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PURPOSE OF THIS MANUAL

This manual is intended to serve as a basic reference to reinforce and supplement the subject material presented in class. As selected topics are introduced in class, the student should review the relevant portions of this manual, as well as notes taken in class. The student should always bring the manual to each class session. This manual belongs to the student and should be kept with him/her as they progress in their law enforcement career.

PRELIMINARY

BREATH

TESTING

(ALCO-SENSOR III)

INTRODUCTION:

The ALCO-SENSOR III is a pocket-sized breath testing device designed to read blood alcohol concentrations. Nothing more than a disposable mouthpiece and a 9-volt alkaline battery are necessary to keep the ALCO-SENSOR III operational. Other types of batteries are unsatisfactory.

With normal usage the unit should provide thousands of tests before the sensor needs replacing. The plug-in 9-volt ALKALINE battery should run 500 tests.

CALIBRATION CHECKS:

ALCO-SENSOR III's generally hold their calibration for months. To get good results the unit must be have its calibration every 60 to90 days by either Toxicology or a member of CDDP.

PRINCIPLE OF OPERATION:

ALCOHOL IN THE BREATH:

The accuracy of any breath alcohol test is dependent upon the relationship between the concentrations of alcohol in the blood and deep lung breath. This ratio of 2100 to 1 is well established.

The amount of alcohol in a properly collected breath sample is governed by the amount of alcohol in the blood in the lungs. To get an accurate reading, a deep lung breath sample must be collected and analyzed.

A recent drink of an alcoholic beverage or regurgitation could introduce "mouth alcohol" to the breath thus causing an exaggerated reading. A 15 minute waiting period prior to testing will insure the elimination of "mouth alcohol."

OPERATING CONDITIONS:

The ALCO-SENSOR III is designed to operate at temperatures **between 20°C (68°F) to 36°C (98°F)**. Tests can be run every 2 minutes. Temperature is important as the rate of the electro-chemical reaction is affected by temperature. The unit will operate at temperatures as low as 0°C but the response is sluggish and some sensitivity is sacrificed. Optimal operation is at 20 to 36°C.

Instrument temperature can be checked by the liquid crystal thermometer built into the back panel. It reads the temperature in centigrade degrees, and has a range of 20°C to 36°C. If no figure is visible the unit is either too hot or too cold. Placed in the shirt pocket the unit will come to operating temperature in a short time.

Once the unit is at operating temperature it will function properly in ambient temperatures of 0°C to 100°C, atmospheric pressure of 435 to 787 mm of mercury, and relative humidity of 0 to 100%.

The higher the operating temperature, the more efficient the unit becomes. These higher temperatures minimize condensation and assure rapid reading. Also the unit becomes reusable in a shorter period of time. The temperature of the unit can be raised carrying it in the shirt pocket where temperature will be kept at 26°C.

ACCURACY:

With a good deep lung breath sample the ALCO-SENSOR III reading of blood alcohol concentration (BAC) should not vary more than -5% from the blood drawn at the same time.

INTERFERING SUBSTANCES:

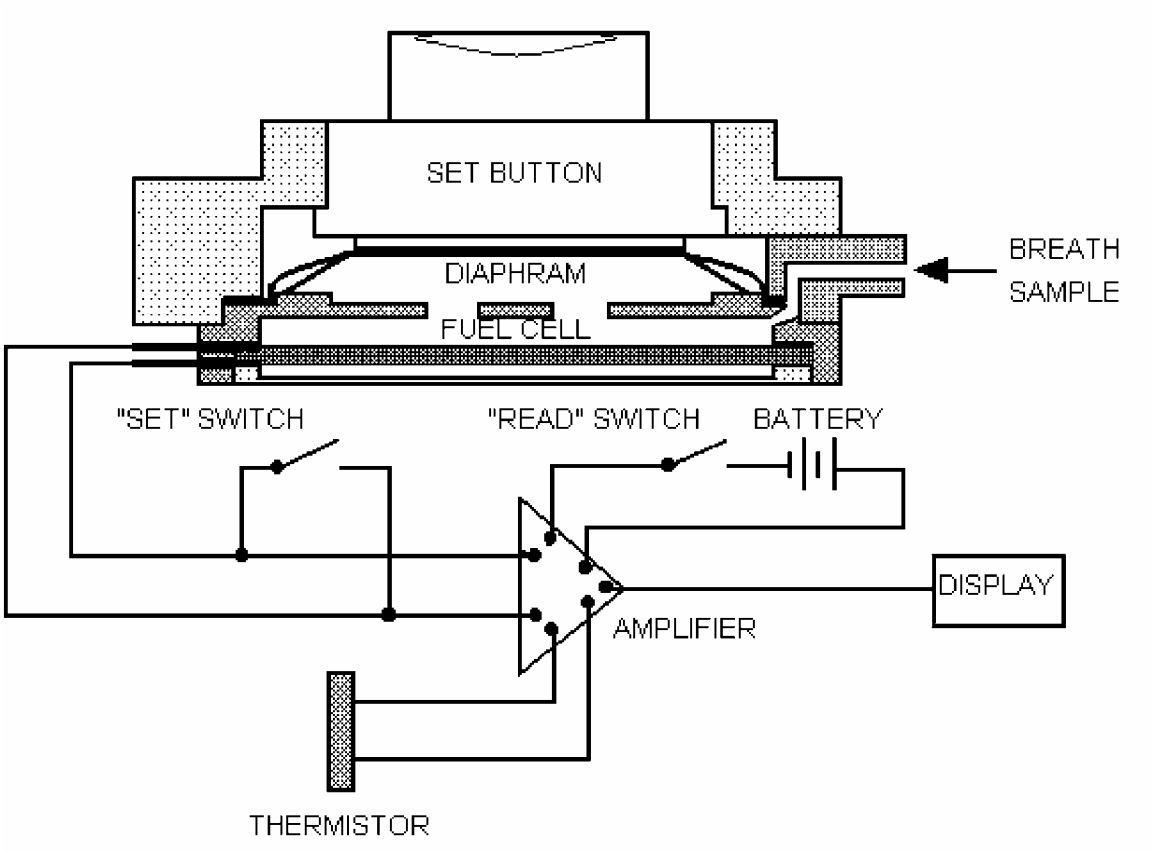
The ALCO-SENSOR III responds to alcohols which might be in the breath, however, it does not read acetone found in the breath or other hydrocarbons.

SIGNIFICANT BLOOD ALCOHOL CONCENTRATIONS (BAC):

West Virginia considers .10% BAC as presumptive evidence of impairment as far as driving skills are concerned. Concerning the Commercial Driver License (CDL), .04% is the upper acceptable level for presumptive evidence.

THEORY AND DESIGN OF THE ALCO-SENSOR III GENERAL COMPONENTS:

The ALCO-SENSOR III contains a FUEL CELL sensor backed by a SPRING LOADED DIAPHRAGM/SAMPLING VALVE which when released, draws a 1cc sample from the breath in the mouthpiece into the FUEL CELL for analysis. A signal is generated in the FUEL CELL in response to alcohol in the breath sample. An amplifier powered by the 9-volt ALKALINE battery, which has a 500± test life, causes the result of the analysis to be displayed when the READ BUTTON is depressed.



GENERAL COMPONENTS (continued):

The READ BUTTON operates in two stages. First, it releases the valve, thus taking a sample. Secondly, at the bottom of its travel, it switches the instrument "on" electrically.

The SET BUTTON cocks the valve when depressed all the way and also "shorts" the cell. This accelerates the destruction of any alcohol left on the cell so that the time delay between tests is minimized.

CAUTION: To assure a correct result, no alcohol should be consumed within 15 minutes of a test, and the subject should not be allowed to smoke.

With the mouthpiece mounted the subject is asked to blow as long as possible. The first portion of breath from the subject must not be sampled since its alcohol content will be low, and not representative. It will take about 3 to 5 seconds to empty the lungs thru the mouthpiece. Toward the end of this period, while the subject is still blowing, the READ BUTTON should be depressed. Then, the action of the valve will draw 1cc of deep lung breath into the FUEL CELL From the passing breath stream.

CAUTION: Use only mouthpieces supplied from the COMMISSION ON DRUNK DRIVING PREVENTION which come from the manufacturer. Other mouthpieces may cause inaccurate reading by as much as 10-20%.

FUEL CELL:

The FUEL CELL is a plastic membrane coated with a thin layer of gold, platinum black and an active chemical. The cell partitions the fuel cell case and when the breath sample is drawn into the cell, all of the alcohol is immediately absorbed on the membrane and is converted to acetic acid within a short period. The resulting electric current is related to a BAC and digitally displayed when the READ BUTTON is depressed. Field use indicates the cells generally have a life of 2-5 years.

DIGITAL DISPLAY:

The unit is perfectly zeroed and clean when the digital display reads .000 when the READ BUTTON is held down for 10 seconds. A reading of .000 to .003 should be considered as zero or insignificant.

--If **.888** is displayed the 9 volt ALKALINE battery is failing and needs replacing.
--Numerical readings refer to percent blood alcohol reading i.e., .120 is 120 milligrams of alcohol per 100 ml of blood.

READING:

A BAC reading takes between 5 to 40 seconds to develop in the standard fuel cell unit. This reading will hold for a few moments before deteriorating. During this period the READ BOTTON can be released and re-activated without affecting the value. However, the SET BUTTON, should not be depressed during this period as it will destroy the accumulating reading.

CHECKING CELL TO SEE IF IT IS READY TO USE:

ALCO-SENSOR III's have automatic zeroing feature. When the READ BUTTON is depressed all the way down for a 10 second period, the digital display should show .000

It this does not occur, depress the SET BUTTON for a few moments and recheck.

EXPLANATION OF THE FUEL CELL CHEMISTRY

Alcohol Breath Sample + Fuel Cell → Acetic Acid + Electrons* → $CO_2 + H_2O + O_2$
(fast reaction; slow reaction)

– REPEATED SAMPLING IN SHORT PERIOD –

Alcohol Breath Sample + Fuel Cell → ACETIC ACID BUILD––UP + Electron → $CO_2 + H_2O + O_2$

EFFECT

Alcohol Breath Sample + Fuel Cell → Reaction slow-up (Loss of sensitivity)

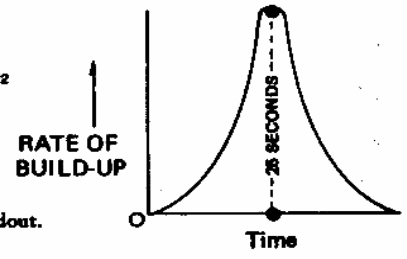
– WITH PASSAGE OF TIME ACETIC ACID ⟶ $CO_2 + H_2O + O_2$

EFFECT

Alcohol Breath Sample + Fuel Cell ⟹ Acetic Acid + Electron $CO_2 + H_2O + O_2$
Sensitivity of cell regained.

Calibration should be accomplished in no more than two tries and should be done when acetic acid has not built-up.

* Electron build-up on the cell in this reaction is registered on digital readout.



OPERATING INSTRUCTIONS

1. Remove unit from box and note number from 20 to 36 in temperature window. Liquid crystal reading of from 20C to 36C indicates the unit is in the operating temperature range.

2. Mount mouthpiece.

3. Press READ BUTTON and hold down. Check to see if .000 is constant. Checking for contamination. (See Flushing Below).

4. Depress SET BUTTON. Flushes unit and prepares for sample taking. (See Flushing Below).

5. Instruct subject to give sample. (No consuming anything by mouth nor smoking within 15 minutes of test.) Ask subject to blow continuously for as long as possible (See Page 4).

6. Push READ BUTTON before exhalation ceases. Sample at least 3 seconds while subject is still blowing. (See Page 4).

7. Keep READ BUTTON depressed until reading. Read Maximum reading attained.

8. Push SET BUTTON to accelerate elimination of reading. Purge and electrically clean cell surface. (See Page 4).

9. ALCO-SENSOR III in pocket with SET BUTTON depressed. Cleans cell.

FLUSHING:

Depressing the SET BUTTON purges 1 cc of air from the syringe into the cell and displaces 1 cc out through the mouthpiece part. This action flushes the chamber prior to each test, but cell surface may still retain alcohol.

If any residual alcohol were present in the system a reading would be obtained on the digital display when the READ BUTTON was depressed and held down for 10 seconds. CAUTION: Sufficient time after each test must be allowed for all traces of alcohol on the cell surface to be eliminated. This can be accelerated by locking the SET BUTTON down to short circuit the cell. If the ALCO-SENSOR III is ready for use no reading will develop when the READ BUTTON is held down for 10 seconds.

The unit will lose sensitivity if more than 5 positive alcohol tests are run in an hour. Avoid mass testing of subjects of more than .10% BAC unless the unit is re-calibrated every 5 tests.

BATTERY REPLACEMENT

A **.888** display indicates that the Battery is not strong enough to support an accurate reading and needs replacing.

PROCEDURE: Slide BATTERY DOOR open. (On Bottom)
Remove old battery and disconnect.
Connect new battery and replace.
Check Calibration of unit.

USE ONLY ALKALINE BATTERIES!!!!!!!!!!

CAUTION:

UNDER NO CIRCUMSTANCES SHOULD RAW CIGARETTE SMOKE BE BLOWN INTO THE INSTRUMENT. IT WILL PERMANENTLY DAMAGE THE FUEL CELL.

STORAGE:

Storage in cold or moderately hot environments will not harm the ALCO-SENSOR III. Avoid extreme Humidity or very dry storage areas for prolonged periods. The more extreme the storage temperatures the longer it will take to get the unit adjusted to proper temperature. To expedite cleanup, have SET BUTTON DEPRESSED when unit is not in use.

OTHER APPLICATIONS OF THE ALCO-SENSOR:

In unconscious persons use a nasal tube on the mouthpiece adapter. With the SET BUTTON depressed, insert the nasal tube into the mouth or nostril of subject and depress READ BUTTON.

To determine alcohol in containers depress SET BUTTON and READ BUTTON. Hold READ BUTTON in for 10 seconds.

If display is .000 or .003 consider the unit clean and ready for use. If reading is higher depress SET BUTTON for 60 seconds and then repeat Step 1.

Re-depress SET BUTTON.

Invert the unit over the opening of the container holding the suspect liquid. Have the gray mouthpiece adapter nipple about 1/2" above the liquid or above the opening of the container and push the READ BUTTON in and hold in for 15 seconds or until the reading stabilizes. A reading of .003 suggests the presence of alcohol. If the liquid is carbonated, hold the adapter nipple at least one inch above the liquid surface to avoid drawing.

PRELIMINARY

BREATH

TESTING

(S-D2)

INTRODUCTION

The Intoxilyzer S-D2 represents a well established concept in breath alcohol testing analysis. It is used worldwide in law enforcement, transportation and workplace safety applications. The S-D2 is just one of the range of instruments manufactured by CMI, Inc. for these purposes. The Intoxilyzer S-D2 is accurate and reliable, allowing a complete breath test procedure to be conducted in about one minute.

This manual describes the operation, maintenance, calibration check, and calibration adjustment of the S-D2. This manual should be read completely and fully understood by each operator prior to testing a subject. It is further recommended that operators practice the breath testing process before giving an actual "in the field" test.

SPECIFICATIONS

MODEL: Intoxilyzer S-D2

DETECTOR:	Electrochemical fuel cell sensor
SPECIFICITY:	Alcohol detector is uneffected by acetone, paint and glue fumes, foods, confectionery,methane and practically any other substance likely found in breath (apart from those which contain alcohol).
ACCURACY:	Better than +/-5% around the calibrated level of a known alcohol standard.
BREATH SAMPLING:	Aspirating sample system with subject blowing through disposable mouthpiece.
DISPLAY:	Illuminated three-digit liquid crystal display giving direct alcohol level readout.
ANALYSIS TIME:	Approximately one minute per test.
CALIBRATION:	With dry gas standard or "wet bath" simulator.
RECOMMENDED: OPERATING TEMPERATURE	32-104° degrees Fahrenheit (0-40° Celsius).
POWER SUPPY:	9-volt battery with sufficient power for at least 500 tests.
DIMENSIONS:	2 3/4" wide x 1 1/2" deep x 5" high (in pouch).
WEIGHT:	71/2 ounces (including pouch and battery).

PRINCIPLES OF OPERATION

The Intoxilyzer S-D2 uses an electrochemical fuel cell, containing two platinum electrodes, to detect and measure the concentration of alcohol vapor in expired breath. When breath is drawn into this fuel cell, by means of the sampling system, a small voltage is generated in proportion to its breath alcohol concentration. This fuel cell is fed to an electronic amplifier and displayed on a digital meter (liquid crystal).

The S-D2 incorporates two breath sampling lights, controlled by an interlinked pressure switch and timer system. The sampling lights show the operator if the subject is blowing correctly, and when he has provided a suitable sample of breath for analysis.

The instrument is simple to operate and may be used as often as required, provided that a suitable delay is allowed between successive tests. This time delay allows the fuel cell to clear itself of alcohol and prevents the possibility of additive readings. If no alcohol is present in a test, a second test may be analyzed immediately, since the fuel cell voltage is already at zero. Unless the breath alcohol level of the subject is very high, The instrument will generally be clear enough to receive and analyze the second sample in less than two minutes.

INSTRUMENT FEATURES

1. **Mouthpiece** - This is attached to the sampling port. For hygenic reasons, mouthpieces are supplied separately packed and are disposable. A new mouthpiece must be used for each breath test. This minimizes health concerns and prevents cross-sample alcohol

2. **Sampling Port** - This forms the entrance to the fuel cell detector. When inserted into the small hole in the side of the mouthpiece, it allows a small portion of breath to be drawn into the instrument for analysis.

3. **'SET' Button** - This button forms part of the sampling system. When fully depressed, the button locks to set the instrument ready for sampling. When the 'SET' button rises, the sample to be analyzed is drawn directly into the fuel cell detector.

4. **'READ' Button** - The 'READ' button is spring loaded and has two functions:
    1. to release the 'SET' button and take the sample.
    2. to switch on the amplifier and display systems.

5. **Alcohol Level Display** - This three digit, liquid crystal display shows the breath alcohol concentration of the subject. The display has built-in illumination and is activated by depressing the 'READ' button. If the figure on the left shows 'L' when the 'READ' button is depressed, the battery needs to be replaced.

6. **Calibration Control** - This screw control, located on the right side of the case, is used for periodic calibration adjustments with either a dry gas standard or wet bath simulator.

7. **Breath Sampling Lights** - Light 'A' illuminates to indicate that the subject is blowing hard enough to obtain a proper breath sample. Light 'B' illuminates when the subject has blown long enough and indicates when the 'READ' button should be pressed. In other words, light 'B' illuminates when the subject has provided a suitable sample for breath analysis.

8. **Battery** - The battery is located directly behind the sliding base on the bottom of the S-D2. It powers the amplifier, digital display and sampling lights and should be replaced when the letter 'L' appears on the left side of the display.

9. **Leather Case** - The S-D2 is supplied in a leather protective case. The unit should be kept inside the case at all times, except when calibrating, changing the battery or during maintenance.

SUBJECT BREATH TEST PROCEDURE

The operating sequence for testing a subject with the Intoxilyer S-D2 is simple, consisting of the following basic steps. These should be understood and followed to insure maximum efficiency of operation.

CHECK AMBIENT TEMPERATURE

The Intoxilyzer S-D2 is designed primarily for use in the 32-104° Fahrenheit (0-400° Celsius) temperature range. Keeping the instrument within this range insures minimum condensation of alcohol and water from the breath and permits both accurate and rapid breath alcohol measurements.

It is recommended that in very cold weather the instrument is stored in a pocket (preferably inside a coat) and returned there after use.

PRELIMINARY CONSIDERATIONS

Ask the subject when he/she last took anything by mouth. Some foods and even "non-alcoholic" drinks may contain traces of alcohol, which the subject may later claim affected the result of the test through a "mouth alcohol" effect. To prevent this, wherever possible, insure that a delay of about 15 minutes has elapsed since the subject took anything by mouth-even medicines which may contain alcohol.

Do not even allow the subject a glass of water prior to the test since this will cool the mouth and dilute the saliva, temporarily reducing the amount of alcohol in the breath, and, consequently, the instrument reading.

Also, smoking just prior to a breath test will not influence the result, but tobacco smoke should not be blown through a mouthpiece attached to the instrument. Tobacco smoke could damage the fuel cell.

Insure that no radio transmitter is currently being used in the immediate vicinity of the test.

READY CHECK

The instrument should first be checked to insure it is ready to receive a sample. This is accomplished by checking to insure the fuel cell is discharged and free of alcohol from any previous sample. Elimination of alcohol from the fuel cell should take no longer than two minutes-except in unusual cases depending on how much alcohol was actually present in the last sample.

To conduct a READY CHECK, depress the 'READ' button and hold it down for at least ten seconds. This will release the 'SET' button and switch on the amplifier and display circuits. Observe the display; it should not exceed .002 after ten seconds. If the display does not show .002 or less during the ten second READY CHECK, the fuel cell may have traces of residual alcohol from a previous sample. If this occurs after a previous test, depress the 'SET' button to lock and wait one minute before repeating the READY CHECK. If the left digit shows 'L', replace the battery.

SET

Once the READY CHECK is complete, the sampling system must now be SET to prepare it to draw a breath sample into the fuel cell for analysis. Press down the 'SET' button until it locks. This pushes down the diaphragm and holds it against a spring-loaded catch. This action also places a short-circuit across the fuel cell, which accelerates its inter-sample recovery time. Press the 'SET' button until it locks.

ATTACH MOUTHPIECE

Attach a mouthpiece to the sampling port on the top of the S-D2. This sampling port forms the entrance to the fuel cell and pressure switch and it is essential that the mouthpiece is pushed fully onto it.

The subject must be offered the unrestricted end of the mouthpiece to blow through. If the subject blows into the other end, the pressure switch will not be activated and the sampling lights will not operate. The instrument is now ready to receive a breath sample from the subject for analysis.

NOTE: The S-D2's sampling port is designed specifically for particular mouthpieces with a restricted end. Use of unrestricted mouthpieces will not allow the sample indicator lights to function properly; however, the unit will still operate and give reliable readings.

INSTRUCT THE SUBJECT

Instruct the subject exactly what must occur to provide a suitable sample of breath for analysis. Tell the subject to take a deep breath, blow strong enough to bring on light 'A' and keep blowing at that pressure long enough to bring on light 'B'. The subject must then continue blowing until told to stop and you have taken the sample by pressing the 'READ' button. Warn the subject that if both sampling lights fail to come on, there will not be a suitable sample of breath for analysis.

If the subject blows too hard then he/she may run out of breath before the 'B' light comes on: just a moderate breath flow rate is required.

Finally, the subject should keep hands away from the instrument. If the subject clasps it, your view of the sampling lights or your operation of the sampling mechanism could be obstructed .

TAKE SAMPLE

Tell the subject to take a deep breath and blow through the unrestricted end of the mouthpiece. The subject must blow strongly enough to bring on sampling light 'A' and then continue to blow at this pressure until the 'B' light is activated. At this point, the subject will have expelled top lung air so that deep lung air is now being blown through the mouthpiece. Press the 'READ' button to release the catch holding down the 'SET' button, allowing it to rise. This pulls up the diaphragm, drawing a small portion of breath from the mouthpiece directly into the fuel cell detector.

It is imperative that the subject is still blowing when the sample is taken. Both sampling lights must be on when the sample is taken. The subject must, therefore, continue blowing until told to stop. If the subject stops blowing prematurely, the sampling lights will go out.

OBSERVE DISPLAY

Withdraw the instrument from the subject and continue to hold down the 'READ' button. The fuel cell now develops its signal, which takes about 30 seconds to complete from the time of sampling. The maximum sample reached is a measure of the amount of alcohol in the breath sample.

As the fuel cell charges, it will cause the display reading to rise. The final value will be displayed after 20-30 seconds and is the alcohol concentration of the subject.

If the 'READ' button is accidentally released during this time, the fuel cell signal will not be affected as long as the 'SET' button is not depressed. Simply re-press the 'READ' button within the 30 second signal development time to continue reading the alcohol level on the digital display.

However, it is important that the 'SET' button is not touched during the reading development time. This would flush the alcohol from the cell and partly discharge its voltage and reduce the alcohol level

DISCARD MOUTHPIECE

Having completed the test and observed the alcohol reading, you should now remove and discard the mouthpiece. Never use the same mouthpiece for subsequent tests, on either the same or different subjects.

RESET AND WAIT

The instrument must now be RESET so it will be ready for another test. This RESET is done by depressing the 'SET' button until it locks. This flushes out the fuel cell and shortcircuits its electrodes, allowing its voltage to return more quickly to zero.

If the display shows .003 or higher as a result of the test, it may take several minutes before a satisfactory READY CHECK can be obtained before re-use of the S-D2.

ROUTINE FIELD SERVICE CHECKS

CALIBRATION CHECKS

S-D2's III's generally hold their calibration for months. To get good results the unit must be have its calibration every 60 to 90 days by either Toxicology or a member of CDDP.

BATTERY CHECK AND REPLACEMENT

If, when the 'READ' button is depressed fully down, the left digit on the display shows the letter 'L', then the battery is low in voltage and must be replaced. The battery compartment is at the base of the instrument, which must be removed from its protective pouch to change its battery. The S-D2 requires one 9-volt battery. Inorder to do this, insert a screwdriver into the hole in the pouch and ease the leather upwards as to prevent the pillar from catching on the pouch. At the same time, push the instrument upwards from the bottom of the pouch, easing the pillar under the edges of the hole. Access to the battery is obtained by sliding away the cover at the base of the instrument. When replacing the battery, be sure to separate the contact carefully and insure that the replacement battery is securely connected and fitted inside its compartment inside the instrument. After the battery is in place, the cover and protective pouch can be reinstalled.

SAMPLING SYSTEM CHECK

A simple routine check on the operating efficiency of the sampling system may be done by the following step:

1. Press the 'SET' button to lock in the down position and place a forefinger tightly over the sampling port forming an airtight seal.

2. Press the 'READ' button fully down and observe the 'SET' button. It should not rise since air cannot be drawn into the system. If the 'SET' button does rise at this time, then there is probably a leak in the system, and the Toxicology section should be notified. Remove your finger from the sampling port and the 'SET' button should immediately rise. If the 'SET' button rises slowly after you remove your finger from the sampling port, the sampling system may be blocked, and the instrument should be returned to the Toxicology section.

NOTE: Do not, for any reason, cover the sampling port and force down the 'set ' button from its up position. This would rupture the sampling diaphragm or fuel cell electrode and necessitate the replacement of either or both of these parts.

BREATH SAMPLING LIGHT CHECK

This procedure checks the operation of the breath pressure switch and the timing and operation of the breath sampling lights:

1. Insure that the 'SET' button is in the locked down position.
2. Place a forefinger over the sampling port and apply continuous pressure to the 'SET' button. This should activate the pressure switch and cause sampling light 'A' to illuminate, followed by light 'B' approximately 2.5 seconds later.

TEST FUEL CELL SWITCH

When an alcohol sample has been taken, the reading is cleared from the display and fuel cell recovery is accelerated by depressing the 'SET' button. This short circuits the fuel cell electrodes and accelerates its discharge; immediate discharge is not generally possible since alcohol will still be present on the electrode surface.

To test and insure that this circuiting switch is working properly, the following procedure should be done:

1. Take a sample from a wet bath simulator into the S-D2.
2. Hold down the 'READ' button and observe the display as it starts to increase to the standard value. While still holding down the 'READ' button, press the 'SET' button fully down- you will be holding both buttons down at the same time. This should cause the display to reset to .000.
3. Allow the instrument to clear before using for further breath tests.

If the fuel cell reset switch test fails, the instrument should be returned to an authorized agent for inspection and repair.

FUEL CELL REPLACEMENT

When the fuel cell has reached the end of its working life, as seen by the inability to calibrate the instrument (see previous section), the complete instrument should be returned to the manufacturer for a replacement fuel cell to be fitted.

POINTS TO REMEMBER

The following information, if applied to the operation of your SD2, will help prevent any problems.

TEST PROCEDURES

Learn the operating sequence thoroughly, and with a little practice, you will soon be completing tests in a little more than one minute:

1. Ready Check
2. Set
3. Attach Mouthpiece
4. Instruct the Subject
5. Take Sample
6. Observe Display
7. Discard Mouthpiece
8. Reset and Wait

READY CHECK

Each breath test must be preceded by a satisfactory READY CHECK.

MOUTH ALCOHOL

15 minutes should pass between the consumption of alcohol and a breath test using the S-D2. This period allows for any "mouth alcohol" to be dispersed.

MOUTHPIECE

Use a new mouthpiece for every test and insure that the subject blows through the unrestricted end.

STORAGE BETWEEN TESTS

Always store the S-D2 with the 'SET' button down. This will keep the cell discharged so that the instrument is always ready for a breath test, provided that a satisfactory READY CHECK was obtained prior to taking the sample. Also, avoid storing the unit in temperature extremes.

RADIO TRANSMITTERS

Do not use the S-D2 in close proximity to radio transmitters while they are transmitting.

PHYSICAL SHOCK

The S-D2 is rugged and reliable but should be treated with respect. Normal physical shock encountered in the field will be no problem, but a hard jolt like a drop on the floor or ground could be damaging. If you suspect that a drop may have damaged the unit, perform a calibration check.

HENRY'S LAW

AND THE

BREATH TO BLOOD

RATIO

HENRY'S LAW

THE BASIS

In 1803 a British chemist, William Henry, developed a chemical principal concerning the actions of volatile substances when placed in water and brought into contact with air. This discovery is called Henry's Law and is stated as follows:

> WHEN THE WATER SOLUTION OF A SOMEWHAT VOLATILE CHEMICAL COMPOUND IS BROUGHT TO EQUILIBRIUM WITH AIR, THERE IS A FIXED RATIO BETWEEN THE CONCENTRATION OF THE COMPOUND IN THE AIR AND IT'S CONCENTRATION IN THE WATER, THIS RATIO IS CONSTANT FOR A GIVEN TEMPERATURE AND PRESSURE.

Alcohol and many other substances are considered to be volatile substances, meaning that they have a tendency to rapidly change states (liquid to air; evaporation, or air to liquid; condensation), whether they are alone or in solution, If one places a volatile substance, such as alcohol, in solution with water in a sealed container, the air in the container will become saturated with alcohol vapor. When the amount of alcohol evaporating into the air space above the solution, equals the amount of alcohol condensing and returning to the water, equilibrium has been reached. At equilibrium, there is a fixed ratio, or direct proportion, between the alcohol in the water and the alcohol in the air above it. This ratio is dependent on the temperature of the solution and atmospheric pressure.

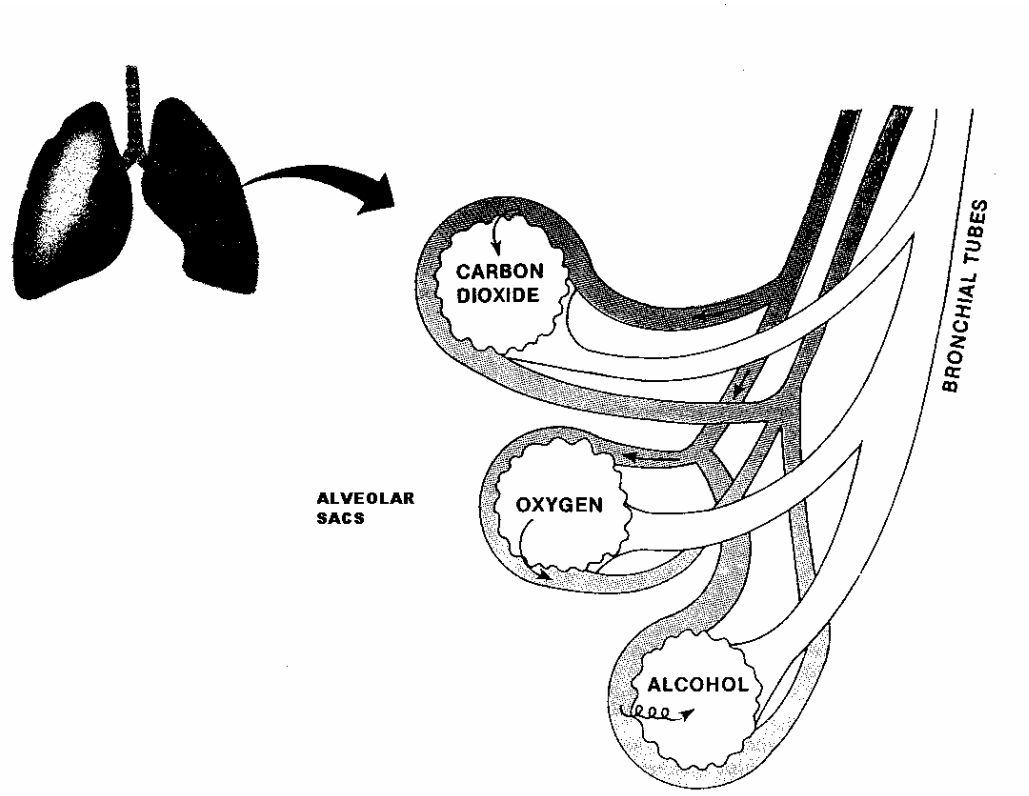
Henry did not use alcohol in his experiments. However, later experimentation confirmed that water and blood solutions using alcohol do obey Henry's Law except when the alcohol concentration exceeds 20% (50 times lethal dosage) which far exceeds any concentrations found in humans.

APPLYING HENRY'S LAW TO THE HUMAN BODY

Does the human body meet the requirements of Henry's Law? First of all when we drink alcohol, we have placed a volatile substance in the "container", there is water present with which the alcohol can come into solution, for all intents and purposes the body is a "closed" container, and the volatile in the water (blood) does come into contact with air (the lungs). The body is regulated at a fairly constant temperature (98.6°F or 37° C) and it self regulates for any pressure changes. Therefore the human body very nicely fits all of the requirements for Henry's Law to apply.

Our respiratory system is designed to quickly bring gaseous and volatile substances contained in the blood into equilibrium with the alveolar air of the lungs. The air passages of the lung may be compared to an inverted tree. The windpipe or "trachea" as the trunk, one large branch or "bronchus" going into

each lung, with these branches further dividing into smaller and smaller branches. These smaller branches or "bronchi" finally become microscopic tubes, each ending in a thin irregular sac. Each sac is composed of a number of smaller sacs called "alveolus". Each alveolus is approximately 0.1 millimeter in diameter, its wall is only two cells in thickness, and it is honeycombed with capillaries. A normal lung will contain about 750 million alveoli, creating a surface area of approximately 600 square feet. It is here in the alveolar region, that the exchange of all gases, including alcohol, occurs.



Each time we breathe, we intake oxygen, this oxygen is brought into the alveolar section of the lungs where it will pass from the alveolar sacs directly into the blood, thereby creating arterial or oxygenated blood. This blood then travels throughout the body delivering oxygen to all body tissues. As the arterial blood is delivering its supply of oxygen and other nutrients, it is collecting carbon dioxide, and other waste products from the various bodily tissues. When the blood carrying the carbon dioxide, now called venous or deoxygenated blood, returns to the alveolar region it will pass the carbon dioxide into the alveolar sac, as it receives new oxygen. When we exhale, the carbon dioxide which has been collected from body tissues will be passed out of the body.

The alcohol in our system follows this same exit route. As blood containing alcohol comes into contact with the alveolar region, the alcohol will pass from the blood into the alveolar sac. This intimate contact between the alcohol laden blood and the alveolar region satisfies the requirements for Henry's Law, not only with alcohol, but oxygen, carbon dioxide and many other volatiles.

It is important to understand and remember that this equilibrium, and therefore the ratio of alcohol between the air and the blood will only occur in the alveolar region of the lungs.

THE DEVELOPMENT OF THE 2100:1 "BREATH TO BLOOD" RATIO

The application of Henry's Law, in an effort to analyze the breath and establish an alcohol concentration, was first conducted by Dr. Rolla Harger. In an effort to assist the law enforcement community in combating the intoxicated driver, Dr. Harger began experimenting with methods of quickly and accurately determining alcohol levels with out the need for intrusion into the body or waiting for lengthy laboratory analysis.

Initial experiments were done by placing whole blood combined with known quantities of alcohol, into a rotating cylinder. By rotating the cylinder Dr. Harger was able to simulate the gas exchange processes occurring in the lung system. Samples were drawn from the blood and the air until a constant ratio was established. Other types of blood and different concentrations of alcohol were used until Dr. Harger was confident that the correct Breath to Blood ratio had been established. Dr. Harger then published his findings and the science of breath analysis was born.

It is critical to understand the exact basis of this "Breath to Blood" statement, since it is constantly brought into question. Dr. Harger stated:

> THAT 2100 ml OF ALVEOLAR AIR WILL CONTAIN THE SAME WEIGHT OF ALCOHOL AS DOES 1 ml OF PULMONARY ARTERIAL BLOOD

This seemingly simple statement has prompted more debate in the arenas of science and law than any other statement to date. Most of the legal debate however, is based on a misunderstanding of the statement. In all most every court across the country this is referred to as "The Breath To Blood Ratio" however this statement does not refer to breath in general, but rather to a very specific type of breath, Alveolar and a specific type of blood, Pulmonary Arterial.

Just as there are specific types of blood in the body, arterial, venous, capillary, and each have specific characteristics, there are different types of breath. The type of breath where the alcohol is in greatest contact and therefore the prime sample to collect for a breath analysis is the alveolar air. However, to promptly collect this type of sample, all the alveolar air must be extracted from the lungs, thereby causing the lung to collapse. Obviously this type of sample capture cannot be conducted in a breath analysis. A breath analysis is mathematically based on the ratio involving the alcohol concentration in the blood and that of the alveolar, but what is referred to as "Deep Lung". A Deep Lung breath sample is the closest one can get to the actual sample mathematically required by breath analysis instrumentation. This type of breath is representative of the alcohol concentration ration between the arterial blood and the alveolar air, but since it is not in as intimate contact with the blood, analysis of Deep Lung breath will consistently provide a lower analysis than if we could capture and analyze a pure sample of alveolar air.

The most incredible fact regarding this statement is that it was developed and published in the late 1930's. Furthermore, breath analysis has been recognized by state statute since 1939. This statement and the science of breath analysis has been established, proven reliable and accepted by all major scientific associations an organizations since the 1940's.

The major aspect of it's reliability is that after years of study and scrutiny this "Breath To Blood Ratio" is still accepted as the best ratio to date for the accurate analysis of breath in an effort to establish alcohol concentrations in the blood.

THE USE OF THE "BREATH TO BLOOD" RATIO IN INSTRUMENTATION

The first breath analysis instrument, known as the "Drunkometer", or "Balloon Test" was developed by Dr. Harger. The critical basis of the instrument was determining the exact amount of alveolar air contained in the sample since the instrument used "Mixed Expired" air which was composed of all the types of breath. The captured breath was bubbled into a reagent until the reagent had turned a specific color. The amount of breath it took to cause this reaction would vary depending on the alcohol concentration of the subject, the higher the alcohol concentration in the subject, the smaller the amount of captured sample it took to cause the reaction. The exact amount of alveolar breath then had to be determined. This was done by measuring the weight of carbon dioxide, which is found only in the alveolar air, captured by an ascarite tube, which had to be weighed before and after the test, and by applying mathematical formulas, assessing the exact amount of alveolar air and then correcting the captured amount of alcohol. The instrument was later modified using a "re-breathing" technique whereby the individual would exhale into a "balloon" breathe the sample back in and then exhale again. By having the subject perform this technique a minimum of four times the sample which was then analyzed was virtually the same composition as alveolar air.

In 1954 Dr. Robert Borkenstien introduced the "Breathalyzer". The Breathalyzer was designed to capture a specific amount of the last breath exhaled from the subject. Whereas the Drunkometer would use different amounts of breath, the Breathalyzer would capture only 52.5 cc of the last breath. The basis in this case was not the amount of breath used, but the amount of reagent destroyed based on a constant sample. The alcohol concentration would be proportional to the amount of reagent which reacted with the alcohol. To determine the amount of reagent destroyed in an ampoule, a "test" ampoule and a "standard" ampoule were used. The ampoules where placed in front of matched photocells and a movable light source was adjusted until the amount of light able to pass through the ampoules was equal. When the alcohol reacted in the test ampoule a portion of the reagent was destroyed thereby altering it's light absorption. The light sources was readjusted until the amount of light passing through the ampoules was equal once again. The distance the light source had to move was directly proportional to the alcohol concentration.

In the 1960's investigations concerning the use of Infrared light as a method of alcohol analysis were under way. A company named Omicron introduced the first Infrared type of device. This device was then purchased by Mr. Jack Fritzlen, president of CMI Inc. in 1975. The basis of the infrared unit was to use an infrared light beam which when brought into contact with alcohol the alcohol molecule would absorb some of the infrared light energy. The actual theory of the infrared instrumentation will be discussed in a later chapter, however once again the Breath to Blood ratio is an intrical part of this type of instrument.

THEORY OF

DRY GAS

REFERENCE

STANDARDS

REV3/26/04

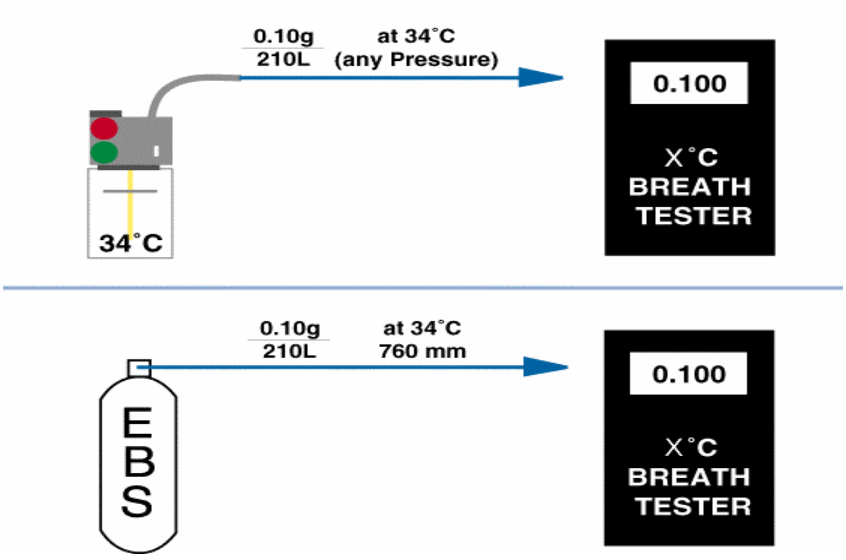
PURPOSE

The purpose of the Dry Gas Standard is used to produce a sample gas of known ethanol concentration for use as a reference in a standard check on the Intox EC/IR II.

The purpose of this **standard check** is to ensure and demonstrate that the instrument is working properly when conducting a breath test.

In accordance with the Bureau of Public Health, the reference standard check on dry gas is accepted if the reading on the Intox EC/IR II is:

0.077 – 0.087 or 0.082 ± 0.005



DEVICE

The dry gas standards are contained in a DOT approved, pressurized, dry gas tank that is connected to the EC/IR II through a single staged regulator. This tank contains a single-phased (gaseous), NIST traceable, mixture of nitrogen and ethanol that will produce a 0.082% at sea level. During a standard check performed by the instrument, the regulator and internal components within the EC/IR II will automatically sample and analyze the reference standard.

CHARACTERISTICS

- Many test samples in one tank
- Shelf life of 24 months on 105 liter tank
- Can be easily automated
- Readings do not deteriorate with use. No depletion
- NIST traceable
- Simple to use
- Disposable
- Cannot be transported on commercial airlines.
- Operates anywhere at any temperature or elevation and does not need electric power
- Adjustments for barometric pressure are necessary.

USAGE CONSIDERATIONS

Pressure

Since the dry gas standards are effected by barometric pressure, the EC/IR II will detect and automatically correct for atmospheric pressure changes due to weather or elevation. No action is required on the part of the operator.

Temperature

The temperature of the gas does not make any difference at normal temperature ranges found within the instrument or its normal operating environment. Care should be taken, however, when transporting dry gas tanks or instruments containing tanks that they are not exposed to prolonged periods of freezing temperatures.

NOTE: If extended cold temperature exposure should occur, allow sufficient time for the tank to return to room temperature. Usage of the tank in a cold condition may ruin the standard resulting in a "Standard Fail".

MONITORING OF DRY GAS STANDARDS

Pressure

The EC/IR II is set up and equipped to monitor the pressure and the expiration of the dry gas tank. During the scrolling mode on the instrument, the display will periodically show the remaining tank pressure or the pressure may be accessed by pressing and holding "Alt P" on the keyboard. Once the pressure of the reference standard drops through continued use to its near empty state, two events will occur:

Low Pressure Warning: 100 PSI (approximately 15 tests remaining)

Low Pressure Disable: 50 PSI (Unit disabled)

The unit will disable at 50 PSI and allow no further testing until the tank is replaced.

Expiration Date

Another consideration to monitor is the expiration date on the reference standard. Once the reference gas is loaded into the disposable tanks, the ethanol/nitrogen mixture is guaranteed stable for two years and this expiration date is labeled on each tank. When a tank is installed into the Intox EC/IR II, the expiration date can be loaded into the EC/IR II software and will then be tracked by the unit. Once the tank is approaching the date of expiration, two events will occur:

EXPIRATION WARNING (while scrolling**): 15 days prior to expiration**

TANK EXPIRED: At the date of expiration.

The unit will be disabled until a new tank is installed and the expiration date is reset within the instrument.

INSTRUMENT ERRORS

1. STANDARD CHECK FAILED

Instrument is out of calibration and needs to be calibrated.

Wrong target value was entered prior to accuracy check. Check target value on ticket as compared to the result.

The instrument may have not correctly compensated for barometric pressure.

2. DRY GAS TANK EMPTY

Gas tank is empty.

The flow from the regulator is not set properly and the instrument needs service.

The gas solenoid is not actuating properly and needs service.

3. TANK IS EXPIRED

The gas tank date has expired and needs replaced.

INTOX

EC/IR II

THEORY AND

OPERATION

INTOXIMETER INTOX EC/IR II

INTRODUCTION

TECHNICAL SPECIFICATIONS

Performance Range
0.000 to 0.400 grams of ethanol/210 liters of breath

Specificity
The measurement system is specific to ethyl, methyl, and isopropyl alcohols; it does not respond to other hydrocarbons found naturally in the breath.

Accuracy
U.S. DOT approved for evidential use. Meets and/or exceeds the federal model specifications for traffic enforcement and omnibus breath alcohol testing. OIML compliant.

INPUTS/OUPUTS

Display
A two line by twenty character vacuum fluorescent display that supports a large international character set. The display provides operator instructions and status information.

Keyboard
101-key, PS2-compatible keyboard. All operator commands are from the keyboard to control instrument functions.

Barcode Scanner
Barcode scanner designed for quick, single pass decoding of drivers' licenses and ID cards for input of subject and officer data.

Internal Printer
A high performance thermal printer produces the evidential records and provides:

- Printing speeds at 7.5 lines per second
- Integrated paper handling system requires no threading
- Changing the paper roll takes seconds and there are no paper jams

FEATURES

Blood Alcohol Concentration (BAC)
Expressed in g/210L of breath

Breath Sampling
Automatically senses alveolar (deep lung) breath by volume and flow rate.

Internal Clock and Calendar
The internal clock, with or without external power, is accurate to ±1 minute per month. The clock also automatically updates month, day, year, and daylight savings time.

MECHANICAL

Modem
The INTOX EC/IR-II can communicate via a built-in Hayes-compatible 9600-baud modem.

I/O
2 - RS-232 serial communications ports
1 - parallel port

Electrical
90 to 250 VAC, 47 to 63 Hz, approximately 65 watts power consumption and possible 12 VDC operation with optional inverter.

Mechanical
Desktop model with an all metal case for RFI hardening

Height: 7 in. (178 mm)	Depth: 18 in. (457 mm)
Width: 17-3/4 in. (451 mm)	Weight: 22 lb. (10 kg)

PARTS, CONTROLS, AND INDICATIONS

Front/Right view

Rear/Left view

PARTS, CONTROLS, AND INDICATIONS

1. **Keyboard** – Common IBM PS2 keyboard.

2. **Barcode Scanner –** ESEEK 200 barcode scanner.

3. **Digital Display** - A two line by twenty character vacuum fluorescent that relates which operation the instrument is performing, alerts the operator to required actions, and expresses results in alcohol concentration units.

4. **Thermal Printer –** High performance thermal Printer

5. **Serial Decal –** Decal displaying the serial number of the instrument

6. **Exhaust fan** – Cools the instrument when internal temperature raises to high levels.

7. **Mouthpiece** - A disposable plastic tube which fits in the end of the breath tube. Its two functions are to accept the subject's breath and prevent the subject from drawing air back into the istrument during breath delivery.

8. **Breath Tube** - A heated reinforced plastic tube through which the subject blows into the sample chamber. This tube is heated to prevent condensation.

9. **Power Switch** – A rocker type switch which turns the instrument on and off.

10. **Power Jack** - This is the port to which the 8 foot power cord connects.

11. **Amp Fuse** - The instrument's main 1.5 Amp bus fuse.

12. **Modem Jack** – Hookup for the phone line (RJ-11) connector used for remote communications.

13. **Serial Port 2** – This port is not used at this time.

14. **Serial Port 1** – Connection port for the E-SEEK 200 bar code scanner.

15. **External Printer port** -- This 25 pin connector is used to interface with a standard parallel printer using a standard CENTRONICS interface cable. This port is only active with the external printer option which is not available at the same time.

16. **12V Supply** – This port is used by mobile versions of the Intox EC/IR II for drawing power from various motor vehicles and is not active in the current setup.

17. **Keyboard Connector** – The keyboard of the instrument plugs into this PS2 (mini-DIN 6) connector. If the keyboard becomes disconnected, the instruement will fail to boot when first turned on.

DATA ENTRY DEVICES

Keyboard

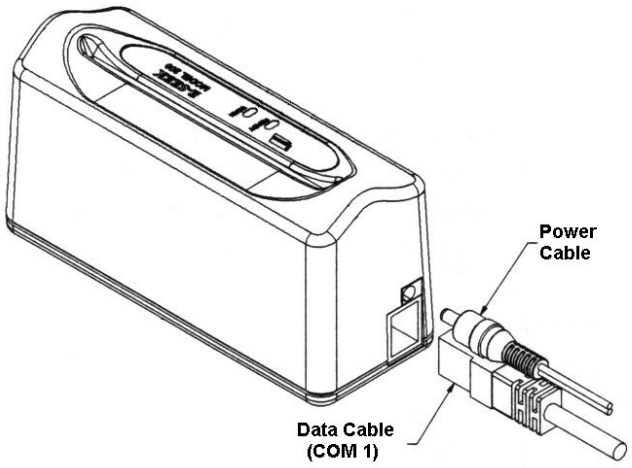
The Desktop INTOX EC/IR-II uses a miniaturized keyboard with a PS2 keyboard connector that is the same kind used in most personal computers today. If for any reason the keyboard malfunctions then any PS2 (or mini-DIN 6 keyboard) can be substituted.

The following keys have special uses in conjunction with the INTOX EC/IR-II:

- Escape Key: found in the upper left-hand corner of the keyboard
- Function Keys: found along the top of the keyboard above the main set of keys
- Cursor Keys: found on the lower portion of the keyboard between the main keys and the numeric keypad.
- Enter Key: also referred to as the Return Key, is found in the center right portion of the main set of keys.

NOTE: The keyboard must be connected before the INTOX EC\IR II is powered up. Failure to do this will result in the instrument locking up during boot up.

Barcode Scanner

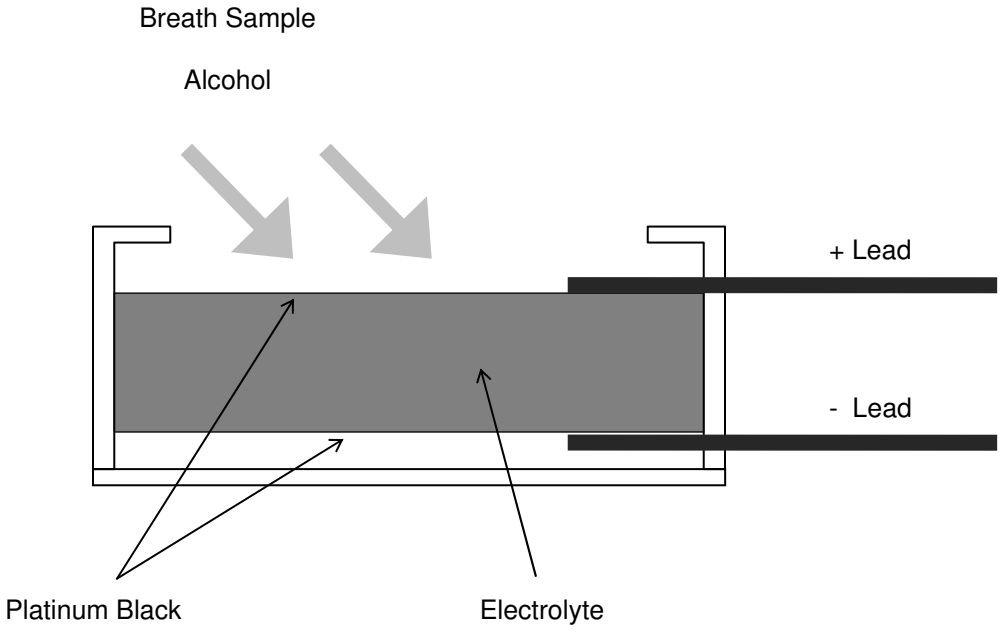


The ESEEK 200 barcode reader is used to scan and decode the 2 dimensional bar code on many drivers license.

ANALYSIS SYSTEM

PRINCIPLES OF FUEL CELL SENSOR

In its simplest form, the alcohol fuel cell consists of a porous, chemically inert disk coated on both sides with finely divided platinum (called platinum black). The porous disk is impregnated with an acidic electrolyte solution, with platinum wire electrical connections applied to the platinum black surfaces. The entire assembly mounts in a plastic case, which has a gas inlet that allows a fixed volume of breath to be introduced to the upper.



Fuel Cell

The reaction on the cell surface is basically this: alcohol is converted to acetic acid, and in the process, produces two free electrons per molecule of alcohol so converted. This reaction takes place on the upper surface of the fuel cell. H+ ions are freed in the process, and migrate to the lower surface of the cell, where they combine with atmospheric oxygen to form water, consuming one electron per H+ ion in the process. Thus, the upper surface has an excess of electrons, and the lower surface has a corresponding deficiency of electrons. If the two surfaces are connected electrically, a current flows through this external circuit to neutralize the charge. With suitable amplification, this current is an indicator of the amount of alcohol consumed by the fuel cell.

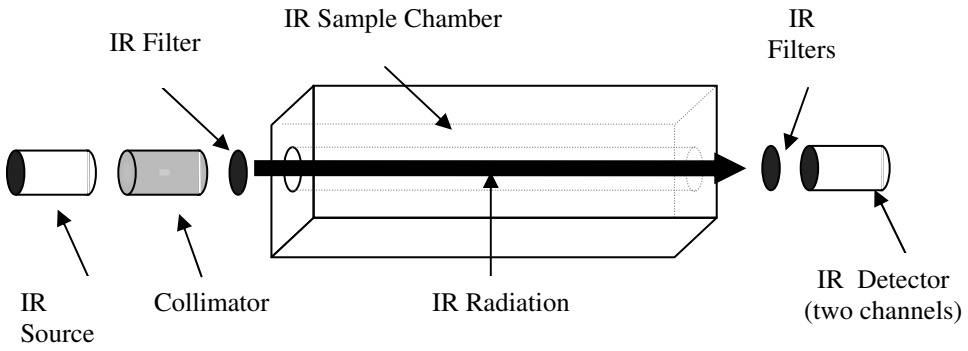
PRINCIPLES OF THE INFRARED CELL

A basic principle of scientific analysis is that all organic molecules absorb infrared light. One can measure the infrared absorption of these by directing infrared light through the sample and measuring the incident light falling on a detecting device. The level of electrical signals produced by detecting device provides quantitative indications of the samples concentration. The instrument can process these signals to produce an output indicating the concentration of

one or more of the constituents being analyzed. Even in the gaseous state, these molecules exhibit absorption characteristics at specific wavelengths in the infrared spectrum.

In the INTOX EC/IR-II, the detector contains two channels, one for carbon dioxide and one for ethanol that are selected by filtering the frequency of incident light reaching the detector. Thus with no ethanol or carbon dioxide present, both develop approximately the same output voltage. When ethanol is introduced into the sample, the radiation reaching the ethanol detector is reduced, but the carbon dioxide channel is unchanged. Similarly, the presence of carbon dioxide reduces the signal output from the carbon dioxide detector.

The amount of signal decrease in either the carbon dioxide or ethanol channels is proportional to the concentration of the gas of interest according to Lambert-Beer's law, which defines the exponential relationship between concentration and signal strength.



IR Bench

GENERAL OPERATING PRINCIPLES OF THE INTOX EC/IR II

The INTOX EC/IR-II employs two distinct analytical techniques to measure alcohol concentration: a fuel cell, (i.e., an electrochemical sensor) and a miniaturized infrared absorption (IR) bench. The instrument employs both of these techniques because each offers different advantages to the sampling process.

The infrared (IR) sensor exhibits cross-sensitivity to several breath constituents (like acetone) and is a non-linear analytical device (difficult to calibrate), making it less attractive to use as the primary analytical system. The IR sensor, however, is able to make continuous determinations of alcohol concentration thus allowing the INTOX EC/IR-II to monitor a breath sample in (near) real time as it is delivered into the Intox EC/IR II. This helps determine the correct moment at which to take a sample of the breath by the fuel cell for analysis and that the sample is not contaminated with mouth alcohol.

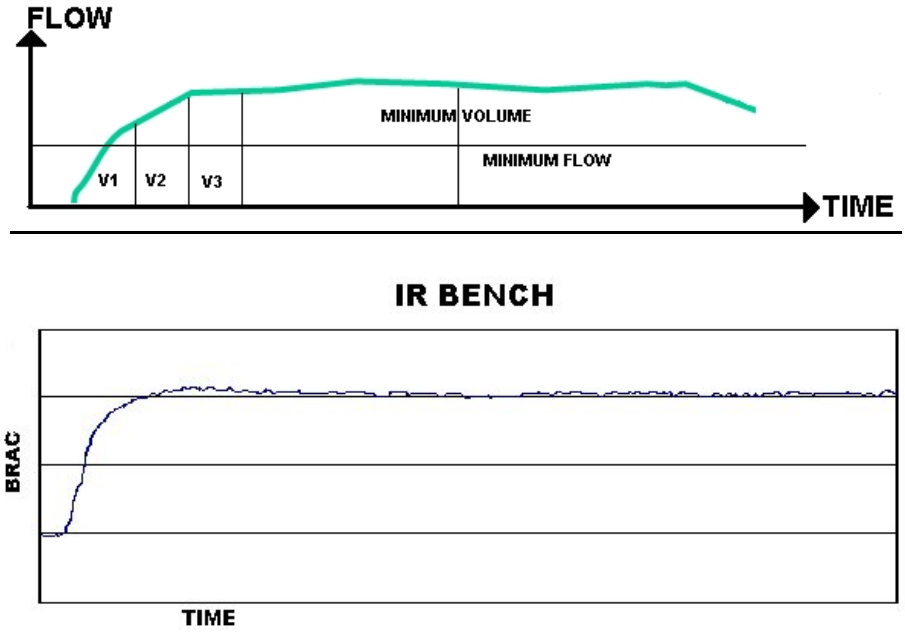
The fuel cell sensor is specific to alcohol and it is a linear sensing device giving a simple one-point calibration ensuring stable calibration across the full range of its sensing capabilities. These features make this analytical device ideal for quantitating alcohol at the end of exhalation

once the infrared sensor has determined that a proper deep lung (alveolar) sample has been reached.

In combination, these two analytical systems provide all the necessary information to make precise and accurate determinations of breath alcohol concentration as well as ensure that the instrument takes a high-quality sample. This sample is one made up of alveolar breath, not a shallow breath sample or one tainted by alcohol from the upper respiratory tract of the subject.

Breath Sample Volume

The unique breath sensing system in the INTOX EC/IR-II requires that sampling takes place at the end of an exhalation if enough breath has been given to reach deep lung breath. A thermistor monitors the flow rate of the breath through the instrument continuously, and the microprocessor accumulates an integral of the flow rate (Volume). Before reaching the required minimum volume, any reduction or cessation of flow rate causes the instrument to reset and request another sample. The subject will then be required to provide another breath sample after the unit clears the delivered breath sample from the instrument. After accumulating the minimum volume, the instrument does not initiate an automatic sample until a reduction in breath flow signifies the approaching end of exhalation. At that instant, the instrument takes a breath sample.



Interferents

Since a fuel cell is unresponsive to interferents that can sometimes be found on a subject's breath, like acetone or toluene, care must be taken when low or zero readings occur on a test subject who shows marked impairment. Though the impairment may not be due to alcohol, this impairment may be the result of diabetes, intoxicating inhalants, medications, or illicit drugs. One substance of note is acetone which is produced in diabetics who are entering a diabetic coma - a condition of extremely low blood sugar. Subjects may be confused, disoriented, and have spells of passing out. The subjects need immediate medical attention. It is advisable for the reason of officer liability and subject safety to seek out medical attention and/or a blood test whenever low or zero readings are encountered on a DUI suspect.

(Are you taking any perscription medications?)

INSTALLATION AND BASIC OPERATION

THE OPERATING ENVIRONMENT

Environments with heavy alcohol vapor, cigarette smoke, high levels of radio frequencies, or magnetic interference should be avoided. In addition, avoid locating the instrument in newly painted rooms.

The INTOX EC/IR-II is not designed for all-weather operation. The ideal operating environment for this instrument is indoors at room temperature.

The INTOX EC/IR-II is designed such that none of these environmental conditions will affect the results of a test. However, prolonged exposure of the INTOX EC/IR-II to these types of environmental factors may shorten the life of various components including the fuel cell.

Note: Cigarette smoke will destroy the fuel cell!

INSTALLING/REMOVING THE INTOX EC/IR II

When installing or removing the instrument from service, proper hardware connections are necessary for the operation of the instrument. Before changing these hardware connections, be sure the instrument is powered down. The following image shows the proper connections and their location that need to be attended to:

When returning the EC/IR II to toxicology, please leave all attachments at the site location as they are not needed for repair of the instrument and will only become lost or damaged during transit; that is unless the problem is with one of the attachments (keyboard, ESEEK scanner, etc.).

TURNING ON THE INTOX EC/IR-II

NOTE: Failure to attach the keyboard will result in an error during startup!

Plug the INTOX EC/IR-II into an AC power outlet and switch the power switch (located on the rear panel of the unit) to the ON position. The instrument should remain on continuously; this allows the user to avoid the warm-up time that is required when the instrument has been turned off for a period of time and also allows remote communications with the instrument. Once you turn the instrument on the alphanumeric display should illuminate and display a series of messages about the firmware version, time, date, serial number of the instrument, and possible warning conditions. During the initial warm-up period, the instrument displays "HIT "ENTER" KEY TO START". Subject tests or calibration cannot be initiated during the warm-up period, which lasts about 20 minutes. When the instrument reaches operating temperature, a scrolling set of messages appear, indicating that the instrument is ready to run tests immediately.

USING THE KEYBOARD

The keyboard supplied with the INTOX EC/IR-II works just as any personal computer keyboard. There are three sets of keys that have special functions when operating the instrument:

Enter Key
This key has two functions. When the INTOX EC/IR-II is ready and the display is scrolling, pressing Enter starts a Subject Test sequence. Also, after answering questions displayed on the INTOX EC/IR-II when entering data, press Enter to send the current answer or data to the instrument. Then move on to the next question.

Escape Key
The "Escape" key interrupts data entry and also aborts a Subject Test whenever pressed during a test sequence.

Space Key
The "Space" key is used to move through the agency types when selecting the agency in data entry.

USING THE BARCODE SCANNER

To scan a license, turn the card such that the 2D barcode is facing left and down and insert into the device and remove. If the card was successfully decoded, the INTOX EC/IR II will respond with a high pitched beep and load this information for review into the data entry fields. To accept the scanned data, press the "Enter" key to view and then load the data for each field.

Note: Defective cards, incompatible 2D formats, or damaged barcodes will make the card unreadable. In these instances the data must be entered manually from the keyboard

OPERATING PROCEDURE

SUBJECT TEST PROTOCOL

The following outlines the testing procedures using the evidential test protocol. The protocol is:

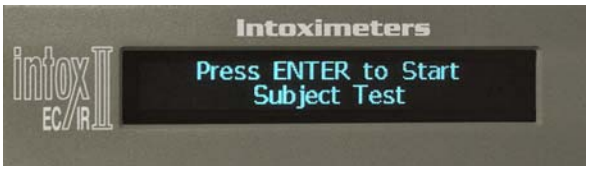
Air Blank, Standard Check, Air Blank, Subject Test, Air Blank, Standard Check, Air Blank

ASABASA

Conducting A Subject Test

Once the system has been turned on and the warm-up cycle completed the display will be in the scrolling mode. The operation of the INTOX EC/IR II requires more effort than simply pushing buttons and proceeding with the test. There are other precautions and procedures that must be followed in order to insure accurate alcohol readings.

The mucous lining of the mouth cavity and nasal passages will store alcohol for some time after a person consumes alcohol. Normal body processes eliminate residual mouth alcohol within 20 minutes. Therefore, observe a subject for at least 20 minutes before performing a test. During the observation time, the subject may not smoke, eat, drink or introduce any substance into his mouth. Furthermore, if the subject regurgitates, delay starting a breath test for at least 20 minutes from the time of the regurgitation. The INTOX EC/IR II is capable of detecting mouth alcohol in a subject, however the 20 minute deprivation period should be closely observed to avoid any question of a test's validity.



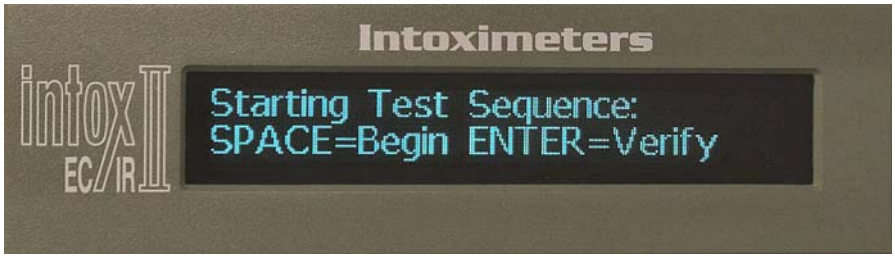
DATA ENTRY

Follow the steps below noting the **DISPLAY**, **KEYBOARD ENTRY**, and **EXPLANATION** at each step [an "*" denotes a scannable entry].

DISPLAY	DATA ENTRY	EXPLANATION
SCAN LICENSE NOW: **SCAN CARD OR PRESS ENTER:**	Scan drivers license of subject or press enter to continue	
***Subject Last Name:**	Enter subjects last name. ***LOSER***	Enter the 20-character alpha/numeric name followed by the Enter key.
***Subject First Name:**	Enter subjects first name. ***BILLY***	Enter the 20-character alpha/numeric name followed by the Enter key.
***Subject Middle Initial:**	Enter subject's middle initial. ***B***	Enter the 1-character alpha/numeric intial followed by the Enter key.

DISPLAY	DATA ENTRY	EXPLANATION
***Subject Sex:**	Use the Space bar to select sex ***M***	
***Subject D.O.B.:**	Enter the subject date of birth followed by the Enter key. ***020270***	Enter the subject Date of Birth by MM/DD/YY.
***Subject D.L. Number:**	Enter the Subject Drivers License ***E123456***	Enter the 20 character alpha/numeric D.L. # followed by the Enter key
***D.L. State of Issue:**	Enter the 2 alpha state characters ***WV***	Enter the 2-character alpha State of Issue followed by the Enter key
Make of Vehicle:	Enter the make of vehicle ***CHEVROLET***	Enter the 20-character alpha/numeric Make of Vehicle followed by the Enter key.
Citation Number:	Enter the citation number ***1234567***	Enter the 20-character alpha/numeric Citation Number followed by the Enter key
LIC/REG Number:	Enter the State and Lic/Reg number of the subject ***WV/ICU812***	Enter the 20-character alpha/numeric Lic/Reg followed by the Enter key
Scan Officer License Now: Scan Card or Press ENTER	Scan the officer drivers license or press enter to continue	
***Operator Last Name:**	Enter the operator last name ***QUADE***	Enter the 20-character alpha/numeric name followed by the Enter key
***Operator First Name:**	Enter the operator first name ***DOUGLAS***	Enter the 20-character alpha/numeric name followed by the Enter key
***Operator Middle Initial:**	Enter the operator middle initial ***E***	Enter the 1-character alpha/numeric name followed by the Enter key
Operator Agency:	Enter the Operator Agency Type. ***SO***	By using the space bar select SO (sheriff), PD (Police), WVSP (Trooper), DNR, PSC(Public Service Comm.), CP (Campus Police) or Other followed by the Enter key
Agency Name:	Enter the Agency Name. ***PENDLETON***	Enter the 20-character alpha/numeric Agency name followed by the Enter key
Arresting Officer Last Name:	Enter the L,F, M of the Officer Name ***QUADE***	Enter the 20-character alpha/numeric name followed by ENTER or just hit ENTER to load previous entries.
Arresting Officer First Name:	Enter the operator first name ***DOUGLAS***	Enter the 20-character alpha/numeric name followed by ENTER or just hit ENTER to load previous entries
Arresting Officer Middle Initial:	Enter the operator middle initial ***E***	Enter the 1-character alpha/numeric name followed ENTER or just hit ENTER to load previous entries

DISPLAY	DATA ENTRY	EXPLANATION
Arresting Agency:	Enter the Arresting Agency Name ***PENDLETON SO***	Enter the 20-character alpha/numeric name followed by ENTER or just hit ENTER to load previous entries
Time of Arrest:	Enter the correct time followed by the Enter key. ***1205***	Default the time of test or Enter the correct time.
Type of Arrest:	Enter the Arrest Type ***DUI***	By pressing the space bar will allow you to select DUI, DUI-Fatality, DUI-Injury, DUI-Fleeing, DWMA, PI, Test, VHC, Other
County of arrest:	Enter the County of Arrest ***PENDLETON***	Enter the 2 character alpha/numeric County of Arrest name followed by the Enter key
Incident route:	Enter the location name. ***WVR33***	Enter the 20 character alpha/numeric Incident route (USI#, USR#, SR#, CR#) name followed by the Enter key
20-MIN Observed (Y/N):	Enter Y/N or press "Enter" to continue.	Press Y to accept and N should never be pressed. This is only present as a reminder for the 20-min waiting period.



After the data entry is complete, the instrument will begin the evidential test sequence.

BLANK CHECK
The instrument will automatically run a check of the breath path to ensure there is no alcohol present. The blank check must result in a zero reading before the instrument will advance to the next step in the testing protocol. If the blank check result is >.000 the instrument will automatically purge and blank check. If on the third attempt the blank result is > .000 the test is aborted.

BLANK CHECK PASSED
The instrument prints the result of the blank check.

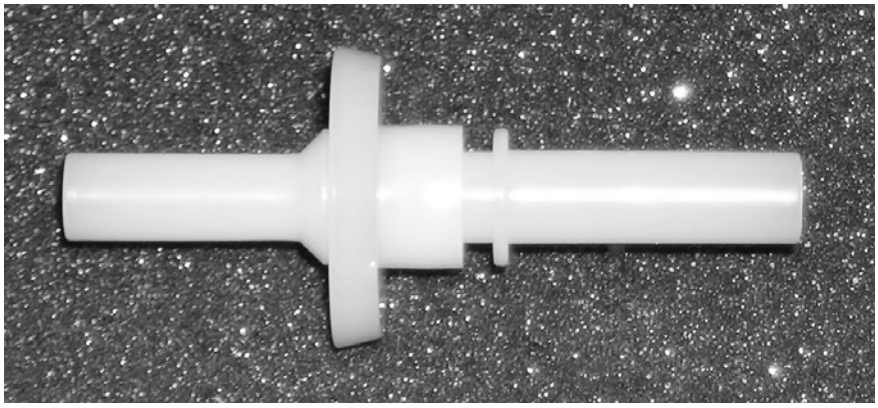
STANDARD CHECK
The instrument is performing an analysis on the dry gas reference standard.

STANDARD .XXX
The instrument displays the result of the Standard Check. If the result falls outside of the tolerance window (0.077 – 0.087) on a 0.082 standard, then the instrument aborts the test and prints Standard Out of Range.

BLANK CHECK
The instrument again checks for alcohol in the breath path.

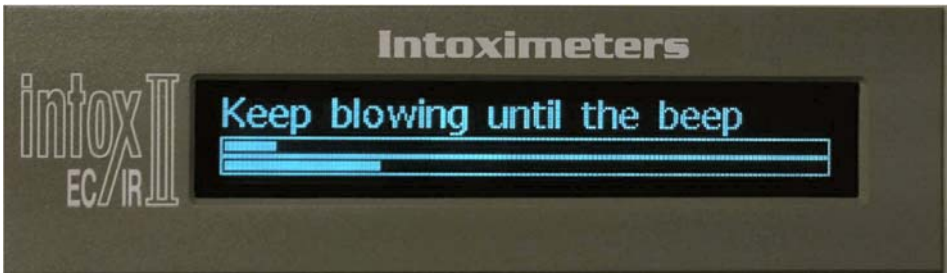
BLANK CHECK PASSED
The instrument displays the result of the blank check.

PLEASE BLOW/R



Insert a new mouthpiece into the breath tube. Always use a new originally packaged mouthpiece for each subject test and use care when opening the mouthpiece package. Residual pieces of plastic wrap may cling to the mouthpiece, which may get blown into the sample assembly causing restriction and possible blockage.

Instruct the subject to “Please take a deep breath and blow into the mouthpiece steadily for as long as possible”. As the subject blows, the flow and volume will be indicated by graphical bars on the display once a sample begins to be delivered.



Some of the typical problems which may be encountered and detected by the instrument at this stage of the test:

- **REFUSAL --** If the subject refuses to deliver a sample at any point during the test, then the test can be refused by typing “R” and “ENTER”. The EC/IR II will stop the test protocol and print the result of the tests up to the point of the refusal and then note the refusal.

- **MOUTH ALCOHOL –** If the instrument detects the presence of mouth alcohol, then the instrument will abort the test.

- **TIME-OUT 3-MINUTES –** If not sample is delivered within a 3 minute time window from the beginning of “Please Blow/R”, then the instrument will time out.

- **INSUFFICIENT SAMPLE --** If the subject stops for any reason while delivering the sample and before the instrument accepts the sample, the EC/IR II will say “**INSUFFICIENT SAMPLE**”. The instrument will then perform a blank check to clear the sample; after which another chance for a proper sample will be offered. This cycle will continue until after the third failed attempt. At this point, the instrument will abort the test and print out the results as an insufficient sample. The EC/IR II will now reset and reload the data from the previous test for a possible retest of the subject. If the officer, at his discretion, decides not to retest the subject or expects no further cooperation on the part of the subject, enter ESC on the keyboard to abort the second test and return the instrument to the scrolling mode.

If all sample criteria are met without any problems, then the instrument will take a sample into the fuel cell for analysis.

SAMPLE XXX
The instrument has evaluated the sample and displays the result.

BLANK CHECK
The instrument again checks for alcohol in the breath path and print of the final results.

BLANK CHECK PASSED
The instrument displays the result of the blank check.

STANDARD CHECK
The instrument is performing an analysis on the dry gas reference standard.

STANDARD .XXX
The instrument displays the result of the Standard Check. If the result falls outside of the tolerance window (0.077 – 0.087)on a 0.082 standard, then the instrument aborts the test and prints Standard Out of Range.

BLANK CHECK
The instrument again checks for alcohol in the breath path.

BLANK CHECK PASSED
The instrument displays the result of the blank check.

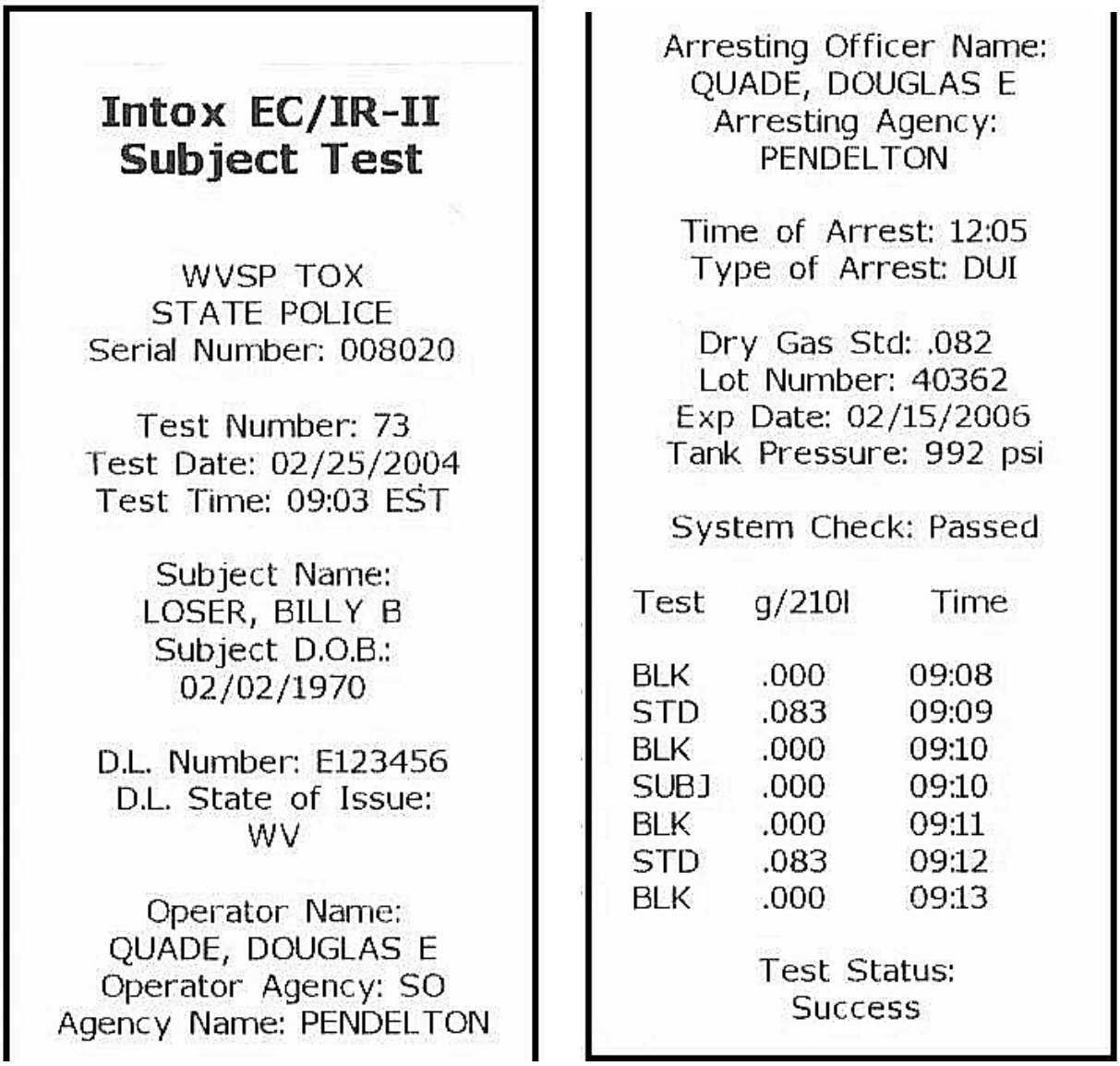
After completion of the evidential test sequence, the instrument will print out the results of the test. Tear off the printed output and leave the instrument as is, no further action or attention is required for the instrument.

PRINTED OUTPUT

The EC/IR II print out contains most of the information entered in the data entry phase and the results of each step during subject test sequence. All the printouts on the EC/IR II are on thermal paper and hence have a limited life span; therefore you must make 2 photocopies of the printed results.

Original: Officers records
Photocopy 1: Officers records (as a backup copy)
Photocopy 2: DMV records

If for any reason the original is destroyed or does not print properly, then a new copy may be reprinted by typing “P” during the scrolling mode. Note: this feature will reprint the last test only.



Intox EC/IR-II
Subject Test

WVSP TOX
STATE POLICE
Serial Number: 008020

Test Number: 73
Test Date: 02/25/2004
Test Time: 09:03 EST

Subject Name:
LOSER, BILLY B
Subject D.O.B.:
02/02/1970

D.L. Number: E123456
D.L. State of Issue:
WV

Operator Name:
QUADE, DOUGLAS E
Operator Agency: SO
Agency Name: PENDELTON

Arresting Officer Name:
QUADE, DOUGLAS E
Arresting Agency:
PENDELTON

Time of Arrest: 12:05
Type of Arrest: DUI

Dry Gas Std: .082
Lot Number: 40362
Exp Date: 02/15/2006
Tank Pressure: 992 psi

System Check: Passed

Test	g/210l	Time
BLK	.000	09:08
STD	.083	09:09
BLK	.000	09:10
SUBJ	.000	09:10
BLK	.000	09:11
STD	.083	09:12
BLK	.000	09:13

Test Status:
Success

EVIDENTIAL TEST ERRORS

These errors will either disable or abort any test at the time they occur.

Instrument Warming Up – The instrument monitors the internal temperatures of many critical components. If these temperatures fall outside of their proper range, this error is generated. Check to make sure the breath hose electrical connection is properly secured and allow more time for the instrument to heat up. Try to perform another test. Discontinue use if the error flag appears again and notify the Toxicology section.

Pressure Sensor – The pressure sensor that detects breath pressure and atmospheric pressure has malfunctioned. Cycle the power on the instrument and attempt to perform another test. Discontinue use if the error flag appears again and notify the Toxicology section.

Standard 1 Expired – The tank expiration date entered into the instrument has passed and the instrument has disabled. The reference standard tank needs to be replaced or if the tank was recently changed out, the expiration may not have been reset. Contact your WVSP District Sergeant for your area.

Dry Gas Tank Empty -- The reference standard tank is exhausted and a new one needs to be installed. Press and hold “Alt P” to verify that the tank is below 50 PSI. If the display shows 0 PSI, then cycle the power for the sensor may not be funtioning properly. Otherwise, notify the District Sergeant in order to have the tank replaced.

Database Full – The Instrument must be downloaded in order for any further testing to be done with the instrument. Notify the Toxicology section.

90 Day Disable – The instrument has diabled because no contact has been maintained with IntoxNet. Unit can not be reenabled until it is linked with IntoxNet. Notify the Toxicology section.

IR Source Not Detected – (self explanatory). Cycle the power on the instrument and attempt to perform another test. Discontinue use if the error flag appears again and notify the Toxicology section.

IR Overflow – Excessive IR signal on the IR detector. Cycle the power on the instrument and attempt to perform another test. Discontinue use if the error flag appears again and notify the Toxicology section.

Ethanol Base Line Error -- Cycle the power on the instrument and attempt to perform another test. Discontinue use if the error flag appears again and notify the Toxicology section.

CO2 Baseline Error -- Cycle the power on the instrument and attempt to perform another test. Discontinue use if the error flag appears again and notify the Toxicology section.

CRC Error – A CRC check sum has detected corruption with in some area of the program space within the instrument. Discontinue use and notify the Toxicology section.

Set Solenoid Error – The instrument has detected that the reset solenoid on the fuel cell has not actuated. Discontinue use and notify the Toxicology section.

Sample Solenoid Error – The instrument has detected that the sampling solenoid on the fuel cell has not actuated. Discontinue use and notify the Toxicology section.

High Blank – The fuel cell has detected residual alcohol in the sample chamber for 3 consecutive tests in a row. Discontinue use and notify the Toxicology section.

Abort – The “Esc” key will abort the evidential breath test when depressed at any point during the performance of the test.

Standard Out of Range – The reference standard has produced a reading outside of the tolerance range entered into the instrument.

Refusal – The “R” key was entered during the subject test and the instrument refused the test.

Mouth Alcohol – The instrument has detected the presence of mouth alcohol on the subject. Without any extraneous circumstances, restart the 20-minute waiting period and attempt to perform another test.

Time-out 3-minute – The subject has failed to deliver a sample into the instrument with the 3 minutes time window allotted for. Attempt to perform another test.

Insufficient Sample – The subject has failed to deliver an acceptable alveolar sample with 3 attempts allotted to them. The instrument by default resets with the previous data preloaded for the performance of another test. If no further test is performed, hit ESC to return the instrument to the scrolling mode.

Internal Printer Error: Printer Offline – The printer is either offline or the door latch on the face plate of the printer is unlocked. Relatch door and/or return the printer to online status. (See printer section of this manual)

Internal Printer Error: Paper Out – The printer is out of paper. Install a new roll of paper into the printer. (See printer section of this manual)

WARNING MESSAGES

These messages serve as warnings about things that will become an event that will disable the instrument if not addressed and resolved in the near future. Please take the necessary corrective action soon or notify the Toxicology section for advice

Memory Almost Full – The memory space of the instrument is almost full and the unit needs to be downloaded to remove these accumulated records.

Dry Gas Pressure Low – The dry gas reference standard tank is about to be exhausted [Warns below 100 PSI / Shuts down at 50 PSI]. Since the instrument will disable in about 15 evidential tests, the district sergeant needs to be notified such that the tank can be replaced before the instrument shuts down.

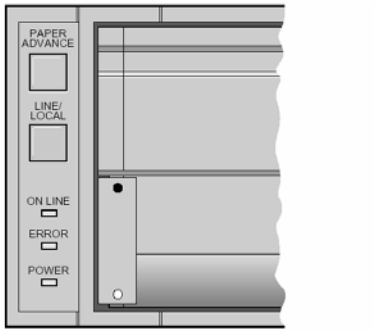
Standard 1 Almost Expired – The dry gas reference standard is about to expire [Warns at 15 days]. Since the instrument will disable on the tank's expiration, the district sergeant needs to be notified such that the tank can be replaced before the instrument shuts down.

Subject Test Disabled – The evidential test sequence has been disabled for one of several reasons. The scrolling display should indicate what error has ocurred. Please notify the Toxicology section for information as to the nature causing this condition.

FC Gain Max – The fuel cell in the analytical bench has reached its final stage of operational life. Though still usable for some time, the instrument needs to be returned to Toxicology for maintenance before the fuel cell expires.

INTERNAL PRINTER CONTROLS AND DISPLAYS

The built-in printer has two push buttons and three indicators:



1. **PAPER ADVANCE button** – depressing advances paper out of the printer when it is "Off Line". Press the "LINE/LOCAL" push-button until the "ON LINE" indicator goes off. Then, hold down the "PAPER ADVANCE" push-button until you have advanced the required amount of paper. Be sure to return the printer to the "On Line" mode before starting Subject Tests.

2. **LINE/LOCAL button** - depressing takes the printer from "On Line" to "Off Line" when pressed.

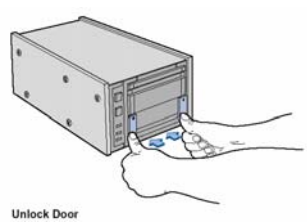
3. **ON LINE indicator** – lights when the printer is ready to print results.

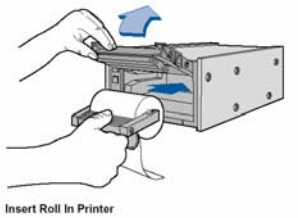
4. **ERROR indicator** - lights continuously when the printer is out of paper and flashes when there is a printer fault: door open, over-voltage or under-voltage condition, or print head over-temperature. See PRINTER ERRORS that follow.

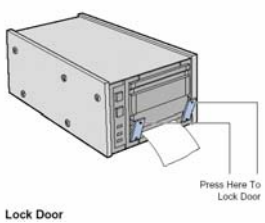
5. **POWER indicator** –lights when there is power to the printer

CHANGING PAPER ROLLS

This is an operator function which will have to be performed at certain times. When a red stripe is apparent on the printout, enough paper remains for about 2 more tickets. When replacing the paper roll in the internal printer, the following procedure should be used:


Unlock Door


Insert Roll In Printer

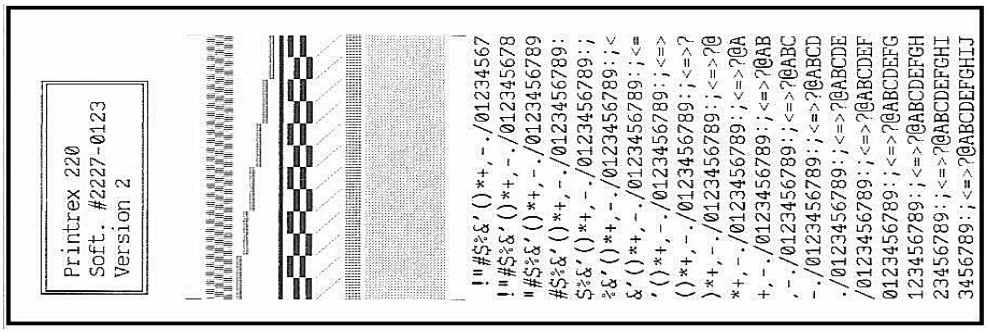


Lock Door

1. Unlock the paper exit door by pressing the open circles printed on the latches on either side of the door.
2. Pull up on the latches to raise the door and gain access to the interior.
3. Remove the paper roll holder by pulling out on the paper holder handle. Slip the empty paper roll core off the bar.
4. Slip the paper roll bar through the core of the new paper roll. Install the roll on the holder so that paper feeds from the top of the roll and under the handle.
5. Feed a few inches of paper from the roll so that the paper will extend out the door after you replace the holder.
6. Insert the paper roll holder into the printer and close the door. Press on the solid circles to lock the latches.
7. Tear off excess paper by pulling up at the right or left side of the paper.
8. Return the printer to “On Line” status.

RUNNING THE INTERNAL PRINTER SELF-TEST

If you suspect a problem with the printer, you can verify its operation by running the self-test. Place the printer in local mode by pressing the **“**LINE/LOCAL**”** push-button. Then press and hold down “PAPER ADVANCE” and “LINE/LOCAL” to start the test. Release the push buttons once the test starts. The “ERROR” indicator should come on and begin a printout showing the printer’s model number, software version, dot and bar patterns and various type styles. You may stop the test at any point by pressing “PAPER ADVANCE”**.** If the printout is not correct or shows variation in density, contact Toxicology for repair.



PRINTER ERRORS

The following conditions cause the front-panel Error indicator to light.

Paper Empty

When the printer detects a paper empty condition, it stops printing, goes off Line and Lights the Error Indicator. Normal operations resume when a new paper roll is installed.

Door Open

When the door is open (left latch unlocked) the printer stops printing, goes off line and flashes the Error indicator.

Over Voltage Error

If the voltage input is too high for the print head, then the printer stops printing, flashes the Error indicator, and waits for the voltage to drop to operating levels before resuming printing.

Under Voltage

If the voltage input is too low for the print head, then the printer stops printing, flashes the Error indicator, and waits for the voltage to return to normal before resuming printing.

Over Temperature

If the Print Head temperature exceeds operating levels, the printer stops printing, flashes the Error indicator, and waits for the temperature to drop to operating levels before resuming printing.

Brown Out

The +5 Volt supply for the printer processor is too low for it to operate. The printer goes into a reset state and all data in its buffers is lost. When the +5 Volts returns to the normal level, the printer resumes operating. Use the “P” feature to reprint subject test.

GERNERAL INSTRUMENT MAINTENANCE

The instrument does not require periodic maintenance. You may need to clean the instrument’s external surfaces to remove dust or finger marks and a weekly quick test (F2) with a breath sample is advisable to help maintain moisture in the fuel cell.

CLEANING

Turn off power to the instrument. Using a soft cloth moistened with any good glass cleaner or an all-purpose detergent, wipe off the top cover, the rear and front panels, and the side panels. Remove dust and smudges from the keyboard. Return power to the instrument after cleaning.

CAUTION: Do not allow any liquid to enter the instrument’s interior.

STORAGE

Storage of the instrument in cold or moderately hot environments will not harm the INTOX EC/IR-II. Avoid storing the instrument for prolonged periods in areas of extremely high or low humidity. When moving a unit from a cold area to a warm area, allow the unit to warm up to room temperature before connecting power. This allows condensation that may have formed inside the unit to dissipate.

PREVENTIVE MAINTENANCE

- To assure adequate clearance and ventilation, locate the instrument at least one inch away from a back wall and on a hard surface, i.e., not on a surface covered with a rug. DO NOT COVER INSTRUMENT WITH A DUST COVER.

- Keep instrument away from extremes of temperature. The instrument's operational temperature range is from around 50° F to 105° F.

- Keep the instrument clean and away from dust. Any good glass cleaner can be used to clean the instruments outer surface (DO NOT USE ANY SOLVENTS). PLEASE DO NOT TAPE NOTES OR PLACE STICKERS ON THE INSTRUMENT.

- Do not place heavy objects on top of the instrument.

Please contact us if you encounter any problems or have any questions at:

WEST VIRGINIA STATE POLICE
TOXICOLOGY SECTION
746-2183