the size of the electrodes, and on the length and area of the solution through which the current flows. The current path is defined by the sensor geometry, or sensor constant, which has units of 1/cm (length/area). Multiplying the conductance by the cell constant corrects for the effect of sensor geometry on the measurement. The result is the conductivity, which depends only on the concentration of ions.

Although the cell constant has a geometric interpretation (length divided by area), it is rarely calculated from dimensional measurements. In most designs the electric field is not confined between the electrodes, so the actual length and area are greater than predicted. In practice, the cell constant is measured against a solution of known conductivity. The cell constant is the ratio of the known conductivity (µS/cm) to the measured conductance (µS).

The usual conductivity range for a contacting sensor is 0.01 to 50,000 uS/cm. Because a given cell constant can be used only over a limited range, two, possibly three, cell constants are required to cover the entire range. Common cell constants are 0.01/cm, 0.10/cm, 1.0/cm, and 10/cm. Higher conductivity samples require larger cell constants.

In the four electrode measurement, the analyzer injects an alternating current through the outer electrodes and measures the voltage across the inner electrodes. The analyzer calculates the conductance of the electrolyte solution from the current and voltage. Because the voltage measuring circuit draws very little current, charge transfer effects at the metal-liquid interface are largely absent in four-electrode sensors. As a result, a single four-electrode sensor has a much wider dynamic range than a two-electrode sensor, roughly 1 to 1,4000,000 µS/cm. Like the two-electrode sensor, the four-electrode sensor has a cell constant, which depends on the area, spacing, and arrangement of the current and voltage electrodes. This variance gives iBall Instruments the ability to change and adjust for the needs of the customer.

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2. DETECTOR HEAD MODULE

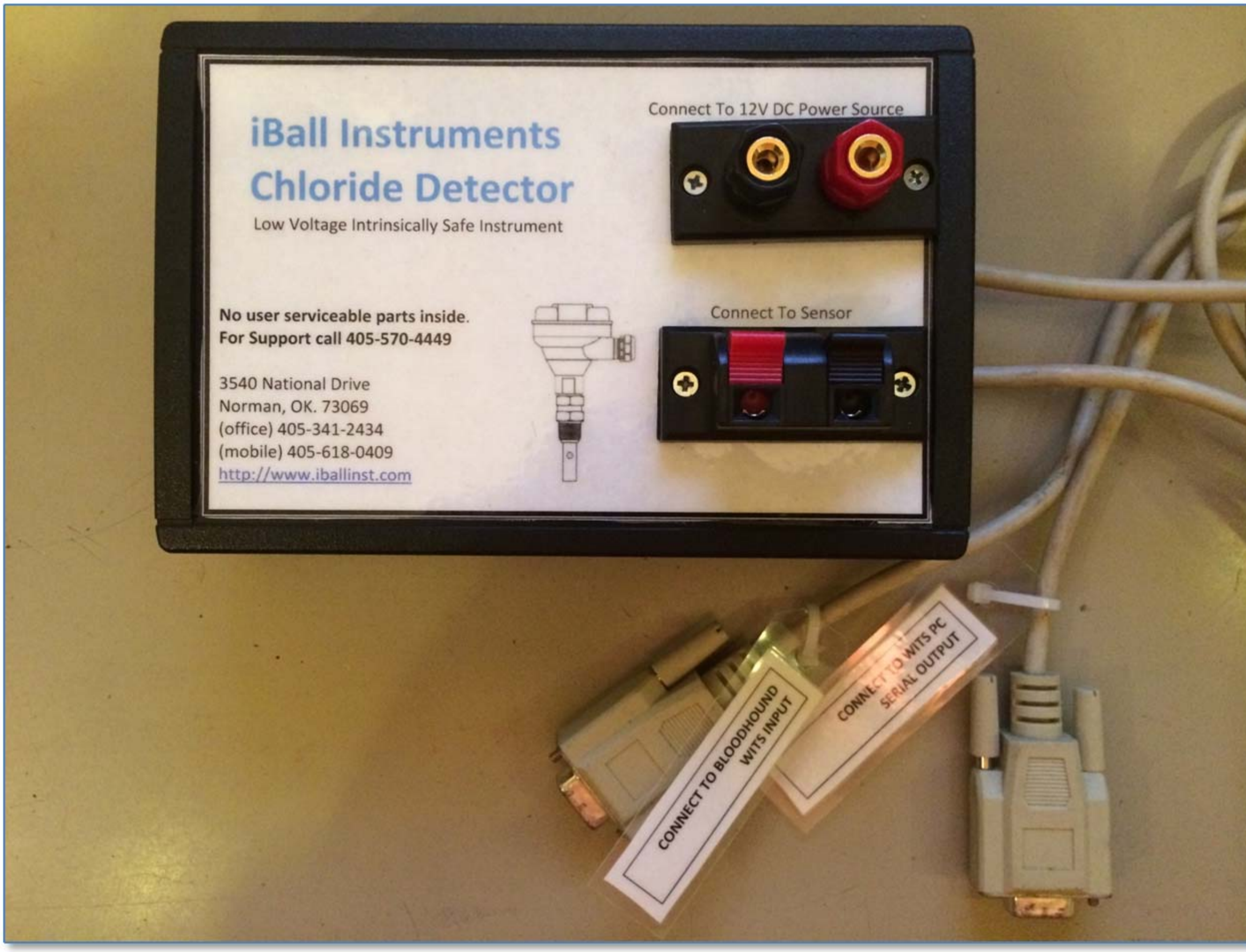

FIG 02. Detector Head Module

The detector head module has four (4) connectors. Two female DB9 connectors and two wire terminals.

One of two DB9 connectors connects to the WITS EDR PC serial output. This cable is clearly marked and tagged. The second DB9 connector connects directly to the Bloodhound Gas Detector and Chromatograph system WITS input.

This DB9 configuration of the detector head eliminates and takes the place of the need for a female to female null modem cable normally utilized between the WITS EDR PC and the Bloodhound.

Power is supplied to the detector head from the Bloodhound system 12VDC power output that normally powers the Cavitator gas extraction system. This 12VDC power output from the Bloodhound system can power both an external Cavitator gas extraction system and the detector head module at the same time. Red to Red and Black to Black.

The Chloride Detector at the Pit or Shaker is best connected to the detector head through a 2 conductor 18 gauge stranded cable. The length of the cable should not exceed 1000 ft.

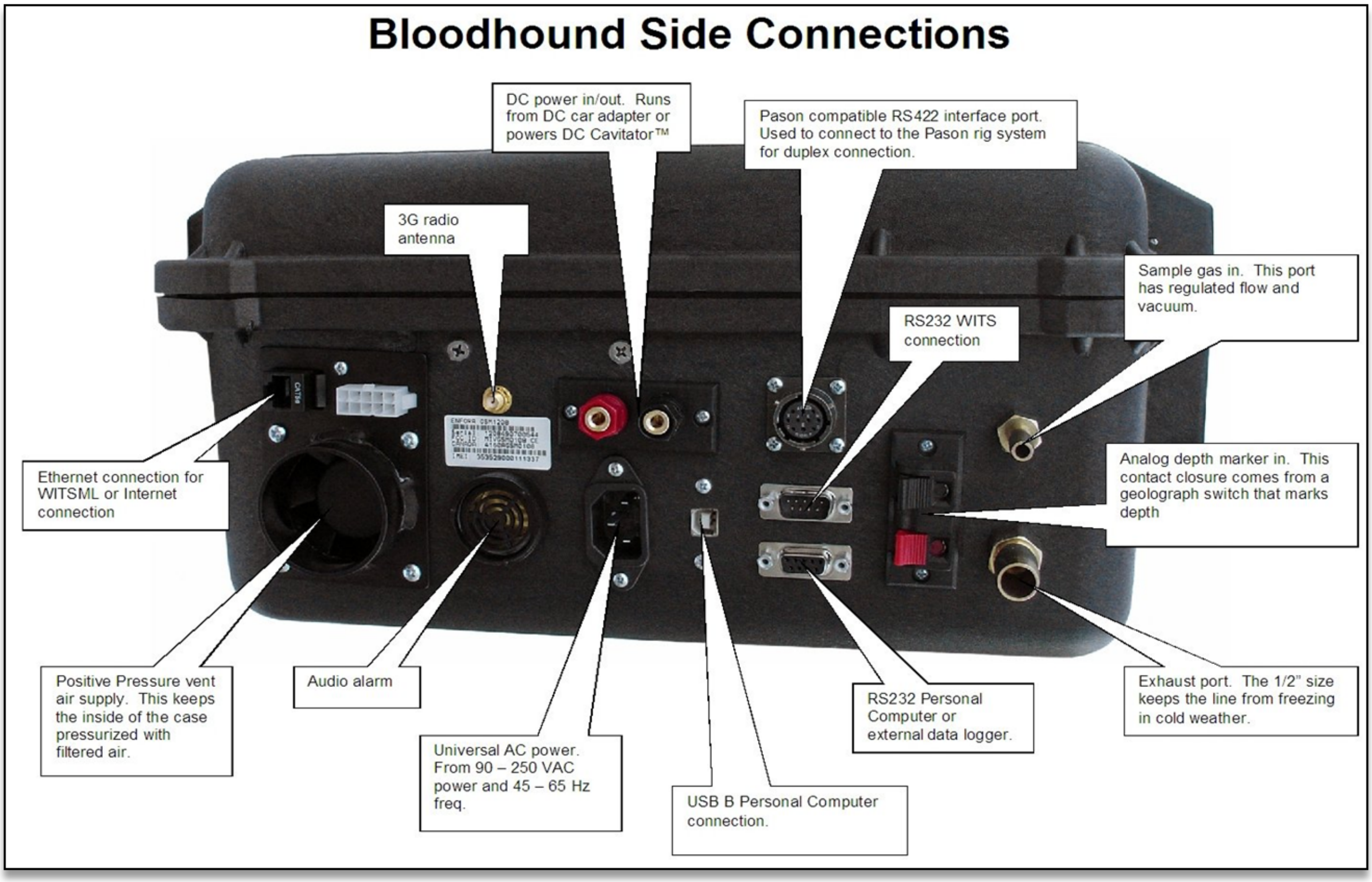

FIG 03. Side Connections On The Bloodhound Gas Detector and Chromatograph

3. CHLORIDE DETECTOR HEAD

The Chloride Detector Head is part of a clamping system that allows the user to attach the head to the side of a shaker spoil separator, at the drilling fluid return path, or the drilling fluid recirculation container.

Best readings are found when the sensor is as close as possible to the ejection of the drilling fluid from the shaker spoil separator (possum belly).

This location gives the best reading of Chlorides and presents the minimal amount of contaminates that can cause inaccurate readings. This is because the mass bulk of contaminates will be removed by the shaker.

FIG 04. Sensor Head Screen

When placing the Chloride Detector Head before the shaker, there is the possibility that spoil, small rock cuttings, or other contaminates will become lodged into the sensor head and cause inaccurate readings.

The Chloride Detector Head has attached at the bottom a removable stainless steel metal screen that when contaminated or clogged can be removed and cleaned and re-attached.

Do not operate the Chloride Detector Head without this screen in place. Failure to do so may contaminate the Chloride Detector Head with debris that is not easily cleaned out.

Output:
The output of the sensor head is **WITS channel 0816**. This information is sent to the Bloodhound and from the Bloodhound to the Bloodhound server system and local computer for storage.

To set up the PC software Gas Chart to log and store this information, just set up the WITS channel to start recording on the right hand side of the setup box. To view the graph of the output just check the box labeled on the left hand side of the setup box. Please see **FIG 05.** For more details.

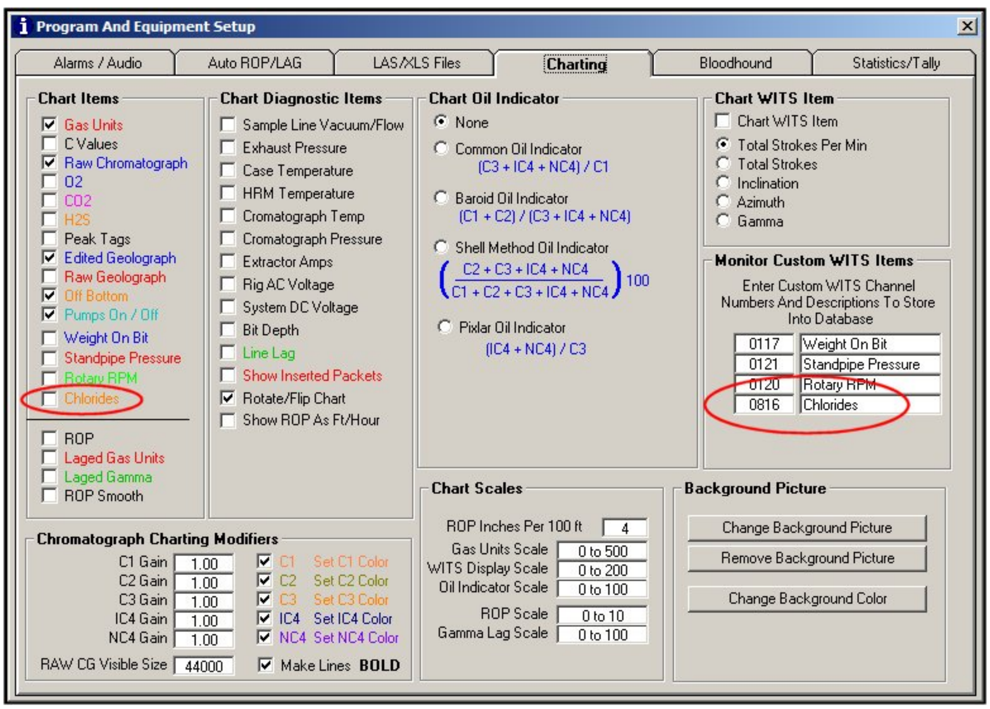

FIG 05. Chloride WITS channel 0816 Storage in Gas Chart.

4. Calibration and Adjustment of the Chloride Detector.

To set the instant value of the Chloride detector, first a solution sample with a known chloride level needs to be prepared. Immerse the detector head sensor into the solution and observe the output going through the WITS system.

When the output of the sensor has stabilized, log into the Bloodhound system and enter the command LINK WITS at the command line interface.

You should see WITS information coming through to you with the chloride channel visible. It should look something similar to this:

&&
0105170613
0106050742
01102525.4
0113-9999.0
012465.0
012364.0
01081467.3
013727618.0
!!
0816507.487300

The Chloride channel being injected into the WITS data stream by the sensor head is highlighted as 0816 and is currently at 507.49.

To set the output to a different value you have to change the correction factor. From this point you can check the current correction factor by entering the command FACTOR ?

It should respond with something similar to:
CONVERSION FACTOR IS NOW 0.350000

You can now set the factor to a new value by entering the command FACTOR and a value representing a higher or lower value. It can be any positive value between 0.0000001 and 4000000.0.

SUGGESTION: When setting the factor for the first time start with FACTOR 1. This will give you a good baseline to set the value going forward. Numbers less than 1 will decrease the output value while numbers higher than 1 increase the output value.

Newer versions of the detector head have a digital screen and a knob to adjust the output value correction factor.

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5. Class 1, Division 1, Groups C & D Guidelines for Bloodhound Systems via National Electrical Code (or) NFPA70

To be distributed to all safety inspectors.

The NEC is developed by NFPA's Committee on the National Electrical Code, which consists of 20 code-making Panels and a technical correlating committee. Work on the NEC is sponsored by the National Fire Protection Association. The NEC is approved as an American National Standard by the American National Standards Institute (ANSI). It is formally identified as ANSI/NFPA 70.

PURPOSE: To inform safety inspectors to the Intrinsic Safety, Suitable for Use in Hazardous Locations, and An Explosion Proof (or Flame Proof, as classified in IEC and Cenelec standards) inherent nature of the iBall Instruments Bloodhound gas detection and logging systems.

Intrinsic Safety: An Intrinsically Safe piece of equipment is an electrical device that is incapable of causing an ignition of the prescribed flammable gas, vapor, or dust, regardless of any spark or thermal effect that may occur in normal use, or under any conditions of fault likely to occur in practice. This means that the device design is limited in such areas as PC Board layout, surface temperature, protection of electrical components, and power supply to the device. The adapted devices are certified with either specific Intrinsic Safety Barriers or general Intrinsic Safety Barrier parameters. These barriers are used outside the hazardous location and limit the amount of current, voltage, capacitance, and inductance entering the certified device. Often considered the safest and most technically elegant approach, there are many benefits of an Intrinsically Safe device to the customer. **Expensive and cumbersome explosion-proof enclosures and conduit connections are not needed, electric shock is eliminated, and controls can be maintained without shutting down the process**. Since the Bloodhound system and the attached Cavitator extractor system uses a low voltage (12VDC) electrically isolated system the Bloodhound system as a whole falls under the NEC Article 504.2 504.4 504.10 504.50 wiring and electrical systems. This is the same wiring and voltage classification as telephone, intercom, and low voltage alarm systems.

Suitable for Use in Hazardous Locations: Factory Mutual (FM) developed this unique approval as a way for products to receive hazardous location approvals that cannot conform to existing protection concepts. There is no documented standard and the definition of this certification is unique to each product. This protection concept for the iBall Instruments Bloodhound equipment was utilized for our highly ventilated, low voltage and electrical isolation products that did not meet the NEC's former Explosion Proof definition. NOTE: Products that receive this approval are certified to the same Divisions as a comparable Explosion Proof or Intrinsically Safe device.

Explosion Proof / Flame Proof: An Explosion Proof (or Flame Proof, as classified in IEC and Cenelec standards) device is an electrical device designed with an enclosure capable of withstanding, without damage, an explosion within it of a specific gas, fiber, or dust. In turn, it prevents ignition of these same materials surrounding the enclosure by a spark or flame from the explosion within. This certification usually requires that devices be designed with sturdy and durable enclosures with conduit connections but since the Bloodhound system is an intrinsically safe, low voltage operated portable device, the outward modifications are not mandated because of the primary benefits of this type of protection in that the device is not limited by.

Infrared E2V Sensor Benefits: The iBall Instruments Bloodhound system uses the latest in infrared technology manufactured and distributed by e2v, thereby inheriting the sensors certification of the ATEX (higher classification than NEC), CSA and FM standards. Since the new infrared, and the system as a whole, has no heated parts that are greater then the flash points of all current regulations, the intrinsic safety measures an allowance of C1D1 exemptions in some circumstances.
NOTE: Housing (head) is fitted with the same high performance infrared optical technology as used by e2v technologies acclaimed mini IR CO2 and flammable gas sensors
NOTE: Sensors are supplied in metal housing and all come with sintered flame arrestors to prevent ignition of any external gases. All housings are certified to ATEX, CSA and FM standards, allowing for easy inclusion and inherent approval. All certifications are available via e2v technologies.