Digital Refractometers

Hanna digital refractometers take the guesswork
out of your measurements

HANNA® instruments

Refractive Index

Refractive Index is an optical characteristic of a substance and the dissolved particles in it.

The refractive index of a substance is strongly influenced by temperature and the wavelength of light used to measure it. Therefore, care must be taken to control or compensate for temperature differences and wavelength. The refractive index measurements are usually reported at a reference temperature of 20°C (68°F), which is considered to be room temperature.

Refractive index is defined as the ratio of the speed of light in a vacuum to the speed of light in a substance. A result of this property is that light will "bend," or change direction, when it travels through a substance with a different refractive index. This is called refraction.

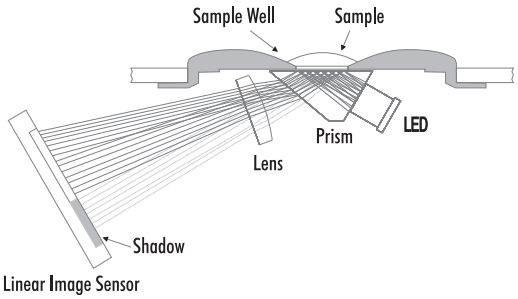
When passing from a material with a higher to lower refractive index, there is a critical angle at which an incoming beam of light can no longer refract, but will instead be reflected off the interface between the two substances. This is called total internal reflection.

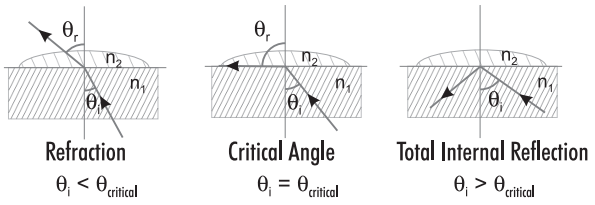
The critical angle can be used to easily calculate the refractive index according to the equation:

$$\sin(\Theta_{critical}) = n_2 / n_1$$

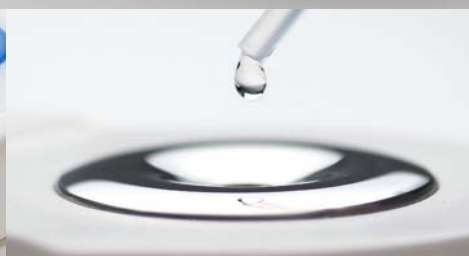
Where n_2 is the refractive index of the lower-density medium; n_1 is the refractive index of the higher-density medium.

A digital refractometer uses an LED to pass light through a prism in contact with the sample. An image sensor determines the critical angle at which the light is no longer refracted through the sample. Specialized algorithms then apply temperature compensation to the measurement and convert the refractive index to the specified parameter.





θ_i = angle of incidence
θ_r = angle of refraction
n_1, n_2 - refractive index



Hanna Digital Refractometers

- Automatic Temperature Compensation
  - For exceptionally accurate measurements
- Easy measurement
  - Place a few drops of the sample in the well and press the READ key
- BEPS
  - (Battery Error Prevention System) alerts the user in the event that low battery power could adversely affect readings
- IP65 water protection
  - Built to perform under harsh laboratory and field conditions
- Single-point calibration
  - Calibrate with distilled or deionized water
- Small sample size
  - Sample size can be as small as 2 metric drops
- Stainless steel sample well
  - Easy to clean and corrosion-resistant
- ABS thermoplastic casing
- Startup
  - When powered on, the meter displays battery life and the set measurement units
- Unit selection
  - Pressing the RANGE key quickly cycles through the units of measurement (if applicable)

HI96811 • HI96812 • HI96813
HI96814 • HI96816

Digital Refractometers

for Measurement of Sugar in Wine

- Dual-level LCD
  - Dual-level LCD displays measurement and temperature readings simultaneously
- ATC
  - Automatic Temperature Compensation
- BEPS
  - Alerts the user of low battery power that could adversely affect readings.
- IP65 water protection
  - Built to perform under harsh laboratory and field conditions.
- Quick, accurate results
  - Readings are displayed in approximately 1.5 seconds
- One-point calibration
  - Calibrate with distilled or deionized water
- Small sample size
  - Sample size can be as small as 2 metric drops
- Automatic shut-off
  - After three minutes of non-use
- Stainless steel sample well
  - Easy to clean and corrosion-resistant
- Easy measurement
  - Place a few drops of the sample in the well and press the READ key
- ABS thermoplastic casing

Five Instruments for Wine Analysis

Hanna offers five wine refractometers to meet the various requirements throughout the wine industry. The HI96811, HI96812, HI96813, HI96814 and HI96816 Digital Wine Refractometers are rugged, lightweight and waterproof for measurements in the lab or field.

Refractive Index

These optical instruments employ the measurement of the refractive index to determine parameters pertinent to the wine industry.

The actual measurement of the refractive index is simple and quick and provides the vintner a standard accepted method for sugar content analysis. Samples are measured after a simple user calibration with deionized or distilled water. Within seconds, the instrument measures the refractive index of the grape must. These digital refractometers eliminate the uncertainty associated with mechanical refractometers and are ideal for fast, reliable measurements.

Instrument Descriptions

HI96811, **HI96813** and **HI96814** convert the refractive index of the sample to sucrose concentration in units of percent by weight, % Brix (also referred to as °Brix). The conversion used is based on the ICUMSA Methods Book (International Commission for Uniform Methods of Sugar Analysis). Since the majority of sugar in grape juice is fructose and glucose and not sucrose, the reading is sometimes referred to as "Apparent Brix".

HI96812 has units of °Baumé. The °Baumé scale is based on density and was originally designed to measure the mass of sodium chloride in water. °Baumé is used in winemaking to measure the sugar in must. The HI96812 converts the % Brix reading to °Baumé based on the table found in the Official Methods of Analysis of AOAC International, 18th Edition. One °Baumé is approximately equal to 1.8 % Brix, and 1°Baumé is roughly equivalent to 1% alcohol when the wine is fully fermented.

In addition to % Brix, **HI96814** includes two other scales used in the wine industry: °Oechsle and °KMW.

°Oechsle (°Oe) is mainly used in the German, Swiss and Luxenbourgish winemaking industry to measure the sugar content of must. The °Oe scale is based on specific gravity at 20°C (S.G.(20/20)) and is the first 3 digits following the decimal point. One °Oe is roughly equal to 0.2 % Brix.

°Oe = [(S.G.(20/20)) - 1] x 1000

°Klosterneuburger Mostwaage (°KMW) is used in Austria to measure the sugar content of must. °KMW is related to °Oe by the following equation:
°Oe = °KMW x [(0.022 x °KMW) + 4.54]

1 °KMW is roughly equivalent to 1% Brix or 5 °Oe. °KMW is also known as °Babo.

"Potential" or "probable" alcohol is an estimation of the alcohol content (% vol/vol) in finished wine based on the conversion between sugar and alcohol. This conversion depends on many factors, such as the type of grapes, the grape maturity, the growing region and yeast fermentation efficiency and temperature.

The **HI96813** allows the user to tailor the instrument to their specific needs based on their experience, since no fixed conversion factor is universally applicable. The first conversion is based on the % Brix value and an adjustable conversion factor between 0.50 and 0.70 (0.55 is a common value).

Potential alcohol (% v/v) = (0.50 to 0.70) x % Brix

One drawback of the above equation is that it does not take into account the nonfermentable sugars and extract. A second equation was also added that takes these factors into account and can give a more accurate estimate of the alcohol content in the finished wine. This conversion is named "C1" on the meter, and uses the following equation:

Potential Alcohol (%V/V) = 0.059 x [(2.66 x °Oe) - 30] (C1)

The **HI 96816** potential alcohol curve is based on the tables found in the European Economic Community Commission Regulation No 2676/90 of September 17, 1990, Determining Community Methods for the Analysis of Wine and International Organization of Vine and Wine (OIV). The potential alcohol curve is based on the following equation:

Potential alcohol (%v/v) = g/L of Sugar / 16.83

Specifications		HI96811	HI96812	HI96813	HI96814	HI96816
Sugar Content	Range	0 to 50% Brix	0 to 28°Baumé	0 to 50% Brix; 0 to 25% V/V Potential Alcohol	0 to 50% Brix; 0 to 230°Oechsle; 0 to 42°KMW	4.9 to 56.8% V/V potential alcohol; (10 to 75% Brix)*
	Resolution	0.1% Brix	0.1°Baumé	0.1% Brix; 0.1% V/V Potential Alcohol	0.1% Brix; 1°Oechsle 0.1°KMW	0.1 %V/V Potential Alcohol
	Accuracy (@25°C/77°F)	±0.2% Brix	±0.1°Baumé	±0.2% Brix; ±0.2 %V/V Potential Alcohol	±0.2% Brix; 1°Oechsle ±0.2°KMW	±0.2 %V/V Potential Alcohol
Temperature	Range	0 to 80°C (32 to 176°F)				
	Resolution	±0.1°C (0.1°F)				
	Accuracy (@25°C/77°F)	±0.3°C (±0.5°F)				
Additional Specifications	Temperature Compensation	automatic between 10 and 40°C (50 to 104°F)				
	Measurement Time	approximately 1.5 seconds				
	Minimum Sample Volume	100 µL (to cover prism totally)				
	Light Source	yellow LED				
	Sample Cell	stainless steel ring and flint glass prism				
	Auto-off	after three minutes of non-use				
	Enclosure Rating	IP65				
	Battery Type / Battery Life	9V / approximately 5000 readings				
	Dimensions / Weight	192 x 102 x 67 mm (7.6 x 4.01 x 2.6") / 420 g (14.8 oz.)				
Ordering Information		**HI96811**, **HI96812**, **HI96813**, **HI96814** and **HI96816** are supplied with battery and instruction manual.				

* hidden range

HI96800 • HI96801 • HI96802
HI96803 • HI96804

Digital Refractometers

for Sugar Analysis Throughout the Food Industry

- Ideal for the analysis of:
  - Fruits, energy drinks, puddings, soy milk, juices, jam, marmalade, honey, soups, jelly, tofu and condiments
- Dual-level LCD
  - The dual-level LCD displays measurement and temperature readings simultaneously
- ATC
  - Automatic Temperature Compensation
- Easy measurement
  - Place a few drops of the sample in the well and press the READ key
- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- IP65 water protection
  - Built to perform under harsh laboratory and field conditions
- Quick, accurate results
  - Readings are displayed in approximately 1.5 seconds
- One-point calibration
  - Calibrate with distilled or deionized water
- Small sample size
  - Sample size can be as small as 2 metric drops
- Automatic shut-off
  - After three minutes of non-use
- Stainless steel sample well
  - Easy to clean and corrosion-resistant
- ABS thermoplastic casing

Five Instruments for Sugar Analysis

Hanna offers five sugar refractometers to meet the requirements of the food industry. The HI96800 Refractive Index/Brix, HI96801 % Brix (sucrose), HI96802 Fructose, HI96803 Glucose and HI96804 Invert Sugar digital refractometers are rugged, portable and water-resistant for measurements in the lab or field.

These optical instruments employ the measurement of the refractive index to determine parameters pertinent to sugar concentration analysis.

Refractive Index

The actual measurement of refractive index is simple, quick and provides the operator a standard accepted method for sugar content analysis. Samples are measured after a simple user calibration with deionized or distilled water. Within seconds these instruments measure the refractive index, apply any necessary calculations and display the results in the selected unit. These digital refractometers eliminate the uncertainty associated with mechanical refractometers and are easily portable for measurements in the field.

Features

These five instruments utilize internationally recognized references for unit conversion and temperature compensation and employ methodology recommended in the ICUMSA Methods Book (internationally recognized body for sugar analysis).

Temperature (in °C or °F) is displayed simultaneously with the measurement on the large dual-level display along with icons for low power and other helpful messages.

5 Digital Refractometers for Sugar Analysis to Choose from

HI96800

Measures the refractive index in aqueous solutions. Readings can also be displayed with sucrose temperature compensation (nD_{20}) or % Brix.

- 1.3300 to 1.5080 Refractive Index range with ±0.0005 accuracy
- 0 to 85% Brix range with ±0.2% accuracy

HI96801

Measures the refractive index to determine the % Brix of sugar in aqueous solutions. The refractive index of the sample is converted to % Brix concentration units.

- Temperature Compensation algorithms based on sucrose solution
- 0 to 85% Brix range with an accuracy of ± 0.2%

HI96802

Measures the refractive index to determine the % fructose in aqueous solutions. The refractive index of the sample is converted to % mass (% w/w) concentration units.

- Temperature Compensation algorithms based on fructose solution
- 0 to 85% fructose by weight range with an accuracy of ± 0.2%

HI96803

Measures the refractive index to determine the % glucose in aqueous solutions. The refractive index of the sample is converted to % mass (% w/w) concentration units.

- Temperature Compensation algorithms based on glucose solution
- 0 to 85% glucose by weight range with an accuracy of ± 0.2%

HI96804

Measures the refractive index to determine the % invert sugar in aqueous solutions. The refractive index of the sample is converted to % mass (% w/w) concentration units.

- Temperature Compensation algorithms based on invert sugar solution
- 0 to 85% invert sugar by weight range with an accuracy of ± 0.2%

Making a Standard % Brix Solution

To make a Brix Solution, follow the procedure below:

- Place container (such as a glass vial or dropper bottle that has a cover) on an analytical balance.
- Tare the balance.
- To make an X % Brix solution, weigh out X grams of high purity sucrose (CAS #: 57-50-1) directly into the container.
- Add distilled or deionized water to the container so the total weight of the solution is 100 g.

Note: Solutions above 60% Brix need to be vigorously stirred or shaken and heated in a water bath. Remove solution from bath when sucrose has dissolved. The total quantity can be scaled proportionally for smaller containers but accuracy may be sacrificed.

Example with 25% Brix:

% Brix	25
g Sucrose	25.000
g Water	75.000
g Total	100.000

Specifications		HI96800	HI96801	HI96802	HI96803	HI96804
Sugar Content	Range	1.3300 to 1.5080 nD; 1.3330 to 1.5040 nD_{20}; 0.0 to 85.0% Brix	0 to 85% Brix	0 to 85% mass (% w/w fructose)	0 to 85% mass (% w/w glucose)	0 to 85% mass (% w/w invert sugar)
	Resolution	0.0001 nD; 0.0001 nD_{20}; 0.1 % Brix	0.1 % Brix	0.1 % mass	0.1 % mass	0.1 % mass
	Accuracy (@25°C/77°F)	±0.0005 nD; ±0.0005 nD_{20}; ±0.2% Brix	±0.2% Brix	±0.2% mass	±0.2% mass	±0.2% mass
Temperature	Range	0.0 to 80.0°C (32.0 to 176.0°F)				
	Resolution	0.1°C (0.1°F)				
	Accuracy (@25°C/77°F)	±0.3°C (±0.5°F)				
Additional Specifications	Temperature Compensation	automatic between 10 and 40°C (50 to 104°F)				
	Measurement Time	approximately 1.5 seconds				
	Minimum Sample Volume	100 µL (to cover prism totally)				
	Light Source	yellow LED				
	Sample Cell	stainless steel ring and flint glass prism				
	Auto-off	after three minutes of non-use				
	Enclosure Rating	IP65				
	Battery Type / Battery Life	9V / approximately 5000 readings				
	Dimensions / Weight	192 x 102 x 67 mm (7.6 x 4.01 x 2.6") / 420 g (14.8 oz.)				
Ordering Information		**HI96800, HI96801**, **HI96802**, **HI96803** and **HI96804** are supplied with battery and instruction manual.				

HI96821

Digital Refractometer

for Sodium Chloride Measurement Throughout the Food Industry

- Ideal for the analysis of:
  - Salad dressings, cheeses, condiments, pickles, canned foods, jarred foods, milk, juices, energy drinks, soups, brines and whey
- High accuracy measurements in g/100 g, g/100 mL, specific gravity and °Baume
- Dual-level LCD
  - The dual-level LCD displays measurement and temperature readings simultaneously
- ATC
  - Automatic Temperature Compensation
- Easy measurement
  - Place a few drops of the sample in the well and press the READ key
- BEPS
  - Alerts the user of low battery power that could adversely affect readings.
- IP65 water protection
  - Built to perform under harsh laboratory and field conditions
- Quick, accurate results
  - Readings are displayed in approximately 1.5 seconds.
- Single-point calibration
  - Calibrate with distilled or deionized water
- Small sample size
  - Sample size can be as small as 2 metric drops
- Automatic shut-off
  - After three minutes of non-use
- Stainless steel sample well
  - Easy to clean and corrosion resistant
- ABS thermoplastic casing

Ideal for the Food Industry

Hanna offers the HI96821 digital sodium chloride refractometer to meet the requirements of the food industry. This optical instrument employs the measurement of the refractive index to determine sodium chloride concentration in aqueous solutions used in food preparation. It is not intended for seawater salinity measurements.

Refractive Index

The measurement of refractive index is simple and quick and provides the user an accepted method for sodium chloride analysis. Samples are measured after a simple user calibration with deionized or distilled water. Within seconds the instrument measures the refractive index of the solution, apply the necessary calculations and display the results in the selected unit. The digital refractometer eliminates the uncertainty associated with mechanical refractometers and is portable for measurements where you need them.

Features

The instrument utilizes internationally recognized references for unit conversion and temperature compensation. It can display the measurement of NaCl concentration 4 different ways: g/100 g, g/100 mL, Specific Gravity, and °Baumé.

Temperature (in °C or °F) is displayed simultaneously with the measurement on the large dual level display along with icons for Low Power and other helpful message codes.

Easy to Operate

Startup Screens

When the HI96821 is turned on, all of the LCD segments will be displayed followed by the percentage of battery life remaining.

Calibration

Perform a quick and easy calibration after startup:

1. Using a pipette, completely cover the prism in the sample well with distilled or deionized water.
2. Press the ZERO key.

Unit Selection

Just press the RANGE key to cycle through the HI96821's units of measurement (g/100 g, g/100 mL, Specific Gravity and °Baumé).

Measurement

Achieve fast, accurate results:

1. Using a plastic pipette, place sample onto the prism surface until the well is full.
2. Press the READ key and the results are displayed in the selected units.

Making a Standard Sodium Chloride Solution

To make a standard NaCl solution (g/100 g), follow the procedure below:

- Place a container (such as a glass vial or dropper bottle that has a cover) on an analytical balance.
- Tare the balance.
- To make an X NaCl solution weigh out X grams of high purity dried Sodium Chloride (CAS #: 7647-14-5: MW 58.44) directly into the container.
- Add distilled or deionized water to the container so the total weight of the solution is 100 g.

Example with g/100 g NaCl:

g/100 g NaCl	10
g NaCl	10.000
g Water	90.000
g Total	100.000

Specifications		**HI96821**
g/100 g	Range	0 to 28
	Resolution	0.1
	Accuracy (@25°C/77°F)	±0.2
g/100 mL	Range	0 to 34
	Resolution	0.1
	Accuracy (@25°C/77°F)	±0.2
Specific Gravity (S.G.)	Range	1.000 to 1.216
	Resolution	0.001
	Accuracy (@25°C/77°F)	±0.002
°Baumé	Range	0 to 26
	Resolution	0.1
	Accuracy (@25°C/77°F)	±0.2
Temperature	Range	0 to 80°C (32 to 176°F)
	Resolution	0.1°C (0.1°F)
	Accuracy (@25°C/77°F)	±0.3°C (±0.5°F)
Additional Specifications	Temperature Compensation	automatic between 10 and 40°C (50 to 104°F)
	Measurement Time	approximately 1.5 seconds
	Minimum Sample Volume	100 µL (to cover prism totally)
	Light Source	yellow LED
	Sample Cell	stainless steel ring and flint glass prism
	Auto-off	after three minutes of non-use
	Enclosure Rating	IP65
	Battery Type / Battery Life	9V / approximately 5000 readings
	Dimensions / Weight	192 x 102 x 67 mm (7.6 x 4.01 x 2.6") / 420 g (14.8 oz.)
Ordering Information	**HI96821** is supplied with battery and instruction manual.	

HI96822

Digital Refractometer

for Natural or Artificial Seawater Analysis

- Designed for seawater salinity analysis
- High accuracy measurements displayed as PSU, ppt and specific gravity
- Dual-level LCD
  - The dual-level LCD displays measurement and temperature readings simultaneously
- ATC
  - Automatic Temperature Compensation
- Easy measurement
  - Place a few drops of the sample in the well and press the READ key
- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- IP65 water protection
  - Built to perform under the harsh field conditions associated with environments containing seawater.
- Quick, accurate results
  - Readings are displayed in approximately 1.5 seconds
- Single-point calibration
  - Calibrate with distilled or deionized water
- Small sample size
  - Sample size can be as small as 2 metric drops
- Automatic shut-off
  - After three minutes of non-use
- Stainless steel sample well
  - Easy to clean and corrosion-resistant
- ABS thermoplastic casing

Ideal for Seawater Analysis

Hanna's HI96822 Digital Refractometer is a rugged, portable, water resistant device that utilizes the measurement of the refractive index to determine the salinity of natural and artificial seawater, ocean water or brackish intermediates. The HI96822 reflects Hanna's years of experience as a manufacturer of analytical instruments. This digital refractometer eliminates the uncertainty associated with mechanical refractometers and is durable and compact enough to be used at home, in the lab, or out in the field.

The HI96822 is an optical device that is quick and easy to use. After a simple user calibration with distilled or deionized water, a seawater sample can be introduced into the sample well.

Within seconds, the refractive index and temperature are measured and converted into one of three popular measurement units: Practical Salinity Units (PSU), parts per thousand (ppt), or specific gravity (S.G. (20/20)). All conversion algorithms are based upon respected scientific publications using the physical properties of seawater.

The Importance of Salinity Measurement Throughout a Variety of Applications

Salinity is a critical measurement in many applications, such as aquaculture, environmental monitoring, aquariums, desalination plants, well water, and many more. Until now, the available technology to measure salinity has relied on mechanical instruments, such as hydrometers and mechanical refractometers, or on high-tech conductivity meters. While easy to use, getting a reading on a mechanical refractometer can be difficult since they are highly susceptible to changes in temperature. Hydrometers, though inexpensive, are typically made of glass and subject to breakage.

The Hanna HI96822 is the solution to all these issues. It is lightweight, easy to use, cost-efficient, and extremely accurate. With the ability to read in three of the most widely used salinity units (PSU, ppt, and Specific Gravity), it is the ideal instrument for any application.

Easy to Operate

Start-up Screens

When the HI96822 is turned on, all of the LCD segments will be displayed followed by the percentage of battery life remaining.

Calibration

Perform a quick and easy calibration after start-up:

1. Using a plastic pipette, completely cover the prism in the sample well with distilled or deionized water.
2. Press the ZERO key.

Unit Selection

Just press the RANGE key to cycle through the HI96822's units of measurement. PSU, ppt, Specific Gravity (20/20).

Measurement

Achieve fast, professional results:

1. Using a plastic pipette, drip sample onto the prism surface until the well is full.
2. Press the READ key and the results are displayed in the selected units.

Making a Standard Sodium Chloride Solution

Sodium Chloride solutions can be used to check the accuracy of the meter. The table below lists two Sodium Chloride solutions and their expected ppt Seawater value. To make a Standard NaCl Solution (g/100 g), follow the procedure below:

- Place container (such as a glass vial or dropper bottle that has a cover) on an analytical balance.
- Tare the balance.
- To make an X NaCl solution weigh out X grams of high purity dried Sodium Chloride (CAS #: 7647-14-5: MW 58.44) directly into the container.
- Add distilled or deionized water to the beaker so the total weight of the solution is 100g.

Example Standard NaCl solution:

	NaCl (g)	Water (g)	Total	Expected Seawater Value (ppt)
3.5% NaCl	3.50	96.50	100.000	34
10% NaCl	10.00	90.00	100.000	96

Specifications		HI96822
PSU	Range	0 to 50
	Resolution	1
	Accuracy (@25°C/77°F)	±2
ppt	Range	0 to 150
	Resolution	1
	Accuracy (@25°C/77°F)	±2
Specific Gravity (S.G.)	Range	1.000 to 1.114
	Resolution	0.001
	Accuracy (@25°C/77°F)	±0.002
Temperature	Range	0 to 80°C (32 to 176°F)
	Resolution	0.1°C (0.1°F)
	Accuracy (@25°C/77°F)	±0.3°C (0.5°F)
Additional Specifications	Temperature Compensation	automatic between 0 and 40°C (32 to 104°F)
	Measurement Time	approximately 1.5 seconds
	Minimum Sample Volume	100 µL (to cover prism totally)
	Light Source	yellow LED
	Sample Cell	stainless steel ring and flint glass prism
	Auto-off	after three minutes of non-use
	Enclosure Rating	IP65
	Battery Type / Life	9V / approximately 5000 readings
	Dimensions	192 x 102 x 67 mm (7.6 x 4.01 x 2.6")
	Weight	420 g
Ordering Information	**HI96822** is supplied with battery and instruction manual.	

Some specific examples of the importance of salinity:

Aquaculture: Young salmon start their lives in fresh water. As they mature, they reach a stage ("smolt") when they transition to salt water. When farming salmon, it is critically important to maintain proper salinity levels at each life stage to prevent unnecessary stress that could negatively affect growth and development.

Salinity is a vital parameter to monitor accurately when raising eggs and larval fish, optimizing juvenile and adult growth, and culturing live food such as rotifers and artemia.

Aquaria: Whether it is the world-renowned, eight million gallon Georgia Aquarium, or a 20 gallon reef tank at home, salinity is a crucial parameter to measure. In closed systems such as these, salinity is easily affected. As water evaporates, it leaves the salt behind, raising the salinity. When evaporated water is replaced with fresh water, the salinity is lowered. The potential for disaster is inherent in both situations. Use Hanna's digital refractometer to accurately measure salinity and to help prevent any mishaps.

Environment: Salinity is almost always a required measurement when doing any kind of environmental monitoring or pollution studies. Salinity has the ability to affect many processes, such as respiration, reproduction, and growth development. If monitoring for the effect of pollution, it is important to make sure a salinity variation is not having an additional influence.

Well Water: In coastal areas, the freshwater aquifer (or water table) is adjacent to salt water. This aquifer often supplies the drinking water for the local population. If too many wells are sunk, or too much water is drawn from the aquifer, the water table may sink so low that salt water intrusion occurs and the water table becomes contaminated.

HI96831

Digital Refractometer

for Ethylene Glycol Analysis

- 0 - 100% Volume range with ±0.2% accuracy
- 0 to -50 °C freezing point range with ±0.5 °C accuracy
- Dual-level LCD
  - The dual-level LCD displays measurement and temperature readings simultaneously
- ATC
  - Automatic Temperature Compensation
- Easy measurement
  - Place a few drops of the sample in the well and press the READ key
- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- IP65 water protection
  - Built to perform under harsh laboratory and field conditions.
- Quick, accurate results
  - Readings are displayed in approximately 1.5 seconds
- Single-point calibration
  - Calibrate with distilled or deionized water
- Small sample size
  - Sample size can be as small as 2 metric drops
- Automatic shut-off
  - After three minutes of non-use
- Stainless steel sample well
  - Resists corrosion from salt water
- ABS thermoplastic casing

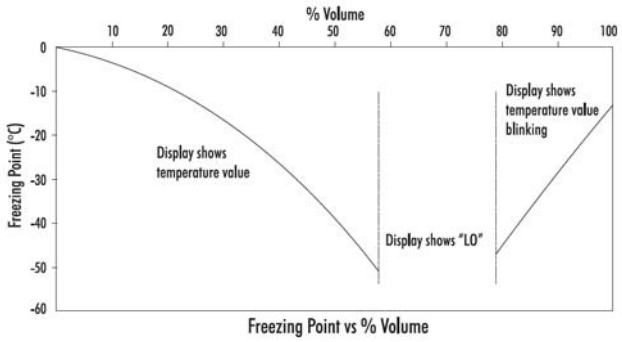
Ideal for Ethylene Glycol Analysis

The HI96831 Ethylene Glycol Digital Refractometer is a rugged, portable, water-resistant devices that utilizes the measurement of the refractive index to determine the percent volume and freezing point of ethylene glycol based solutions.

This digital refractometer eliminates the uncertainty associated with mechanical refractometers. HI96831 samples are measured after a simple user calibration with distilled or deionized water. Within seconds, the refractive index and temperature are measured and converted into one of two measurement units; % volume or freezing point. This meter uses internationally recognized references for unit conversion and temperature compensation for glycol solutions (e.g. CRC Handbook of Chemistry and Physics, 87th Edition).

Measurement Units

Freezing point is displayed as a temperature from 0.0 to -50.0°C corresponding to 0-58 % by volume. The display blinks the freezing point when the concentration of ethylene glycol is greater than 78 % concentration by volume. When the display shows "LO", the freezing point is at a minimum (below -50 °C).



Easy to Operate

Start-up Screens

When the HI96831 is turned on, all of the LCD segments will be displayed followed by the percentage of battery life remaining.

Calibration

Perform a quick and easy calibration after start-up:

1. Using a plastic pipette, completely cover the prism in the sample well with distilled or deionized water.
2. Press the ZERO key.

Unit Selection

Just press the RANGE key to cycle through the HI96831's units of measurement. % Volume (% V/V), Freezing Point (FP).

Measurement

Achieve fast, professional results:

1. Using a plastic pipette, drip sample onto the prism surface until the well is full.
2. Press the READ key and the results are displayed in the selected units.

Making a Standard Sodium Chloride Solution

To make an Ethylene Glycol Solution, follow the procedure below:

- Place container (such as a glass vial or dropper bottle that has a cover) on an analytical balance.
- Tare the balance.
- Volumetrically add X mL of high purity ethylene glycol (CAS #: 107-21-1; MW 62.068) to a 100 mL Grade A volumetric flask
- Use distilled or deionized water to bring the flask close to the total volume, mix, allow the solution to return to room temperature.
- Once the solution has returned to room temperature use distilled or deionized water to bring the total volume to 100 mL. Mix solution well before use.

Example Standard Solution:

	Ethylene Glycol	Total Volume	Expected Freezing Point Value
10% V/V	10.00 mL	100.000	-3.8°C (25.2°F)
40% V/V	40.00 mL	100.000	-26.3°C (-15.4°F)

Specifications		HI96831 Ethylene Glycol
% Volume (% v/v)	Range	0 to 100%
	Resolution	0.1 %
	Accuracy (@25°C/77°F)	±0.2 %
Freezing Point (FP)	Range	0 to -50°C (32 to -58°F)
	Resolution	0.1°C (0.1°F)
	Accuracy (@25°C/77°F)	±0.5°C (±1.0°F)
Temperature	Range	0 to 80°C (32 to 176°F)
	Resolution	0.1°C (0.1°F)
	Accuracy (@25°C/77°F)	±0.3°C (±0.5°F)
Additional Specifications	Temperature Compensation	automatic between 0 and 40°C (32 to 104°F)
	Measurement Time	approximately 1.5 seconds
	Minimum Sample Volume	100 µL (to cover prism totally)
	Light Source	yellow LED
	Sample Cell	stainless steel ring and flint glass prism
	Auto-off	after three minutes of non-use
	Enclosure Rating	IP65
	Battery Type / Battery Life	9V / approximately 5000 readings
	Dimensions / Weight	192 x 102 x 67 mm (7.6 x 4.01 x 2.6") / 420 g (14.8 oz.)
Ordering Information	**HI96831** and **HI96832** are supplied with battery and instruction manual.	

HI96832

Digital Refractometer

for Propylene Glycol Analysis

- 0 to 100% Volume range with ±0.3% accuracy
- 0 to -50 °C freezing point range with ±0.5 °C accuracy
- Dual-level LCD
  - The dual-level LCD displays measurement and temperature readings simultaneously
- ATC
  - Automatic Temperature Compensation
- Easy measurement
  - Place a few drops of the sample in the well and press the READ key
- BEPS
  - Alerts the user of low battery power that could adversely affect readings
- IP65 water protection
  - Built to perform under harsh laboratory and field conditions.
- Quick, accurate results
  - Readings are displayed in approximately 1.5 seconds
- Single-point calibration
  - Calibrate with distilled or deionized water
- Small sample size
  - Sample size can be as small as 2 metric drops
- Automatic shut-off
  - After three minutes of non-use
- Stainless steel sample well
  - Resists corrosion from salt water.
- ABS thermoplastic casing

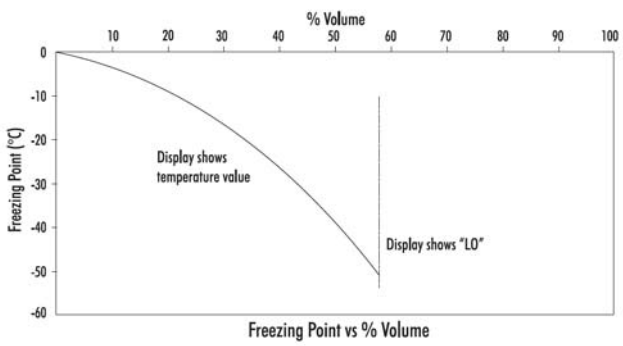
Ideal for Propylene Glycol Analysis

The HI96832 Propylene Glycol Digital Refractometer is a rugged, portable, water-resistant devices that utilize the measurement of the refractive index to determine the percent volume and freezing point of propylene glycol based solutions.

This digital refractometer eliminates the uncertainty associated with mechanical refractometers. HI96832 samples are measured after a simple user calibration with distilled or deionized water. Within seconds, the refractive index and temperature are measured and converted into one of two measurement units; % volume or freezing point. This meter uses internationally recognized references for unit conversion and temperature compensation for glycol solutions (e.g. CRC Handbook of Chemistry and Physics, 87th Edition).

Measurement Units

Freezing point is displayed as a temperature from 0.0 to -51.0 °C corresponding to 0-60 % by volume. When the display shows "LO", the freezing point is at a minimum (below -51 °C).



Freezing Point vs % Volume

Easy to Operate

Start-up Screens

When the HI96832 is turned on, all of the LCD segments will be displayed followed by the percentage of battery life remaining.

Calibration

Perform a quick and easy calibration after start-up:

1. Using a plastic pipette, completely cover the prism in the sample well with distilled or deionized water.
2. Press the ZERO key.

Unit Selection

Just press the RANGE key to cycle through the HI96831's units of measurement. % Volume (% V/V), Freezing Point (FP).

Measurement

Achieve fast, professional results:

1. Using a plastic pipette, drip sample onto the prism surface until the well is full.
2. Press the READ key and the results are displayed in the selected units.

Making a Standard Sodium Chloride Solution

To make an X % Propylene Glycol Solution, follow the procedure below:

- Place container (such as a glass vial or dropper bottle that has a cover) on an analytical balance.
- Tare the balance.
- volumetrically add X mL of high purity propylene glycol (CAS #: 57-55-2; MW 76.09) to a 100 mL Grade A volumetric flask.
- Use distilled or deionized water to bring the flask close to the total volume, mix, allow the solution to return to room temperature.
- Once the solution has returned to room temperature use distilled or deionized water to bring the total volume to 100 mL. Mix solution well before use.

Example Standard Solution:

	Propylene Glycol	Total Volume	Expected Freezing Point Value
10% V/V	10.00 mL	100.000	-3.4°C (25.9°F)
40% V/V	40.00 mL	100.000	-21.3°C (-6.3°F)

Specifications		HI96832 Propylene Glycol
% Volume (% v/v)	Range	0 to 100%
	Resolution	0.1 %
	Accuracy (@25°C/77°F)	±0.3 %
Freezing Point (FP)	Range	0 to -51°C (32 to -59.8°F)
	Resolution	0.1°C (0.1 °F)
	Accuracy (@25°C/77°F)	±0.5°C (±1.0°F)
Temperature	Range	0 to 80°C (32 to 176°F)
	Resolution	0.1°C (0.1°F)
	Accuracy (@25°C/77°F)	±0.3°C (±0.5°F)
Additional Specifications	Temperature Compensation	automatic between 0 and 40°C (32 to 104°F)
	Measurement Time	approximately 1.5 seconds
	Minimum Sample Volume	100 µL (to cover prism totally)
	Light Source	yellow LED
	Sample Cell	stainless steel ring and flint glass prism
	Auto-off	after three minutes of non-use
	Enclosure Rating	IP65
	Battery Type / Battery Life	9V / approximately 5000 readings
	Dimensions / Weight	192 x 102 x 67 mm (7.6 x 4.01 x 2.6") / 420 g (14.8 oz.)
Ordering Information	**HI96831** and **HI96832** are supplied with battery and instruction manual.	

We Design, Manufacture, Supply and Support All of Our Products.

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Offering research grade quality at competitive prices, every Hanna office strives to work with each customer to develop a solution tailored to their needs, and within their budget.

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