

Tint Meter

Online Training course

Learning Objectives:

Fundamental principles of tint enforcement

Basic theory of tint measurement

Basic operation of the Tint Meters

Determining probable cause to stop a vehicle for excessive tint

Officer safety considerations

How to test a suspect vehicle

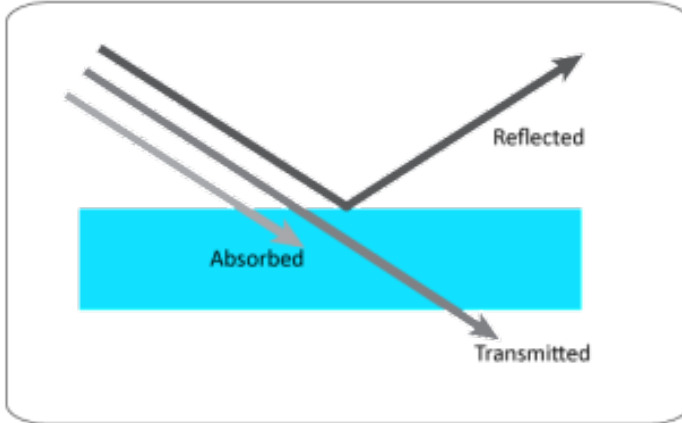
Identify the information required for court proposes.

Tint Meter maintenance

Fundamental principles of tint enforcement

Tint meters measure the amount of visible light transmitted through glass, VLT. The measurement range goes from 100%, which is just air, to 0% which is totally black.

Clear house glass (float glass) measures about 92% because of reflection. 4% for the front surface and 4% for rear surface. (All clear material has surface reflections unless coated with anti reflective coatings, i.e. the purple coating on camera lens)

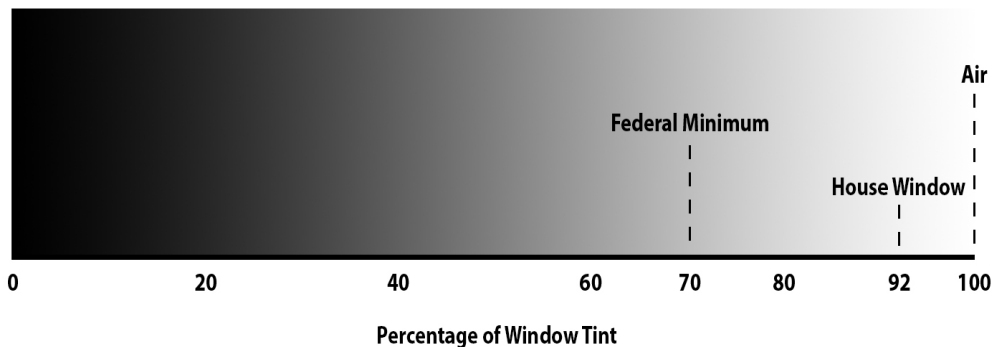


Drawing of glass showing light passing through glass

Most auto glass has tint added during manufacture to help lower the demand on air conditioning. (The green color you see if you look down the edge of a car window) US federal law minimum from the factory (FMVS 205) is 70%. There is a federal fine if car manufacturers tint below 70%, thus they are very careful not to go below 70%.

Typical factory auto glass is 70% to 80%.

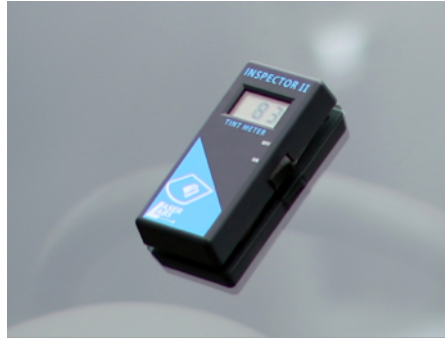
Levels of Window Tint



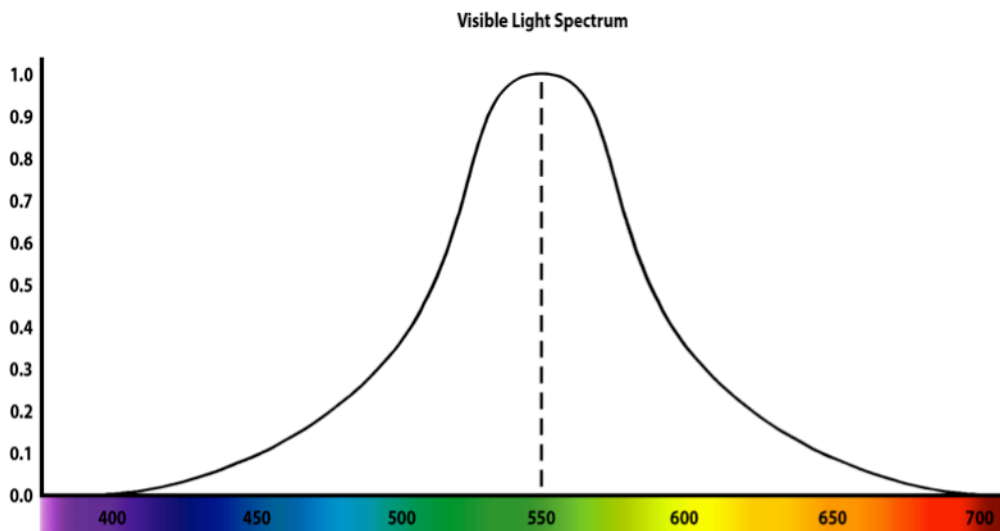
Factory auto glass can vary by up to 2% spot to spot. Any variation less than 3% is not discernable by the human eye.

Basic theory of tint measurement

A Tint Meter is used to measure the darkness of after market automobile window tint.



It measures the amount of visible light that passes through the combination of stock auto glass and the added window tint film. Tint Meters measure at a wavelength of 550 nanometers that corresponds to the color green. 550nm was chosen as it is the center of the human eyes sensitivity and is the universal wavelength for optics measurement.



Graph of eye response and spectrum

Using a specific wavelength also allows the measurement of a tint meter to be compared to laboratory spectrophotometers that are available at universities and labs worldwide.



Pic of spectrophotometer

Theory of Operation

During power up, the computer in the Tint Meter performs a self-test to verify correct operation. This includes a battery check, sensor check, factory calibration check and auto calibration.

Laser Labs Tint Meters work by first shining a beam of light (primarily green, 550 nanometers, the center of the human eye response) onto the meters optical sensor.

The meter measures this light level, converts it to a voltage, and saves it in its memory. This is the Auto-Calibration Phase and makes the meter immune to temperature variations and dust and dirt.



Auto-Calibration phase

After the window intercepts the beam, the meter again measures the level of light and converts it to a voltage. This is called the Testing Phase.



Testing Phase

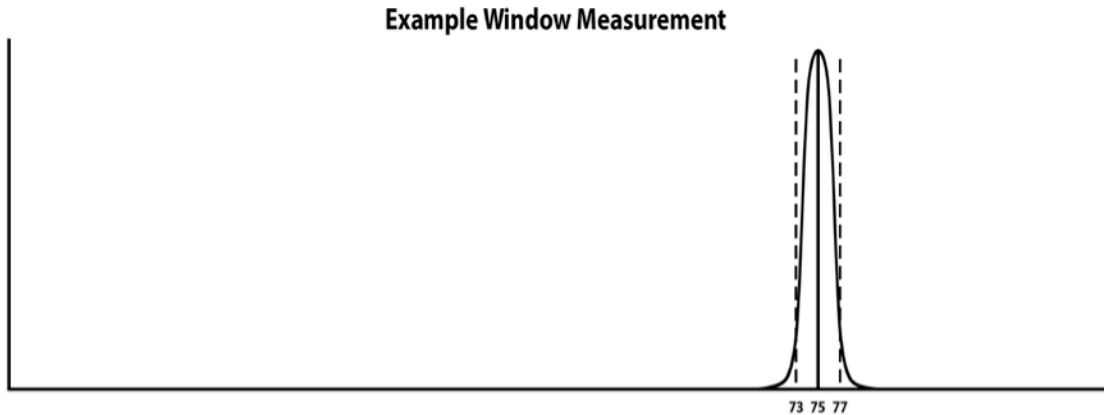
The computer inside the Tint Meter then divides the Testing Phase value by the Calibration Phase value and displays the percentage calculation.

$$\frac{\text{Testing value}}{\text{Calibration value}} = \% \text{ Transmitted}$$

Understanding the Results

The tint meter reading is a relative measurement, i.e. percentage(%), unlike speed or B.A.C. which are discrete measurements.

The Tint Meter is accurate to plus or minus 2 percentage points of true visible light transmittance (VLT). For example, a 32% meter reading means the light transmittance could be between 30% and 34%. Please take this measurement tolerance into account when using the meter. The Tint Meter is unaffected by sunlight and can be used anytime.



Graph showing 75% plus or minus 2%

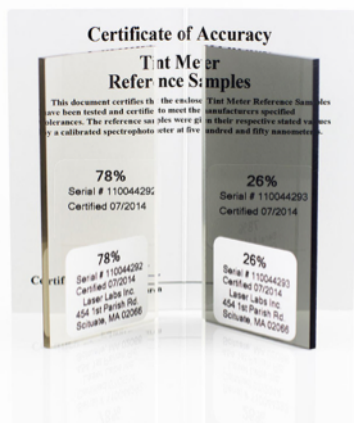
Verifying accuracy

Laser Labs Tint Meters have been tested by an N.I.S.T. traceable independent laboratory.

<http://www.laser-labs.com/wp-content/uploads/2017/03/l-00176306-Automotive-Glass-Tint-Meter.pdf>

Link to lab report

Reference standards are supplied with every meter, with the light transmittance values printed on their labels and also a dated certificate of calibration.



Pic of standards and certificate

The values are accurate to plus or minus 1 percentage point of a N.I.S.T. (National Institute of Standards and Technology, former N.B.S , National Bureau of Standards), calibrated reference spectrophotometer.



Starna N.I.S.T standards set and NIST(NBS) SRM 930D standards

<http://www.laser-labs.com/wp-content/uploads/2017/03/23135c.pdf>

Link to Starna certification

To verify that the Tint Meter is working properly and within specification, take a reading of the reference standards before you use your meter. The meter should display a reading of not more than plus or minus 2% points of the reference standards. Test your meter on a regular basis.

http://www.laser-labs.com/wp-content/uploads/2015/10/TM1000GlassSmallCropGifR2_06.gif

<http://www.laser-labs.com/wp-content/uploads/2015/10/Laser-Labs-Tint-Meter-InspectorII-TM2000-Usage05.gif>

Gifs of meter testing standards

Basic operation of a Tint Meter

For officer safety, we suggest opening all doors under test.

ENFORCER II

Step 1

Roll window down half way. Wipe the window clean if it is very dirty. Light dust or water spots have little effect on the reading.

Position meter so the bottom of the foam covered slot is over the edge of the glass



Step 2

Press the meter downward until the window is touching the top of the foam slot. The meter will display the Visible Light Transmission (VLT) reading.



Enforcer II Operators Manual

ENFORCER II

Tint Meter



User Manual



Getting Started

Congratulations on purchasing your Enforcer II. Read this guide to understand its use.

The new Enforcer II offers you the simplicity of auto calibration in a small, easy to use package. The Enforcer II follows in the line of tint meters that have been in production by Laser Labs, Inc. since 1989.

The Enforcer II is a full-featured tint meter for use on roll down car windows. It is used by police and inspection stations to measure total Visible Light Transmittance (VLT). The meter has an accuracy of $\pm 2\%$ and can measure from 0% (totally black) to 100% (air only). Use the Enforcer II to verify the legality of after market window tint.

About your Enforcer II

Your Enforcer II has a slot up the center that is covered by neoprene rubber. This is the entry slot for the glass you wish to test. Above the slot is the Liquid Crystal Display (LCD), which shows the light transmitted by the glass and also the battery condition. Inside is a switch that activates the meter when glass is slid into the meter from the bottom.

How to use your meter

For officer safety, we suggest opening all vehicles doors under test.

Step 1

Roll the window down half way and wipe clean of any dirt. Position meter so the bottom of the foam covered slot is over the edge of the window.



Step 2

Press the meter downward until the window is touching the top of the slot. The meter will display the VLT reading.



Low battery indicator

The battery is good for about 1000 tests. The display will show "bat" when the battery is too weak to operate.



Battery Replacement

- 1) Remove the four screws at the corners on the back of the meter.
- 2) Place a screwdriver in the slot in the circuit board and slide the coin cell out.
- 3) Replace with quality 3 volt lithium coin cell, type CR2032, available at most stores.
- 4) Note battery polarity: the negative side faces up. Meter will not function if battery is installed in reverse.

Verifying accuracy

Reference standards are included with VLT values printed on their labels. The values are accurate to $\pm 1\%$ of an N.I.S.T. calibrated spectrophotometer at 550 nanometers. To verify the Enforcer II is working properly and within specification, take a reading of the reference standards before you begin to use your meter. The meter should display a reading within 2% of the labeled value.

Error codes

The computer generates error codes in case of faulty operation to protect the user from potential false readings.

- E1 Autocalibration error
- E2 Excess stray light
- E3 Factory calibration error
- E4 Excess RF field
- E5 Temperature extreme



- 1) Insert glass from the bottom only

- 2) DO NOT slide meter sideways on window

- 3) Remove meter from window by lifting it vertically

Understanding results

During power up, the computer in the Enforcer II performs a self test to verify correct operation. This includes a battery check, sensor check, factory calibration check, and autocalibration. The Enforcer II is accurate to $\pm 2\%$ of true VLT. For example, a 32% meter reading means the VLT could be between 30% and 34%. Please take this measurement tolerance into account when using the meter. The Enforcer II measures the combination of factory tint and after market tint. A reading of 0% is totally black, a reading of 100% would be no sample present. The highest reading on clear glass is typically 93% because some light is blocked by surface reflections.

Recertification

Replacement reference sample sets are available to meet state recertification requirements. Factory recertification of the Enforcer II is also available. Please contact Laser Labs, Inc for details.

Theory of operation

The Enforcer II works by shining a beam of light (predominantly green, the center of the human eye response) across the slot when the meter is slid over the window. Before the glass breaks the beam, the meter instantly measures this light level, converts it to a voltage, and saves it in its memory. This is the autocalibration phase and it makes the meter immune to temperature variations, bright sunlight, dust, and dirt. After the glass breaks the beam,

called the testing phase, the meter again measures the level of light and converts it to a voltage. The computer inside the Enforcer II then divides the testing phase value by the autocalibration phase value and displays this percentage calculation.

$$\frac{\text{Testing Value}}{\text{Calibration Value}} = \% \text{ Transmitted}$$

Specifications

| | |
|-----------------------|--|
| Wavelength | 550 nanometers |
| Bandwidth | 50 nanometers |
| Accuracy | $\pm 2\%$ |
| Repeatability | 1% |
| Measurement range | 0% to 100% |
| Humidity range | 0% to 100% Non-condensing |
| Sample thickness | 0.0 to 0.25 in. 0.0 to 6.35 mm |
| Sample size | 1 x 3 in (25 x 75 mm) minimum |
| Testing time | 4 seconds |
| Effect of stray light | Not affected |
| Lamp life | 10 years |
| Power source | Lithium battery, type CR2032 (3 Volt) |
| Weight | 2 oz. (60 grams) |
| Dimensions | 3.75 x 1.75 x 1.0 in 95 x 45 x 22 mm |

1 Year Limited Warranty North America Only

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For international warranty, see our website.

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Designed in Massachusetts
by Laser Labs, Inc.
Assembled in China and the USA

INSPECTOR II

STEP 1

Wipe the window clean if it is very dirty. Light dust or water spots have little effect on the reading. **With the 2 units held together, turn on both switches.** The meter will auto calibrate and display “100”



Inspector II turning on

Step 2

Leaving both units turned on, separate the 2 boxes and place the light source box behind the glass to test. Hold it in place by hand or using the suction cup.

Step 3

Place the display unit on the other side of the glass and allow the magnets to self align the 2 units. On rear windows be sure the defroster lines do not block the light source, as this might lower the reading. The display will show the Visible Light Transmission (VLT) reading. **Turn both units off when testing is complete.**



Inspector II on window

Inspector II Operators Manual

INSPECTOR II

Tint Meter



User Manual



Getting started

You've purchased a top of the line Inspector II. Read this guide to understand its use.

The new Inspector II offers you the simplicity of autocalibration in a small, easy to use package. The Inspector II follows in the line of tint meters that have been in production by Laser Labs, Inc. since 1989.

The Inspector II is a full-featured tint meter for use on all car windows. It is used by police and inspection stations to measure total Visible Light Transmittance (VLT). The meter has an accuracy of $\pm 2\%$ and can measure from 0% (totally black) to 100% (air only). Use the Inspector II to verify the legality of after market window tint.

About your Inspector II

Your Inspector II has a light source in one box and the sensor and computer in the other box. The Liquid Crystal Display (LCD) shows the light transmitted by the glass and also the battery condition. Every time it is turned on using the on/off switches, the meter autocalibrates to 100%. This feature protects the meter against adverse conditions such as dust, temperature fluctuation, bright sunlight, and changes in battery voltage.

How to use your meter

For officer safety, we suggest opening all vehicle doors under test.

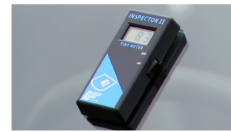
Step 1

Wipe the window clean of any dirt. With the 2 units held together, turn on both boxes. The meter will autocalibrate and display "100".



Step 2

Leaving both units turned on, separate the 2 boxes and place the light source box behind the glass to test. Hold it in place by hand or by using the suction cup.



Step 3

Place the display unit on the other side of the glass and allow the magnets to self align the 2 units. On rear windows be sure that defroster lines do not block the light source, as this may lower the reading. The display will show the VLT. Turn both units off when testing is complete.

Verifying accuracy

Reference standards are included with VLT values printed on their labels. The values are accurate to $\pm 1\%$ of an NIST calibrated spectrophotometer at 550 nanometers. To verify the Inspector II is working properly and within specification, take a reading of the reference standards before you begin to use your meter. The meter should display a reading within 2% of the labeled value.

Error codes

The computer generates error codes in case of faulty operation to protect the user from potential false readings.

- E1 Autocalibration error
- E2 Excess stray light
- E3 Factory calibration error
- E4 Excess radio frequency (RF) field
- E5 Temperature extreme

Low battery indicator

The battery is good for about 1000 tests. The display will show "bat" when the battery is too weak to operate.



Battery replacement



- 1) Remove the four screws at the corners on the back of each meter unit.



- 2) Using your thumb or a flathead screwdriver, carefully pry each battery from its retaining clip.

- 3) Replace with quality 3 volt lithium coin cells, type CR2032, available at most stores.

- 4) **Note battery polarity: the positive side faces up.** Meter will not function if battery is installed in reverse.

Understanding results

During power up, the computer in the Inspector II performs a self test to verify correct operation. This includes a battery check, sensor check, factory calibration check, and autocalibration.

The Inspector II is accurate to $\pm 2\%$ of true VLT. For example, a 32% meter reading means the VLT could be between 30% and 34%. Please take this measurement tolerance into account when using the meter. The Inspector II measures the combination of factory tint and after market tint. A reading of 0% is totally black, a reading of 100% would be no sample present. The highest reading on clear glass is typically 93% because some light is blocked by surface reflections.

Recertification

Replacement reference sample sets are available to meet state recertification requirements. Factory recertification of the Inspector II is also available. Please contact Laser Labs, Inc. for details.

Theory of operation

The Inspector II works by shining a beam of light (predominantly green, the center of the human eye response) from the back box to the display box. The meter measures this light level, converts it to a voltage, and saves it in its memory. This is the **autocalibration phase**, and it makes the meter immune to temperature variations, bright sunlight, dust, and dirt. After placing the boxes around the

test sample, called the **testing phase**, the meter again measures the level of light and converts it to a voltage. The computer inside the Inspector II then divides the testing phase value by the autocalibration phase value and displays this percentage calculation.

$$\frac{\text{Testing Value}}{\text{Calibration Value}} = \% \text{ Transmitted}$$

Specifications

| | |
|-----------------------|---|
| Wavelength | 550 nanometers |
| Bandwidth | 50 nanometers |
| Accuracy | $\pm 2\%$ |
| Repeatability | 1% |
| Measurement range | 0% to 100% |
| Humidity range | 0% to 100% non-condensing |
| Sample thickness | 0.0 to 0.25 in. 0.0 to 6.35 mm |
| Sample size | 1 x 3 in. (25 x 75 mm) minimum |
| Testing time | 4 seconds |
| Effect of stray light | Not affected |
| Lamp life | 10 years |
| Power source | 2 lithium batteries, type CR2032 (3 volt) |
| Weight | 3.2 oz. (90 grams) |
| Dimensions | 3.75 x 1.75 x 1.25 in. 95 x 45 x 30 mm |

1 Year Limited Warranty North America Only

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For international warranty, see our website.

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www.LASER-LABS.com
Designed in Massachusetts
by Laser Labs, Inc.
Assembled in China and the USA

Error codes

The computer generates error codes in case of faulty operation to protect the user from potential false readings. The meter will not display a reading under these conditions.

- E1 Auto calibration error
- E2 Excess stray light
- E3 Factory calibration error
- E4 Excess radio frequency (RF) field
- E5 Temperature extreme

Determining probable cause to stop a vehicle for excessive tint

Determining if a vehicle might be in violation requires the officer to be able to articulate his reasons for suspecting the offender's vehicle is in excess of state regulations. An officer's eye is limited in its ability to discern small differences in tint because of the non-linear sensitivity of the human eye. Variations in environment (rain, fog, night) compound this difficulty. A tint meter is the only way to get an accurate reading.

Probable cause to suspect a violation includes;

- 1) If the driver's face is only a silhouette, then it is probably illegal in all states.
- 2) If the window looks like it is darker than the reference samples included with the meter, it is reasonable to stop and test with a meter.
- 3) If the window looks darker than the following sample pictures it is reasonable to stop and test with a meter.



70 % transmittance

This is legal in all states.



50% Transmittance



30% Transmittance



20% Transmittance



10% Transmittance

Officer safety considerations

Excessively tinted windows are a hazard to police officers. The shooting death of NYPD officer Timoshenko during a traffic stop is an unforgettable reminder of the dangers inherent when approaching a car with tinted windows.

<http://www1.nyc.gov/office-of-the-mayor/news/903-16/mayor-de-blasio-police-commissioner-o-neill-join-forces-law-enforcement-leaders-and#/0>

Use of standard procedures for a high risk or felony stop should be considered, especially if the windows are so dark that you cannot see the occupants clearly. If visibility of the occupants is poor, consider asking the occupants to exit the vehicle before approaching.

When testing the windows with a tint meter, we suggest opening the door for officer safety. Because of the close proximity to the door during testing, there have been instances of the occupant attacking the officer with the vehicle door.

How to test a suspect vehicle

While not necessary for proper operation, we suggest testing your meter with the supplied standards before testing a suspect window. Some departments keep a log of these pretests for court purposes. Other departments test on a weekly or monthly basis depending on their court's requirement.

Wipe clean the window if it is wet, very dirty or covered by salt spray. Water spots and dust will not affect the readings.

Measure at least 2 spots on the same window as there can be spot to spot variation. This variation can be quite pronounced if the window film was of poor quality or poorly installed.

When measuring a rear window, make sure that the LED light is not blocked by the heater wires in the glass.

Identify the information required for court purposes.

- 1) Make and model of Tint Meter (Laser Labs Enforcer II or Inspector II)
- 2) Meter serial number and date of certification
- 3) Test standard serial numbers and date of certification
- 4) Percentage reading of each window tested
- 5) Log book of test standards reading if available
- 6) Copy of your State's law
- 7) Weather conditions
- 8) Condition of window
- 9) Copy of operator training certificate
- 10) Be able to articulate reasonable suspicion why you stopped the vehicle.

Tint Meter Maintenance

The Tint Meter does not require any user maintenance other than an occasional battery change. Lithium button cells powering the Tint Meters have a 10-year shelf life. The Enforcer II only uses power when on a window and will power down if left on the window for a few minutes. The Inspector II also automatically powers down after a few minutes if you forget to turn it off.

Low battery

The battery is good for approximately 4000 tests. The display will show "bat" when the battery is too weak to operate.



Battery Replacement-Enforcer II



Remove the four screws on the back of the meter.

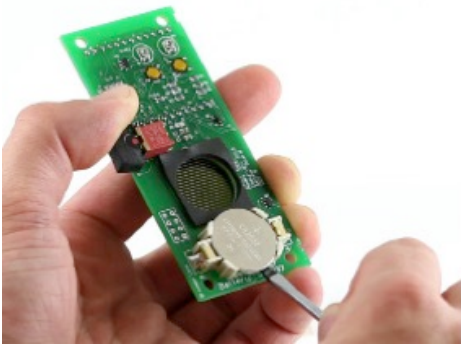


Place screwdriver in slot in circuit board and slide the coin cell out. Replace with a CR2032 lithium coin cell, available everywhere.

Battery Replacement-Inspector II



Remove the four screws on the back of the meter.



Using your thumb or a flathead screwdriver, carefully pry each battery from its retaining clip. **Remember, there is a battery in each box.** Replace with a CR2032 lithium coin cell, available everywhere.

Recertification

Replacement reference sample sets are available to meet state recertification requirements. Laser Labs does not mandate a recertification period. Common practice is the standards are replaced once a year or at whatever interval required by state law. Factory recertification of the meters is also available.



Replacement set