Alcotest® 9510 Technical Manual
State of Idaho
Version 1.0

Confidential

Dräger. Technology for Life®

Table of Contents

1 For your safety

1.1 General safety statements

- Read and follow the instructions contained in this document.
- The instrument is only to be used for the purposes specified herein.
- Use only a Draeger AC power cord and only connect to a grounded connection. If the connection is not grounded the metal parts of the instrument may deliver an electric shock.

1.1.1 Maintenance

Repairs of the described instrument may only be performed by Draeger Safety Diagnostics, Inc., or an authorized Idaho State technician, and only Draeger spare parts may be used. Otherwise the proper functioning of the device may be impaired.

1.1.2 Note

In this document the Dräger Alcotest® 9510 is also referred to as the “9510”.

1.2 Definition of alert icons

The following alert icons are used in this document to provide and highlight areas of the associated text that require a greater awareness by the user. A definition of the meaning of each icon is as follows:

CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in physical injury or damage to the product or environment. It may also be used to describe unsafe practices to be avoided.

NOTICE

Indicates additional information regarding the operation of the device.

2 Copyright and legal disclaimer

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2.1 Disclaimer

The authors of this manual have incorporated their best efforts in preparing this information and ensuring that the technical content is completely accurate at the time of publication.

For use in Idaho only.

Draeger Safety Diagnostics, Inc. accepts no responsibility for technical inaccuracies and reserves the right to make periodic changes, enhancements, revisions, and alterations to the programs and/or its manuals without obligation to notify any person, institution, or organization of such changes, enhancements, revisions and alterations. This manual is only valid for Idaho State Law Enforcement use.

2.2 License Agreement

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(4) Purchaser shall not take any actions inconsistent with Draeger Safety Diagnostics, Inc.’s ownership of the Firmware/Software.

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3 Definition of terms used throughout this manual

Term	Definition
Breath Test Criteria	Various criteria have to be met in order for the 9510 instrument to accept a breath sample and ensure that the breath sample analyzed represents a deep lung air sample. The following conditions have to be satisfied before the profile analysis is activated: ● Minimum flow rate 4.5L/min. ● Minimum blow duration 4.5 sec. ● Minimum breath volume1.3L ● Slope (plateau) detection The plateau is reached if the concentration increases ≤4% in 1 second. A successful breath test is characterized by a nearly constant alcohol concentration in time (plateau) at the end of the subject's sample.
Purging	The internal pump flushes the cuvette and breath hose with ambient air to ensure that an alcohol and absorbing compound free environment exists.
Ambient Air Check	After the purging cycle, an air sample from the cuvette is drawn into the EC sensor for analysis. This procedure ensures that the air in the cuvette is clear.
Air Blank Check	After the ambient air check, the intensity of the infrared energy is analyzed and stored as a reference for successive IR comparisons after purge.
Breath Test	The subject's breath is introduced through the mouthpiece and the breath hose into the cuvette. Once equilibrium is achieved, the intensity of the infrared energy is analyzed. Immediately after the IR analysis, the EC sensor pulls a 1 cc sample out of the cuvette for analysis.
Mouth Alcohol	Mouth alcohol is characterized by a sharp increase of the alcohol concentration at the beginning of the subject's breath sample followed by a decrease (described in Section 9.1).

4 Description

4.1 Application

The Dräger Alcotest® 9510 is a breath alcohol analyzer used for evidential breath alcohol measurements. The 9510 provides accurate, tamper-proof BrAC results which can be displayed both on the instrument's display and the printout produced by the internal or external printer.

4.2 Product Description

The 9510 can be used in either a stationary or mobile location. It comprises a graphic color display, multiple interfaces (USB, Ethernet, Serial, and modem), and a comprehensive range of adaptable accessories. The 9510 has an easy one-button operation as well as a stylus stored in the recess on the top of the instrument for touch screen operation. The 9510 features a new ergonomic design and a low-noise thermal internal printer with easy to read and durable document printouts.

4.3 Operating System

Two controller systems are active in the 9510; A Windows CE operating system for the interfacing with peripherals, display, external printer, communication via RJ-45 Ethernet, RS-232 Serial, etc. and the Renesas M16 controller system for the handling of the measuring systems and for providing the results directly to the internal printer.

4.4 Peripheral Connections

The 9510 has the following peripheral connections: (3) USB ports, (2) RS-232 Serial Interfaces, RJ-45 Ethernet Interface,AC/DC receptacles and an RJ-11 Modem Interface.

4.5 Servicing

It is recommended that the 9510 instrument should have its operation analytical accuracy verified yearly by trained personnel.

4.6 Cleaning

When cleaning the 9510 instrument, please follow these guidelines (external only):

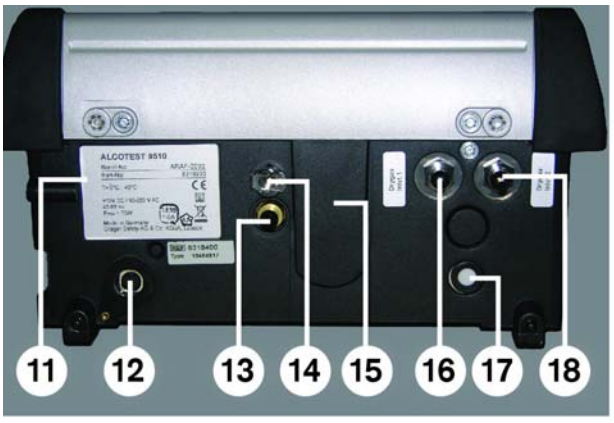
- Disconnect power supply
- Wipe outside of instrument with a damp cloth
- Dry thoroughly
- Do not use any solvents or cleaning agents
- Do not allow liquids to enter the case or the Breath Hose

4.7 Product Overview

Front view

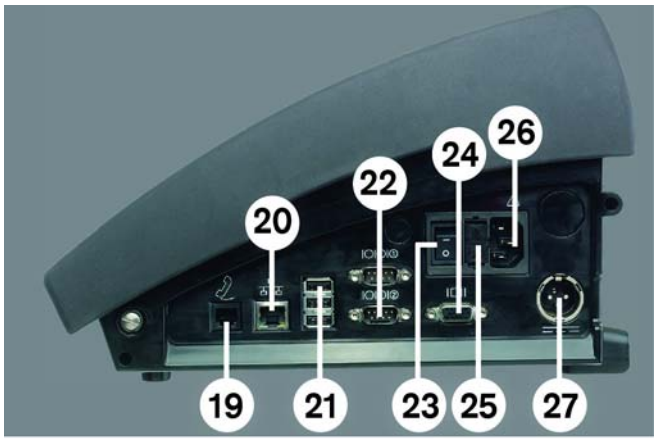
1 Breath hose (heated and temperature controlled)
2 Stylus
3 Rubber bumpers
4 Display and touchscreen
5 Start button
6 IR port (port not used)
7 Transport handle (detachable), optional
8 Speaker
9 Unlocking button of the printer flap
10 Internal thermal printer

Rear view



11 Type plate
12 Accessory socket (for interface of peripherals)
13 Cuvette Inlet (Simulator vapor inlet port)
14 Simulator pump outlet port
15 Exhaust port (cuvette outlet, protected against blockage)
16 Dry gas inlet 1 port(internally valved with electro solenoids)
17 Purge outlet port
18 Dry gas inlet 2 port(internally valved with electro solenoids)

Side view



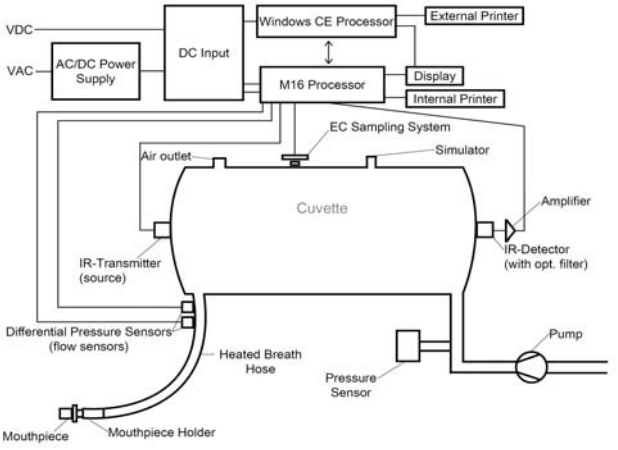
19 RJ-11 Modem interface
20 RJ-45 Ethernet interface
21 USB (3 interfaces for keyboard, memory stick, printer, etc)
22 RS 232 Serial Interface
23 Power switch I/0 (ON/OFF)
24 Video Port (port not used)
25 Fuse compartment (holds two 2amp slow fuses)
26 AC Receptacle (90-260VAC operation with 2 fuses)
27 12V DC Receptacle

4.8 Intended use

The Dräger Alcotest 9510 is a measuring instrument for evidential breath alcohol testing. It automatically analyzes the alcohol concentration (ethanol content per respiratory volume) in a specimen of breath. The Dräger Alcotest 9510 is designed for stationary use and mobile use.

4.9 Functional Description

Schematic view of the components of the 9510:



The Windows CE system controls the peripheral accessories. The M16 processor operates the measuring system and enables data transfer of the result to the Windows CE system.

5 System and Components

5.1 Cuvette

The cuvette represents the IR absorption chamber, internally housing the IR source and IR detector (see Section 6.2).

5.2 EC Sampling System

The sampling system with the EC sensor consists of a small piston pump assembly which pulls a fixed sample (1cc) of gas from the IR cuvette into the EC sensor.

5.3 Differential Pressure Sensor

The differential pressure sensor is used to measure the breath flow rate. The instrument records the flow during the subject's breath test from the beginning to the end. The recording allows the instrument to calculate the breath volume. The sensor monitors the pressure drop between the entrance of the cuvette and the entrance of the gas into the IR chamber.

5.4 Pressure Sensor

The pressure sensor monitors proper operation of the pump. Also, the pressure sensor constantly monitors ambient air pressure, which is necessary if dry gas standards are used for calibration.

5.5 Breath Hose

The breath sample is transferred through the breath hose into the cuvette. The breath hose is heated to a minimum of 35°C, and temperature controlled by the microprocessor to avoid condensation. The instrument will halt an evidential breath test sequence with a hardware error if the breath hose temperature is outside the range of 35°C and 60°C. The temperature at the time of the test is also recorded in the test data records within the instrument. It has excellent insulation to keep power consumption minimal at low temperatures. The breath hose is 46 inches long and flexible.

5.6 Microprocessor

All incoming signals from the sensors are passed to the microprocessor via a multiplexer and 12 bit A/D converters for further analysis. The microprocessor continuously checks all supply voltages and important components to ensure proper operation. It hands over the information directly to the Windows CE controller. It also has an extra pathway to send data/results to the internal printer, which is independent from Windows CE.

5.7 Windows CE Controller System

The interface between the operator and subject is controlled by the Windows CE controller system, which handles the display messages, addressing the peripherals, etc. It is an embedded Windows CE operating system.

5.8 Signal Processing

The IR detector converts the pulses from the IR source to a small sinusoidal electrical signal. This signal is first amplified by a low noise amplifier and then sent through a band-pass-filter stage. At the A/D converter, this signal is sampled 128 times per second with 12 bit resolution and then sent to the microprocessor.

5.9 Keyboard

If an external keyboard is plugged into the instrument, all data entry fields will take input from the external keyboard. If there is no external keyboard connected to the instrument, the instrument will display a virtual keyboard for all data entry fields. To change the case of the characters displayed on the virtual keyboard, press the "up arrow" button on the virtual keyboard. The "left arrow" key is the "Enter" key, and the blank key is the space bar.

5.10 Internal Printer

The internal printer prints on 2.25" thermal paper that does not require a printer cartridge or ink ribbons. The internal printer may be disabled, if desired.

Replace the paper roll when depleted. Press the black button to open the paper flap and insert a new roll of paper with the end of the paper outside of the compartment and press the paper flap closed.

5.11 Radio Frequency Interference

The Alcotest® 9510 is designed to be non-susceptible to the effects of Electromagnetic Interference (in certain frequencies also known as Radio Frequency Interference or RFI). The 9510 has been evaluated by an independent test laboratory and found to meet the requirements in accordance to relevant standards. The 9510 was subjected to and passed Electrostatic Discharge, Electrical Fast Transient bursts, Surge immunity, power-frequency magnetic field, short interruption power supply drops, low frequency harmonic current, and low frequency power supply flicker tests. Additionally, the 9510 was subjected to and passed Electromagnetic field and RF-field conducted disturbance tests, which expose the instrument to various test voltages ranging from 5-30V/m across a frequency range of 150kHz-2.7GHz at a variety of orientations (polarizations). Likewise, the 9510 passed Electromagnetic Compatibility (EMC) tests which ensure that it is not a source of emitted energy that would adversely affect other equipment.

6 Measuring Technologies

The Alcotest® 9510 employs two different and independent technologies, each analyzing and quantifying a subject's breath alcohol concentration: IR spectroscopy (Infrared) and Electrochemical Cell (Fuel Cell) technology. This offers the highest possible level of forensic analytical integrity.

6.1 Infrared Technology

The use of infrared technology for detection of alcohol in the breath by Law Enforcement has been around since the late sixties. In the early 1970's, scientists from the United States and Germany combined worked to develop standardization on breath testing devices utilizing infrared theory. The list of definitions below are some of the common terms used involving infrared technology.

- **Molecule:** The smallest physical unit of a compound that can exist separately and still keep the properties of the original substance.
- **Wavelength:** The distance between two successive points in a wave.
- **Amplitude:** The strength or height of a wave.
- **Frequency:** The number of periodic oscillations, cycles or waves per unit of time (cycles per second).
- **Electromagnetic Radiation:** A form of energy transmission through space or a medium (glass) in which electric and magnetic fields are extended or transmitted as waves.
- **Electromagnetic Spectrum:** The complete range of frequencies of electromagnetic radiation from the lowest to the highest frequency.
- **Infrared Energy:** The part of the invisible spectrum, contiguous beyond the red end of the visible spectrum of electromagnetic radiation, which travels through space in waves. Behavior of such waves is similar to that of visible light waves.
- **Micron:** The unit of linear measurement of electromagnetic radiation. One micron is equal to one millionth of a meter. The symbol µm" denotes a micrometer (e.g. 9.50µm).

6.1.1 Infrared Theory

Depending on their physical size and structure, molecules absorb energy at specific wavelengths and areas in the IR spectrum. Ethanol molecules absorb IR energy in two distinct areas in the IR spectrum, the 3.4µm range and the 9.5µm range.

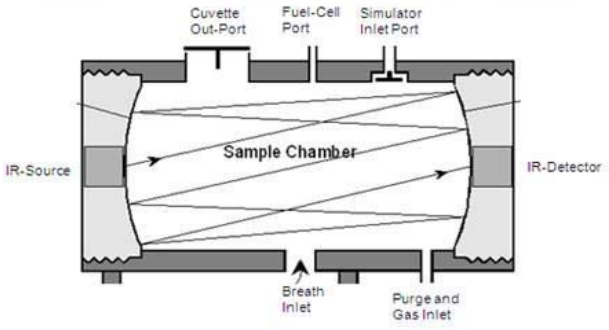
6.1.2 Infrared System

The central part of the measuring system is the infrared absorption cuvette, where the breath sample is being observed. The cuvette comprises a chamber of 70mL in volume with gold-coated parabolic mirrors, an electronically modulated infrared transmitter (source) and a pyro detector with an integrated IR filter.

6.2 IR System

The breath sample is transferred into the system via the breath hose. The cuvette is heated to a minimum of 39°C to avoid condensation and to guarantee defined conditions for the analysis. The instrument will halt an evidential breath test sequence with a hardware error if the cuvette temperature is outside the range of 39°C and 50°C. The temperature at the time of the test is also recorded in the test data records within the instrument.

The cuvette is a multi-reflection cell which provides a long absorption path for high precision (resolution) yet, at the same time, has a volume of only 70mL. This small volume makes it possible to trace the concentration-time profile very carefully (dynamic range) because fast changes are noticed. At both ends of the cell are gold coated parabolic mirrors which contain the IR-source and the IR-detector plus IR-filter. The energy from the IR-source enters the cuvette from a central orifice in one of the mirrors onto the detector. The IR energy makes 7 passes before it is received by the IR detector.



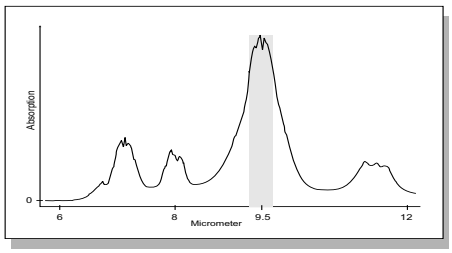
The infrared source, with its low thermal mass, can be modulated at 2 Hz by a 50% duty-cycled power source. This eliminates the need for an optical chopper or chopper-wheel. Furthermore, the power consumption is less than 1 Watt.

The detector is a thermally compensated Pyro-IR-Detector with very high sensitivity. It also houses the alcohol specific IR-filter centered at 9.5µm.

The output signal is fed into a very low noise amplifier, which brings the voltage to higher magnitude levels for further analysis.

Absorption of Ethanol

This illustration shows an ethanol spectra. The shaded area represents the infrared filter of the 9510. It shows the center frequency as 9.5µm with a half band width which significantly increases the signal to noise ratio (Resolution).



The 9510 measures ethanol at 9.5µm because, in this area of the IR spectrum, the cross sensitivity to potentially interfering compounds found in the human breath is virtually non existent.

6.2.1 Beer-Lambert Law

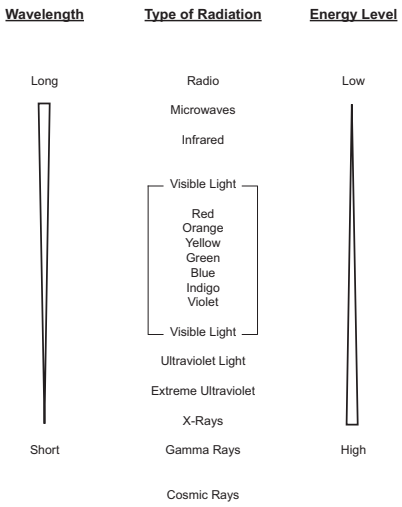
Law of Absorption

The Beer-Lambert Law states: *For a defined path length (the sample chamber), containing an absorbing system (concentration of ethanol molecules), the transmitted energy (IR energy) will proportionally decrease with the increase in concentration of the absorbing system.*

Law Applied

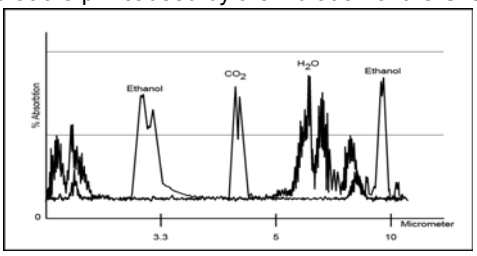
In an IR chamber one end has an IR source and the other end has an IR detector. The IR detector converts IR energy to electrical energy. Prior to a subject test, the IR chamber contains only ambient air. The IR detector produces a voltage output based on the energy emitted by the IR source.

A breath sample containing ethanol is introduced into the chamber and the ethanol will absorb some of the IR energy causing less IR energy to reach the IR detector resulting in a voltage decrease. An increase in the BrAC will result in a proportional decrease in the detector's output.



Infrared Spectrum

The illustration below shows a spectrum of human breath containing 200 ppm ethanol. Besides ethanol, there is the sharp absorption line of carbon dioxide at 4.2 µm and a broad absorption band of water ranging from 5 to 8 µm. Ethanol exhibits two strong absorption lines: one at 3.4 µm which corresponds to the stretching of the C-H bond, and the other centered at 9.5 µm caused by the vibration of the C-O bond.



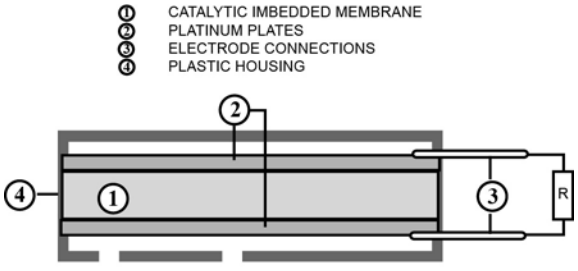
6.3 Electrochemical Sensor Technology

The device known as an electrochemical fuel cell was originated in 1839 by Sir William Grove. He discovered that if two platinum electrodes were immersed in a sulfuric acid electrolyte, and hydrogen was supplied at one electrode and oxygen at the other, an electric current was produced as long as gas was supplied to the device. The chemical reaction was the same as if the hydrogen was burned, but in this case, electricity was produced directly instead of heat. The fuel cell was long envisioned as a desirable electrical generator, since no moving parts were involved, the platinum (or other catalytic material) was not consumed, and no significant heat was developed in the process. High cost and many technological problems have prevented the fuel cell from fulfilling its promise as a low cost generator of electricity and its use has, to date, been confined to relatively exotic applications such as spacecraft and satellite power sources.

A highly important by-product of this effort has emerged in recent years; using the fuel cell as a sensor to detect the presence of chemical components that are capable of being oxidized by this process.

6.3.1 Electrochemical Theory

In its simplest form, the fuel cell consists of a porous, acidic membrane (electrolyte), which is laminated by two platinum black plates. An electric wire is attached to each of the platinum plates. This assembly is packed into a sealed plastic housing which has a small hole (gas inlet) leading into a sample chamber, where a breath sample is introduced.



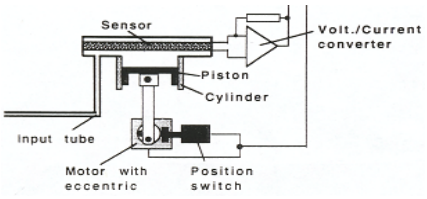
Only one platinum plate will be exposed to the breath sample. Once ethanol reaches the platinum, a chemical reaction is triggered. This chemical reaction produces an electrical

current between the two platinum plates, the current of which is measured. This becomes the usable indicator of the amount of ethanol consumed by the fuel cell, and is directly proportional to the ethanol concentration of the breath sample. After processing, a quantitative result is determined. A rise in BrAC will result in a proportionate increase in voltage.

Other alcohols will react in the cell, but because the chemistry is different, the rate of reaction is also different (e.g. Isopropanol and Methanol).

6.4 Fuel Cell Analytical System of the 9510

The fuel cell contained within the instrument is located directly on top of the cuvette and therefore heated by the cuvette.



The fuel cell sampling system consists of:

- **Fuel Cell:** An alcohol specific sensor.
- **Piston:** Draws a 1cc sample out of the cuvette and into the fuel cell.
- **Cylinder:** The housing for the piston.
- **Breath Inlet Pathway:** Allows the breath sample to pass from the breath hose to the cuvette.
- **Motor:** Drives the piston.
- **Position Switch:** Indicates that the motor has completed its cycle.

6.4.1 Electrochemical Sensor

Measures small samples from inside the cuvette. Once ethanol reaches the sensor, a chemical reaction is triggered. The resulting current is used to determine the amount of alcohol in the sample.

6.5 Benefits of Dual Sensing Technology

By combining two distinct analytical systems to analyze a subject's breath, the 9510 is able to provide two precise, accurate, and independent test results.

Infrared spectroscopy requires that a zero reference be established prior to a subject's breath test. Because the fuel cell of the 9510 is "piggy backed" on the IR cuvette, the 9510 can draw a sample out of the chamber and analyze it, to ensure that a zero set is based on one that is free of absorbing alcohol vapor.

The dual system also allows for a greater degree of sensitivity to any possible existence of interfering substances. Because the fuel cell is alcohol specific, and the IR sensor operates at 9.5µm in the IR spectrum, the possibility of an interfering substance influencing a subject's ethanol reading is virtually impossible.

To quote A.W. Jones in his article, "Measuring Alcohol in Blood and Breath for Forensic Purposes - A Historical Review":

"The use of a higher wavelength (9.5µm) offered the advantage that the results were much less prone to interference from acetone and hydrocarbons which absorb IR radiation at 3.4µm and under some circumstances might be expelled in the breath. In the latest generation of evidential breath alcohol instruments, IR and electrochemical detectors are contained within the same unit (Alcotest® 9510). As mentioned earlier, analyzing alcohol by two independent methods is highly desirable feature for medicolegal purposes."

7 Wet Bath Simulator Methodology

Using wet bath simulators for calibration testing has been the standard method for decades. Breath alcohol simulators are specially designed instruments which provide equilibration of alcohol between water and air at a controlled temperature.

The water-alcohol solution is maintained at a temperature of 34°C. The alcohol concentration of the vapor produced by a wet bath simulator is proportional to the alcohol concentration of the alcohol-water solution at a constant temperature (34°C) in accordance with Henry's Law.

7.0.1 Henry's Law

Henry, an English chemist, studied the behavior of solutions in which a volatile substance (one which readily evaporates to form a gas) was dissolved and in 1803 he described the behavior as a law now known as Henry's Law. Although Henry did not study alcohol solutions in his work, his law applies to aqueous (water) solutions of alcohol containing less than 20 percent alcohol.

When a volume of alcohol is added to water it dissolves to form a solution. If an alcohol solution is poured into a bottle (so as to partially fill it), and the bottle is sealed, the concentration of alcohol vapor in the air (and water vapor) above the solution increases rapidly until it reaches a certain concentration and it then remains at this concentration. At this stage, there will be a definite ratio between the concentration of alcohol in the solution and that in the air. The concentration of the alcohol vapor above the solution depends on two factors: the temperature of the system and the concentration of alcohol in the solution.

From these observations a simplified version of Henry's Law may be stated:

"When an aqueous solution of a volatile compound comes to equilibrium with air, there is a fixed ratio between the concentration of the compound in air and its concentration in the solution and this ratio is constant for a given temperature."

8 Dry Gas Methodology

8.1 General Information

CAUTION

The penalty for refilling a gas cylinder, or flying on an airplane with compressed gas, can result in a fine and/or imprisonment. Refer to the Material Safety Data Sheet (MSDS) for proper handling, care, storage and disposal of dry gas cylinders.

Calibration checks are performed to validate the accuracy of EBTs. It is recommended that the National Institute of Standards and Technology (NIST) traceable gaseous Ethanol standards be used and that the cylinder is approved by NHTSA or is on the Conforming Products List (CPL).

8.2 Dry Gas Component Specifications

- Dual stage regulator with a flow rate equal or greater than 3 liters per minute.
- Male/Female connectors provide easy positive connection.
- The gas hoses are configured with check valves to prevent the backflow of gas.
- Internal solenoids control the flow of gas.
- Gas canisters are easily changed.

8.3 Using Dry Gas

In the Federal Register of August 13, 1997, Model Specifications for Calibrating Units for Breath Alcohol Testers; Conforming Products List of Calibrating Units (97 F.R. 43416), NHTSA addresses two topics regarding the use of dry gas standards: extreme cold temperatures and atmospheric pressure.

8.3.1 Cold Temperature Exposure

Low temperature Storage
When the mixture reaches a given temperature (the dew point of the ethanol), a small portion of the ethanol in the mixture returns to the liquid state and condenses on the cylinder's inner walls. If it is suspected that the cylinder has been exposed to temperatures below 35 °F, the cylinder should be allowed to warm up to room temperature (68 - 77 °F) for 24 hours before use. As the temperature of the mix rises, condensed ethanol will return to its original gaseous state.

8.3.2 Atmospheric Pressure

When a Calcheck is performed, some of the gas in the cylinder is released by operating the release valve. The volume of the released gas will expand according to the prevailing atmospheric pressure. The gas is prepared so that the desired concentration is obtained at sea level pressure of 760 milliliters of mercury. However, atmospheric pressure varies slightly from day to day and can change suddenly. The most significant effect comes from high elevations, where prevailing atmospheric pressure is significantly lower than 760mmHg*. Atmospheric pressure corrections are made using an equation derived from the Ideal Gas Law: $C=C_{760}XP/760$, where C is concentration and P is the prevailing atmospheric pressure. *Please note, 760mmHG is equivalent to 1,013 millibar.

8.3.3 Shipping and Storage

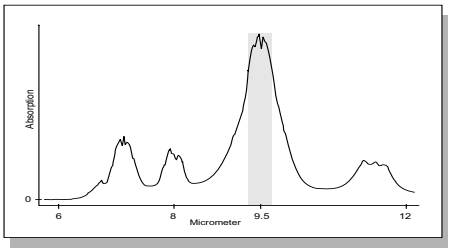
Please refer to the gas manufacturer's Material Safety Data Sheet.

8.4 Cylinder Pressure Monitoring

During the breath test sequence, the 9510 will monitor the dry gas cylinders to ensure following criteria are met: the transducer is connected to the 9510, sufficient pressure is available in the cylinder, and the cylinder is not past its expiration date. If the 9510 detects any of the above conditions for the primary cylinder, a drygas cylinder error will be displayed and the test sequence will be aborted.

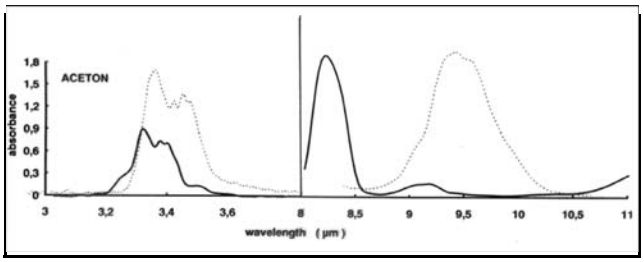
9 Detecting Interfering Substances

As previously mentioned, the 9510's infrared sensor operates in the 9.5µm range of the infrared spectrum. Acetone, toluene, and acetaldehyde, the most mentioned "interfering substances", can have a slight influence in breath analyzers operating at the 3.4µm range of the infrared spectrum. By shifting the operating range to 9.5µm, the 9510 is virtually free from the influence of these compounds.

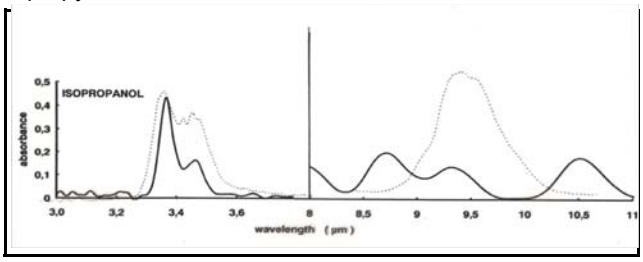


Absorption of ethanol at 9.5 µm

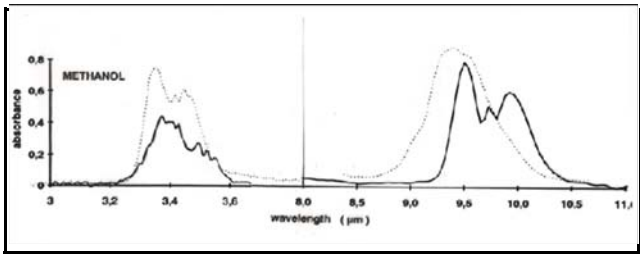
Acetone/Ethanol



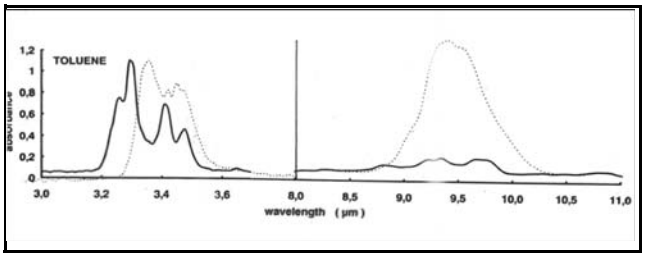
Isopropyl Alcohol/Ethanol



Methanol/Ethanol

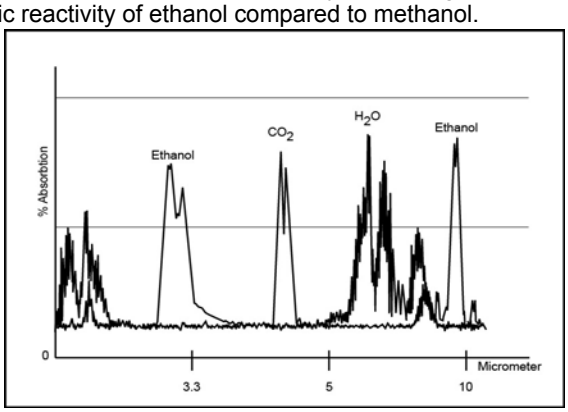


Toluene/Ethanol



The 9510 also employs an alcohol specific electrochemical (fuel cell) sensor which is not influenced by acetone or toluene.

During either a calibration or a calibration check, the fuel cell sensor's response to ethanol (only) is memorized in the form of a curvature analysis profile. From this analysis, the presence of methanol can be detected by comparing the fuel cell's kinetic reactivity of ethanol compared to methanol.



If the analysis of the subject's breath reveals different curvature characteristics, a message indicating that an interfering substance was detected will be displayed and the test aborted.

During a test, the subject's breath is analyzed by both the infrared and fuel cell sensors. There is a preset detection threshold that both readings must fall within for a breath test to be successful. The EC results must be within .008 g/210L or 10% of the IR reading, whichever is greater. If the two results exceed the preset tolerance, an interference message is displayed and the test invalidated.

NOTE: The interfering substance detection is activated in the regular breath test sequence only. Never run a Calcheck Test when using substances other than ethanol.

9.1 Mouth Alcohol Detection

The detection of mouth alcohol ("invalid sample") is based on the analysis of the IR's alcohol vs. time profile taken during the subject's breath sample. A normal profile is characterized by a sharp increase in the concentration at the beginning of the blow followed by a more moderate increase in the concentration until the end of the blow. Sometimes the slope of the profile may become zero at the end. For a regular breath test, the concentration always increases with time and never decreases.

In the case of mouth alcohol, the alcohol vs. time profile changes considerably. There will be sections with decreasing concentration and thus, a negative slope. The 9510 employs an advanced detection algorithm that can identify the various sudden changes (positive or negative) in the slope of this curve that are associated with mouth alcohol scenarios.

10 Evidential Breath Test Sequence

When you turn the 9510 on, an internal self-test is performed and the following messages will be displayed on the display:

PLEASE WAIT
SELFCHECK
WARMING UP
NOT READY

The display will also provide the current psi of dry gas cylinder 1 and dry gas cylinder 2 in the lower-left corner.

When the instrument is ready to begin a Breath Test Sequence, the instrument will beep, and “READY” will be displayed on the display.

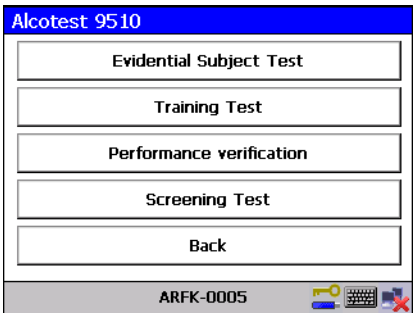
Depending on the length of time between Breath Tests or fluctuations in room temperature, the instrument may have to go through the WARM UP phase before performing a breath test. If the screen is blank or the screen displays “STANDBY”, tap on the display to light up the screen, and press the start button to begin the instrument’s “WARM UP” phase.

Once the display shows “READY”, press the green start button to begin the test.

The instrument proceeds to the data entry sequence (if applicable.) Follow the instructions on the display and enter the appropriate data into each field following the prompts. Use the “Next” and “Prev.” buttons to scroll between the entries. Press the “Stop” button at any time to abort the test by selecting “Cancel Test” or “Continue” to return to the data entry sequence. Press “Summary” to review all entered data on the display, scroll down and then ”Save” to save all entered data to proceed to the next series of data entry or the breath test. NOTE: The virtual keyboard will only be displayed if the USB keyboard is not plugged into the instrument.

10.1 Data Entry Sequence

Press the Green button from the Ready screen to begin a test. You will be given several options.



►Evidential Subject Test - Normal Test

►Training Test - Setting used to train a new operator

►Performance Verification - Run a Performance Verification test, see 13.1

►Screening Test - A test done for screening and not for evidential purposes.

►Back - Return to the Ready Screen.

If you select an Evidential Subject Test the instrument will take you through the data entry sequence. Enter the correct data in the data entry fields:

- ►Subject Last Name
- ►Subject First Name
- ►Subject Middle Initial
- ►Subject Date of Birth (MM/DD/YYYY format)
- ►Subject Driver License Number
- ►Subject Driver License State
- ►Operator Last Name
- ►Operator First Name
- ►Operator Agency
- ►County of Offense
- ►Date of Offense
- ►Time of Offense

►Summary - Review the information entered and press Save if it is correct. Note that you must scroll through all the information before pressing Save.

The instrument will prepare for the breath test by performing a series of checks.

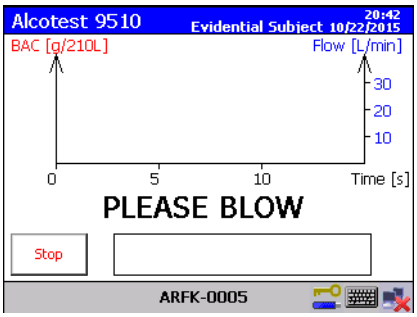
An airblank and ambient air analysis is performed to ensure that the ambient air conditions are safe for breath and standard analysis. Then an internal standard check is performed with a +/- 5% tolerance.

Another airblank and ambient aircheck are run and then an external standard check using a 0.080 drygas cylinder is performed. Note that if this check fails the instrument will lock out until the cylinder is replaced (see 13.7).

Finally another airblank and ambient air check are performed. After this the instrument is ready to accept a breath sample.

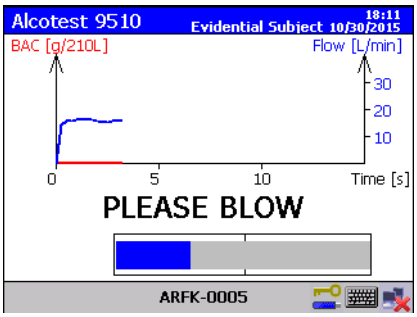
10.2 Breath Test

The instrument is ready for the subject breath test when PLEASE BLOW appears on the display.



Remove the breath hose from the storage recess. Fit a new mouthpiece onto the breath hose. Request the person being tested to inhale deeply and blow continuously and evenly into the mouthpiece. The bar at the bottom of the display represents the accumulated breath volume provided in the sample. The center of the progress bar represents the minimum required breath volume. The frame of the volume progress bar turns bold when all minimum breath criteria have been met (as described below).

A second breath sample must be collected. A two minute minimum waiting period between breath samples must be observed. The instrument will display a countdown timer.



The test results of the two tests are compared to the test criteria. To calculate whether a third sample is needed the lowest of all four results (both the IR and EC individual results from both tests) is subtracted from the highest of the four results. If the difference is less than or equal to 0.020 then the test is complete. If the difference is greater a third breath sample must be collected.

If a breath sample does not meet all of the test requirements, the instrument will display an error message, perform a purging cycle, and then return to the PLEASE BLOW prompt so the test can be repeated.

10.2.1 Breath-Analytics Criteria

The various breath flow thresholds:
- Start flow rate is 8.0 L/min.
- Minimum/Stop flow rate is 4.5 L/min.

NOTICE

Setting the start flow rate above the minimum/stop flow rate ensures that the breath test is not prematurely rejected due to a minor fluctuation in the flow rate from the subject.

Acceptance criteria for a Breath Test:
- Minimum blow time is 4.5 seconds.
- Minimum breath volume 1.3 liters.
- Plateau recognition if the concentration increases ≤4% in 1 second.
- Inhalation is detected by the 9510. If the subject inhales through the breath hose, an error “Inhalation detected” will be generated.

Acceptance criteria of Breath Test Results:
- If after two samples are collected all four test results (IR and EC from each of the two breath samples) is greater than or equal to 0.010 g/210L, the difference between the highest of the four results and the lowest are compared. If the difference is equal to or less then 0.020 g/210L then the results are accepted. If the difference is greater a third breath sample is needed.
- If a third breath sample is needed the instrument will collect it and perform the same comparison between test 1 and test 3 and then test 2 and test 3. If neither of these tests comparisons are within tolerance the test is aborted.

Acceptance criteria of the external standard checks within the breath test sequence:
- External standard checks must be within 0.072 and 0.088 g/210L inclusive.

10.2.2 Refusals

To indicate refusal, press the “Stop” icon once all data entry sequences have been completed. Three separate buttons can be selected indicating “Refusal”, “Incomplete” or “Continue”. If “Refusal” is selected, the test will be aborted and the printout will indicate “Test Result: SUBJECT REFUSED”. If “Incomplete” is selected, a printout will be provided automatically. A printout can be printed manually by selecting “Reprint” from the “READY” screen.

10.2.3 Failure to Achieve Acceptance Criteria

Any interruption of blowing or failure to satisfy the minimum requirements, such as minimum volume and minimum blowing time, will result in an insufficient breath sample. If any of the breath test acceptance criteria are not satisfied the instrument will display an error message showing the problem:

MINIMUM VOLUME NOT ACHIEVED
BLOWING TIME TOO SHORT
BLOWING NOT ALLOWED
PLATEAU NOT ACHIEVED
INHALATION DETECTED

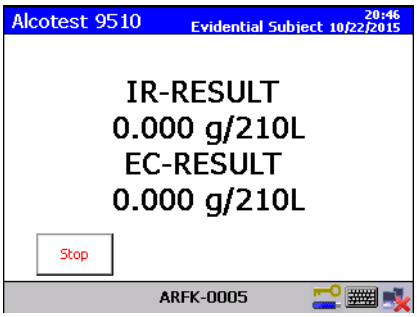
Try the following remedies:

- The subject needs to blow for a longer time.
- Have the subject take a deeper breath and blow for a longer time at a slower rate.
- Ensure that the subject waits for the “PLEASE BLOW” prompt to appear on the display before blowing into the instrument.

If an insufficient breath sample was provided, the breath test will be repeated. The instrument will allow the subject as many attempts as necessary to obtain a successful breath sample in a 180 second period. The operator can press "STOP" at any time to indicate a "Refusal", “Incomplete”, or to return to the test using "Continue".

10.2.4 Printout

After the final result is displayed, a complete data and measurement report is printed to the printer. Note that not all data entered is reproduced on the printout. The instrument is now ready to perform another breath test.



To reprint a test other than the previous test performed, please refer to the “Reprint” function in the Settings menu.

11 Preparation for Use

Place the instrument on an open, solid surface. This surface does not need to be level. The instrument should be free of strong drafts during measurement. Remove dust cover and stow away from the instrument.

Attach the AC power cable to the AC Receptacle. Apply power to the instrument by flipping the Power Switch adjacent to the Fuse Compartment. Attach all accessories like the keyboard, external printer, card reader, etc.

The display is on the right, and the internal printer is on the left side of the instrument. The storage recess for the Breath Hose is on the top. Accessories can be connected accordingly.

11.1 Stationary Use

Plug in the supplied power cord into a grounded power receptacle or a multi-outlet surge protector. Switch on the 9510 using the power switch located on side of the instrument.

11.2 Mobile Use

Connect the 12 Volt DC receptacle power cable to the 9510 and the vehicle's electrical system (cigarette lighter receptacle). The instrument will be powered up as soon as 12VDC is connected.

11.3 Disposal

At the end of the instrument's service life, dispose of the instrument in accordance with local and national waste disposal regulations or ask a suitable disposal contractor to dispose of the instrument. The local environment agency can supply further details.

12 Operation

Once 110 VAC is applied to the instrument, and the power switch is on, the display shows the desktop with a headline in the top block, the Menu, the instrument's serial number, peripheral interfaces at the bottom block, and the current status in the center of the display.

The necessary interactions of the operator and the person being tested with the device are indicated by short messages and instructions on the screen (touchscreen) of the device. The device is designed for one-button operation and use of the internal keypad. Additional accessories like an external keyboard can be used. The microprocessor control ensures a correct measurement sequence and safeguards against manipulation.

Only if all steps of the breath alcohol determination are performed correctly and all of the internal test criteria meet specifications and are within the defined tolerances, the final result of the breath alcohol analysis is displayed and a protocol is printed on the external printer.

Each operating step carried out on the 9510 is supported visually and acoustically. The device leads the operator through the testing cycle with full-text messages on the screen.

12.1 Menus

"Menu" is displayed on the lower left-hand corner of the READY screen. This Menu provides access to instrument information, functions, and settings.

12.1.1 "About" Menu

To read the software version information, choose the option "About." Press Print to print the information. Press "Cancel" to close the window.

12.1.2 "Maintenance" Menu

Maintenance functions perform different diagnostic, functionality, and verification tasks to ensure the accuracy and quality assurance of the device. These functions should only be used by trained and authorized personnel.

12.1.3 "Settings" Menu

Settings functions allow the user to change the instrument's parameters. These settings can include date and time, internal/ external printing, data management, communication settings, etc.

12.1.4 Menu Navigation

- **►Menu**
  - ►About
  - **►Maintenance**
    - ►Performance Verification
    - ►Performance Verification Test Scheduler
    - ►Calcheck Test
    - ►Screening Test
    - ►Lab ABA Test
    - ►Dry Gas Cylinder Information
    - ►Dry Gas Cylinder 1 Change
    - ►Dry Gas Cylinder 2 Change
    - ►Statistical Data
    - ►General Functions
    - ►Factory Init.
    - ►Control Mode
    - **►Calibration**
      - ►Alcohol
      - ►Heat
      - ►Pressure + Flow
      - ►Calibration Procedure
      - ►Auto Adjust
      - ►Internal Standard Adjust
      - ►IR / EC Correction
      - ►Ambient Air Check Threshold
      - ►Ambient Pressure Correction
    - ►Update WinCE application
    - ►Update measurement system firmware
    - ►Update Configuration Files
    - ►Start Selftest
    - ►Interference Settings
    - ►ScreenshotManager
    - ►Bootloader Update
    - ►Transfer records to USB
  - **►Settings**
    - ►Display
    - ►Sound
    - ►Printer
    - ►Errorlogger
    - ►Database management
    - ►Reprint
    - ►Location Database
    - ►Change current location
    - ►Set date and time
    - ►Network
    - ►CommHub Configuration
    - ►Instrument Locks

13 Menu: Maintenance

13.1 Performance Verification

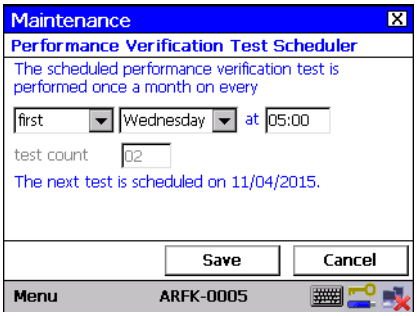
This test runs an automatic test using a dry gas cylinder to verify the instrument is operating correctly.

To begin first enter the operator's last and first name and then select which cylinder you want to use. The test will then run automatically.

The instrument will run a series of three tests using the attached dry gas cylinder with Air Blank tests interspersed between each test. The results will be printed after the tests are completed and display individual EC and IR results for each test.

13.2 Performance Verification Test Scheduler

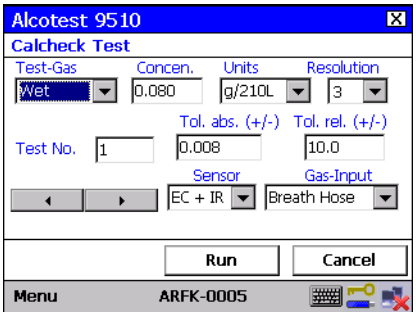
Use this function to set a time for the instrument to automatically run a Performance Verification test. You can set it to run monthly or weekly.



13.3 CalCheck Test

The CalCheck Test is used when the technician wants the instrument to measure and report the values of an external standard (accuracy verification).

The function will request the operator's last and first name before proceeding.



Verify all options are correct and press the "Save" button.

- Test Gas: Dry gas or wet bath.
- Concen. (Target Concentration): Enter the alcohol concentration of the dry gas canister or wet bath simulator being used.
- Units: Make sure it is set to "g/210L" for use in Idaho.
- Resolution: Number of digits behind the decimal in the measurement.
- Test No.: Number of consecutive tests to be performed.
- Tol. abs (+/-) (Absolute Tolerance): The allowed difference from the target concentration expressed in terms of units as defined in the Units field.
- Tol rel. (+/-) (Relative Tolerance): The allowed difference from the target concentration expressed in terms of percentage of the target co
- Sensor: Defines which sensor in the instrument is used: the fuel cell (EC), the infrared system (IR), or both.
- Gas Input: Defines which inlet path will be used to supply the external standard.

The instrument will go through the following sequences: PURGING, BLANK CHECK, DRY GAS CHECK, ANALYZING, PURGING, BLANK CHECK. The results of the Supervisor Test will appear on the display.

Depending on the number of tests selected, the instrument will either proceed with another CalCheck or finish printing (on the internal printer) and return to the "READY" mode.

NOTICE

The testing for breath dynamics such as mouthalcohol, minimum volume, minimum flow rate, and interfering substances are best done with this test sequence.

13.4 Screening Test

A Screening test is performed in the same way as an Evidential Test but no data entry is required for the test.

13.5 Lab ABA Test

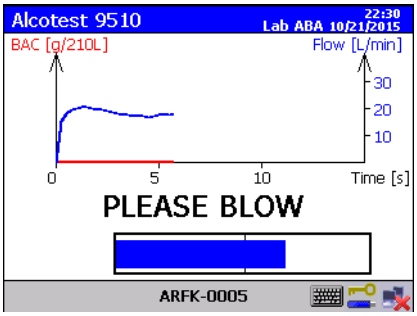
The ABA (Air Blank, Breath Test, Air blank) Test allows for convenient testing of breath test criteria. First the system will ask for details regarding the test for the record along with the first and last name of the operator.

The instrument with then ask for the number of consecutive tests to be performed (Test No.)

The instrument will go through a purging cycle, and the following messages will be shown on the Display:

PURGING
BLANK CHECK
AMBIENT AIR CHECK

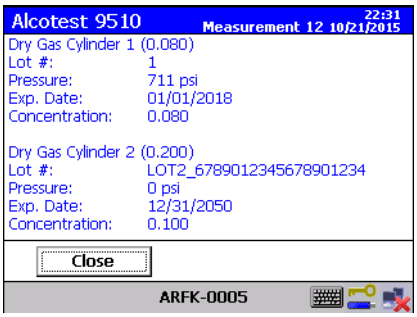
When “PLEASE BLOW” appears on the display, a breath sample should be provided. After the sample has been provided, the following messages will be displayed on the screen: STOP, REMOVE, MOUTHPIECE, PURGING, BLANK CHECK, AMBIENT AIR CHECK.The results of the ABA will appear on the display.



Depending on the number of tests selected, the instrument will either proceed with another ABA or print the results and return to the ”READY” mode.

13.6 Dry Gas Cylinder Information

This screen displays the Lot #, current pressure, expiration date, and concentration of both gas cylinders.



13.7 Dry Gas Cylinder 1 (and 2) Change

This function is used when replacing gas cylinders.

The instrument will give you the following fields to fill in:

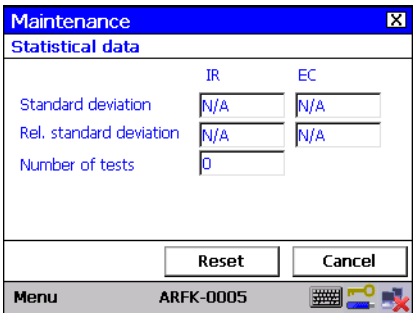
- ▶Cylinder Lot Number
- ▶Cylinder Expiration Date
- ▶Cylinder Manufacturer
- ▶Cylinder Target Concentration
- ▶Operator Last Name
- ▶Operator First Name

A pop up will appear instructing you to install the new cylinder and to press the OK button when done.

The instrument will proceed to perform an external standard check on the newly installed cylinder. Once the external standard has been verified an external printout is provided and the instrument returns to “READY” mode.

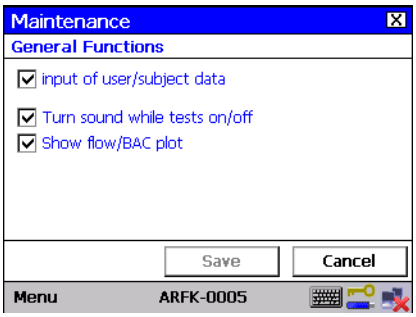
13.8 Statistical Data

This function allows you to view the standard deviation and relative standard deviation of the IR and EC systems. Hitting the Reset button will reset the history.



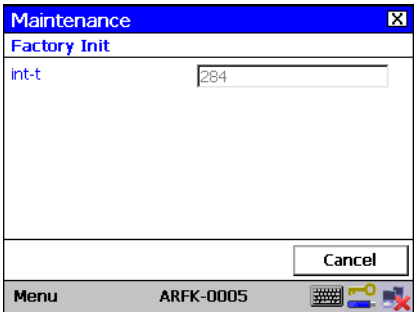
13.9 General Functions

This function allows you to toggle the requirement for user and subject data when performing tests. It also allows you to turn on and off the audible cues used by the instrument during tests and toggle whether the flow/BAC plot is shown while a test is being performed.



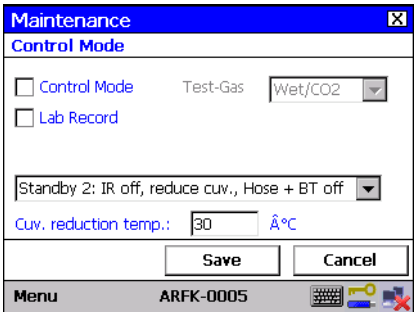
13.10 Factory Init

Allows viewing of the instrument test number.



13.11 Control Mode

The Control Mode function lets you turn on and off control mode and lab record mode and adjust standby modes.



13.12 Calibration Sub-Menu

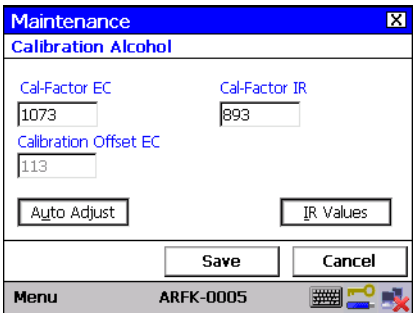
Calibration of the 9510 is performed by using the MARK IIA, Alcotest CU34, or other NHTSA approved calibrating unit. Prior to Calibrating the 9510 instrument, make sure the wet bath Simulator contains fresh certified solution, is at operating temperature and a ”Seal Check” has been performed.

NOTICE

Use of the “Alcohol” and “Auto-Adjust” functions are not normally used since they duplicate capabilities that exist in the “QAP” function.

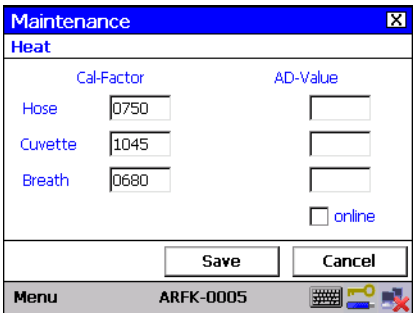
13.12.1 Alcohol

This function allows the technician to adjust the Cal-Factor EC and Cal-Factor IR. The “Calibration Offset EC” represents the A/D output of the EC’s DC offset. The value is the actual A/D output based on 12 bit resolution and a 5VDC rail. Granularity=1.23mV.



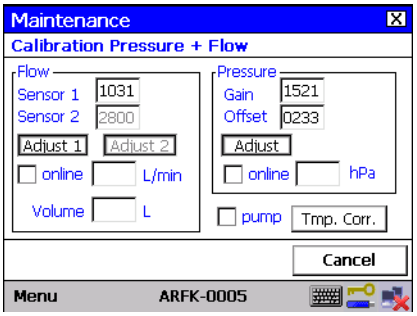
13.12.2 Heat

Allows you to adjust the Calibration factor of the hose, cuvette, and breath heat.



13.12.3 Pressure + Flow

This function is used to adjust the flow and pressure sensors of the instrument.



13.12.4 Calibration Procedure

This runs a calibration. Before it begins you must enter the following data entry items:

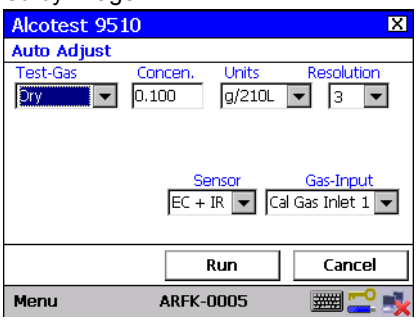
- ▶Cylinder Lot Number
- ▶Cylinder Expiration Date
- ▶Cylinder Manufacturer
- ▶Cylinder Target Concentration
- ▶Gas Inlet (select from drop-down menu)
- ▶Operator Last Name
- ▶Operator First Name

13.12.5 Auto Adjust

This function is to adjust the IR and the EC sensors to a certified alcohol standard (often referred to “calibration”).

Prior to executing the Auto Adjust function, verify the following:

- The standard being used is fresh (water/ethanol standard), and within the expiration date.
- The standard being used should be NIST traceable and listed on NHTSA’s CPL for “calibrating units” (dry-gas only).
- The simulator has been running for >20 minutes and the solution temperature is within 33.8 °C to 34.2 °C.
- The simulator has been leak tested.
- The 9510 is in "READY" mode.
- The simulator’s vapor outlet tube is maximum of 2” long or heated.
- The pressure flow regulator on top of the dry-gas cylinder is supplied by Dräger.



Adjust the values to be used for the calibration. To perform the calibration with the values entered, select “Run”. If you do not wish to perform this function, tap on “Cancel”. During the Calibration procedure, the 9510 will display the following screens: PURGING, BLANK CHECK, INSERT CAL-GAS, CALIBRATION, PURGING, ADJUSTMENT, END OF ADJUST. The instrument has now been calibrated with the values provided. The instrument will return to the Maintenance menu.

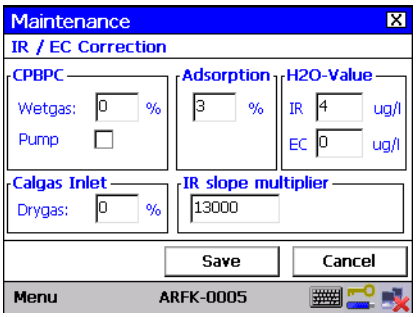
13.12.6 Internal Standard Adjust

The internal standard is automatically checked during a breath test. The analytical process in the internal standard check is virtually identical to that of an actual breath alcohol analysis. The IR-detector related algorithm is the same as for a breath test which produces a quantitative reading. More specifically, a very precise and consistent amount of the radiated IR energy from the IR Source passing through the absorption chamber is attenuated. This resembles the effect of alcohol vapor has in the absorption chamber thus, the instrument computes the drop in IR energy to a corresponding alcohol concentration reading.

The Internal Standard Adjust function performs an automated procedure which adjusts the internal standard alcohol concentration result and the attenuation of the IR energy. Technicians have menu access to initiate the Internal Standard Adjust function during the quality assurance procedure.

13.12.7 IR/EC Correction Function

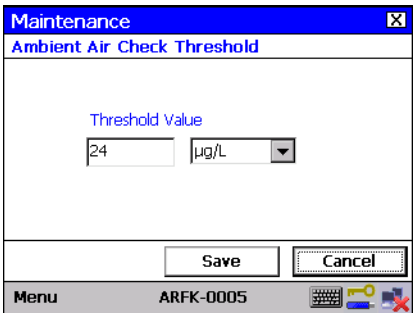
This function allows the technician to change the IR/EC Correction for Calgas Inlet and IR slope multiplier. The “Calgas Inlet" is a parameter setting which allows the fine tuning of the pressure sensor to address the dry-gas readings (EC&IR) whenever a dry-gas test is performed.



The "IR Slope Multiplier" is the logarithmic adjustment of the IR system's high concentration performance. This adjustment is performed only if needed and by utilizing the special PC program called "Linearity Adjust".

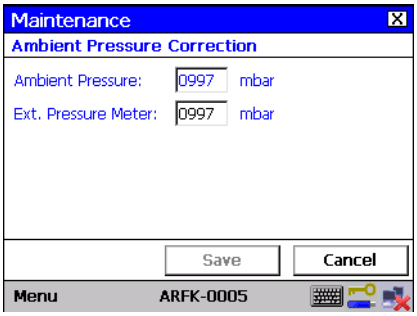
13.12.8 Ambient Air Check Threshold

This function allows you determine the threshold for determining that the ambient air around the instrument is clear.



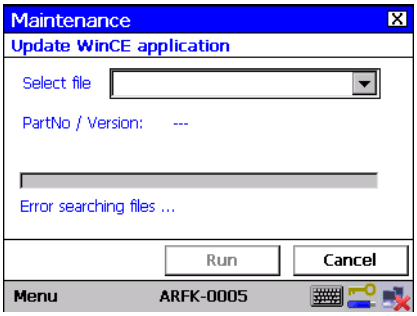
13.12.9 Ambient Pressure Correction

When accuracy checking with dry gas, the internal ambient pressure sensor must be calibrated by use of a certified NIST traceable external pressure meter. The ambient pressure will be displayed in blue as “Ambient Pressure”. The Ext. Pressure Meter displayed in black should be changed to the current reading of the barometric pressure of a NIST traceable external pressure meter. This will adjust the pressure of the sensor within the instrument.



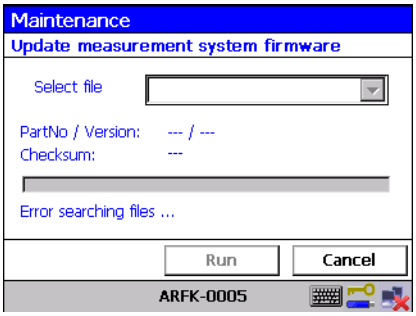
13.13 Update WinCE application

A new WinCE application can be loaded on the instrument with this option. The instrument will automatically select the appropriate file. Click the button to start the update. The instrument will return to the “READY” prompt when the WinCE application has been successfully loaded. The instrument must now be loaded with the measurement system firmware.



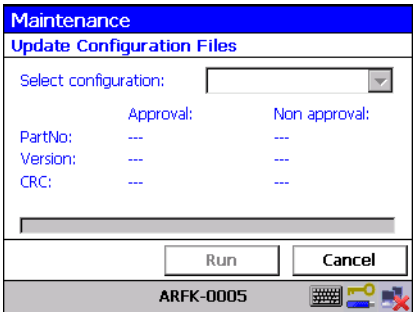
13.14 Update measurement system firmware

New measurement system firmware can be loaded on the instrument with this option. The instrument will automatically select the appropriate file. Click “Run” to start the update. The instrument will display a message when the update is complete. The instrument must now be loaded with Configuration Files.



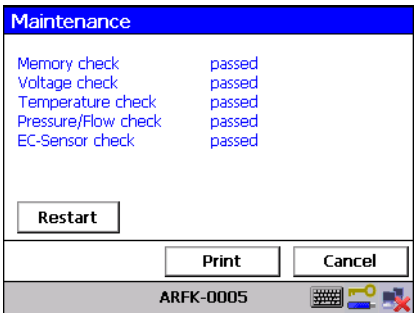
13.15 Update Configuration Files

New configuration files can be loaded on the instrument with this option. If the WinCE application or measurement system firmware has been loaded, the Configuration files must be loaded again. The instrument will automatically select the appropriate file. Click the “Run” button to start the update. The instrument will display a message when the configuration files have been successfully loaded.



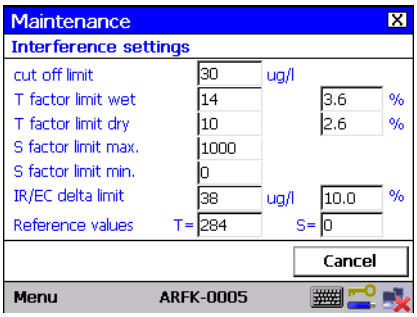
13.16 Start Selftest

Runs a test on instrument to test memory, voltage, temperature, pressure, flow, and the fuel cell and reports the results.



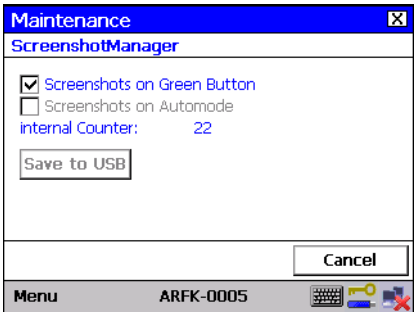
13.17 Interference Settings

This function displays and allows you to adjust values regarding interference detection.



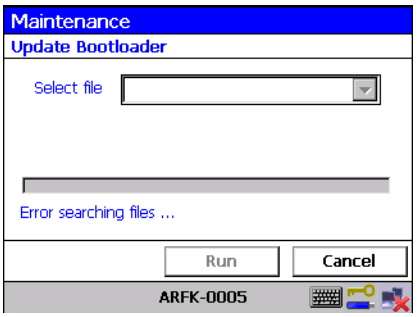
13.18 ScreenShot Manager

Allows you to take screenshots of the display of the 9510 and copy them to a USB.



13.19 Bootloader Update

This function allows you to update the Bootloader software with updates stored on a USB drive.



13.20 Transfer records to USB

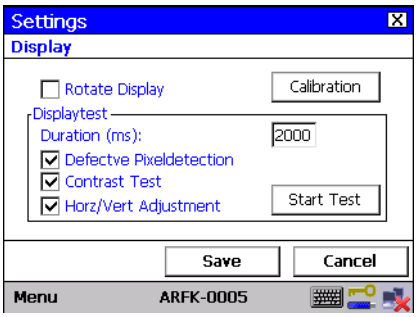
This function allows the technician to transfer encrypted breath test data stored in the 9510 to a USB.

This can be used if communication is not possible between the instrument and the host server.

14 Menu: Settings

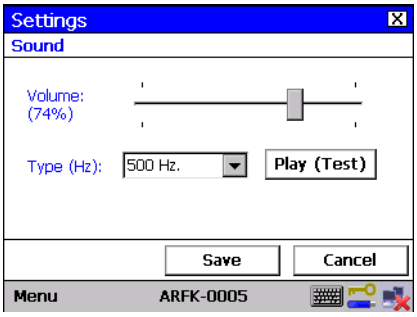
14.1 Display

This function allows the technician to calibrate/adjust display features. The display can be rotated, tested for defective pixels, and contrast and horizontal / vertical adjustment.



14.2 Sound

This function allows the technician to adjust the volume and volume frequency of the 9510. Settings can be tested prior to saving.

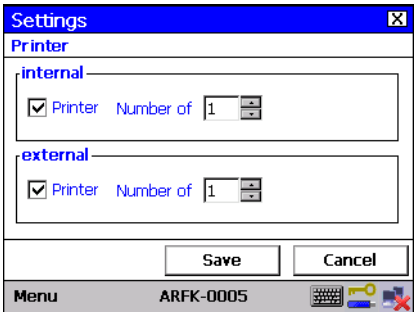


14.3 Errorlogger

Allows the technician to access a log of errors recorded by the instrument. The log records the time and date of the error and the error number.

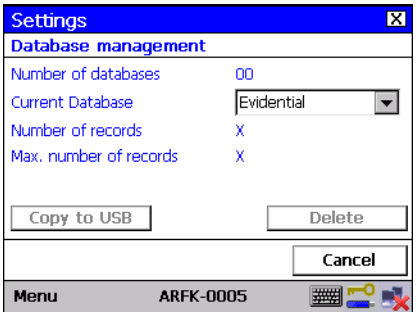
14.4 Printer

This function allows the technician to enable/disable the internal and external printer and select the number of copies. Printers can be tested prior to saving changes. The 9510 can print externally to most printers (i.e. laser, inkjet).



14.5 Database management

This function displays the number of tests per test-type currently stored in memory, with the option to download test data to a USB stick by selecting “Copy to USB” or remove stored data by selecting “Delete”.

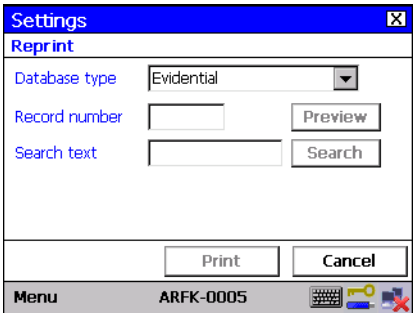


NOTICE

To ensure that authorized personnel are able to generate reprints of recently performed test the “Delete Older Measurement Tests” function should be the primary method to delete data records from instrument local memory.

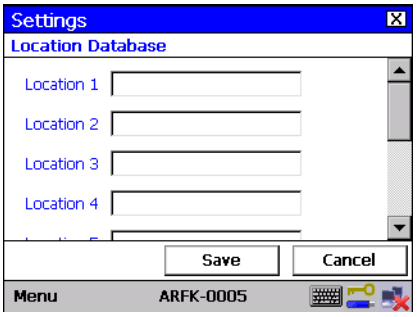
14.6 Reprint

This function allows the technician to reprint a test stored in memory. A test record can be located by entering the record number or searching for text (dates, names, etc.)



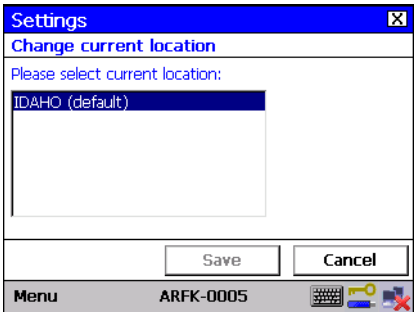
14.7 Location Database

This function allows for designation of 10 stored locations selectable in the “Change current location” function. If an instrument is regularly moved this function allows the technician to quickly select a new location.



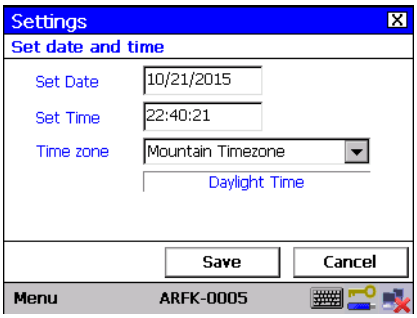
14.8 Change current location

This function allows the technician to change the current location of the instrument amongst the locations designated in the “Location Database” function.



14.9 Set date and time

This function allows the technician to set the date and time.

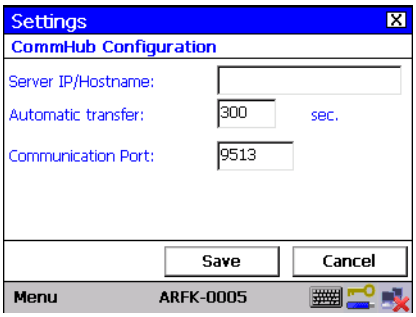


14.10 Network

This function provides network access information.

14.11 CommHub Configuration

The CommHub Configuration lets you alter server IP and hostname and set your communication port.



14.12 Instrument Locks

Allows the user to select which situations which will lock out the instrument.

15 Troubleshooting Table

Alcotest 9510 software status code/error table for Idaho

status code id	status text string	Offer restart test with previous data option	Purge and remain in test sequence	Print test record	Disable instrument	Description	Remedy Action
1	TEST ABORTED					Test procedure was aborted	Status code is for information only. No remedy required.
3	CAL GAS SUPPLY				X	Minimum flow not observed from drygas cylinder or simulator	Check to see if cylinder is empty or if tubing from drygas regulator is properly connected. If using simulator, check tubing connections between simulator and instrument. Contact technician
4	ADJUST ERROR					Observed only in calibration procedures. An IR or EC sensor calibration factor required a significant change	Technician can manually adjust alcohol calibration factors closer to target and repeat calibration procedure.
5	BLANK ERROR	X				The difference between the pre- and post purge IR output is too high	Ensure ambient air is free of alcohol vapor.
6	AMBIENT FAIL	X				After purging, the calculated ec-reading too high	Ensure ambient air is free of alcohol vapor.
7	INVALID SAMPLE - MUST COMPLETE NEW MONITORING PERIOD"					Mouth alcohol is detected	Status code relates to analyzed sample. No instrument remedy required. Perform a new Monitoring period and repeat the test.
8	INTERFERENT DETECTED	X				Interfering substances are detected	Status code relates to analyzed sample. Instrument will offer opportunity to start new test sequence retaining previously-entered data.
9	DETECTOR OVERFLOW					The calculated alcohol concentration exceeded the maximum range of the instrument	Status code is for information only. No remedy required. Follow procedures regarding possibly dangerously intoxicated subject.
10	SAMPLES OUTSIDE 10%	X				The comparison of calculated breath test results failed. IR values from subject sample 1 and 2 were compared and exceeded the required acceptable limits	Status code relates to analyzed sample. Instrument will offer opportunity to start new test sequence retaining previously-entered data.

11	DETECTOR OVERFLOW	X				Calculated breath test concentration > max. range +25%	Status code is for information only. No remedy required. Follow procedures regarding possibly dangerously intoxicated subject.
12	ALC. CONC. NOT STABLE		X			Requirements for plateau detection of the IR profile plot are not met. Continues within the 120 sec time, 3 seconds "TAKE BREATH" then "PLEASE BLOW".	Status code is for information only. Instruct subject to provide more volume in next sample attempt.
13	BLOWING NOT ALLOWED		X			Flow is detected when the instrument is not expecting flow	Status code is for information only. Ensure blowing does not occur unless PLEASE BLOW appears on the display.
14	TIMED OUT	Operator dependent	Operator dependent	Operator dependent		Maximum time for delivering a breath sample is expired. Will be followed with window: "REFUSAL INCOMPLETE CONTINUE"	Provide breath sample soon after PLEASE BLOW first appears on the display.
15	BLOWINGTIME TOO SHORT		X			Blowing time of subject is too low. Continues within the 120 sec time, display for 3 seconds "TAKE BREATH" then "PLEASE BLOW"	The instrument will initiate another breath sample attempt.
17	MIN VOLUME NOT ACHIEVED		X			Delivered blowing volume is too low. Continues within the 120 sec time, display for 3 seconds "TAKE BREATH" then "PLEASE BLOW"	The instrument will initiate another breath sample attempt.
21	EXT. STANDARD FAILED				X	The calculated gas concentration did not meet the tolerance limits	Contact technician
23	COMMUNICATION ERROR	N/A during breath test	N/A during breath test	N/A during breath test	N/A during breath test	A communication exception occurred between processors within the instrument	Turn instrument off and on. If status message persists, contact technician.
28	PUMP ERROR				X	Minimum purging volume (0.5l) was not met. Or maximum purging time was exceeded	Contact technician

34	INHALATION DETECTED					Negative breath hose flow was detected when the instrument is not expecting any flow or negative breath flow (inhalation) was detected during Please Blow mode	Status code is for information only. Ensure blowing does not occur unless PLEASE BLOW appears on the display. Ensure subject is blowing into breath hose during PLEASE BLOW instead of inhaling.
36	CALIBRATION EXPIRED - OUT OF SERVICE				X		Contact technician
37	REALTIME CLOCK ERROR				X	General error message for Real Time Clock hardware errors	Contact technician
38	HARDWARE-ERROR				X	General indicator for hardware related error messages	Contact technician
39	INTERNAL STD. ERROR				X	The results of the internal standard measurement were outside of the tolerance limits	Contact technician
41	DATA INPUT TIMEOUT					Data entry activity was not completed within the allowable time	Perform another test and complete the data entry section without leaving the instrument idle for more than 10 minutes at a time.
42	BATTERY VOLTAGE ERROR				X	The DC power supply drops below 10.5V	Depending on the voltage level, this error may not be possible. Contact technician.
43	FLASH DELAY ERROR				X	A potential problem was observed during the write cycle of EEPROM	Contact technician
45	DATALOG ERROR				X	A problem was observed while sending or storing information to the database	Contact technician
46	REFUSAL			X		Subject Refusal	Status code is for information only based on operator assessment that subject refused to provide breath samples. No instrument remedy required. Follow procedures for handling subject refusals.

49	OPERATOR TIMEOUT					Time for operator's response (e.g. no button pressed on message box) is expired	Perform another test and complete the test sequence answering all operator prompts without leaving the instrument idle for extended periods of time.
50	PUMP ERROR 2		X			This error is most likely triggered by a test with a very high concentration of alcohol and an issue with alcohol in the ambient air	Ensure ambient air is free of alcohol vapor.
51	PRINTER ERROR				X	A hardware-related problem with the internal printer. Although the internal printer is not required in normal circumstances for Evidential Breath Tests, it is a fault that must be addressed	Contact technician
52	SMARTCARD PIN ERROR				X	Problem with smartcard that can cause problems with communication with the host PC	Contact technician
53	SMARTCARD TIME ERROR				X	Problem with smartcard that can cause problems with communication with the host PC	Contact technician
54	SMARTCARD CANCEL ERROR				X	Problem with smartcard that can cause problems with communication with the host PC	Contact technician
55	SMARTCARD LOCK ERROR				X	Problem with smartcard that can cause problems with communication with the host PC	Contact technician
56	INCOMPLETE TEST	X		X		Operator terminated test sequence with Incomplete test assessment	Status code is for information only based on operator assessment that the test should be terminated as an incomplete test. No instrument remedy required. Instrument will offer operator opportunity to start a new test.

61	EC AGING COMP. ERROR				X	A problem was observed with the aging compensation algorithm, caused by an invalid time difference	Contact technician
68	DIAGNOSTIC CHECK FAILED					Any of the internal functionality tests were outside of tolerance	Repeat test. If problem continues contact technician.
70	DRYGAS CHECK ERROR				X	An empty or expired drygas cylinder was observed while checking the pressure of the dry gas cylinder(s)	Contact technician.
71	EC_SENSOR_STRESSED					This error would only be encountered by a technician. This error is only applicable during a calibration procedure and may occur when the EC sensor’s alcohol load is too high due to previously performed tests	Wait the time recommended by the instrument.

16 Message, Cause, Remedy

STATUS MESSAGE	POSSIBLE CAUSE	REMEDY
<ALCOHOL IN AMBIENT AIR>	Fuel Cell detected alcohol in the IR cuvette.	Ensure that the ambient air is free of alcohol vapors.
<BLOWING NOT ALLOWED>	Blowing without being prompted to do so.	Repeat the breath test. The instrument will initiate another breath sample.
<BLOWING TIME TOO SHORT>	The blowing duration was less than the minimum required time.	Repeat the breath test. The instrument will initiate another breath sample.
<CAL GAS SUPPLY>	The gas supply is not reaching the 9510 instrument.	Make sure the connections from the gas supply are properly attached.
<CHECK AIRWAY>	No air, or not enough air flow was detected to purge the system.	Make sure that neither the breath hose nor the cuvette exhaust port is obstructed.
<INTERFERENT DETECTED>	Interfering substance detected.	Repeat the test. If breath test cannot be completed, refer to the state regulator options.
<MEMORY FULL>	Data storage area is either uninitialized or completely full.	Upload data (if any) to the PC, initialize memory area.
<MEMORY NEARLY FULL>	Data storage area nearly full.	Upload data to the PC.
<MINIMUM VOLUME NOT ACHIEVED>	The provided breath volume is less than the minimum required volume.	Repeat the breath test.
<MOUTH ALCOHOL DETECTED>	Residual mouth alcohol detected. Either the observation period was insufficient, or the subject may have vomited, regurgitated, or placed a foreign substance into their mouth prior to the test.	Repeat the breath test.
<OUT OF MEASURING RANGE>	The breath test result is higher than the acceptable measuring range (0.00 to 0.63% BrAC).	Subject should be checked by a physician immediately!
<PLATEAU NOT ACHIEVED>	The provided breath sample has not reached a plateau (equilibrium).	Repeat the breath test. The instrument will initiate another breath sample.
<READINESS TO BLOW EXPIRED>	The maximum allowable time to deliver a breath sample has expired.	Repeat the breath test. The instrument will initiate another breath sample.
<EXT. STANDARD FAILED>	Gas-standard or instrument out of calibration	9510 is disabled. Contact certified 9510 Technician.

17 Technical Data

Resolution:	0.001%BrAC (0.001 g/210 liters of breath)
Measurement Range:	0.000% to 0.630% BrAC
Operational Conditions	
Temperature Range:	0°C to 40°C; 32°F to 104°F
Relative Humidity:	10% to 99% relative (non condensing)
Atmospheric pressure:	600 hPa to 1050 hPa
Elevation:	Maximum height of 3000 meters.
Storage Temperature Range:	-20°C to 70°C; -4°F to 158°F
Warm-up Time:	Less than 15 minutes at 20°C
Printer:	High speed, high resolution thermal printer. Standard paper 2 1/4” wide (58 mm) and 85’ long
Date/Time Display:	Month/Day/Year and Hour:Minute (24 hour clock)
Calibration Interval:	Recommended interval for verifying accuracy of instrument and, if required, recalibration: 12 months
Standard compliance:	NHTSA, OIML R 126 : 1998
Electrical Characteristics	
Operating voltages	
AC power:	110 - 240 VAC, 50/60 Hz
DC power:	10.5 - 15.5 VDC
Fuse:	T 2A H, 250 V; IEC 60127-2/V (two fuses)
Power Consumption	
During warm-up:	approx. 70 Watts
During measurement:	approx. 30 Watts
Stand-by:	< 15 Watts
Dimensions:	12.9” x 9.8” x 2.2” (front) 7.3” (back) (W x H x D)
Weight:	Approximately 15.3 lbs
CE-Markings:	Directive 2004/108/EC for electromagnetic compatibility Low Voltage Directive (LVD) 2006/95/EC

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