www.HANNAINST.com

Digital

REFRACTOMETERS

HANNA® instruments

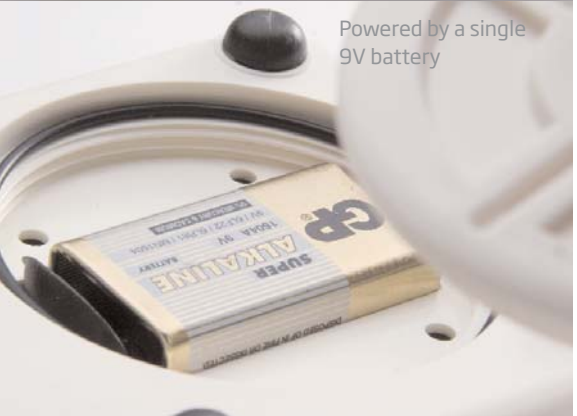
With Great Products, Come Great Results™

Primary Display and Secondary Display

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.

Battery life on display

Easy to clean stainless steel sample well



Powered by a single 9V battery

WE DESIGN, MANUFACTURE, SUPPLY AND SUPPORT ALL OF OUR PRODUCTS.

THAT'S 360° VALUE

Over the past 30 years, HANNA has never failed to design fresh and innovative products and our new Digital Refractometers are no exception. We are excited to introduce these refractometers as a continuing effort to bring to market what our valued customers want.

HANNA is the largest family-owned manufacturer of analytical instrumentation in the world. Our Digital Refractometers are manufactured in our European state-of-the-art ISO 9001:2000 production facility and is CE compliant to EN 61326-1 and EN 61010-1 standards.

When you buy a HANNA product, you're not only buying the best value for your money, but you're also adding the benefit of HANNA's unsurpassed customer service and post-sale technical support.

FEATURES

Quick, Precise Results

Readings are displayed in approximately 1.5 seconds.

Easy Measurement

Place a few drops of the sample in the well and press the READ key.

Dual Level LCD

Can display primary measurement and temperature readings simultaneously.

Small Sample Size

Sample size can be as small as 2 metric drops.

IP 65 Waterproof Protection

Built to perform under harsh laboratory and field conditions.

Stainless Steel Sample Well

Easy to clean and corrosion resistant.

Single Point Calibration

Calibrate with distilled or deionized water.

B.E.P.S. (Battery Error Prevention System)

Alerts you in the event that low battery power could adversely affect readings.

Automatic Shut-off

After 3 minutes of non-use.

Automatic Temperature Compensation

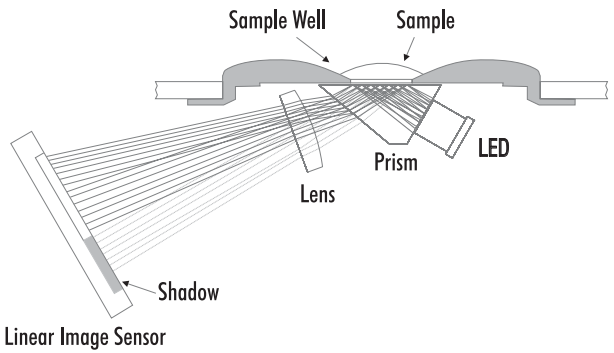
For exceptionally accurate measurements.

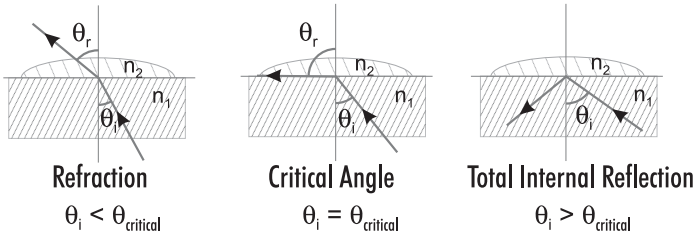
WP WATERPROOF

B.E.P.S. ± Battery Error Prevention System

2 YEAR WARRANTY

ISO 9001:2000 CERTIFIED COMPANY





REFRACTIVE INDEX

Determinations are made by measuring the refractive index of a solution. Refractive Index is an optical characteristic of a substance and the number of dissolved particles in it.

Refractive Index is defined as the ratio of the speed of light in empty space to the speed of light in the substance. A result of this property is that light will "bend", or change direction, when it travels through a substance of 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.

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; n1 is the refractive index of the higher-density medium.

Light from an LED passes 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: % Volume or Freezing Point.

GENERAL SPECIFICATIONS FOR ALL MODELS

Temperature Range	0 to 80°C (0 to 176°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 3 minutes of non-use
Enclosure Rating	IP 65
Battery Type / Battery Life	9V / Approx 5000 readings
Dimensions / Weight	192 x 102 x 67 mm (7.6 x 4 x 2.6") / 420 g

ORDERING INFORMATION

All models are supplied with battery and instruction manual.

EASY OPERATION

HI 96821 screens are used for example.

Start-up

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).

Calibration

Perform a quick and easy calibration after start-up with distilled or deionized water.

Measurement

Achieve fast, professional results in a matter of seconds.

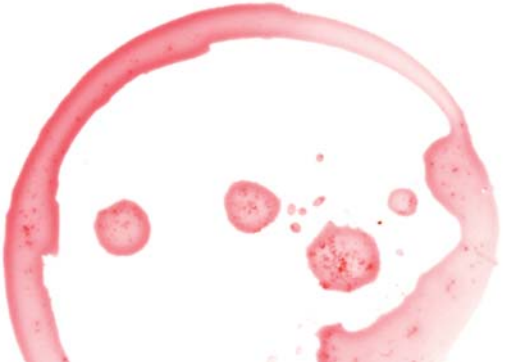
SPECIFICATIONS	HI 96811	HI 96812	HI 96813	HI 96814	HI 96816
Range	0 to 50 %Brix	0 to 28 °Baumé	0 to 50 %Brix 0 to 25 %v/v Potential Alcohol	0 to 50 %Brix 0-230 °Oechsle 0-42 °KMW	4.9 to 56.8 %v/v Potential Alcohol (10 to 75 %Brix)
Resolution	0.1 %Brix	0.1 °Baumé	0.1 %Brix 0.1 %v/v	0.1 %Brix 1 °Oechsle 0.1 °KMW	0.1 %v/v
Accuracy	±0.2 %Brix	±0.1 °Baumé	±0.2 °Baumé ±0.2 %v/v	±0.2 %Brix ±1 °Oechsle ±0.2 °KMW	±0.2 %v/v

Digital Refractometers for
SUGAR ANALYSIS IN WINE

HANNA offers five wine refractometers to meet the requirements of cultural differences found throughout the wine industry. The HI 96811, HI 96812, HI 96813, HI 96814 and HI 96816 Digital Wine Refractometers are rugged, lightweight and waterproof for measurements in the lab or field. Each instrument offers a different but valid way to measure the density of grape must and other sugar based liquids.

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 in the field.



MEASUREMENT

HI 96811, **HI 96813** and **HI 96814** 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".

HI 96812 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 wine making to measure the sugar in must. The HI 96812 converts the %Brix reading to °Baumé based on the table found in the Official Methods of Analysis of AOAC International, 18th Edition. 1 °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, **HI 96814** includes two other scales used in the wine industry: °Oechsle and °KMW.

°Oechsle (°Oe) is mainly used in the German, Swiss and Luxenburgish winemaking industry to measure the sugar content of must. The °Oe scale is based on specific gravity at 20°C (SG20/20) and is the first 3 digits following the decimal point. 1 °Oe is roughly equal to 0.2 %Brix.

°Oe = [(SG20/20) - 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 **HI 96813** 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 17 September 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

Analyze: Fruits • Energy Drinks • Puddings • Soy Milk • Juices • Jam • Marmalade • Honey • Soups • Jelly • Tofu • Condiments

FOODCARE line

SPECIFICATIONS	HI 96801 Brix	HI 96802 Fructose	HI 96803 Glucose	HI 96804 Invert Sugar
Range	0 to 85 %Brix	0 to 85%	0 to 85%	0 to 85%
Resolution	0.1 %Brix	0.1%	0.1%	0.1%
Accuracy	±0.2 %Brix	±0.2%	±0.2%	±0.2%

Digital Refractometers for
SUGAR ANALYSIS IN THE FOOD INDUSTRY

HANNA offers four Sugar refractometers to meet the requirements of the food industry. The HI 96801 Sucrose, HI 96802 Fructose, HI 96803 Glucose and HI 96804 Invert Sugar Digital Refractometers are rugged, portable and water resistant for measurements in the lab or field. Each instrument offers a specific analysis to determine accurate sugar concentration.

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

The actual measurement of refractive index is simple and 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 of the sample and convert it to percent by weight concentration units (or %Brix for HI 96801). These digital refractometers eliminate the uncertainty associated with mechanical refractometers and are easily portable for measurements in the field.

These four 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).

Digital Refractometer for

SODIUM CHLORIDE ANALYSIS IN THE FOOD INDUSTRY

HANNA offers the HI 96821 digital sodium chloride refractometer to meet the requirements of the food industry. This optical instrument that employs the measurement of the refractive index to determine sodium chloride concentration in aqueous solutions used in food preparation. It is not intended for sea water salinity measurements.

The measurement of refractive index is simple and quick and provides the user an accepted method for NaCl 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. The digital refractometer eliminates the uncertainty associated with mechanical refractometers and is portable for measurements where you need them.

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.

SPECIFICATIONS	HI 96821 Sodium Chloride
Range	0 to 28 g/100 g 0 to 34 g/100 mL 1.000 to 1.216 Specific Gravity 0 to 26 °Baumé
Resolution	0.1 g/100 g 0.1 g/100 mL 0.001 Specific Gravity 0.1 °Baumé
Accuracy	±0.2 g/100 g ±0.2 g/100 mL ±0.002 Specific Gravity ±0.2 °Baumé

SPECIFICATIONS	HI 96822 Seawater
Range	0 to 50 PSU 0 to 150 ppt 1.000 to 1.114 Specific Gravity (20/20)
Resolution	1 PSU 1 ppt 0.001 Specific Gravity (20/20)
Accuracy	±2 PSU ±2 ppt ±0.002 Specific Gravity (20/20)

Digital Refractometer for
NATURAL OR ARTIFICIAL SEAWATER ANALYSIS

HANNA's HI 96822 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 HI 96822 benefits from HANNA's years of experience as a manufacturer of analytical instruments. This digital refractometer eliminates the uncertainty associated with mechanical refractometers and is rugged and portable enough to be used at home, in the lab and out in the field.

The HI 96822 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 3 popular measurement units: Practical Salinity Units (PSU), Salinity in 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 (not sodium chloride).

THE IMPORTANCE OF SALINITY MEASUREMENT

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 traditional refractometers, or on high-tech conductivity meters. While easy to use, traditional refractometers can be difficult to get a precise reading from and are highly susceptible to changes in temperature.

The HANNA HI 96822 is the solution. It is lightweight, easy to use, cost-efficient, and is extremely precise and 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.

SOME SPECIFIC EXAMPLES OF WHEN SALINITY IS IMPORTANT:

Aquaculture: Young salmon start their lives in fresh water. As they mature, they reach a stage ("smoltification") 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 when culturing live food such as rotifers and Artemia.

Aquariums: Whether it is 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 and when evaporated water is replaced with fresh water, the salinity is lowered. There is a potential for disaster in both situations. Using the HANNA digital refractometer to accurately measure salinity will help prevent any mishaps.

Environment: Salinity is almost always a required measurement when doing any kind of environmental monitoring or pollution study. Salinity has the ability to affect many processes, such as respiration, reproduction, and growth development.

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 incursion occurs and the water table has become contaminated.

SPECIFICATIONS	HI 96831 Ethylene Glycol	HI 96832 Propylene Glycol
Range	0 to 100 %Volume	
	0 to -50 °C (32 to -58 °F) Freezing Point	0 to -51 °C (32 to -59.8 °F) Freezing Point
Resolution	0.1 %Volume	
	0.1 °C (0.1 °F) Freezing Point	
Accuracy	±0.2 %Volume	±0.3 %Volume
	±0.5 °C (±1.0 °F) Freezing Point	

Digital Refractometers for
ETHYLENE AND PROPYLENE GLYCOL ANALYSIS

The HI 96831 (Ethylene Glycol) and HI 96832 (Propylene Glycol) Digital Refractometers are rugged, portable, water resistant devices that utilize the measurement of refractive index to determine the percent volume and freezing point of ethylene or propylene glycol based solutions.

These digital refractometers eliminate mechanical refractometer uncertainty. HI 96831 and HI 96832 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. These instruments utilize internationally recognized references for unit conversion and temperature compensation for glycol solutions (e.g. CRC Handbook of Chemistry and Physics, 87th Edition).

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