



**Tennessee Bureau of Investigation  
Forensic Services Division**

**INTOX EC/IR II  
TWO TEST PROTOCOL  
OPERATOR'S MANUAL  
Effective November 1, 2012**

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**TENNESSEE BUREAU OF INVESTIGATION  
FORENSIC SERVICES DIVISION  
BREATH ALCOHOL PROGRAM**

Tennessee Code Annotated (TCA), Section 38-6-103 (g) requires the Tennessee Bureau of Investigation (TBI) through its Forensic Services Division to "...establish, authorize, approve, and certify techniques, methods, procedures, and instruments for the scientific examination and analysis of evidence...and to teach and certify qualifying personnel in the operation of such instruments to meet the requirements of the law for the admissibility of evidence."

The TBI Breath Alcohol section is comprised of 3 Special Agent Forensic Scientists and 1 Special Agent Forensic Scientist Supervisor that maintain this requirement statewide. They are responsible for approximately 200 instruments in the State of Tennessee. The TBI Breath Alcohol Section is an ANAB accredited calibration laboratory since 2014.

All breath tests are performed in accordance with the standards and operating procedures promulgated by the forensic services division of the Tennessee Bureau of Investigation. Only personnel from a law enforcement agency shall be trained and certified as breath test operators.

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## OVERVIEW OF TENNESSEE'S BREATH ALCOHOL TESTING INSTRUMENT

### Intoximeter EC/IR II

The Intoximeter EC/IR II is manufactured by Intoximeters, Inc. in St. Louis, Missouri. Intoximeters, Inc. has manufactured breath alcohol instruments since 1945. The Intoximeter EC/IR II is listed on the National Highway Traffic Safety Administration's (NHTSA) Conforming Products List (CPL) and has been approved by the Tennessee Bureau of Investigation for use as an evidential instrument.



**Figure 1. Intoximeter EC/IR II**

- A. Breath Tube      An insulated, heated tube which the subject provides a breath sample to the instrument. A sterile mouth piece is to be placed on the end of the breath tube. Mouth pieces are provided by TBI.
- B. Printer            A thermal printer that prints 3 test copies of an Evidential Test. The LED (green) will be on if the printer is ready to print. Instructions on how to change the paper will be discussed on page 13.
- C. Keyboard          A smaller keyboard with a USB connection is used to navigate instrument prompts. Specific keys can also perform actions.
- ENTER**            This key will start an evidential test, accept data entry, and review data entry when prompted.

**SPACE** This key will change options in data entry and begin the test after data entry is completed.

**P** Print the last test performed on the instrument.

**T** Restart the 20 minute observation countdown timer.

**R** Indicate the subject as having refused the test, i.e. refusal.

**ESC** This key will abort an evidential test at any time.

D. Display A two-line alphanumeric display. All information about the instrument's status, location, date and time, etc. will be shown here while the instrument is in ready mode.

E. Scanner A 2D barcode scanner. The operator has the option to scan the driver's license of the subject. This would take the place of the operator manually entering data.



**Figure 2. Intoximeter EC/IR II Rear Panel Connectors and Controls**

F. AC Power/ Power Switch The AC Power cord plugs into this port. This rocker type switch is what turns the instrument's power on and off.

- G. Serial Output                      Used to connect a null modem cable from a computer to the instrument. The TBI Breath Alcohol Section uses this for data collection and troubleshooting.
- H. Dry gas lock box                    The locked area is where the dry gas standard is connected to the instrument. Only TBI authorized personnel has access to this area.
- I. Keyboard Connection                This keyboard plugs into any of the USB connections or the 7 pin port.
- J. Internal Enhancement Module    USB connections for accessories including the keyboard

## **OPERATION**

### **HOW TO RUN AN EVIDENTIAL TEST**

The subject will be required to provide 2 breath samples in one test sequence in order for the test to be completed. The following is an outline of steps taken by an operator to achieve a successful evidential test. For the purpose of this section, the bold print will represent the instrument display.

In ready mode, the display will be scrolling through information. This information will include: status, location, date, time, database capacity, and manufacturer's name.

Please ENTER to Start Evidential Test.

#### **Initializing...**

#### **Swipe Driver's License: Or Press ENTER...**

When a DL is scanned, all data will be entered automatically. Or, one can press enter to manually type information.

#### **Subject Last Name:**

Up to 20 characters can be typed  
*This data must be completed in order to advance to the next field.*

#### **Subject First Name:**

Up to 20 characters can be typed  
*This data must be completed in order to advance to the next field.*

#### **Subject Middle Initial:**

1 character only

#### **Subject Sex:**

The Instrument defaults to MALE. You can press the space bar to change to FEMALE.

#### **Subject D.O.B.:**

Has to be entered in this format, MM/DD/YYYY. The instrument will calculate the date of birth.

#### **Subject D.L.N:**

Type up to 20 characters/ numerals

#### **D/L State of Issue:**

Abbreviation code for the state.

#### **Subject race:**

The instrument defaults to Caucasian. You can press the space bar to change between the options of: Caucasian, African American, Hispanic, Asian, and Other.

- Operator Last Name:** Up to 20 characters can be typed  
*This data must be completed in order to advance to the next field.*
- Operator First Name:** Up to 20 characters can be typed  
*This data must be completed in order to advance to the next field.*
- Operator Middle Initial:** 1 character
- Time of Arrest:** 24 hour time
- County of Arrest:** County of the State of Tennessee
- Accident Involved:** The instrument defaults to “No Accident”. You can press the space bar and change the option to: “Accident w/ no fatalities”, “Accident w/ fatalities”.

**Starting Test Sequence**  
**Space = Begin, Enter = Verify**

This concludes the data entry portion of the test. The operator will have the option of reviewing data by pressing the enter key or going forward with the test by pressing the space bar.

Press the space bar to continue.

**Test Number: XXX**

**Observation Period...**  
**20:00**

The observation time starts from 20:00 and counts down to zero. There is an audible beep at 3 minutes, 2 minutes, 1 minute, and zero. During this time, the operator is to observe the subject and ensure that the subject has no foreign matter in his/ her mouth and/ or has not regurgitated. With 30 seconds left, the purge fan will cut on.

**First Sample**

**Purging**

The purge fan is drawing clean air through the instrument’s sampling system.

**Blank Check**

Ambient air will be drawn into the sample chamber and tested to ensure that the instrument is clean and free of contamination.



**Blank Checked Passed** This will be displayed if the fuel cell has measured .000 g/210 L on the blank check.

**Please Wait...**

**Please Blow  
Press 'R' for Refusal**

The subject will have 3 minutes to provide a sample. The operator is to obtain a new mouthpiece and place it on the breath tube. The operator is to instruct the subject to take a deep breath, place their mouth on the mouthpiece, and blow as long as they can. It is important that the subject does not blow until their mouth is securely on the mouthpiece.

**Analyzing Sample**

**Subject X.XXX g/210 L**

The result of the first sample will be displayed. It takes 2 samples within 0.020 g/210 L of each other to complete the test.

**Second Sample**

Take the mouthpiece from the 1<sup>st</sup> sample off and put a new mouthpiece on for the 2<sup>nd</sup> sample.

**Purging**

The purge fan is drawing clean air through the instrument's sampling system.

**Blank Check**

Ambient air will be drawn into the sample chamber and tested to ensure that the instrument is clean and free of contamination.

**Blank Check Passed**

This will be displayed if the fuel cell has measured .000 g/210 L on the blank check.

**Please Wait...  
00:02:00**

Countdown between the 1<sup>st</sup> sample and 2<sup>nd</sup> sample is a maximum of 2 minutes.

**Please Wait...**

**Please Blow  
Press 'R' for Refusal**

The subject will have 3 minutes to provide a sample. The operator is to obtain a new mouthpiece and place it on the breath tube. The operator is to instruct the subject to take a deep breath, place their mouth on

the mouthpiece, and blow as long as they can. It is important that the subject does not blow until their mouth is securely on the mouthpiece.

### Analyzing Sample

**Subject X.XXX g/210L** The result of the second sample will be displayed. It takes 2 samples within 0.020 g/210L.

**Final Result:  
X.XXX g/210L** This final result is the lower of the 2 samples.

If the difference between the first sample and second sample is greater than 0.020 g/210 L, the instrument will prompt the same sequence as the first and second sample for a third and final sample. **A new mouthpiece will be placed on the breath tube.**

Two of the three samples must correlate within 0.020 g/210L and the lowest of the two samples will be displayed as the final result.

## **OPERATOR INSTRUMENT MESSAGES/ BASIC TROUBLESHOOTING**

### **High Blank Test Aborted**

The instrument is unable to detect 0.000 g/210L during its blank check. The instrument will attempt 3 times before it will display this message.

To Avoid a **High Blank**:

Keep subject's mouth away from breath tube during purge/ blank sequence.

Make sure there is no alcohol odor in the air or near the instrument. i.e. Lysol or hand sanitizer

The ventilation in the room could be poor. Open the door. Allow fresh air into the room.

Purge fan could not be working properly. Listen for the buzz on the fan during the purge cycle.

### **Insufficient Sample Test Aborted**

The subject was unable to meet the minimum requirements for a proper breath sample. The subject will be allowed 3 attempts before the test aborts.

*The operator should change the mouthpiece after every **Insufficient Sample** message.*

To Avoid an **Insufficient Sample**:

Ensure the subject is capable of providing a sample by asking health related questions.

Ensure the subject's posture is upright when providing a sample.

Check the breath tube for any obvious kinks.

### **NO .02 AGREEMENT**

2 test samples failed to agree within .020 g/210L. The operator must retest the subject.

### **Mouth Alcohol Test Aborted**

Mouth alcohol was detected by the instrument. The instrument will abort the test immediately and the operator must retest the subject.

*The operator should change the mouthpiece after every **Mouth Alcohol** message.*

To Avoid a **Mouth Alcohol**:

Do not allow the subject to blow into the mouthpiece before his/ her lips have a seal on the mouthpiece.

Place an unused mouthpiece on the breath tube.

**Please Wait...**

**Instrument warming up**

Some components of the Intoximeter EC/ IR II are heated to prevent condensation inside the instrument. If one of those heaters is not working, this will be displayed.

Allow 15 minutes for the instrument to warm up.

If this message is continuously displayed, contact TBI for assistance.

**Accuracy Check Required**

**Subject Test Disabled**

The instrument is designed to test itself with the dry gas standard locked inside every Sunday at 11 am. This message will display when the test was not successful or completed.

If the instrument was powered off at Sunday at 11am, this message will be displayed until the instrument is warmed up. Then, the test should perform automatically.

If the dry gas tank is expired, this message will be displayed.

If the last accuracy check performed failed to meet the preset tolerances on the instrument, this message will be displayed.

If this message is continuously displayed, contact TBI for assistance.

**Subject Test Disabled**

**Test Database Full**

The instrument can hold over a thousand tests inside its database. When this database is full, this message will appear on the display. A message will also be displayed when the test database is almost full.

When this message is displayed, you must contact TBI.

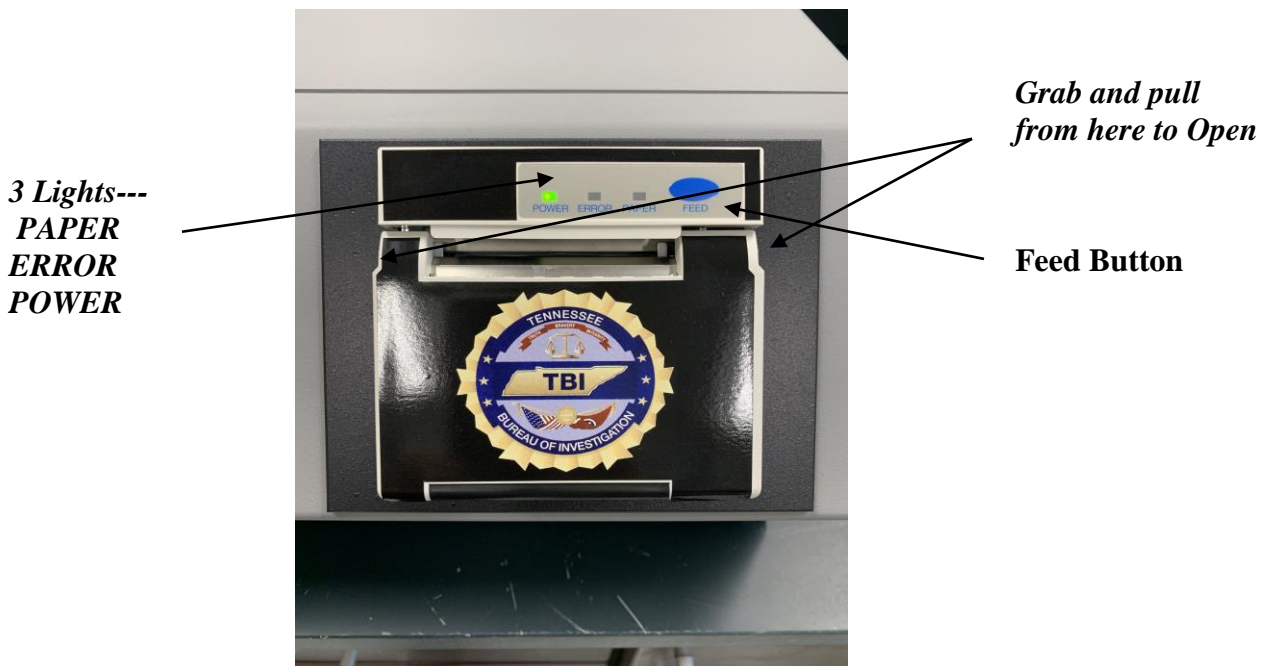
**Breath Timeout-  
No Sample Provided**

When the display reads “Please Blow”, the subject has 3 minutes to provide a sample.

**Internal Printer Error  
Paper Out**

The paper roll is empty. See instructions below to change the paper.

**PRINTER TROUBLESHOOTING**



**Figure 3. A photo of the thermal printer of the Intoximeter EC/IR II**

**Feed** The button advances the paper. Holding the button more than 2 seconds will cut the paper as well.

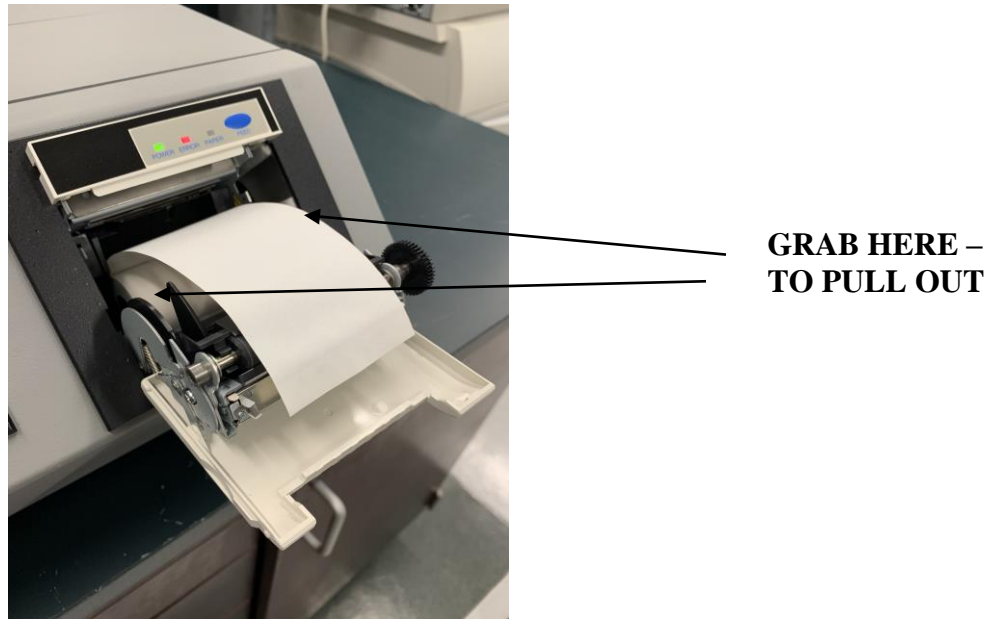
**Power Light** Green Light. If on, printer is ready.

**ERROR Light** Red light. If on, printer is not ready.

**PAPER Light** Orange light. When the paper is out or the printer doors are open, this light will display.

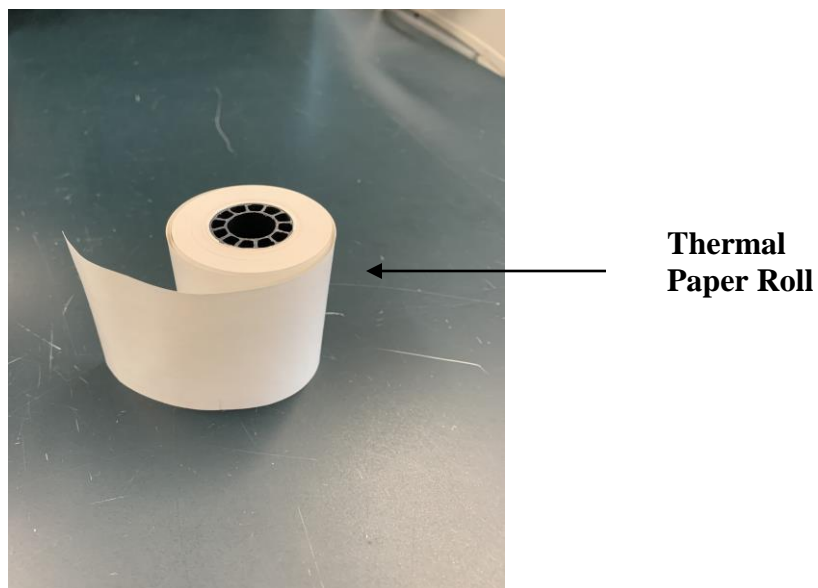
The printer paper is supplied by TBI.

Once the paper reaches the end of the roll, an indicator in the paper will be visible. A colored line noting that the end of the roll is near. The operator will open the latches as shown above by pulling from the top down..



**Figure 4. An open printer of Intoximeter EC/IR II.**

Once opened, grab the paper roll. The paper should pull straight out. The paper sits on its own.



**Figure 5. A photo of a roll of printer paper.**

Replace the old spool of paper with a new spool.

Make sure that the edge of the new paper roll is falling forward like the photo. If it is in backwards, or underneath the roll, the paper will not print.

Slide the paper back in the instrument and close the lid.

## **SCIENTIFIC PRINCIPLES THE USE OF BREATH AS A SAMPLE**

***Operators that are certified with the TBI are certified to operate instrumentation. They are not expected to master the scientific material of this manual. This manual contains more in-depth material for those who wish to gain more knowledge than expected.***

Measuring blood alcohol concentration by means of breath sampling have been around since the 1940's. In fact, studies were done as early as 1910 with the discovery of using breath as means to determine alcohol in the blood. The use of breath as a sample has been proven through years and many studies to be accurate and reliable.

Breath alcohol analysis follows the scientific law of Henry's Law which states that "The weight of any gas that dissolves in a definite volume of liquid is directly proportional to the vapor pressure that the gas exerts above the liquid." This law governs the interaction between a gas and a liquid. Alcohol is a liquid in the blood stream, and a vapor in the lungs. When exhaled, alcohol will be exhaled in a small but measurable amount. The amount of alcohol exhaled will be approximately 1/2100<sup>th</sup> of the amount of alcohol in the blood stream. This breath to blood ratio is achievable because of Henry's Law.

This 2100 to 1 ratio means that there is the same amount of alcohol for 1 part blood as there is to 2100 parts deep lung air. This ratio is currently used by every breath alcohol instrument in the United States.

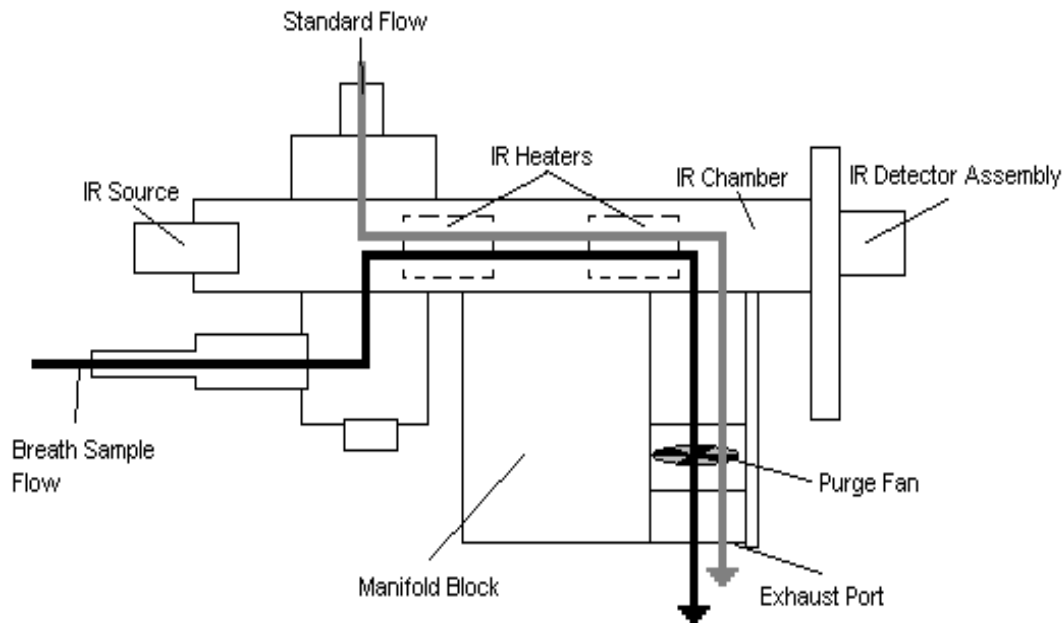
### **OPERATING PRINCIPLES OF THE EC/IR II**

The Intoximeter EC/ IR II use two different types of analytical techniques to achieve an alcohol concentration. The electrochemical cell (EC), or fuel cell, is responsible for measuring the alcohol. The Infrared (IR) is responsible for the quality of the sample. These two types of technology offer a different advantage to the sampling process.

#### **Electrochemical Cell (EC)**

This is more commonly known as a fuel cell. The fuel cell is responsible for measuring the amount of alcohol in a sample. The fuel consists of a porous, chemically inert disk that is coated on both sides with finely divided platinum. An acidic solution is applied to the disk and electrical connections applied to the surface. The fuel cell is encased in a sampling system that allows about 1 cubic centimeter (CC) of air inside the chamber.





**Figure 6. A schematic drawing of the Intoximeter EC/IR II Sampling System.**

When alcohol is introduced into the sample chamber via breath, an electrochemical reaction occurs. When this reaction takes place, an electrical charge is produced. This charge is directly related to the amount of alcohol that is produced on the fuel cell. When the two surfaces of the fuel cell are connected electrically, a current flows through this circuit to neutralize the charge. This current can be measured, and with signal processing, a breath alcohol concentration can be determined.

One advantage of the fuel cell is it is specific for alcohol. Interfering substances are not triggered by the fuel cell.

#### INFRARED SPECTROSCOPY (IR)

The Intoximeter EC/IR II uses an IR sampling assembly that is designed specifically for its application in this instrument. The breath sample is blown into the instrument and flows between the IR source and the IR detectors where the absorption is measured. The greater the alcohol concentration, the more light will be absorbed. The IR spectroscopy on the Intoximeter EC/IR II is responsible for the quality of the sample. That is, it constantly monitors the sample for mouth alcohol and determines the appropriate time to introduce a sample into the fuel cell.

**LEGAL PRINCIPLES**  
***State v. Sensing***

This traffic stop occurred on October 2, 1988 in Dickson County.

As a result of this case, preset requirements must be met in order for the breath test results to be admitted into court. The requirements are as follows:

That the tests were performed in accordance with the standards and operating procedure promulgated by the forensic services division of the Tennessee Bureau of Investigation.

That the operator was certified in accordance with those standards.

That the evidentiary breath-testing instrument used was certified by the forensic services division was tested regularly for accuracy and was working properly when the breath test was performed.

That the motorist was observed for the requisite twenty (20) minutes prior to the test, and during this period, he did not have foreign matter in his mouth, consume any alcoholic beverage, smoke, or regurgitate.

Evidence that the operator followed the prescribed operational procedure.

Identify the printout record offered in evidence as the result of the test given to the person tested.

Remember, you are just an operator. You are not required to know the theory of breath alcohol testing or principles of breath alcohol analysis.