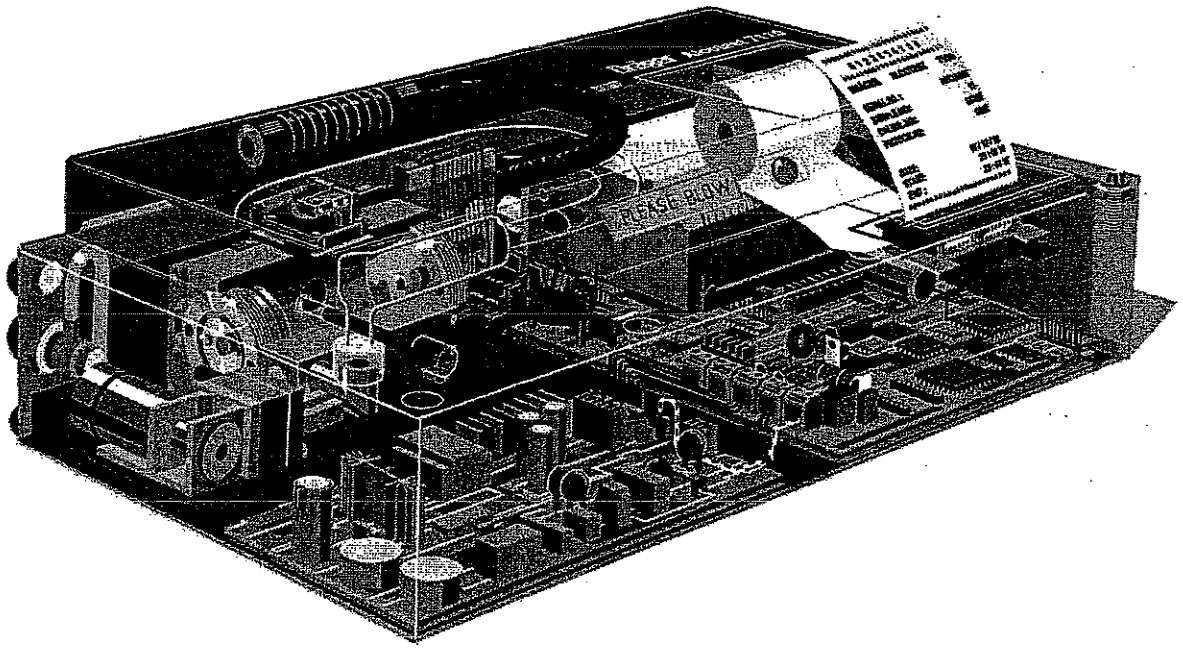
Dräger safety

ALCOTEST® 7110 MKIII-C

New Jersey State Police



User Manual-Technical

Part # MPTECHMAN71 – NJ v1.0

Draeger Safety Diagnostics, Inc.
185 Suttle Street, Suite 105
Durango, Colorado 81303-7911
Tel: (970) 385-5555
Fax: (970) 385-5522
E-mail: DSDI-info@draeger.us
Website: www.draeger-breathalyzer.com

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 printing.

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.

Safety

For correct and effective use of the Alcotest® 7110 MKIII-C system, it is essential to read and strictly follow the instructions contained in this document. The Alcotest® 7110 MKIII-C system is to be used only for the purposes specified herein.

License Agreement:

The Firmware/Software is the property of DSDI and is protected by US Copyright Law, Trademark Law and International Treaty Provisions. No ownership in or title to the Firmware/Software is transferred to the Purchaser. DSDI does not grant any express or implied right to Purchaser under DSDI's patents, copyrights, trademarks or trade secret information, except as set forth immediately below. DSDI grants Purchaser a non-exclusive license to use the Firmware/Software as part of Purchaser's use of the Hardware and under the following terms and conditions. (1) Purchaser shall not remove or obscure DSDI's copyright, trademark or proprietary notice from the Hardware and any documentation associated with the Hardware.
(2) Purchaser shall not copy, sell, transfer, loan, rent, lease, modify, extend, improve or create derivative works or alter the Firmware/Software in any way, nor shall Purchaser allow any other entity to do so, without the express written consent of DSDI. (3) Purchaser shall take appropriate steps to prevent any unauthorized copying of the Firmware/Software. (4) Purchaser shall not take any actions inconsistent with DSDI's ownership of the Firmware/Software. (5) Purchaser shall not reverse engineer, decompile or disassemble the Firmware/Software or otherwise attempt to derive source code from the Firmware/Software, nor shall Purchaser allow any other entity to do so. The foregoing license is non-transferable, except in conjunction with a permanent transfer of the Hardware to another entity and providing such other entity expressly acknowledges and agrees to the terms and conditions of this license.

Maintenance

Repairs of the Alcotest® 7110 MKIII-C System may only be performed by Draeger Safety Diagnostics, Inc., or an authorized service technician.

Only original Draeger spare parts may be used.

Table of Contents

Introduction

Application

The Alcotest® 7110 MKIII-C (also referred to as "7110" or "instrument") is a breath-alcohol analyzer used for evidential measurements in law enforcement, workplace, and other analytical environments. The Alcotest® 7110 MKIII-C provides accurate, tamper proof, BAC results that are displayed on the instrument and as a report.

Design

The Alcotest® 7110 MKIII-C is portable, fitted in a metal case, has a flexible breath hose, an illuminated alphanumeric display, a printer, and can operate in either AC or DC mode.

Specifications

Dimensions:	W x H x D: 15.8" x 5.1" x 10.4"
Weight:	Approximately 16.5 lbs.
Data Storage:	Storage capacity is approximately 1000 tests, depending on the complexity of the collected data.
Infrared Measurement:	Detects alcohol in the 9.5µm region of the IR spectrum. Utilizes an absorption chamber (cuvette) with 70 mL chamber volume, gold-coated parabolic mirrors, an electronically modulated infrared transmitter, and a pyro-infrared detector with an integrated IR filter.
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.
Range of Measurement:	0.000% to 0.630% BrAC
Resolution:	0.001% BrAC (0.001 g/210 liters of breath)
Operational Temperature Range:	32° to 104° F Relative humidity: 20 to 99% Atmospheric pressure: 700 to 1060 hPa
Storage Temperature Range:	Temperature: - 40°F to 140°F Relative humidity: 20 to 99%
Electromagnetic influences:	EC 801-3, 10 V/m direct voltage input:DIN408a39-1
Interference suppression:	DIN57871, VDE0871, Class B
Warm-up Time:	Approximately 12 minutes at room temperature.

Specifications (continued)

Printer:	Dot matrix impact printer with ribbon cassette and dual motor operation for printer head and paper advance. Standard paper, 2 1/4" wide (58 mm) and approximately 22' long.	
Calibration Interval:	Recommended interval for verifying calibration and performance: 12 months.(alcohol and breath temperature sensing system)	
Standard compliance:	NHTSA OIML	
Electrical Characteristics:		
Operating voltages:		
AC power	90-260 V AC, 50 - 80 Hz	
DC power	10.5 V DC to 15 V DC car battery supply	
Fuses:		
AC power	5x20 mm, T2/250 V (2 pieces required)	
DC power	5x20 mm, M6.3/250 V	
Power consumption:	during warm-up time	approx. 70 Watts
	during test	approx. 30 Watts
	Standby mode	approx. 15 Watts

Instrument Technology

Dual Sensing Systems

Benefits of Dual Technology

By combining two distinct analytical systems – Infrared (IR) and Electrochemical (EC, also referred to as Fuel Cell) to analyze a subject's breath, the 7110 MKIII-C is able to provide two precise, accurate, and independent test results. Due to the fact that these systems are based on different technologies, it is therefore not unusual to observe slightly different results.

Infrared spectroscopy requires that a zero reference be established prior to a subject's breath test. Because the fuel cell of the 7110 MKIII-C is "piggy backed" on the IR cuvette, we 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® 7110 MKIII-C). As mentioned earlier, analyzing alcohol by two independent methods is a highly desirable feature for medicolegal purposes."

Infrared

The IR measurement system detects alcohol in the 9.5µm region of the IR spectrum. It utilizes an absorption chamber (cuvette) with 70 mL chamber volume, gold-coated parabolic mirrors, an electronically modulated infrared transmitter, and a pyro-infrared detector with an integrated IR filter.

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 work to develop standardization on breath testing devices utilizing infrared theory. The list of definitions below will help you become familiar with some of the 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 to 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 a 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).

Infrared Theory

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

If infrared energy from a source is passed through a concentration of ethanol molecules, the molecules will absorb IR energy at two specific wavelengths. By selectively filtering the energy from the source, we may select a narrow region of the infrared spectrum over which to measure the amount of absorption. Ethanol molecules will strongly absorb infrared energy at approximately the 3.30µm to 3.60µm wavelength, and at approximately the 9.00µm to 10.00µm wavelength. Thus, we can select, by means of an optical filter, a narrow slice of energy in the near infrared region desired and will absorb that energy if ethanol molecules are present.

A breath sample containing ethanol is introduced into the sample chamber where IR energy is present. A specific amount of IR energy will be absorbed by the ethanol molecules. An IR detector will detect the drop in IR energy due to the absorption by the ethanol molecules, and will convert this change into a reading.

Beer-Lambert Law

Law of Absorption

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

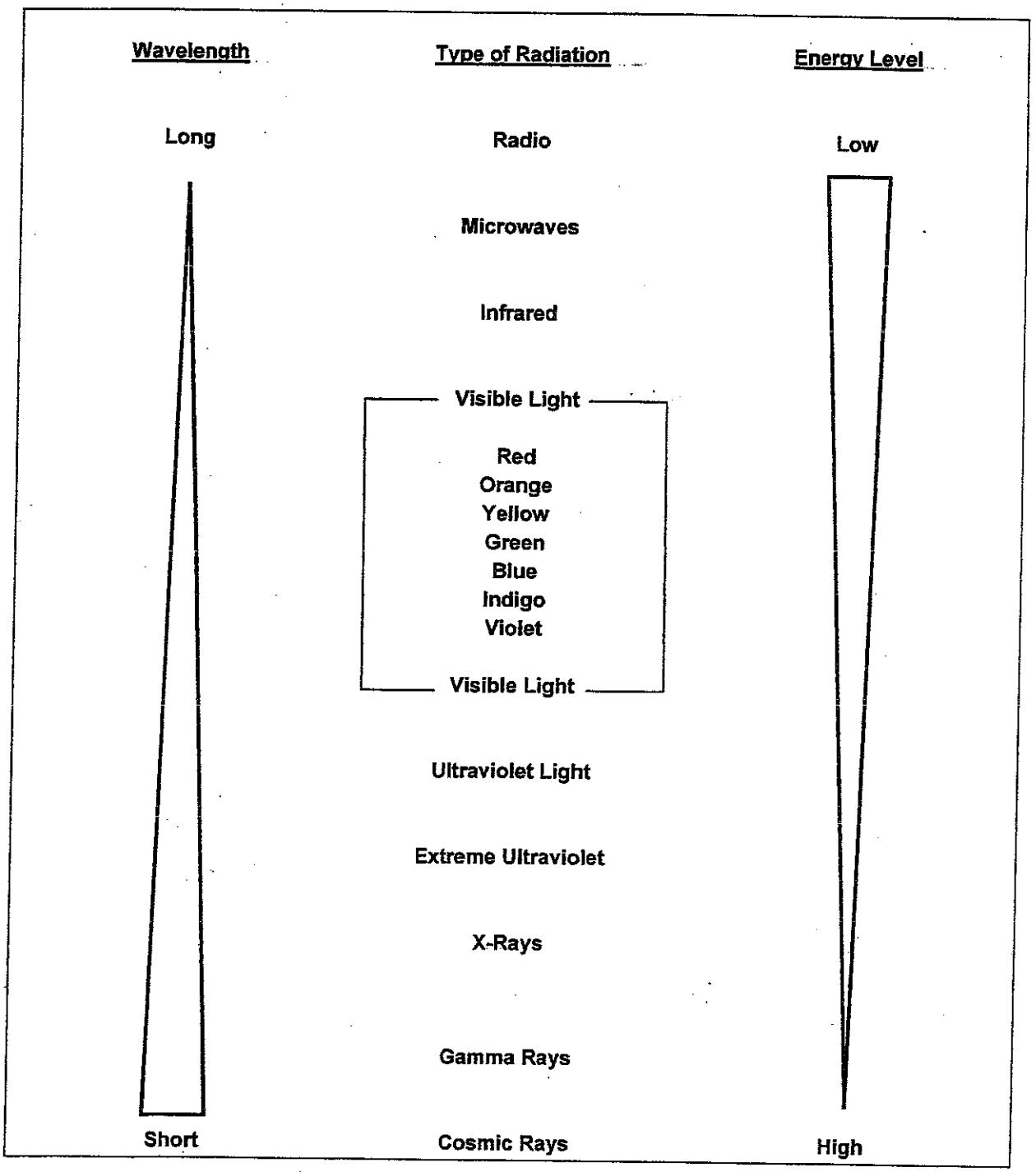
Law Applied

In an IR chamber one end has an IR source and at the other end 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 from the IR source striking it.

A breath sample containing ethanol is introduced into the chamber, the ethanol will absorb some of the IR energy causing less IR energy to reach the IR detector resulting in a voltage decrease.

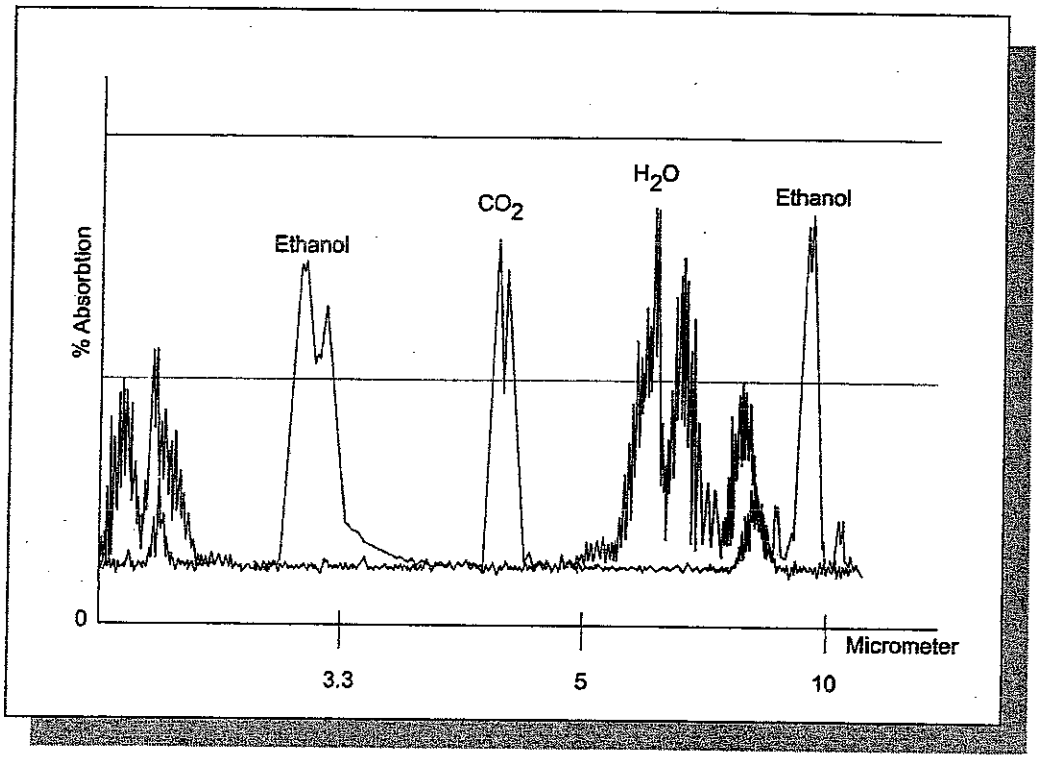
An increase in the BrAC will result in a proportional decrease in the detector's voltage.

The Electromagnetic Spectrum:



Infrared Spectrum

Fig. 1 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 near 3.4 µm which corresponds to the stretching of the C-H bond, and the other near 9.5 µm caused by the vibration of the C-O bond.



IR - spectrum of a human breath sample containing 200 ppm ethanol (approximately 0.08% BrAC)

Figure 1 -
Infrared Spectrum

Absorption of Ethanol

Fig. 2 below shows the absorption of ethanol. The shaded area represents the infrared filter of the 7110 MKIII-C. It shows the central frequency as 9.5µm with a half band width of 0.50µm which significantly increases the signal to noise ratio (Resolution).

The 7110 MKIII-C 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.

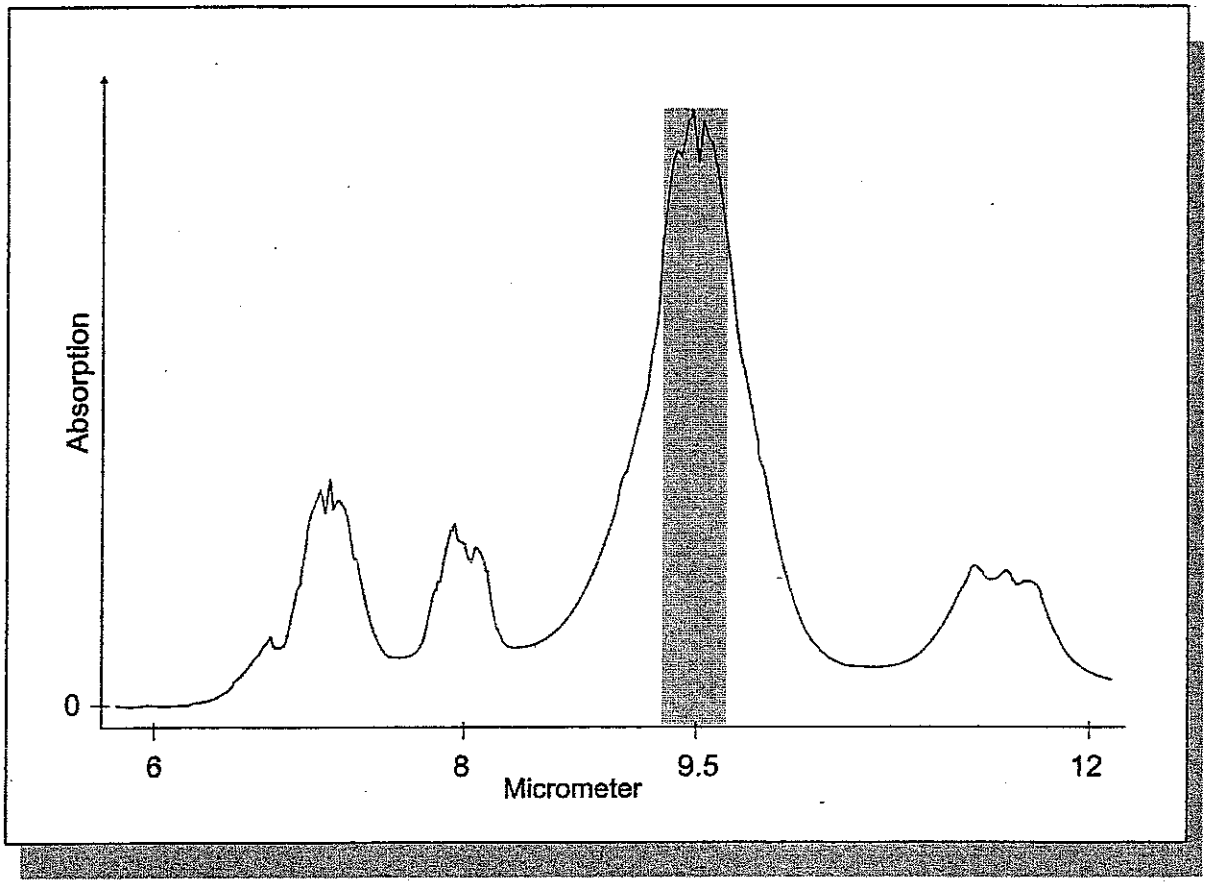


Figure 2 -
Ethanol Absorbtion

Electrochemical

The EC sensor system 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.

Electrochemical Cell

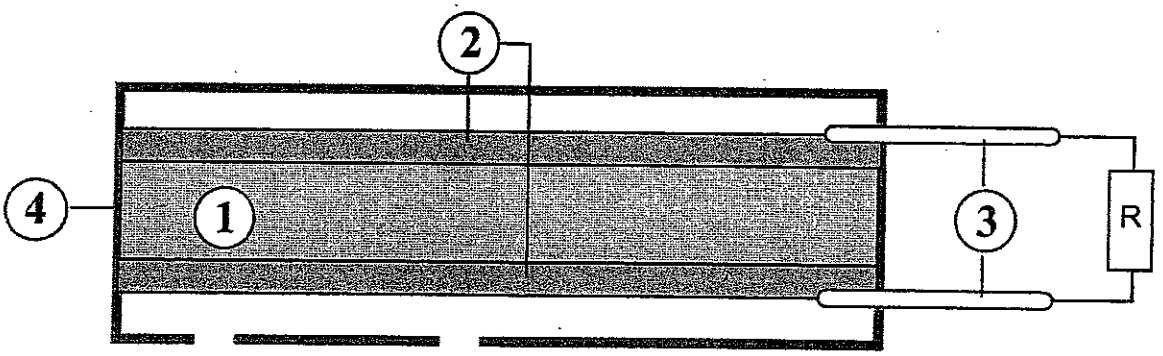
The device known as an electrochemical fuel cell was originated in 1839 by Sir William Grove. He discovered that if two platinum electrodes were immersed in a sulfuric acid electrolyte, and hydrogen was supplied at one electrode and oxygen at the other, an electric current was produced as long as gas was supplied to the device. The chemical reaction was the same as if the hydrogen were 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. In the early 1960s, a group at the University of Innsbruck, Austria, demonstrated a practical construction for an ethanol detector.

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 one small hole (gas inlet) leading into a sample chamber, where a breath sample is introduced and another small hole for the pump port.

① CATALYTIC IMBEDDED MEMBRANE
② PLATINUM PLATES
③ ELECTRODE CONNECTIONS
④ PLASTIC HOUSING



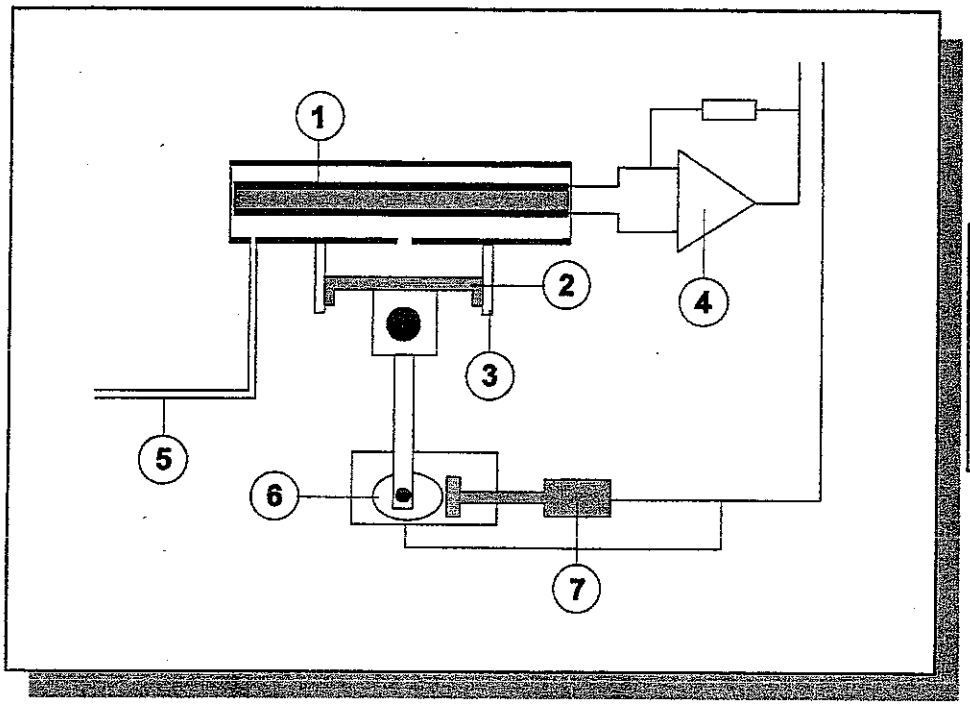
Only one platinum plate will be exposed to the breath sample. Once ethanol reaches the platinum, a chemical reaction is triggered. This chemical reaction produces an electrical current between the two platinum plates, the voltage of which is measured. This becomes the useable indicator of the amount 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.

In the reaction that takes place in a fuel cell, it is known that ethanol is converted to acetic acid. (ethanol + oxygen = acetic acid + water).

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)

Fuel Cell Analytical System of the Alcotest® 7110 MKIII-C



EC Sampling System

1	Fuel Cell
2	Piston
3	Cylinder
4	Current/Voltage converter
5	Breath inlet pathway
6	Motor
7	Position switch

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

The fuel cell assembly 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.
• Current/Voltage Converter	Sends the voltage change to the microprocessor.
• Breath Inlet Pathway	Allows breath sample to pass from IR sample chamber within the cuvette.
• Motor	Drives the piston.
• Position Switch	Indicates that the motor has completed its cycle.

Calibration Method

Wet Bath Simulator Methodology

Using wet bath Simulators for Calibration testing has been the standard method used for many years. Breath alcohol Simulators are specially designed water-alcohol instruments, which provide equilibration of alcohol vapor between water and air at a controlled temperature.

The water-alcohol solution is maintained at a temperature of 34°C (+/- 0.2°C), which is the approximate temperature of exhaled breath. 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.

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.

When a volume of alcohol is added to water it dissolves to form a solution. There is a tendency for some of this alcohol to escape from the solution in the form of gaseous alcohol, which can be detected by the odor of alcohol lingering above the solution.

If an alcohol solution is poured in 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 solution 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."

Distribution ratios are **NOT** related to a person's weight and/or physique. The formation of a fixed ratio (at a given temperature) of the concentration of a volatile substance in solution and in the air above the solution is called partitioning. The ratio of concentrations at equilibrium is called the distribution ratio, which is more specifically the weight of alcohol in a given volume of air to the weight of alcohol in the same volume of solution (when the air and the solution are at equilibrium).

Henry's Law also applies to the human body. The partitioning of alcohol between blood (in the lungs) and breath occurs in the same fashion as described for alcohol in aqueous solutions.

Henry's Law (continued)

An application of Henry's Law to describe the partitioning of alcohol between blood and breath in the human body is shown in the following table:

HENRY'S LAW	**HUMAN BODY**
When an *aqueous solution*	blood
of a *volatile compound*	alcohol
comes to *equilibrium with air*	in lungs
there is a *fixed ratio* between the concentration of the compound in air and its concentration in solution	Ratio: 2100 : 1 (assumption) Concentration of alcohol in blood varies.
and this ratio is constant for a *given temperature*	Body temperature
% Alcohol Reading	**Blood alcohol reading is dependent on how much alcohol is present in a person's blood.**

Breath Ethanol Measurement Specificity

Detection of Interfering Substances

As previously mentioned, the Alcotest® 7110 MKIII-C's infrared sensor operates in the 9.5µm range of the infrared spectrum. For example, acetone, toluene, and acetaldehyde 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 Alcotest® 7110 MKIII-C is free from the influence of these compounds as they relate to a living, breathing subject taking a breath test.

The Alcotest® 7110 MKIII-C also employs an alcohol specific electrochemical (fuel cell) sensor which is not influenced by acetone, toluene, or acetaldehyde. Both sensing systems were tested independently by NHTSA and found to be within its specifications for use in an evidential breath tester.

During either a calibration or an accuracy check, the instrument memorizes the fuel cell response to ethanol in the form of a curvature analysis profile. From this analysis, the presence of methanol or isopropanol can be detected by comparing the time constant of the curve of ethanol compared to methanol or isopropanol (see Fig. 3).

If the analysis of the subject's breath reveals different curvature characteristics, "Interference" will be displayed and the test invalidated.

During a test, the subject's breath is analyzed by both the infrared and fuel cell sensors. There is a preset tolerance that both readings must fall within for a test to be valid. The results must be within .008 gm/210L up to a .08 gm/210L BAC and 10% thereafter. If the two results are within the preset tolerance, the results are displayed and printed. If, however, 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 an Accuracy check or Standard check when using substances other than ethanol.

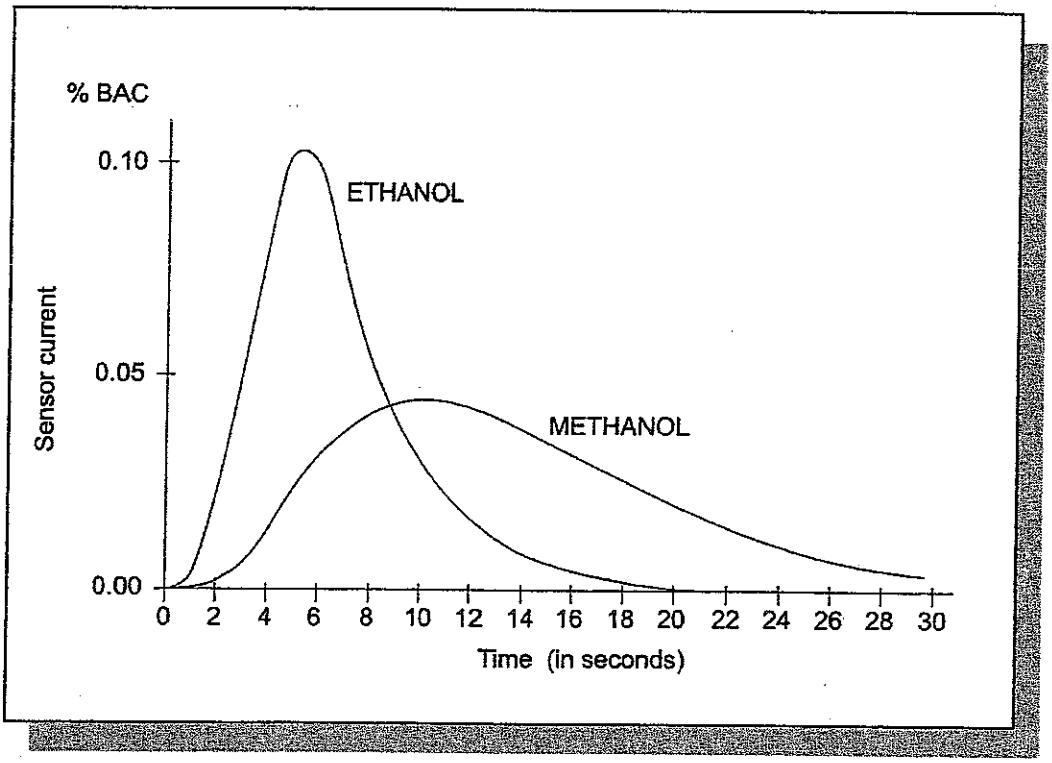


Figure 3 - Response of the electrochemical sensor to ethanol in comparison to methanol.

Mouth Alcohol Detection

Mouth alcohol is characterized by a sharp increase of the alcohol concentration at the beginning of the subject's sample followed by a decrease until the end of the sample. While a breath sample is delivered, the breath's alcohol concentration is continuously monitored. If mouth alcohol is detected, a reference message is displayed and the test is aborted.

- The 7110 will flag "mouth-alcohol", if after 4 seconds of blowing at the rate of >2.5L/Min., a negative slope of $\geq$ 10μg/L per 1/4 second over a period of three consecutive 1/4 second windows is detected.
- The 7110 will flag "mouth-alcohol", if the IR end value (alcohol concentration) is $\leq$200μg/L, but $\geq$ 50μg/L and the IR peak value is $\geq$ [IR end value + 50μg/L].
- The 7110 will flag "mouth-alcohol", if the IR peak value is $\geq$ [IR end value + 50μg/L+5%(IR end value - 200 μg/L)].

For your reference, in order to get % BAC, multiply μg/L by 0.00021.

Internal Components

Optics

The central part of the measuring system is the infrared absorption cuvette, where the breath sample is analyzed. The breath sample is transferred into the system via the breath hose. The cuvette is heated to 41°C (± 1°C) to avoid condensation and to guarantee defined conditions for the analysis. The cuvette is a multi-reflection cell which provides a long absorption path for high precision 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 because fast changes are noticed. At both ends of the cell, gold coated parabolic mirrors contain the infrared source and the detector with the IR-filter. Energy from the infrared source passes through a central orifice in the mirror onto the detector. The IR energy makes 7 passes before it is received by the IR detector. The infrared source is a small platinum heating element. Due to its low thermal mass, it can be modulated by supplying it with short current pulses, thus totally avoiding a mechanical chopper. Furthermore, power consumption is only 1.5 Watts. The detector is a pyro-detector with very high sensitivity. Its housing also contains the alcohol specific filter. The output signal is fed into a very low noise amplifier, which brings the voltage to a considerable level for further analysis.

Sampling System

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

Flow Sensor

At the inlet of the cuvette there is a sensor which measures the breath flow during a subject's test. The resistance of this heated thin filament changes when it is cooled down by the incoming air. Due to its very low thermal capacity, response time is very fast and interruptions in the flow of the breath sample can be easily detected.

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 to check calibration.

Breath Hose

The breath sample is transferred through the breath hose into the cuvette. The breath hose is heated to 43°C to avoid condensation and the temperature is controlled to ± 3°C by two temperature sensors. It has excellent insulation to keep power consumption minimal at low temperatures. The breath hose is 46 inches long and flexible.

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 also has an RS 232 interface to communicate with a computer allowing all stored data to be uploaded with optional communication software.

Signal Processing System

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 for noise reduction. At the A/D converter, this signal is sampled 128 times per second with 12 bit resolution and then it is transferred to the micro processor.

SYSTEM SETUP

Preparation

The Alcotest® 7110 MKIII-C should be placed on a solid, level surface free of obstructions. Excessive vibration and drafts should be avoided.

To certify the instrument and verify accuracy, execute the functions in the following checklist in consecutive order (see 'Functions' section for further details):

Certification Checklist

❑ **PROBE:**	To enter a value for the simulator temperature probe used.
❑ **SIM-EQULIB:**	To set the length of a lockout countdown timer that begins after the solution has reached operating temperature to allow uniform temperature equilibration of the entire simulator.
❑ **SET-CLOCK:**	To set the instrument's date and time.
❑ **LOCATION:**	To define the location of the instrument.
❑ **PRINTOUT:**	To select the printer settings.
❑ **CALIBRATE:**	To calibrate the instrument (see 'Instrument Calibration' section).
❑ **CTRL-CONFIG:**	To define the appropriate settings required for the control tests.
❑ **CTRL-TEST:**	To perform a control test (see 'Control Test' section).
❑ **LIN-CONFIG:**	To define the appropriate settings required for the linearity tests.
❑ **LIN-TEST:**	To perform a linearity test (see 'Linearity Test' section).
❑ **SOLN-CONFIG:**	To define the appropriate settings required for the solution change tests.
❑ **SOLN-DAYS:**	To set the maximum number of days allowed prior to a solution change.
❑ **SOLN-TESTS:**	To set the maximum number of tests allowed prior to a solution change.
❑ **SOLN-CHANGE:**	To perform a solution change (see 'Change Solution' section).

WARNING: Never use interfering substances while performing CALIBRATE, CTRL-TEST, LIN-TEST, or SOLN-CHANGE. Unspecified interfering substances (i.e. isopropyl, acetaldehyde, etc.) can be tested at the PLEASE BLOW/R prompt while using the ABA function or during the Breath Test.

Usage

The Alcotest® 7110 MKIII-C can be used in either stationary or mobile locations.

Stationary Location:

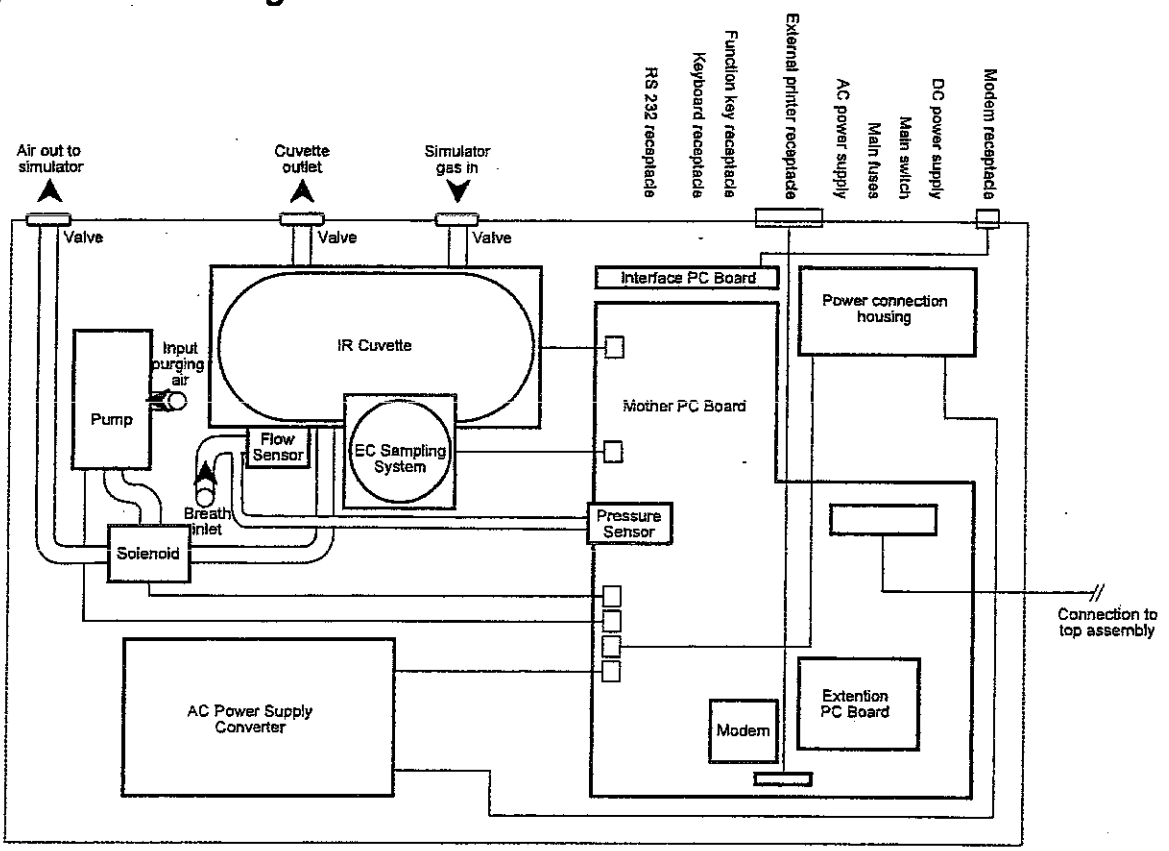
For stationary use, the power cord should be plugged into a "grounded" power supply or multi-outlet surge protector.

Mobile Location:

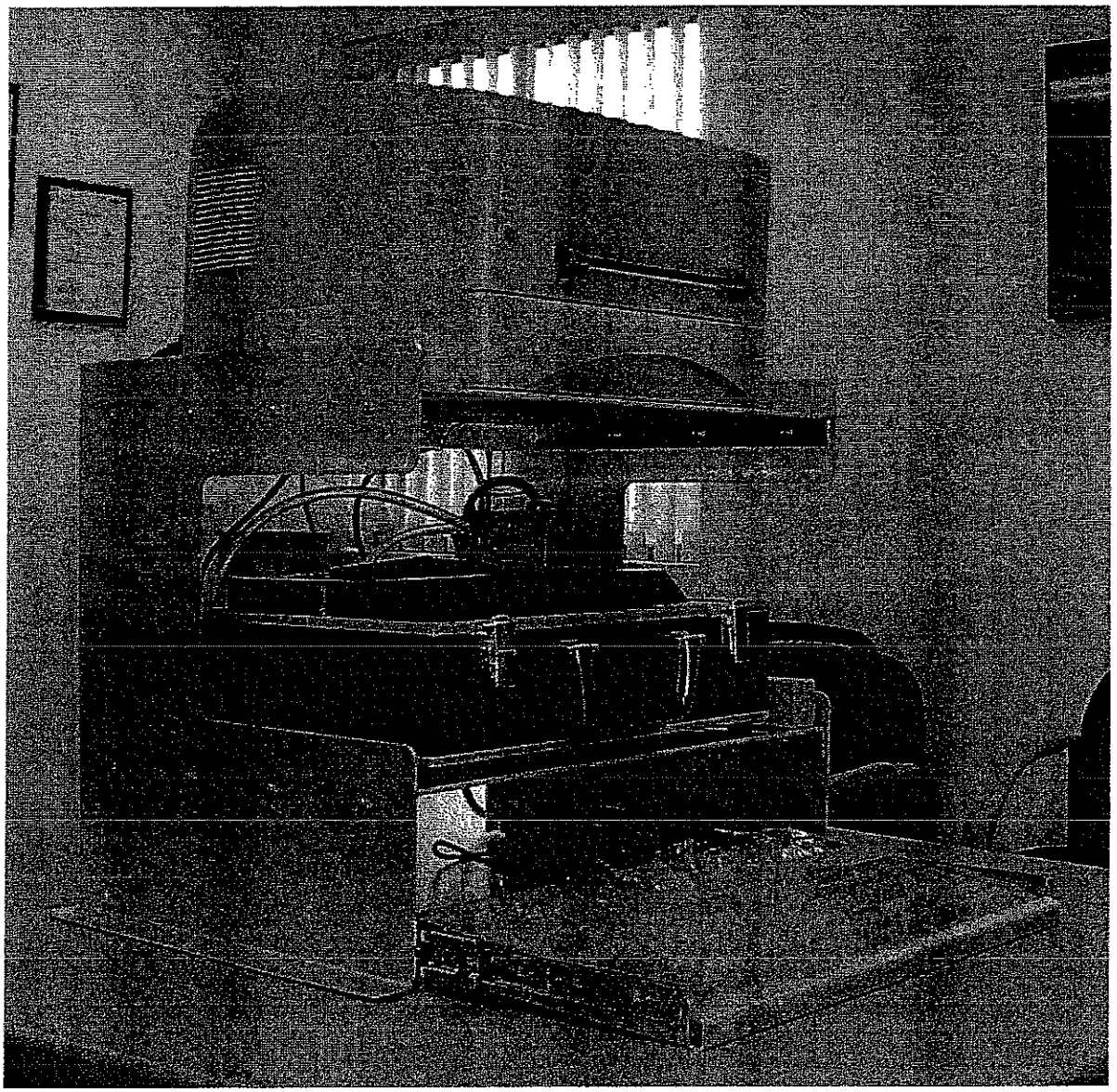
For mobile purposes, connect the 12 VDC power cable to the automobile's electrical system (cigarette lighter receptacle). The "ON/OFF" switch of the 7110 will be deactivated. It can be turned off by simply unplugging the power cord from either the electrical supply or the 7110.

Note: The automobile battery must be in good condition and capable of continuously delivering a minimum of 10.5 volts. Ensure that the cigarette lighter receptacle is clean and free of obstructions to ensure proper contact.

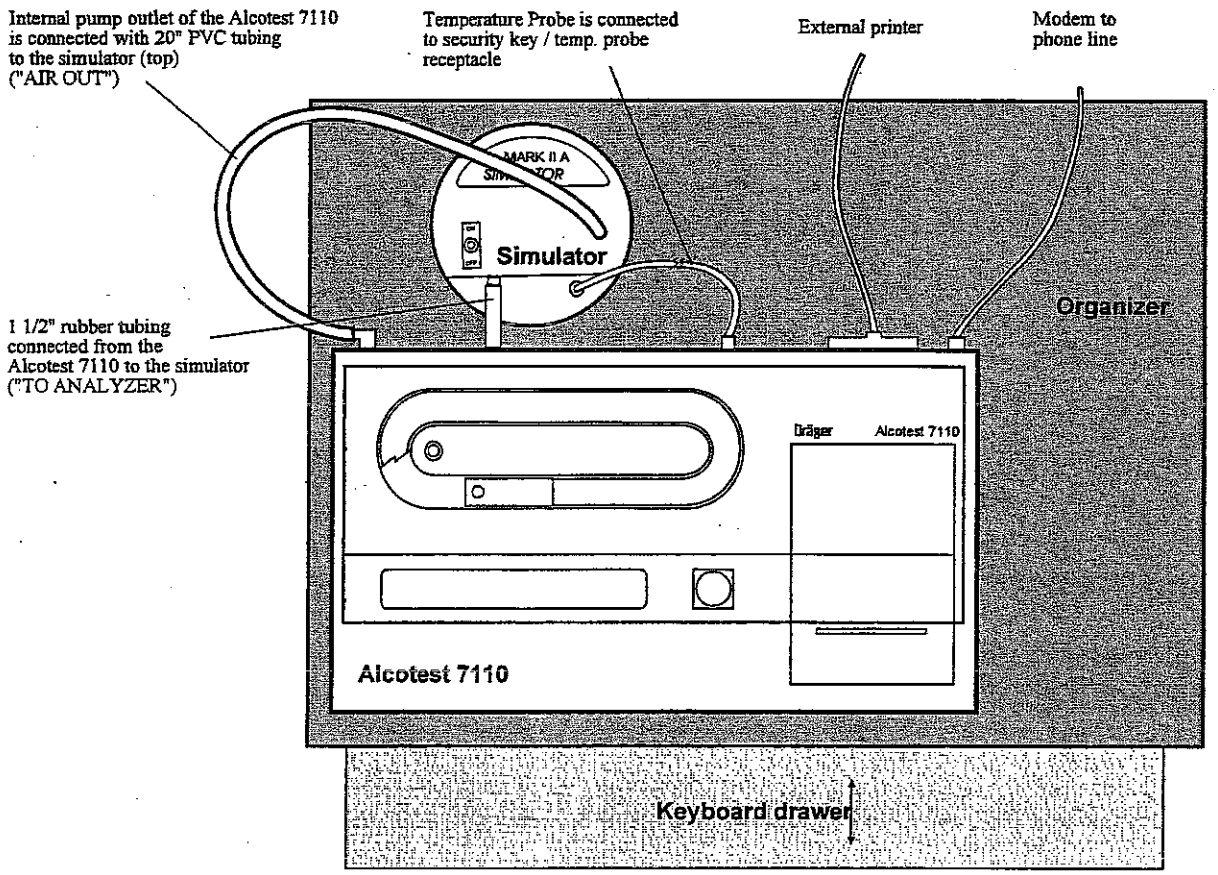
System Block Diagram



Complete System



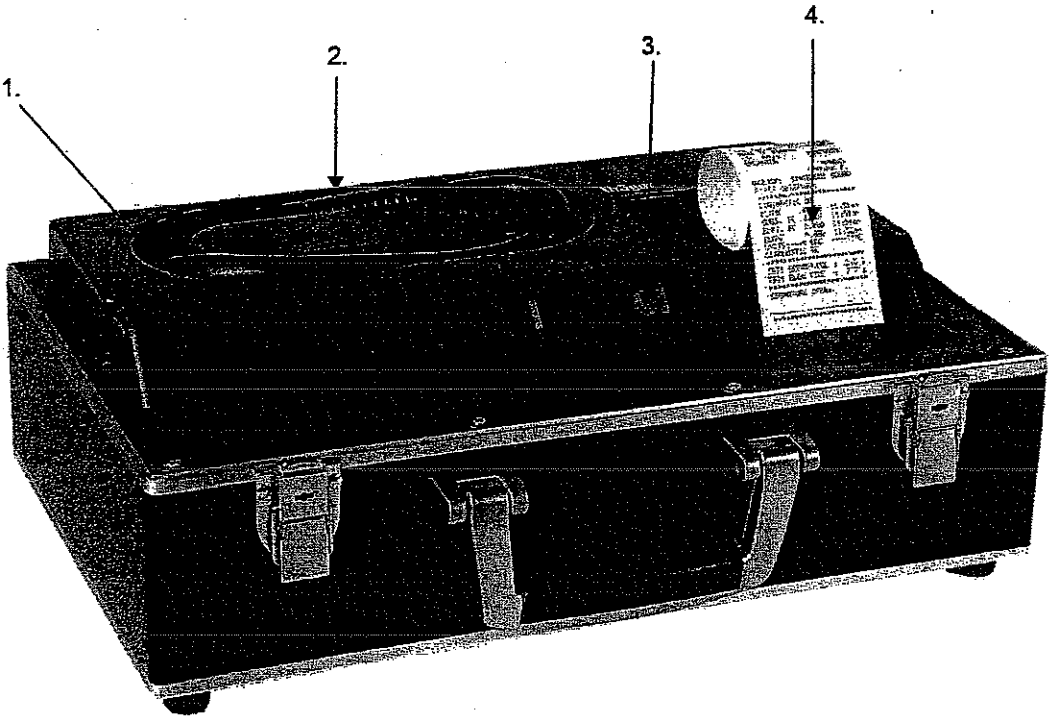
System Overview

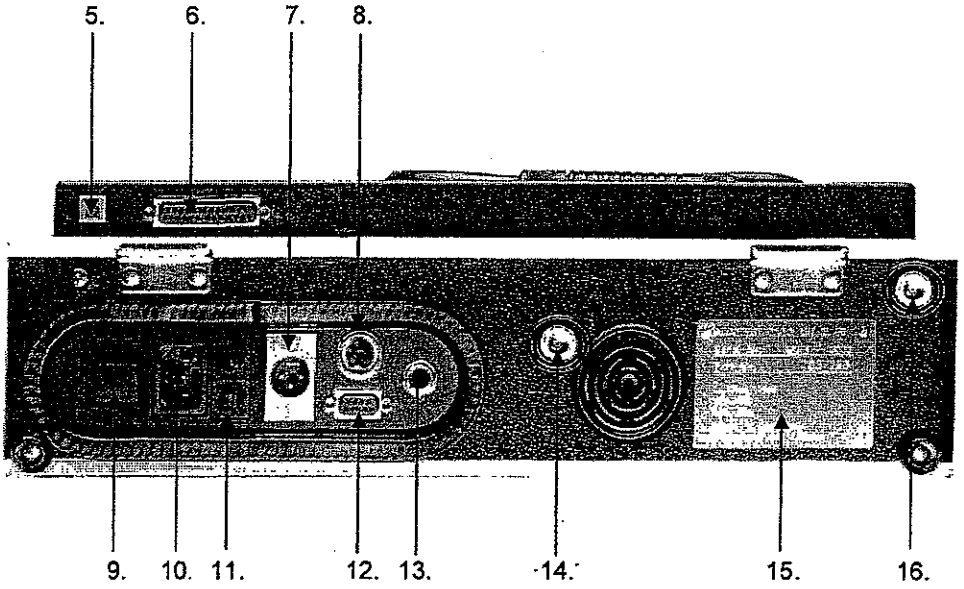


Components

Front View

1. Display
2. Breath Hose (in storage)
3. "Start" Button
4. Internal Printer





Rear View:

5. Modem port
6. Printer port
7. VDC port
8. Keyboard port
9. ON/OFF Switch
10. VAC port
11. Main fuses
12. RS-232 port
13. Temp. Probe/ Function Key port
14. Wet Gas inlet
15. Serial # Plate
16. Air outlet

SYSTEM FUNCTIONALITY

Warm-Up

Start-up Mode:

When you turn on the instrument, an internal self-test is performed and the following will display:

MEMORY TEST MODEM OK WARMING UP NOT READY LOCATION: {Instrument Location} MM/DD/YYYY xx:xx am/pm

The 7110 automatically purges the cuvette and breath hose with ambient air and the following messages will be alternately displayed:

WARMING UP NOT READY

When the instrument is warmed up, the unit beeps twice and the following will appear:

READY

Stand-by Mode:

The 7110 automatically goes into "STAND-BY" mode whenever it is not being used. The display will read as follows:

STAND-BY (READY = > PUSH BUTTON)

- Push the orange, 'Start' button.
- Instrument will warm up and the following messages will be alternately displayed:

WARMING UP NOT READY

When the instrument is warmed up, the unit beeps twice and the following will appear:

READY

Test Data

A breath test can be performed whenever the display reads as follows:

READY

- Press the orange, 'start' button (briefly) to begin the test. This button may also be used to manually abort a test by pressing it for 2 seconds.
- Follow instructions on the display and enter information (via keyboard) after each prompt.
- After typing data into a field, press the **'Enter'** key to proceed (Note: The 7110 will not proceed to the next prompt until data is entered into each field).

Note: The number shown in brackets behind each prompt indicates the maximum characters allowed.

SOLUTION CHANGE REQUIRED IN XXX DAYS OR XX TESTS
(when the number of days or tests expires, the solution must be changed)
SUBJ LAST: {24}
SUBJ FIRST: {24}
SUBJ MIDDLE: {2}
D.O.B.: MM/DD/YYYY
SUBJ GENDER <M> <F>:
SUBJ WEIGHT: {4}
SUBJ HEIGHT < f-il >: {4}
DRIVER LICENSE NO.: {24}
ISSUING STATE: {2}
DEPT. CASE NO.: {14}
SUMMONS NO.: {24}
ARR. OFF. LAST NAME: {24}
ARR. OFF. 1ST NAME: {24}
ARR. OFF. M.I.: {2}
ARR. OFF. BADGE #: {10}
ARREST DATE & TIME: MM/DD/YYYY HHMM am/pm
ARREST LOCATION: {4}
OPER LAST NAME: {24}
OPER FIRST NAME: {24}
OPER MIDDLE INITIAL: {2}
OPER BADGE #: {10}
REVIEW DATA <Y/N>:

- If you want to review the data, enter **'Y'** and press **'Enter'** to scroll through prompts (type in any changes to data).
- Enter **'N'** to proceed.

The 7110 will run a 'Control Check' and display the following:

PURGING
AMBIENT AIR CHECK
AIR BLANK CHECK
CONTROL CHECK
PURGING
AMBIENT AIR CHECK
AIR BLANK CHECK

Breath Test

The instrument is now ready for a breath test, and will show the following display:

PLEASE BLOW/R >

The instrument is designed to require a Valid Breath Sample as defined here.
VALID BREATH SAMPLE – A breath sample that meets all validation criteria required by the instrument:

- Uninterrupted delivery of breath at ≥ 2.5 l/min flow rate
- Uninterrupted delivery of breath of ≥ 4.5 seconds
- Minimum breath volume of ≥ 1.5 liter
- Having reached the IR absorption plateau (Level slope
- No detection of mouth-alcohol or interfering substance

- Remove the breath hose from storage and insert a new mouthpiece.
- Advise the subject according to the alcohol testing procedures defined in the Operating Manual.
- Perform the breath test, verifying that the subject follows the instructions provided.

The instrument will show the following display:

STOP

The instrument will purge the system and display the following:

PURGING AMBIENT AIR CHECK AIR BLANK CHECK

The instrument allows the required wait time (2 minutes) to pass and *flashes* the following message:

PLEASE WAIT

A second purging process is performed and the display will read:

PURGING AMBIENT AIR CHECK AIR BLANK CHECK

The instrument is now ready to collect the 2nd breath sample, and will indicate it with the following:

PLEASE BLOW/R >

- Follow the instructions listed above to complete the breath test and the display will show:

STOP

NOTE: If the first two valid breath samples are not within acceptable tolerance agreement, the instrument will automatically require collection of a third valid breath sample (see 'Tolerance Calculations' section).

*** Acceptable tolerance agreement:** The instrument requires that the measured alcohol concentration of two breath samples must agree within the following specified limits:

- Every valid breath sample is analyzed by each the IR sensor and the EC sensor.
- Two valid breath sample measurements (four readings) must be within specified limits of each other for acceptance and validation by the instrument.
- All four measurements must be within 0.010%BAC of the average of all measurements or within 10% of the average of all measurements, whichever is greater.

The 7110 will run a second 'Control Check' by displaying the following:

PURGING
AMBIENT AIR CHECK
AIR BLANK CHECK
CONTROL CHECK
PURGING
AMBIENT AIR CHECK
AIR BLANK CHECK

Note: If a control check fails, the instrument will abort the test and print out the failure. Locate the fault message in the 'Remedies' section of this guide. The instrument will not proceed until the issue has been resolved and a 'Solution Change' performed. If the issue continues, contact Draeger Safety Diagnostics, Inc.

When the checks are completed, the display will read as follows:

DATA STORED
SEARCHING...
PRINTING
REMOVE MOUTHPIECE
READY

*Please see printout of the breath test in the following section.
To obtain extra copies, use the **COPY** function (see 'function table').

Breath Test Printout

ALCOHOL INFLUENCE REPORT FORM, ALCOTEST 7110 MKIII-C
TBI CRIME LAB

Department Case No.: 6786
Summons No(s): 97987
Sequential File No.: 00081

Subject
Last Name: SMITH First Name: JOHN MI: A
D.O.B.: 01/26/1965 Age: 39 Gender: MALE Ht: 5 ft. 08 in. Wt: 180 lbs.
Driver License Number: 098-76-5676 Issuing State:NJ

Arresting Officer
Last Name: HALL First Name: BOB MI: D
Badge No.: 67866 Arrest Date: 10/04/2004 Arrest Time: 08:00am Arrest Location: NJ

Instrument Alcotest 7110 MKIII-C Serial No.: ARLD-0010
Location: TBI CRIME LAB
Calibration File No.: 00065 Calib. Date: 06/30/2004 Calib. No.: 00026
Certification File No.: 00076 Cert. Date: 08/12/2004 Cert. No.: 00014
Linearity File No.: 00080 Lin. Date: 08/12/2004 Lin. No.: 00014
Solution File No.: 00078 Soln. Date: 08/12/2004 Soln. No.: 00039
Sequential File No.: 00081 File Date: 10/04/2004

Calibrating Unit: WET Model No.: 67 Serial No.: 67897987
Control Solution %: 0.100% Expires: 08/01/2005
Solution Control Lot: 67857 Bottle No.: 0456

Breath Test Information Date of Test: 10/04/2004

Function	Result %BAC	Time HH:MM	Volume (L)	Duration Sec (s)	Temp. Sim.(°C)	Error Message
Ambient Air Blank	0.000%	11:05am				
Control Test 1					34.0°C	
EC Result	0.103%	11:06am				
IR Result	0.102%	11:06am				
Ambient Air Blank	0.000%	11:07am				
Breath Test 1			2.8L	6.6s		
EC Result	0.000%	11:08am				
IR Result	0.000%	11:08am				
Ambient Air Blank	0.000%	11:08am				
Breath Test 2			2.7L	6.3s		
EC Result	0.000%	11:10am				
IR Result	0.000%	11:10am				
Ambient Air Blank	0.000%	11:11am				
Control Test 2					34.0°C	
EC Result	0.102%	11:11am				
IR Result	0.102%	11:11am				
Ambient Air Blank	0.000%	11:12am				

REPORTED BREATH TEST RESULT: 0.00% BAC

Breath Test Operator
Last Name: JONES First Name: SAM MI: D
Badge No.: 234
Signature: _____ Date: 10/04/2004

Copy Given to Subject

Page 1 of 1.

Exceptions

There are 3 scenarios where *exceptions* to a normal test result will occur – Terminations, Refusals, and Invalid Samples. Any of these *exceptions* will result in the following option appearing on the display:

<1> TERMINATE <2> REFUSAL <3> CONTINUE

Terminations:

Termination of a test can be performed in one of two ways:

- To terminate a test prior to a subject providing a sample, press **'R'** at the **PLEASE BLOW/R>** prompt and then select # 1.
- To terminate a test following an invalid sample (see table below), select # 1 after the option is displayed.

The instrument will perform a 'Control Check' and record "Test Terminated" on the display. The printout will record "Test Terminated" in the Test Result Row and the "Invalid Sample" result (if applicable) in the Error Message column. *Please see printout of Invalid Samples in the following section.

Refusals:

A refusal can be performed in one of two ways:

- If the subject refuses to take a test prior to providing a sample, press **'R'** at the **PLEASE BLOW/R>** prompt and then select # 2.
- If the subject refuses after providing an invalid sample (see table below), select # 2 after the option is displayed.

The instrument will perform a 'Control Check' and record "Subject Refused" on the display.The printout will record "Subject Refused" in the Test Result Row and the "Invalid Sample" result (if applicable) in the Error Message column. *Please see printout of Invalid Samples in the following section.

Invalid Samples:

Any breath interruption or failure to satisfy the minimum requirements of a valid breath sample will result in an 'invalid sample'. The issue will be displayed for a few seconds along with the measured result (i.e., **BLOWING TIME TOO SHORT 2.6s**). If an invalid sample was provided, the breath test can be terminated, refused, or continued.

NOTE: If option #3 (continue) is selected, the system will purge and return to the **PLEASE BLOW/R** prompt. The subject is allowed 11 attempts to collect a maximum of 3 valid breath samples.

Invalid Samples:	Action:
MINIMUM VOLUME NOT ACHIEVED	Instruct the subject to take a deeper breath and exhale longer.
BLOWING TIME TOO SHORT	Instruct the subject to exhale for a longer time and/or at a lower flow rate.
BLOWING TIME TOO LONG	Instruct the subject to exhale for a shorter time.
BLOWING NOT ALLOWED	Ensure that the subject waits for the **PLEASE BLOW/R >** prompt before blowing.
PLATEAU NOT ACHIEVED	Instruct the subject to take a deeper breath and exhale longer.
READY TO BLOW EXPIRED	Instruct the subject to provide sample within 3 minutes of when **PLEASE BLOW/R** prompt first appears.

Invalid Samples Printout

ALCOHOL INFLUENCE REPORT FORM, ALCOTEST 7110 MKIII-C
NEW BRUNSWICK PD

Department Case No.: 1234567890
Summons No(s): 12345-67890
Sequential File No.: 00084

Subject

Last Name: SMITH First Name: JOE MI: A
D.O.B.: 06/06/1955 Age: 49 Gender: MALE Ht: 5 ft. 11 in. Wt: 185 lbs.
Driver License Number: A14215415 Issuing State: NJ

Arresting Officer

Last Name: JONES First Name: ANDREW MI: A
Badge No.: 1234567890 Arrest Date: 10/05/2004 Arrest Time: 10:00am Arrest Location: 12

Instrument Alcotest 7110 MKIII-C Serial No.: ARLD-0010
Location: NEW BRUNSWICK PD
Calibration File No.: 00065 Calib. Date: 06/30/2004 Calib. No.: 00026
Certification File No.: 00076 Cert. Date: 08/12/2004 Cert. No.: 00014
Linearity File No.: 00080 Lin. Date: 08/12/2004 Lin. No.: 00014
Solution File No.: 00082 Soln. Date: 10/04/2004 Soln. No.: 00040
Sequential File No.: 00084 File Date: 10/05/2004

Calibrating Unit: WET Model No.: 67 Serial No.: 67897987
Control Solution %: 0.100% Expires: 10/30/2005
Solution Control Lot: 56 Bottle No.: 0888

Breath Test Information Date of Test: 10/05/2004

Function	Result %BAC	Time HH:MM	Volume (L)	Duration Sec (s)	Temp. Sim.(°C)	Error Message
Ambient Air Blank	0.000%	11:16am				
Control Test 1					34.0°C	
EC Result	0.102%	11:17am				
IR Result	0.102%	11:17am				
Ambient Air Blank	0.000%	11:17am				
Breath Test 1			0.2L	0.7s		MIN. VOL. NOT ACHIEVED
EC Result	-.---%	11:18am				
IR Result	-.---%	11:18am				
Ambient Air Blank	0.000%	11:19am				
Breath Test 2			--.-L	--.-s		READY TO BLOW EXPIRED
EC Result	-.---%	--:--				
IR Result	-.---%	--:--				
Ambient Air Blank	0.000%	11:26am				
Breath Test 3			1.8L	2.8s		BLOWING TIME TOO SHORT
EC Result	-.---%	11:28am				
IR Result	-.---%	11:28am				
Ambient Air Blank	0.000%	11:28am				
Breath Test 4			6.6L	25.4s		BLOWING NOT ALLOWED
EC Result	-.---%	11:30am				
IR Result	-.---%	11:30am				
Ambient Air Blank	0.000%	11:31am				

Page 1 of 2

ALCOHOL INFLUENCE REPORT FORM, ALCOTEST 7110 MKIII-C
NEW BRUNSWICK PD

Department Case No.: 1234567890
Summons No(s): 12345-67890
Sequential File No.: 00084
Subject Last Name: SMITH

Breath Test Information (continued) Date of Test: 10/05/2004

Function	Result %BAC	Time HH:MM	Volume (L)	Duration Sec (s)	Temp. Sim.(°C)	Error Message
Breath Test 5			--.-L	--.-s		READY TO BLOW EXPIRED
EC Result	-.---%	--:--				
IR Result	-.---%	--:--				
Ambient Air Blank	0.000%	11:35am				
Breath Test 6			6.7L	34.3s		BLOWING TIME TOO LONG
EC Result	-.---%	11:36am				
IR Result	-.---%	11:36am				
Ambient Air Blank	0.000%	11:38am				
Breath Test 7			2.1L	6.8s		
EC Result	0.000%	11:38am				
IR Result	0.000%	11:38am				
Ambient Air Blank	0.000%	11:39am				
Breath Test 8			1.1L	5.7s		MIN. VOL. NOT ACHIEVED
EC Result	-.---%	11:41am				
IR Result	-.---%	11:41am				
Ambient Air Blank	0.000%	11:42am				
Breath Test 9			--.-L	--.-s		READY TO BLOW EXPIRED
EC Result	-.---%	--:--				
IR Result	-.---%	--:--				
Ambient Air Blank	0.000%	11:46am				
Breath Test 10			2.1L	3.8s		BLOWING TIME TOO SHORT
EC Result	-.---%	11:47am				
IR Result	-.---%	11:47am				
Ambient Air Blank	0.000%	11:49am				
Breath Test 11			1.2L	6.8s		MIN. VOL. NOT ACHIEVED
EC Result	-.---%	11:50am				
IR Result	-.---%	11:50am				
Ambient Air Blank	0.000%	11:51am				
Control Test 2					34.0°C	
EC Result	0.101%	11:52am				
IR Result	0.101%	11:52am				
Ambient Air Blank	0.000%	11:52am				

TEST RESULT: TEST TERMINATED

Breath Test Operator
Last Name: SHOEMAKER First Name: THOMAS MI: P
Badge No.: 12345678
Signature: _____ Date: 10/05/2004

Copy Given to Subject

Page 2 of 2

Aborted Tests

A test will automatically be aborted whenever the following errors are encountered:

- CTRL GAS SUPPLY
- AMBIENT AIR CHECK ERR
- MOUTH ALCOHOL
- INTERFERENCE
- OUT OF MEASURING RANGE
- TESTS OUTSIDE +/- TOL
- CONTROL TEST FAILED
- QUICK RESET
- PURGING ERROR
- MEMORY FULL
- SIMULATOR TEMP. ERROR

The instrument will purge the system, run a control check and print the results. The printout will read "TEST RESULT: TEST ABORTED" followed by the error name in the Result Row. The error name will also be printed in the Error Message column on the printout. *Please see the 'Aborted Test Printout' in the following section.

Aborted Test Printout

ALCOHOL INFLUENCE REPORT FORM, ALCOTEST 7110 MKIII-C
NEW BRUNSWICK PD

Department Case No.: 23423424
Summons No(s): 235423424
Sequential File No.: 00085

Subject
Last Name: JONES First Name: JIM MI: A
D.O.B.: 09/09/1909 Age: 95 Gender: MALE Ht: 6 ft. 02 in. Wt: 222 lbs.
Driver License Number: A5253262 Issuing State: NJ

Arresting Officer
Last Name: SMITH First Name: JOE MI: P
Badge No.: 234141 Arrest Date: 10/06/2004 Arrest Time: 01:00pm Arrest Location: 333

Instrument Alcotest 7110 MKIII-C Serial No.: ARLD-0010
Location: NEW BRUNSWICK PD
Calibration File No.: 00065 Calib. Date: 06/30/2004 Calib. No.: 00026
Certification File No.: 00076 Cert. Date: 08/12/2004 Cert. No.: 00014
Linearity File No.: 00080 Lin. Date: 08/12/2004 Lin. No.: 00014
Solution File No.: 00082 Soln. Date: 10/04/2004 Soln. No.: 00040
Sequential File No.: 00085 File Date: 10/06/2004

Calibrating Unit: WET Model No.: 67 Serial No.: 67897987
Control Solution %: 0.100% Expires: 10/30/2005
Solution Control Lot: 56 Bottle No.: 0888

Breath Test Information Date of Test: 10/06/2004

Function	Result %BAC	Time HH:MM	Volume (L)	Duration Sec (s)	Temp. Sim.(°C)	Error Message
Ambient Air Blank	0.000%	01:53pm				
Control Test 1					34.0°C	
EC Result	0.101%	01:54pm				
IR Result	0.102%	01:54pm				
Ambient Air Blank	0.000%	01:55pm				
Breath Test 1			2.9L	6.0s		MOUTH ALCOHOL
EC Result	-.---%	01:56pm				
IR Result	-.---%	01:56pm				
Ambient Air Blank	0.000%	01:56pm				
Control Test 2					34.0°C	
EC Result	0.100%	01:57pm				
IR Result	0.101%	01:57pm				
Ambient Air Blank	0.000%	01:57pm				

TEST RESULT: TEST ABORTED - MOUTH ALCOHOL

Breath Test Operator
Last Name: THOMAS First Name: NED MI: Z
Badge No.: 134134114
Signature: _____ Date: 10/06/2004

Copy Given to Subject

Page 1 of 1

SYSTEM MANAGEMENT

Instrument Maintenance

Four tests are available to determine that the instrument is working properly (Calibrate; Control test; Linearity test; and Solution Change). A solution change will be required before the instrument will return to the READY prompt.

Calibrate

Follow the steps below to adjust EC & IR sensors using certified, new solution:

- Ensure that new, certified solution is in the simulator (and perform a 'Seal Check' – see 'Simulator Maintenance' section).
- Wait for the solution and simulator to become fully temperature equilibrated.
- Plug the black-key simulator temperature probe into the instrument.
- Press **'Esc'** to access the **FUNCTION:** prompt (see 'Functions' section).
- Type **CALIBRATE** and press **'Enter'** key.
- Enter corresponding data into the following prompts:

```
OPER LAST NAME: {24}
OPER FIRST NAME: {24}
OPER MIDDLE INITIAL: {2}
OPER BADGE #: {10}
SOLN LOT #: {20}
SOLN BOTTLE #: {4}
SOLN %: {5}
EXPIRES: MM/DD/YYYY
SOLN CALIB. UNIT: {5}
SOLN CALIB. UNIT MODEL #: {7}
SOLN CALIB. UNIT SERIAL #: {12}
REVIEW DATA <Y/N>
```

- The following will appear on the display:

```
CTRL-GAS
CALIBRATION
PURGING
ADJUSTMENT
DATA STORED
END OF ADJUST
```

The instrument will print the calibration record printout (shown on next page) and will display:

```
SOLUTION CHANGE REQUIRED
READY
```

Calibration Record Printout

Alcotest 7110 Calibration Record

Equipment	Alcotest 7110 MKIII-C			Serial No.:	ARLD-0010
Location:	NEW BRUNSWICK PD				
Calibration File No.:	00092	Calib. Date:	10/19/2004	Calib. No.:	00027
Certification File No.:	00076	Cert. Date:	08/12/2004	Cert. No.:	00014
Linearity File No.:	00080	Lin. Date:	08/12/2004	Lin. No.:	00014
Solution File No.:	00082	Soln. Date:	10/04/2004	Soln. No.:	00040
Sequential File No.:	00092	File Date:	10/19/2004		
Calibrating Unit:	CU34	Model No.:	CU34	Serial No.:	DDSH-0123456
Control Solution %:	0.100%			Expires:	02/02/2005
Solution Control Lot:	121212			Bottle No.:	0033

Coordinator

Last Name: SMITH First Name: JOE MI: P

Badge No.: 123456789

Signature: _____ Date: 10/19/2004

Control Test

Follow the steps below to obtain EC & IR readings from the simulator solution:

- Plug the black-key simulator temperature probe into the instrument.
- Ensure that the settings in **CTRL-CONFIG** (see 'Functions' section) are configured properly for this test.
- Press **'Esc'** to access the **FUNCTION:** prompt (see 'Functions' section).
- Type **CTRL-TEST** and press **'Enter'** key.
- Enter corresponding data into the following prompts:

```
OPER LAST NAME: {24}
OPER FIRST NAME: {24}
OPER MIDDLE INITIAL: {2}
OPER BADGE #: {10}
CERT LOT #: {20}
CERT BOTTLE #: {4}
CERT %: {5}
EXPIRES: MM/DD/YYYY
CERT CALIB. UNIT: {5}
CERT CALIB. UNIT MODEL #: {7}
CERT CALIB. UNIT SERIAL #: {12}
REVIEW DATA <Y/N>
```

The system will perform a control check by displaying the following:

This display will appear once:

```
PURGING
AMBIENT AIR CHECK
AIR BLANK CHECK
```

This display will repeat 3 times:

```
CONTROL CHECK
PURGING
AMBIENT AIR CHECK
AIR BLANK CHECK
```

When the countdown reaches zero and the 'Control Check' is completed, the 7110 will print the results and display as follows:

```
DATA STORED
READY
```

Note: If a control check fails, the instrument will abort the test and report the failure. Locate the error and compare it to the 'Remedies' section of this guide. The instrument will not proceed until the issue has been resolved and a 'Solution Change' performed. If the issue continues, contact Draeger Safety Diagnostics, Inc.

Control Test Printout

Alcotest 7110 Calibration Certificate

Part I - Control Tests

Equipment	Alcotest 7110 MKIII-C			Serial No.:	ARLD-0010
Location:	NEW BRUNSWICK PD				
Calibration File No.:	00092	Calib. Date:	10/19/2004	Calib. No.:	00027
Certification File No.:	00093	Cert. Date:	10/19/2004	Cert. No.:	00015
Linearity File No.:	00080	Lin. Date:	08/12/2004	Lin. No.:	00014
Solution File No.:	00082	Soln. Date:	10/04/2004	Soln. No.:	00040
Sequential File No.:	00093	File Date:	10/19/2004		
Calibrating Unit:	WET	Model No.:	CU34	Serial No.:	DDSH-123456
Control Solution %:	0.100%			Expires:	02/02/2005
Solution Control Lot:	123456			Bottle No.:	0033

Function	Result %BAC	Time HH:MM	Temperature Simulator (°C)	Comment(s) or Error(s)
Ambient Air Blank	0.000%	04:21pm		
Control 1 EC	0.099%	04:21pm	34.0°C	*** TEST PASSED ***
Control 1 IR	0.099%	04:21pm	34.0°C	*** TEST PASSED ***
Ambient Air Blank	0.000%	04:22pm		
Control 2 EC	0.100%	04:23pm	34.0°C	*** TEST PASSED ***
Control 2 IR	0.099%	04:23pm	34.0°C	*** TEST PASSED ***
Ambient Air Blank	0.000%	04:24pm		
Control 3 EC	0.099%	04:24pm	34.0°C	*** TEST PASSED ***
Control 3 IR	0.099%	04:24pm	34.0°C	*** TEST PASSED ***
Ambient Air Blank	0.000%	04:25pm		

All tests within acceptable tolerance.

Coordinator

Last Name: SMITH First Name: JOE MI: Z

Badge No.: 987654321

Signature: _____ Date: 10/19/2004

Linearity Test

Follow the steps below to ensure accuracy of the sensors (EC & IR) while measuring solutions across a range of alcohol concentrations:

- Plug the black-key simulator temperature probe into the instrument.
- Ensure that the settings in **LIN-CONFIG** (see 'Functions' section) are configured properly for this test.
- Press **'Esc'** to access the **FUNCTION:** prompt (see 'Functions' section).
- Type **LIN-TEST** and press **'Enter'** key.
- Enter corresponding data into the following prompts. The prompts will appear three times (i.e., **LIN #2, LIN #3,** etc.). Enter the appropriate solution information for each Linearity test to be performed.

```
OPER LAST NAME: {24}
OPER FIRST NAME: {24}
OPER MIDDLE INITIAL: {2}
OPER BADGE #: {10}
LIN #X LOT #: {20}
LIN #X BOTTLE #: {4}
LIN #X %: {5}
EXPIRES: MM/DD/YYYY
LIN #X CALIB. UNIT: {5}
LIN #X CALIB. UNIT MODEL #: {7}
LIN #X CALIB. UNIT SERIAL #: {12}
REVIEW DATA <Y/N>
```

The instrument will perform two control check tests on each of the three solutions entered (i.e., six tests) and will display the following:

```
CONNECT 0.XXX% BRAC SIMUL PRESS BUTTON
```

- Attach the breath hose to the simulator that corresponds to the solution entered and press the orange, 'Start' button.

The instrument will perform a 'Control Check' and display as follows:

```
CONTROL CHECK
DISCONNECT HOSE FROM SIMULATOR
```

- Detach the breath hose from the simulator that is being tested and the following messages will display:

```
PURGING
AMBIENT AIR CHECK
AIR BLANK CHECK
```

- Connect the next simulator and repeat the process.

When the tests are finished, the instrument will print the results and display as follows:

```
DATA STORED
SOLUTION CHANGE
```

Note: If a control check fails, the instrument will abort the test and report the failure. Locate the error and compare it to the 'Remedies' section of this guide. The instrument will not proceed until the issue has been resolved and a 'Solution Change' performed. If the issue continues, contact Draeger Safety Diagnostics, Inc.

Linearity Test Printout

Alcotest 7110 Calibration Certificate

Part II - Linearity Tests

Equipment	Alcotest 7110 MKIII-C			Serial No.: ARLD-0010
Location:	NEW BRUNSWICK PD			
Calibration File No.:	00092	Calib. Date:	10/19/2004	Calib. No.: 00027
Certification File No.:	00093	Cert. Date:	10/19/2004	Cert. No.: 00015
Linearity File No.:	00094	Lin. Date:	10/20/2004	Lin. No.: 00015
Solution File No.:	00082	Soln. Date:	10/04/2004	Soln. No.: 00040
Sequential File No.:	00094	File Date:	10/20/2004	
Calibrating Unit:	WET	Model No.:	CU34	Serial No.: DDSH-123456
Control Solution %:	0.100%			Expires: 12/12/2004
Solution Control Lot:	1234			Bottle No.: 0033
Calibrating Unit:	WET	Model No.:	CU34	Serial No.: DDSH-123456
Control Solution %:	0.100%			Expires: 12/13/2004
Solution Control Lot:	2345			Bottle No.: 0033
Calibrating Unit:	WET	Model No.:	CU34	Serial No.: DDSH-123456
Control Solution %:	0.100%			Expires: 12/14/2004
Solution Control Lot:	3456			Bottle No.: 0033

Function	Result %BAC	Time HH:MM	Temperature Simulator (°C)	Comment(s) or Error(s)
Ambient Air Blank	0.000%	07:44am		
Control 1 EC	0.098%	07:45am	34.0°C	*** TEST PASSED ***
Control 1 IR	0.096%	07:45am	34.0°C	*** TEST PASSED ***
Ambient Air Blank	0.000%	07:47am		
Control 2 EC	0.097%	07:47am	34.0°C	*** TEST PASSED ***
Control 2 IR	0.096%	07:47am	34.0°C	*** TEST PASSED ***
Ambient Air Blank	0.000%	07:51am		
Control 3 EC	0.097%	07:52am	34.0°C	*** TEST PASSED ***
Control 3 IR	0.097%	07:52am	34.0°C	*** TEST PASSED ***
Ambient Air Blank	0.000%	07:53am		
Control 4 EC	0.096%	07:54am	34.0°C	*** TEST PASSED ***
Control 4 IR	0.097%	07:54am	34.0°C	*** TEST PASSED ***
Ambient Air Blank	0.000%	07:55am		
Control 5 EC	0.095%	07:56am	34.0°C	*** TEST PASSED ***
Control 5 IR	0.096%	07:56am	34.0°C	*** TEST PASSED ***
Ambient Air Blank	0.000%	07:58am		
Control 6 EC	0.095%	07:58am	34.0°C	*** TEST PASSED ***
Control 6 IR	0.095%	07:58am	34.0°C	*** TEST PASSED ***
Ambient Air Blank	0.000%	08:00am		

All tests within acceptable tolerance.

Coordinator

Last Name: JONES First Name: ED MI: Z

Badge No.: 123456

Signature: _____ Date: 10/20/2004

Simulator Maintenance

Solution Change

When a **CONTROL CHECK** fails or the allotted number of days and/or number of tests expire, the following message appears on the display:

SOLUTION CHANGE REQUIRED.

The simulator solution should be changed and a **Solution Change Test** (see next section) performed.

Follow the steps below to change the simulator solution:

- Turn the simulator switch to 'Off'.
- Unplug the simulator power cord.
- Detach the simulator by disconnecting the following items from the 7110:
  - Two-inch gum rubber hose.
  - Six-inch clear, tubing.
  - If necessary, the Temperature Probe Connector. ***(Do not remove the Temperature probe from the Simulator.)***
- Unscrew the jar from the top assembly of the simulator.

CAUTION: DO NOT remove the Top Assembly and expose the heating element to open air with the simulator plugged into the power source. This improper handling will result in damage to the heating element.

- Properly discard the old solution.
- Clean the jar by rinsing with water and drying with a lint free towel.
- Add 500 ml of certified solution into the clean, dry jar.
- Perform a 'Seal Check' by doing the following:
  - Moisten the top of the jar and the lid o-ring with the solution.
  - Screw the jar tightly to the top assembly.
  - Cover the outlet port (marked "To Analyzer") with thumb and cup hand around the jar.
  - Blow forcefully into the "air-in" tube.
  - Observe bubbles in the jar (Initially, many bubbles appear, but when pressure starts to build, the bubbles should stop. This indicates that the simulator assembly is air tight).
  - If bubbles continue to form, repeat the 'Seal Check' steps.
- Re-attach the simulator to the 7110 by doing the following:
  - Reconnect the two-inch gum rubber hose into the simulator outlet and the 7110 'wet gas inlet'.
  - Reconnect the six-inch clear tubing into the 7110 'air outlet' port.
  - If the temperature probe was removed, *carefully* re-insert the connector into the 7110 'temperature probe port'. ***Warning: The Temperature Probe connector may be damaged if not inserted properly.***
- Turn the simulator switch 'On'.
- The 7110 will proceed through the "Warm-up" phase and the display will alternate between the **READY** prompt and **SOLUTION CHANGE REQUIRED.**
- Perform a **SOLN-CHANGE** test (see next section).

Solution Change Test

Follow the steps below to certify a new solution for the instrument:

- Ensure that the settings in **SOLN-CONFIG** (see 'Functions' section) are configured properly for this test.
- Press **'Esc'** to access the **FUNCTION:** prompt (see 'Functions' section).
- Type **SOLN-CHANGE** and press **'Enter'** key.
- Enter corresponding data into the following prompts:

```
OPER LAST NAME: {24}
OPER FIRST NAME: {24}
OPER MIDDLE INITIAL: {2}
OPER BADGE # : {10}
SOLN LOT # : {20}
SOLN BOTTLE # : {4}
*SOLN % : {5}
EXPIRES: MM/DD/YYYY
*SOLN CALIB. UNIT: {5}
*SOLN CALIB. UNIT MODEL #: {7}
*SOLN CALIB. UNIT SERIAL #: {12}
REVIEW DATA <Y/N>
* = Data for these prompts is retained
from previous solution change(s).
```

- If you want to review the data, enter **'Y'** and press **'Enter'** to scroll through prompts (type in any changes to data).
- Enter **'N'** to proceed.

Note

If the following message appears, the temperature probe is not properly installed:

```
CONNECT TEMP. PROBE (PUSH BUTTON)
```

- Ensure that the simulator temperature probe is inserted correctly into the back of the 7110.
- Push the orange 'Start' button to proceed.

The 7110 will conduct a temperature check to see if the simulator is within operational limits. Once the simulator has reached the correct temperature, an internal equilibrium countdown will start and show this display:

```
SOLN-CNG SIM. EQULIB        34.0 C        00:XX
```

The system will perform a control check by displaying the following:

This display will appear once:

```
PURGING
AMBIENT AIR CHECK
AIR BLANK CHECK
```

This display will repeat 3 times:

```
CONTROL CHECK
PURGING
AMBIENT AIR CHECK
AIR BLANK CHECK
```

When the countdown reaches zero and the 'Control Check' is completed, the 7110 will print the results and display as follows:

```
DATA STORED
READY
```

Solution Change Printout

Calibrating Unit
New Standard Solution Report

Equipment	Alcotest 7110 MKIII-C			Serial No.:	ARLD-0010
Location:	NEW BRUNSWICK PD				
Calibration File No.:	00096	Calib. Date:	10/20/2004	Calib. No.:	00028
Certification File No.:	00093	Cert. Date:	10/19/2004	Cert. No.:	00015
Linearity File No.:	00094	Lin. Date:	10/20/2004	Lin. No.:	00015
Solution File No.:	00097	Soln. Date:	10/20/2004	Soln. No.:	00042
Sequential File No.:	00097	File Date:	10/20/2004		
Calibrating Unit:	WET	Model No.:	CU34	Serial No.:	DDSH-123456
Control Solution %:	0.100%			Expires:	03/03/2005
Solution Control Lot:	121212			Bottle No.:	0033

Function	Result %BAC	Time HH:MM	Temperature Simulator (°C)	Comment(s) or Error(s)
Ambient Air Blank	0.000%	11:22am		
Control 1 EC	0.100%	11:23am	34.0°C	*** TEST PASSED ***
Control 1 IR	0.099%	11:23am	34.0°C	*** TEST PASSED ***
Ambient Air Blank	0.000%	11:23am		
Control 2 EC	0.099%	11:24am	34.0°C	*** TEST PASSED ***
Control 2 IR	0.099%	11:24am	34.0°C	*** TEST PASSED ***
Ambient Air Blank	0.000%	11:25am		
Control 3 EC	0.099%	11:26am	34.0°C	*** TEST PASSED ***
Control 3 IR	0.099%	11:26am	34.0°C	*** TEST PASSED ***
Ambient Air Blank	0.000%	11:26am		

All tests within acceptable tolerance.

On this date, I installed the above indicated "NEW SOLUTION" in acordance with Alcotest 7110 operator training and procedures established by the (NJSP) Chief Forensic Scientist.

Changed By:

Last Name: JONES First Name: PETER MI: Q

Badge No.: 123456

Signature: _____ Date: 10/20/2004

Functions

The following access levels are available:

***Open*: Open Operator Access**
This access level allows the operator to perform breath tests on the Alcotest® 7110 MKIII-C. No special keys are required to access these functions. For more information on the functions that can be accessed by this level, see the 'Functions' table.

***Key*: Black-key Technician Access**
This access level can perform all tests and functions along with the ability to perform certifications and other functions that the open access levels cannot. For more information on the functions that can be accessed by this level, see the 'Functions' table.

***PC*: Host Computer Access**
Functions and tests can be performed remotely via running Draeger-supplied software on the PC. For more information on the functions that can be accessed by the PC, see the 'Functions' table.

Follow these instructions when accessing any of the functions:

- Press the **'Esc'** key.
- Type function name at the prompt (i.e., **FUNCTION: COPY**).
- Press **'Enter'** key to exit and return to the **READY** mode.

Note: The "copy" functions will not be possible if the data has been retrieved from the instrument.

FUNCTION	DEFINITION	ACCESS *Open*	*Key*	*PC*
ABA	**<1> # TESTS** - To enter number of tests to be performed, select between 1 and 20. **<2> GAS TYPE** - *Not Applicable.* **<3> GO** - To run Breath Test sequence according to parameter settings in #1 (Results will print on the 'internal' printer only).		X	X
CALIBRATE	To calibrate instrument, enter required data at each prompt: **OPER LAST NAME:** {24} **OPER FIRST NAME:** {24} **OPER MIDDLE INITIAL:** {2} **OPER BADGE #:** {10} **SOLN LOT #:** {20} **SOLN BOTTLE #:** {4} **SOLN %:** {5} **EXPIRES: MM/DD/YYYY** **SOLN CALIB. UNIT:** {5} **SOLN CALIB. UNIT MODEL #:** {7} **SOLN CALIB. UNIT SERIAL #:** {12} **REVIEW DATA <Y/N>** **CTRL-GAS** **CALIBRATION** **PURGING**		X	

FUNCTION	DEFINITION	ACCESS Open	Key	PC
	(continued from above) **ADJUSTMENT** **DATA STORED** **END OF ADJUST** **SOLUTION CHANGE REQUIRED** **READY** *NOTE*: Prior to performing this test, you may encounter a message stating CALIBRATE THE UNIT XX:XX LATER. **If this message appears, the instrument is unable to run the test at that time. The 'wait' time will be displayed in hours/minutes.**			
CALIB-COPY	**<1> LAST TEST** - To obtain a copy of the last calibration test performed. **<2> BY FILE #** - To obtain a copy of a calibration test by file number.	X	X	X
CALL	To send the data stored in the instrument to a PC.	X	X	
CERT-COPY	**<1> LAST TEST** - To obtain a copy of the last control test performed. **<2> BY FILE #** - To obtain a copy of a control test using file number.	X	X	X
COPY	**<1> LAST TEST** - To obtain a copy of the last breath test performed. **<2> BY FILE #** - To obtain a copy of a breath test using file number.	X	X	X
CTRL-CONFIG	**<1> INLET/GAS TYPE** - To define inlet and gas type. **<1> HOSE <2> CUV.INLET <3> GAS PORT** To select the appropriate inlet method, type number and press **'Enter'** key. **<1>WET <2>WET + CO2 <3>DRY <4>DRY + CO2** To select the appropriate gas method, type number and press **'Enter'** key. **<2> CONC/TOL** - To define concentration & tolerances. **CTRL-GAS (0.080..0.120 % BAC):** To define the concentration level of the gas. **ABS-TOL (0.005..0.020 % BAC): 0.010** To define an Absolute Tolerance. **RELATIVE TOLERANCE [10%]** To define a Relative Tolerance percentage. <3> - - - - *FUNCTION NOT POSSIBLE*		X	X
CTRL-TEST	To perform a control test defined by '**CTRL-CONFIG**' settings.		X	X

FUNCTION	DEFINITION	ACCESS Open	Key	PC
DATE	To verify the current date and time.	X	X	X
LIN-CONFIG	**<1> INLET/GASTYPE** - To access the 'Inlet' menu. **<1>WET <2>WET + CO2 <3>DRY <4>DRY + CO2** To select the appropriate gas method, type number and press **'Enter'** key. **<2> CONC/TOL** - To define concentration & tolerances. **ABS-TOL (0.005..0.020 % BAC): 0.010** To define an Absolute Tolerance. **RELATIVE TOLERANCE [10%]** To define a Relative Tolerance percentage. <3> - - - - *FUNCTION NOT POSSIBLE*		X	X
LIN-COPY	**<1> LAST TEST** - To obtain a copy of the last linearity test performed. **<2> BY FILE #** - To obtain a copy of a linearity test using file number.	X	X	X
LIN-TEST	To perform a linearity test defined by the '**LIN-CONFIG**' settings.		X	X
LOCAL-PRINT	To send printed messages to the 7110 instrument's printer (via the personal computer).			X
LOCATION	To change the name, type new one and press 'Enter'.		X	X
MEMORY	To change the memory. **<1> CLEAR MEM** - **FUNCTION EXECUTED** **<2> SHOW MEM** - **MEMORY X.X% USED** **<3> - - - - - - - - -** - *FUNCTION NOT POSSIBLE*		X	X
MESSAGE	**ENTER STRING, PRESS ENTER, ESC TO STOP** To send a message from the instrument to the host PC. - Maximum length of 24 characters. - Use **'Enter'** key to start a new line. - Use **'Esc'** key to end the message.	X	X	
MODEM	To change modem settings. **<1> HOST NUMBER** - To enter host modem number. **<2> DIAL** - To call host PC for data upload. **<3> INIT MODEM** - To test and initialize the modem.		X	X

FUNCTION	DEFINITION	ACCESS Open	Key	PC
OPTIONS	**<1> TIME** - To enter time in HH:MM format. **<2> DATE** - To enter date in MM/DD/YYY format. **<3>UNITS** - *FUNCTION NOT POSSIBLE*		X	X
PRINTOUT	**<1> # PRINTOUTS** - To enter number of printouts. **<2> TEXT – INP** - To select **PROTOCOL-ITEMS** turned on/off by pressing spacebar. **<3> INT/EXT** - To select printer by pressing spacebar (internal, external or both).		X	X
PROBE	**<1> SHOW** - To display simulator solution temperature. **<2> ADJUST** - To enter value from simulator temperature probe tag. **<3> AUTO-ADJUST** - *FUNCTION NOT POSSIBLE*		X	X
SECURITY-KEY	To customize the security key and prevent unauthorized communication. **INSERT SECURITY-KEY:** - To set security code, enter code and press **'Enter'**. **CONFIRM SECURITY KEY:** - To confirm, re-enter code and press **'Enter'**.		X	X
SET-CLOCK	To set date and time (via military time). **PLEASE INSERT: MM/DD/YYYY HH:MM** If **SET THE CLOCK AT A LATER TIME** appears, access the **CALIBRATE** function to display the 'wait time' required.		X	X
SIM-EQULIB	To set the length of a lockout countdown timer that begins after the solution has reached operating temperature to allow uniform temperature equilibration of the entire simulator. **MINUTES OF EQUILIBRIUM DELAY:** (1-255 minutes)		X	X
SOLN-CHANGE	To run a solution test based on the **SOLN-CONFIG** settings.	X	X	X
SOLN-CONFIG	**<1> # TESTS** - To enter number of tests (between 1 & 20) to be performed. **<2> INLET/GAS TYPE** - To define inlet and gas type. **<1> HOSE <2> CUV.INLET <3> GAS PORT** To select the appropriate inlet method, type number and press **'Enter'** key.		X	X

FUNCTION	DEFINITION	ACCESS Open	Key	PC
	<1>WET <2>WET + CO2 <3>DRY <4>DRY + CO2 To select the appropriate gas method, type number and press **'Enter'** key. **<3> CONC/TOL** - To define concentration & tolerances. **CTRL-GAS (0.080..0.120 % BAC):** To define the concentration level of the gas. **ABS-TOL (0.005..0.020 % BAC): 0.010** To define an Absolute Tolerance. **RELATIVE TOLERANCE [10%]** To define a Relative Tolerance percentage.			
SOLN-COPY	**<1> LAST TEST** - To obtain a copy of the last solution test performed. **<2> BY FILE #** - To obtain a copy of a solution test using file number.	X	X	X
SOLN-DAYS	To set the maximum number of days allowed before a simulator solution change is required. **SOLUTION CHANGE DAYS LIMIT:** (1-255)		X	X
SOLN-TESTS	To set the maximum number of breath tests allowed before a simulator solution change is required. **SOLUTION CHANGE TEST LIMIT:** (1-255)		X	X
STND-CHECK	To perform a standard check based on **SOLN-CONFIG** settings (Results will print on the 'internal' printer only).		X	X
TIME	To verify the current date and time.	X	X	X
VERSION	To display the current firmware version.	X	X	X

Remedies

FAULT MESSAGE	POSSIBLE CAUSE	REMEDY
<AMBIENT AIR CHECK FAILED>	Alcohol vapor is detected in the ambient air.	Ensure that the ambient air is free of alcohol vapors.
<BLOWING NOT ALLOWED>	Blowing when prompt isn't displayed.	Repeat test at the "Please Blow" prompt.
<BLOWING TIME TOO SHORT>	The blowing duration was less than the minimum required time.	Repeat the breath test. The instrument will ask for another breath sample.
<BLOWING TIME TOO LONG>	The blowing duration was more than the maximum required time.	Repeat the breath test. The instrument will ask for another breath sample.
<CTRL GAS SUPPLY>	The instrument did not detect proper alcohol concentration during a CTRL-TEST.	Check the Simulator and its external connections.
<CTRL TEST FAILED>	The CTRL-TEST result was outside the acceptable tolerance agreement.	Use new solution, check the Simulator temperature, and check the lid for a tight seal.
<ERROR STORING DATA>	Data storage area is either uninitialized or is completely full.	Contact Draeger Safety Diagnostics, Inc. Service Department.
<EXTERNAL PRINTER ERROR>	The external printer may have run out of paper, a paper jam may exist, or the printer is "Off".	Make sure there is paper in the printer and the printer is turned "On". Check for a paper jam. Use the **COPY** function to re-print test results.
<FUNCTION NOT POSSIBLE>	Specific functions require that the 7110 be in the **READY** mode. Operator may be trying to access a function that requires a black-key.	Press the 'Orange' start button to begin the Warm-up phase. Retry the function when the 7110 is in the **READY** mode. Make sure operator has access to black-key functions.
<INTERFERENCE>	Interfering substance detected.	Repeat test. If test cannot be completed, refer to the state regulatory options.
<KEYBOARD ERROR>	Faulty keyboard.	Repeat function. If necessary, disconnect the existing keyboard and reconnect. If the error still appears, connect a new keyboard.
<MEMORY FULL>	Data storage area is either uninitialized or completely full.	Contact Draeger Safety Diagnostics, Inc. Service Department.

FAULT MESSAGE	POSSIBLE CAUSE	REMEDY
<MEMORY NEARLY FULL>	Data storage area approximately 98% full.	Upload data.
<MINIMUM VOLUME NOT ACHIEVED>	The breath volume is less than the minimum required.	Repeat test. The instrument will initiate another breath sample.
<MODEM ERROR>	Faulty modem.	Contact Draeger Safety Diagnostics, Inc. Service Department.
<MOUTH ALCOHOL>	Residual mouth alcohol detected. Either the observation period was insufficient, or subject may have vomited or belched prior to test.	Repeat test after specified waiting period.
<OUT OF MEASURING RANGE>	The breath test result is higher than the acceptable measuring range: (0.00 to 0.63% BAC)	Subject should be checked by a physician immediately.
<PLATEAU NOT REACHED>	The sample did not reach the plateau (equilibrium).	Repeat test. The instrument will initiate another breath sample.
<PURGING ERROR>	Lack of air required to purge the system.	Ensure that neither the breath hose nor the cuvette exhaust port is obstructed.
<READY TO BLOW EXPIRED>	The maximum allowable time to deliver a breath sample has expired.	Repeat test.
<SIMULATOR TEMP. ERROR>	The Simulator is not turned on. Simulator not warming to correct operating temperature (33.8° - 34.2° C). Simulator out of Calibration.	Make sure the Simulator is turned on and ensure that all connections are tight. Let Simulator warm up to correct temperature and attempt to test again. Use a different Simulator.
<SOLUTION CHANGE REQUIRED>	Solution has expired or control test has failed.	Change solution and perform SOLN-CHANGE function.
<SOLUTION HAS EXPIRED>	Solution expiration date is not within the acceptable date range set for expiration.	Change solution and perform SOLN-CHANGE function.
<TESTS NOT WITHIN +/- TOL.>	Test results are not within acceptable tolerance level.	A 3rd breath test will initiate if the first two are out of tolerance (see "Tolerance Calculations" section).
<WARNING LOW BATTERY>	Internal lithium battery voltage is low.	Contact Draeger Safety Diagnostics, Inc. Service Department.

Tolerance Calculations

Control Checks

Terms – CONC = Simulator Target Concentration %BAC value entered in CTRL-CONFIG.
ABSTOL = Absolute tolerance %BAC value entered in CTRL-CONFIG.
RELTOL = Relative tolerance percentage value entered in CTRL-CONFIG.
Absolute Tolerance Range = CONC +/- ABSTOL
Relative Tolerance Range = CONC +/- (CONC * RELTOL)

Control Check Tolerance is acceptable if the IR and EC results are within the absolute or relative tolerance range, whichever is greater.

Breath Test

Terms – AVG = Average of four readings (two IR and two EC) from two acceptable breath samples being compared.
Absolute Tolerance Limits = AVG +/- 0.010%BAC
Relative Tolerance Limits = AVG +/- (10% * AVG) (whichever is greater)

The instrument requires that the measured alcohol concentration of two breath samples must agree within the specified limits:

- Every valid breath sample is analyzed by each the IR sensor and the EC sensor.
- Two valid breath sample measurements (four readings) must be within specified limits of each other for acceptance and validation by the instrument.

Acceptable Tolerance Agreement requires that all four measurements must be within the absolute or relative tolerance limits, whichever is greater.

Reported BAC Value

When two valid breath samples are collected and are found to be within acceptable tolerance agreement, the firmware compares these four readings (one IR result and one EC result for each valid sample) to find the lowest reading.

If the first two valid breath sample measurements are found not to be within acceptable tolerance agreement, the firmware will require that a third valid breath sample be collected. Upon successful completion of the third valid breath test, the results of tests 1 and 3 are checked to verify proper tolerance agreement. Then the results of tests 2 and 3 are checked to verify proper tolerance agreement. Four different scenarios are possible: only tests 1 and 3 agree, only tests 2 and 3 agree, both tests 1 and 3 agree and tests 2 and 3 agree, or none of the tests have tolerance agreement. If there is no agreement in any of the tests, an error is generated and the entire test will be invalidated.

If valid breath samples 1 and 3 agree, the firmware compares these four readings to find the lowest reading.

If only valid breath samples 2 and 3 agree, the firmware compares these four readings to find the lowest reading.

If the two breath measurements are within these specified limits, the legitimate and legally binding breath alcohol concentration is the lowest of all four measurements.

If both valid breath sample pairs 1 and 3 and 2 and 3 agree, the firmware compares all (3 IR and 3 EC) readings. **In this scenario, the legitimate and legally binding breath alcohol concentration is the lowest of all six measurements.**

Servicing

Inspection

It is recommended that the Alcotest® 7110 MKIII-C instrument be inspected every 12 months and should only be performed by Draeger Safety Diagnostics, Inc., or a Draeger certified technician.

Cleaning

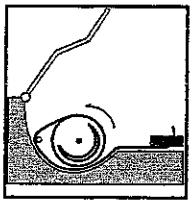
When cleaning the Alcotest® 7110 MKIII-C instrument, please follow these guidelines:

- Disconnect power supply.
- Wipe outside of instrument and breath hose 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.

Printer Maintenance

Loading Paper:

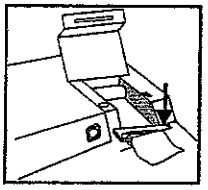
- Load new paper when colored stripe appears on roll.
- Open lid of printer.
- Remove remaining roll.
- Place new roll into compartment.
- Feed edge of paper under metal bar.
- Feed edge into slot of the printing device.



- Press and hold 'orange' button (inside of printer) to feed paper through printer head.
- Pull tight and insert paper through slot in lid.
- Close lid tightly.

Changing Ribbon:

- Open lid of printer.
- Eject old cassette by pressing on right side of ribbon cassette labeled "Push".
- Remove old cassette and discard.
- Rotate thumb wheel in direction of arrow on new cassette to tighten ribbon.
- Insert and click new cassette into place.
- Close lid.



Hardware Issues

Please contact Draeger Safety Diagnostics, Inc. (Service Department) or a Draeger certified technician if one of these issues is encountered.

CODE	MESSAGE	POTENTIAL CAUSE
002	MAIN-SYSTEM (EEPROM Memory)	Defective memory cell.
003	MAIN-SYSTEM (RAM memory)	Defective memory cell.
004	MAIN-SYSTEM (External RAM memory)	Defective memory cell.
008	MAIN-SYSTEM (Battery for memory)	Discharged battery.
009	MAIN-SYSTEM (Power supply)	12 VDC insufficient. Turn instrument 'Off' and 'On' again.
023	IR-SYSTEM	IR-System not stable.
031	EC-SYSTEM (EC-signal)	Incorrect voltage or early warning that the fuel cell may need replacing.
032	EC-SYSTEM (Sampling system)	Motor, pump, switch.
035	EC-SYSTEM (EC-peak signal)	Signal peak not found.
041	FLOW-SYSTEM (Flow sensor)	Short or interrupted circuit.
043	FLOW-SYSTEM (Purge)	Insufficient flow for air blank. Check to see that back of unit is not obstructed.
051	PRESSURE-SYSTEM (Pressure sensor)	Short or interrupted circuit.
071	HEATER-SYSTEM (NTC for cuvette)	Short or interrupted circuit.
072	HEATER-SYSTEM (NTC for breath hose)	Short or interrupted circuit.
073	BREATH TEMP PROBE HEATER	Breath temperature probe malfunctioning.
075	HEATER-SYSTEM (Temperature)	Cuvette or breath hose-heater malfunctioning.
081	INTERFACE-SYSTEM (Printer)	No printer commands.
084	INTERFACE-SYSTEM (Function-Key)	Unacceptable voltage.
101	CALIBRATION (IR-System)	Unacceptable adjustment.
112	CALIBRATION (Calibration data)	Lost date in EEPROM
113	CALIBRATION (Configuration)	System parameters incorrect.