INSTRUCTION MANUAL



HI96800

Digital Refractive Index and Brix Refractometer

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www.hannainst.com

Dear Customer,

Thank you for choosing a Hanna Instruments® product.
Please read this instruction manual carefully before using this instrument as it provides the necessary information for correct use of this instrument, and a precise idea of its versatility.
If you need additional technical information, do not hesitate to e-mail us at tech@hannainst.com.
Visit www.hannainst.com for more information about Hanna Instruments and our products.

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1. PRELIMINARY EXAMINATION

Remove the instrument and accessories from the packaging and examine it carefully. For further assistance, please contact your local Hanna Instruments® office or email us at tech@hannainst.com.

Each HI96800 instrument is supplied with:

- Plastic pipette
- 9 V battery
- Quick reference guide with QR code for manual download and instrument quality certificate

Note: *Save all packing material until you are sure that the instrument works correctly. Any damaged or defective item must be returned in its original packing material with the supplied accessories.*

2. GENERAL DESCRIPTION

The HI96800 Digital Refractometer is a rugged portable, water resistant device that benefits from Hanna Instruments' years of experience as a manufacturer of analytical instruments.

The HI96800 is an optical instrument that is both simple and quick. Samples are measured after a simple user calibration with deionized or distilled water. Within seconds the instrument measures the refractive index of the sample. Reading can also be displayed with sucrose temperature compensation (nD_{20}) or % Brix.

The HI96800 digital refractometer eliminates the uncertainty associated with mechanical refractometers and is easily portable for measurements in the field.

The measurement technique and temperature compensation employ methodology recommended in the ICUMSA Methods Book (International Commision for Uniform Methods of 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 message codes.

Key features include:

- Dual-level LCD
- Automatic Temperature Compensation (ATC)
- Easy setup and storage
- Battery operation with Low Power indicator (BEPS)
- Automatically turns off after 3 minutes of non-use.

3. SPECIFICATIONS

nD	Range	1.3300 to 1.5080 nD
	Resolution	0.0001 nD
	Accuracy	±0.0005 nD
nD_{20}	Range	1.3330 to 1.5040 nD_{20}
	Resolution	0.0001 nD_{20}
	Accuracy	±0.0005 nD_{20}
% Brix	Range	0.0 to 85.0 % Brix
	Resolution	0.1 % Brix
	Accuracy	±0.2 % Brix
Temperature	Range	0.0 to 80.0 °C (32.0 to 176.0 °F)
	Resolution	0.1 °C / 0.1 °F
	Accuracy	±0.3 °C / ±0.5 °F
Temperature compensation		Automatic 10.0 to 40.0 °C (50.0 to104.0 °F)
Measurement time		Approximately 1.5 seconds
Minimum sample volume		100 μL (cover prism totally)
Light source		Yellow LED
Sample cell		Stainless steel ring and flint glass prism
Case material		ABS
Enclosure rating		IP65
Battery type / life		9V / 5000 readings
Auto-off		After 3 minutes of non-use
Dimensions		192×102×69 mm (7.6×4.1×2.7″)
Weight		350 g (12.3 oz.)

4. PRINCIPLE OF OPERATION

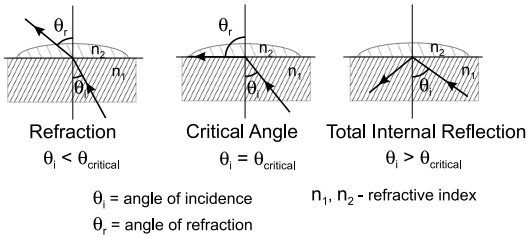
Refractive Index is an optical characteristic of a substance and the number of dissolved particles in it. Refractive Index is defined as the ratio of the speed of light in empty space to the speed of light in the substance. A result of this property is that light will **"bend"**, or change direction, 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:

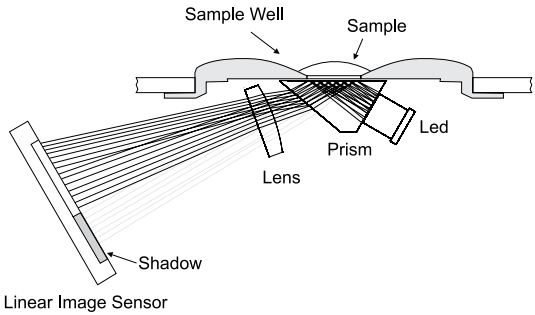
$$\sin(\theta_{critical}) = n_2 / n_1$$

Where:

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

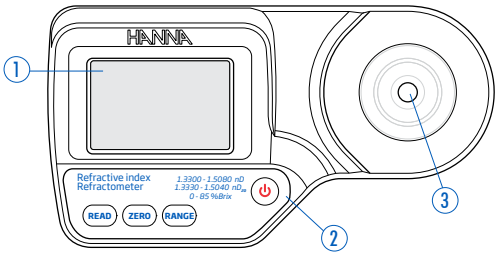


In the HI96800, light from an LED passes through a prism in contact with the sample. An image sensor determines the critical angle at which the light is no longer refracted through the sample.

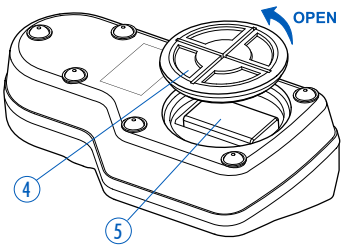


5. FUNCTIONAL DESCRIPTION

Top View



Rear View

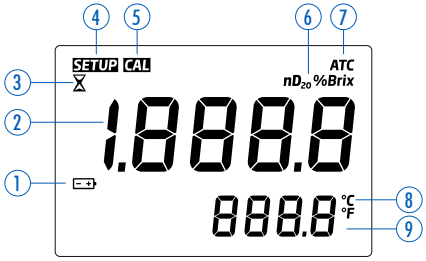


1. Liquid Crystal Display (LCD)
2. Keypad
3. Stainless steel sample well and prism
4. Battery cover
5. Battery compartment

Keypad

- ON/OFF
- READ User measurement
- ZERO User calibration
- RANGE User measurement unit

Display Elements



1. Battery (blinks when low battery condition detected)
2. Primary display (displays measurement and error messages)
3. Measurement in progress tag
4. SETUP: factory calibration tag
5. CAL: calibration tag
6. Measurement units
7. Automatic temperature compensation
   (blinks when temperature exceeds 10.0–40.0 °C / 50.0–104.0 °F range)
8. Temperature units
9. Secondary display (displays temperature measurements; when blinking, temperature has exceeded operation range: 0.0–80.0 °C / 32.0–176.0 °F)

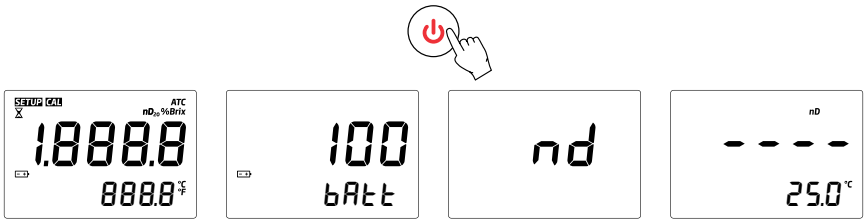
6. MEASUREMENT GUIDELINES

- Handle instrument carefully. Do not drop.
- Do not immerse instrument under water.
- Do not spray water to any part of instrument except the “sample well” located over the prism.
- Do not expose instrument or prism to solvents that will damage it. This includes most organic solvents and extremely hot or cold solutions.
- Particulate matter in a sample may scratch the prism. Absorb sample with a soft tissue and rinse sample well with deionized or distilled water between samples.
- Use plastic pipettes to transfer all solutions. Do not use metallic tools such as needles, spoons or tweezers as these will scratch the prism.
- To reduce the effects of evaporation or absorption of water when taking readings over a period of time, the prism and sample well can be covered with plastic wrap.

7. CALIBRATION PROCEDURE

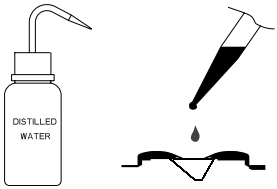
Calibration should be performed daily, before measurements are made, when the battery has been replaced, between a long series of measurements, or if environmental changes have occurred since the last calibration.

1. Press the **ON/OFF** key, then release. Two instrument test screens will be displayed briefly; all LCD segments followed by the percentage of remaining battery life. The meter will briefly display an indication of the measurement units set. When LCD displays dashes, the instrument is ready.



2. Using a plastic pipette, fill the sample well with distilled or deionized water. Make sure the prism is completely covered.

   Note: *If the ZERO sample is subject to intense light such as sunlight or another strong source, cover the sample well with your hand or other shade during the calibration.*



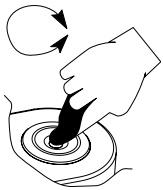
3. Press the **ZERO** key. If no error messages appear, your unit is calibrated (see Error Messages section).

   Note: *The -0- or 0.0 screen will remain until a sample is measured or the power is turned off.*



4. Gently absorb the ZERO water standard with a soft tissue. Use care not to scratch the prism surface. Dry the surface completely. The instrument is ready for sample measurement.

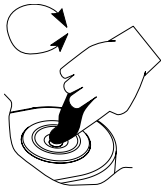
   Note: *If the instrument is turned off the calibration will not be lost.*



8. MEASUREMENT PROCEDURES

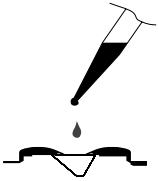
Verify the instrument has been calibrated before taking measurements.

1. Wipe off prism surface located at the bottom of the sample well. Make sure the prism and sample well are completely dry.



2. Using a plastic pipette, drip sample onto the prism surface. Fill the well completely.

   Note: *If the temperature of the sample differs significantly from the temperature of the instrument, wait approximately 1 minute to allow thermal equilibration.*

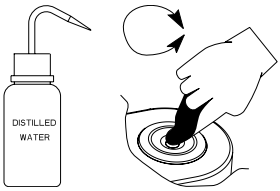


3. Press the **READ** key. The result is displayed in the selected units.



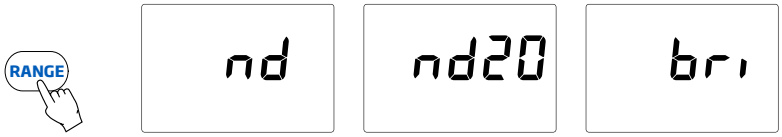
   Note: *The last measurement value will be displayed until the next sample is measured or the instrument is turned off. Temperature will be continuously updated.*
   The ATC tag blinks and automatic temperature compensation is disabled if the temperature exceeds the 10-40 °C/50-104 °F range.

4. Remove sample from the sample well by absorbing with a soft tissue.
5. Using a plastic pipette, rinse prism and sample well with distilled or deionized water. Wipe dry. The instrument is ready for the next sample.



To Change Measurement Unit

Press the **RANGE** key to select measurement units. The instrument scales each time the key is pressed and the primary display indicated **"nd"** for refractive index, **"nd20"** for temperature compensated refractive index and **"bri"** for % Brix, when the instrument displays the screen with 4 dashes, it is ready for measurement.



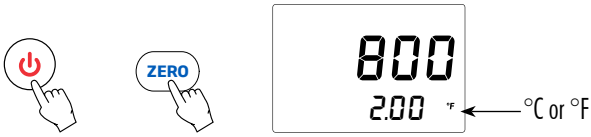
To Change Temperature Unit

To change the temperature measurement unit from Celsius to Fahrenheit (or vice versa), follow this procedure.

1. Press and hold the **ON/OFF** key continuously for approximately 15 seconds. The LCD will display the "all segment" screen followed by a screen with the model number on the primary display and the version number on the secondary display. Continue pressing the **ON/OFF** key.



2. While continuing to hold the **ON/OFF** key, press the **ZERO** key. The temperature unit will change from °C to °F or vice versa.



9. MAKING AN X % BRIX STANDARD 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.*

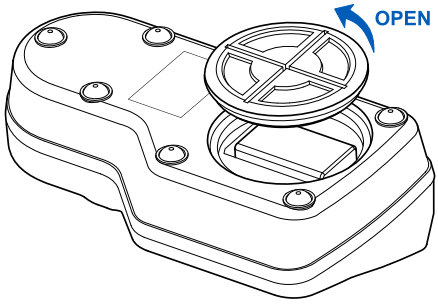
Example with 25 % Brix:

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

10. BATTERY REPLACEMENT

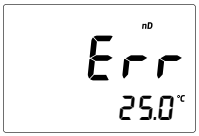
To replace the instrument's battery, follow these steps:

- Make sure the instrument is off.
- Turn instrument upside down and remove the battery cover by turning it counterclockwise.
- Extract the battery from its location.
- Replace with a new 9V battery making sure to observe polarity.
- Insert the back battery cover and fasten it by turning clockwise to engage.



11. ERROR MESSAGES

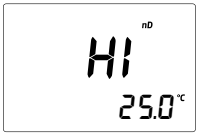
"Err"
General failure. Cycle power to instrument.
If error persists, contact your local Hanna Instruments® office.



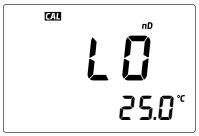
"LO" primary display
Sample exceeds minimum measurement range.



"HI" primary display
Sample exceeds maximum measurement range.



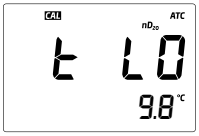
"LO" primary display Cal segment ON
Wrong solution used to zero instrument.
Use deionized or distilled water. Press **ZERO**.



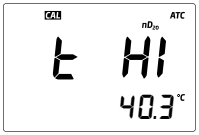
"HI" primary display Cal segment ON
Wrong solution used to zero instrument.
Use deionized or distilled water. Press **ZERO**.



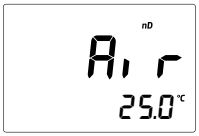
"t LO" primary display Cal segment ON
Temperature exceeds ATC low limit (10.0 °C) during calibration.



"t HI" primary display Cal segment ON
Temperature exceeds ATC high limit (40.0 °C) during calibration.



"Air"
Prism surface insufficiently covered.



"ELt"
Too much external light for measurement.
Cover sample well with hand.



"nLt"
LED light is not detected.
Contact your local Hanna Instruments® office.



Battery segment blinking
< 5 % of battery life is remaining.



Temperature values are blinking "0.0 °C" or "80.0 °C"
Temperature measurement out of range (0.0 to 80.0 °C).

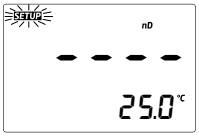




ATC segment blinking
Outside temperature compensation range (10.0 to 40.0 °C).



SETUP segment blinking
Factory calibration lost.
Contact your local Hanna Instruments office.



12. ACCESSORIES

Ordering Information	Product Description
HI4020-11	50 % Brix standard, 10 mL
HI740157P	Plastic refilling pipette (20 pcs.)
HI740029P	9V battery (10 pcs.)

CERTIFICATION

All Hanna® instruments conform to the **CE European Directives** and **UK standards.**



Disposal of Electrical & Electronic Equipment. The product should not be treated as household waste. Instead, hand it over to the appropriate collection point for the recycling of electrical and electronic equipment, which will conserve natural resources.

Disposal of waste batteries. This product contains batteries, do not dispose of them with other household waste. Hand them over to the appropriate collection point for recycling. Ensuring proper product disposal prevents potential negative consequences for the environment and human health. For more information, contact your city, your local household waste disposal service, or the place of purchase.

RECOMMENDATIONS FOR USERS

Before using this product, make sure it is entirely suitable for your specific application and for the environment in which it is used. Any variation introduced by the user to the supplied equipment may degrade the meter's performance. For your and the meter's safety do not use or store the meter in hazardous environments.

WARRANTY

HI96800 is warranted for two years against defects in workmanship and materials when used for its intended purpose and maintained according to instructions.

This warranty is limited to repair or replacement free of charge. Damage due to accidents, misuse, tampering or lack of prescribed maintenance is not covered.

If service is required, contact your local Hanna Instruments® office. If under warranty, report the model number, date of purchase, serial number, and the nature of the problem. If the repair is not covered by the warranty, you will be notified of the charges incurred. If the meter is to be returned to Hanna Instruments, first obtain a Returned Goods Authorization number from the Technical Service department and then send it with shipping costs prepaid. When shipping any instrument, make sure it is properly packed for complete protection.