



Hand Held Instrumentation

PORTABLE REFRACTOMETERS & APPLICATION SPECIFIC TEST KITS



**Bellingham
+ Stanley**

a xylem brand

Precision concentration measurement in the palm of your hand

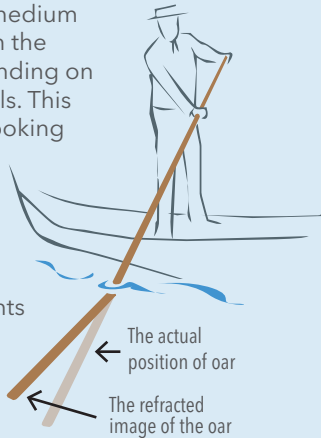
What is Refractive Index?

When light passes from one medium to another, the speed at which the light travels will change depending on the parameters of the materials. This principle can be seen when looking at a straw in a glass or an oarsman on the river, as shown in the diagram.

The ratio or change in the speed of light is called refractive index and instruments that measure this are called refractometers.

The refractive index of a liquid is uniquely related to its specific density, a refractometer may be used to measure the purity or more importantly the concentration of a sample when mixed with other liquids. Refractometers are therefore commonly used to measure dilution and blend ratios of many different solutions found within food, beverage, environmental, life science and industrial applications including sugars (°Brix, glucose, sucrose, etc.), salts (sodium chloride, seawater, calcium chloride, etc.) and heat transfer fluids (antifreeze, de-icing, heat pump, machine shop lubricants, etc.).

Additionally, refractometers may also be used as part of a more complex multiple parameter experiment such as that required to determine the alcohol content of beer, wine or cider.



Stainless steel prism dish rapidly stabilises sample temperature.

Ultrasonically welded ABS case and silicon rubber switch membrane protects against water ingress to IP65.

OPTi Digital Refractometers



Bellingham + Stanley designed OPTi digital hand held refractometers are manufactured in the UK as highly reliable premium quality instruments suitable for use in the harshest of environments across a wide application scope.

OPTi refractometers are constructed using the latest manufacturing techniques including stainless steel injection moulding to construct the easy clean prism dish, ultrasonic welding to bond the housings and a rubberized switch membrane to further protect against moisture ingress and excess wear. The OPTi refractometer may be used to control the dissolved solids or blend ratios of numerous products from fresh fruit to industrial chemicals.



Full resolution display of concentration or temperature.

Simple ZERO calibration requires only water on all models.

- Precise digital LCD readout
- Ergonomic IP65 rated design
- Shallow stainless steel prism dish
- Rapid temperature stabilisation
- Durable silicon rubber keypad
- Certificate of Calibration

Common Specifications - OPTi Refractometers

Resolution (Brix/RI)	0.1 / 0.0001 (or scale equivalent)
Accuracy (Brix / RI)	+/- 0.2 / 0.0003 (or scale equivalent)
Temperature Compensation (ATC)	ICUMSA / App. Specific / None / AG Test
Ambient / Sample Temperature Range	5-40°C / 5-95°C
Relative Humidity	<95% RH (non condensing)
Battery Life	10,000 readings (2 x AAA/LR03)

BS Bellingham + Stanley
 Bellingham + Stanley
 Longfield Road, Turbidge Walk, Kent TN2 3EY
 Web: www.bellinghamstanley.com

Product: OPTi Digital Handheld Refractometer
 Code: 28A1
 Model: Brix W+
 Serial No: 021499

Calibration Date: 08 February 2013
 Certificate No: CD000042

Certificate of calibration

This instrument has been calibrated and checked for precision at 20°C.
 Analytical Grade Water¹⁾, Surface Calibration Standards²⁾ and Calibration Oil³⁾ were employed to check the accuracy of the instrument specified above.

Sample Type	Certified Value	Sample	Test Result
% Brix (RI)	Lab. Batch	Lab. Batch	Pass
Analytical Grade Water	0.00 / 1.32209	111220320	Pass
Surface Calibration Standard	30.00 / 1.45000	813079	Pass
Calibration Oil	89.87 / 1.31732	BDC018	Pass

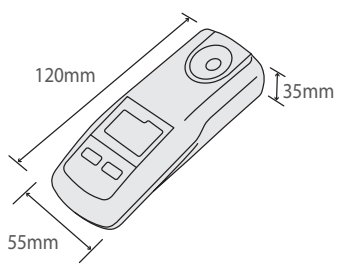
1) Reference table values for Water are derived from "Reference Information for the Reference Index of Water and Steam as a Function of Wavelength, Temperature and Density", selected by the International Association for the Properties of Water and Steam (IAPWS) and available as part of IEST Standard Reference Database 10. Refractive indices calculated from the formulation are absolute refractive indices, corrected for reflection index against air requirements by the respective absolute refractive index of air (NIST Engineering Thermology Toolbook).

2) B + S Surface Calibration Standards are prepared according to ISO6 certified calibration standards (e.g. 0034, according to ISO/IEC 17025:2005) using high purity analytical grade (AnalaR) H₂O and NaCl. Specifications represent maximum permitted total impurities, and not typical analysis, ensuring a minimum degree of quality. Certificate of suitability for samples used are available on request.

3) B + S Calibration Oils are mineral oils analysed using a high accuracy refractometer with measurement system 2801 and 20.0 °C following B + S Laboratory Procedure QC-102.

For the measurements to continue to agree with the procedure specified in this certificate of calibration, it should be kept in a clean condition and used in accordance with the instructions included. If the calibration is disrupted, contact us at 01622 830000 or Refractometer@bellinghamstanley.com.

Certificate of Calibration



Simple Operation



Fill the dish with sample



Press READ



Press ZERO for temperature



Hold ZERO then press READ to change scale
(Duo models only)

OPTi Digital Refractometers

Bellingham + Stanley's OPTi digital hand held refractometers are versatile and simple to operate and as one of the smallest instruments of its type on the market, provide for excellent on-the-spot concentration analysis that is automatically corrected for temperature. This produces highly reliable results, particularly when measurements are taken by a number of different operators.

**OPTi
ONE**

OPTi Brix 0-54

Specifications

Code	38-02
Scale	Sugar % (°Brix)
Range	0-54
Resolution	0.1
Accuracy	±0.2

**OPTi
THREE**

OPTi Brix 95+

Specifications

Code	38-A1
Scale	Sugar % (°Brix)
Range	0-95
Resolution	0.1
Accuracy	±0.2

Specialty Food & Beverage

Code	Type	Scale	Range	Resolution
38-04	Jam 75	Sugar % (°Brix)	20-75	0.1
38-06	Honey	Water-in-Honey %	10-30	0.1
38-54	Canning	A Sugar % (°Brix)	0-54	0.1
		B % Saline (NaCl)	0-28	0.1
38-75	Dispense	A Sugar % (°Brix)	0-54	0.1
		B Propylene Glycol % by volume	0-60	0.1

Other scales available

HFCS 42, HFCS 55, HFCS 90 and user defined custom models amongst many others.

Visit www.bellinghamandstanley.com for details



OPTi digital instruments are available in four common models with a choice of single and 'Duo' scale formats, and either half or the full 'Brix' range dependent on application need.

As shown below, the common models make measuring as simple as ONE, TWO, THREE, FOUR...

- Half or full Brix range
- Single and Duo scale models
- Over 40 different scale types
- Brix or scale specific ATC
- Temperature display (°C/F)
- Zero calibrate with water
- Unique "AG Fluid Test Mode"



OPTi HiBrix



Specifications

Code	38-33
Scale	Sugar % (°Brix)
Range	40-95
Resolution	0.1
Accuracy	±0.2



OPTi Brix 85



OPTi Belt Pouch

Code 38-016

Specifications

Code	38-34
Scale	Sugar % (°Brix)
Range	0-85
Resolution	0.1
Accuracy	±0.2



General Purpose & Industrial

Code	Type	Scale	Range	Resolution
38-B1	Brix 95/RI 1.54+	A Sugar % (°Brix)	0-95	0.1
		B Refractive Index (RI)	1.33-1.54	0.0001
38-39	Bio Fuel	A Ethanol %	0-20	0.5
		B Sugar % (°Brix)	0-54	0.1
Other scales available		Saline, Practical Salt Units, Glycol, Acid SG, Urea, Calcium Chloride and user defined custom models amongst others. See page 6 & 7 or visit www.bellinghamandstanley.com for details		



AG Test Mode



OPTi refractometers have an "AG Test Mode" that uniquely facilitates verification using long-life NIST traceable AG Fluids without the need to consider the scale or ATC type.

Custom Models

In the event that a particular scale is not listed, an OPTi Custom may be available.

Please contact Bellingham + Stanley or your local distributor for details.



0834

OPTi refractometers are supplied with a Certificate of Calibration as standard. OPTi refractometers are verified using UKAS Certified Reference Materials manufactured in accordance with EN ISO IEC 17025:2005.

OPTi Digital Refractometers

The Bellingham + Stanley OPTi range of application-specific instruments and custom models cater for a wide range of industrial uses, particularly where expression of the reading needs to be displayed in units relevant to the solution under test or must comply with local regulations.

Additionally, for "non sugar" solutions that cannot use commonly adopted "Brix" sugar temperature compensation, these OPTi refractometers may be programmed with correction factors specific to the solution under test. This and the direct digital readout results in a higher level of accuracy when compared to other makes of digital and all optical refractometers for "non sugar" analyses. Also, most application-specific and custom OPTi refractometers are 'Duo' models, providing two measurements from a single hand held device.

Whether it is grapes or apples being tested in the field to ascertain the optimum ripeness for harvest, dilution testing of automotive or industrial heat pump systems, analysis of salt solutions in aquaculture or aquaria, body-fluid testing by veterinarians, or sportspersons looking to enhance their performance by ensuring optimal hydration - OPTi provides a solution for all solution analyses!



Beer, Wine & Cider

Code	Type	Scale	Range	Resolution
38-41	Wine AP	A % Mass w/w	0-35	0.1
		B Alcohol Probable (AP)	0-22	0.1
38-42	Wine OE-D	A % Mass w/w	0-35	0.1
		B Oechsle (German)	30-130	1
38-45	Wine Baume	A % Mass w/w	0-35	0.1
		B °Baumé	0-28	0.1
38-48	Brew SG	A ABV (RI-°Zeiss)	10-135	0.1
		B Wort Specific Gravity (Sucrose Equivalent)	1.000-1.120	0.0005

Other scales available

°Brix, Oechsle (Swiss), KMW (Babo), °Plato and user defined custom models amongst others.

Visit www.bellinghamandstanley.com for details



Life Science & Environmental

Code	Type	Scale	Range	Resolution
38-51	Aquatic	A Seawater PPT (Parts Per Thousand)	0-180	1
		B Seawater Specific Gravity (SG)	1.000-1.070	0.0005
38-52	Sport	A Urine Specific Gravity (SG) Human (<i>not IVD</i>)	1.000-1.050	0.0005
		B Sugar % (°Brix)	0-30	0.1
38-53	Vet	A Urine Specific Gravity (SG) Small Mammal	1.000-1.050	0.0005
		B Urine Specific Gravity (SG) Large Mammal	1.000-1.050	0.0001

Other scales available
Colostrum Quality (Mares Milk), % NaCl, Practical Salt Units, Calcium Chloride, Water in Honey, Serum Protein and user defined custom models amongst others.

Visit www.bellinghamandstanley.com for details

Heat Transfer

Code	Type	Scale	Range	Resolution
38-71	HT-1 Antifreeze EG C/vol	A Ethylene Glycol % by volume	0-60	0.1
		B Ethylene Glycol °C Protection	0 to -50	1
38-72	HT-2 Plumber EG/PG vol	A Ethylene Glycol % by volume	0-60	0.1
		B Propylene Glycol % by volume	0-60	0.1
38-81	HT-11 Workshop	A % Concentration (°Brix) ¹	0-18	0.1
		B Refractive Index (RI)	1.33-1.38	0.0001
38-83	HT-13 Aviation	A Refractive Index (RI)	1.33-1.42	0.0001
		B FSII DiEGME ATC	0.0 to 0.25	0.01

Other scales available
Propylene Glycol °C Protection, Propylene Glycol °F Protection, Ethylene Glycol °F Protection, Custom antifreeze, and user defined custom models amongst many others.

Visit www.bellinghamandstanley.com for details

Automotive

Code	Type	Scale	Range	Resolution
38-65	A4 DEF/Antifreeze EG/C	A DEF	0-40	0.1
		B Ethylene Glycol °C Protection	30 to -40	1
38-66	A5 DEF/Antifreeze EG/F	A DEF	0-40	0.1
		B Ethylene Glycol °F Protection	30 to -40	1
38-67	A6 Antifreeze EG-PG/C	A Ethylene Glycol °C Protection	0 to -50	1
		B Propylene Glycol °C Protection	0 to -50	1
38-68	A7 Auto Antifreeze EG-PG/F	A Ethylene Glycol °F Protection	30 to -40	1
		B Propylene Glycol °F Protection	30 to -40	1

Other scales available
% Concentration (°Brix), Ethylene Glycol °F Protection, Propylene Glycol °C Protection, Windscreen Wash, Battery Acid SG, Battery Acid GO/NO-GO and user defined custom models amongst many others.

Visit www.bellinghamandstanley.com for details

DEF is used to describe an aqueous urea solution scale for measuring diesel exhaust fluids such as AdBlue®. AdBlue® is a registered trademark of the VDA Verband der Automobilindustrie e.V.

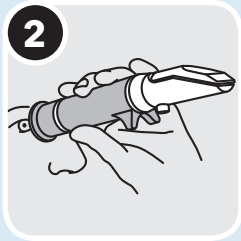
For DEF hydrometers and contamination test strips - see page 11

1. Used as an arbitrary scale for general concentration measurement.

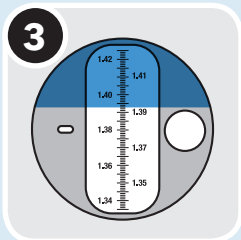
Simple Operation



Apply the sample.



View the scale



Take the reading



0834

Eclipse refractometers are supplied with a Certificate of Calibration as standard. Eclipse refractometers are verified using UKAS Certified Reference Materials manufactured in accordance with EN ISO IEC 17025:2005.

Eclipse Professional Optical Refractometers

Manufactured in the UK using only the highest quality optical components and the most modern manufacturing practices, the Eclipse refractometer is the ultimate optical hand held refractometer on the market today. A comprehensive choice of scale types offers versatility across a wide application scope from testing fruit ripeness in the field to monitoring industrial fluids in harsh machine shop environments. Eclipse refractometers have a number of unique features not available on many other brands of refractometer and are supplied complete with a foam carry case, instruction manual and a Certificate of Calibration showing traceability to International standards.

Bellingham + Stanley
Longfield Road, Tunbridge Wells, Kent TN11 9JY
Web: www.bellinghamstanley.com

Product: Eclipse Handheld Refractometer Calibration Date: 09 January 2013
Code: 45-02 Certificate No.: CE0000099
Model: Brix 30
Serial No: 039536

Certificate of calibration

This instrument has been calibrated and checked for precision at 20°C.

Analytical Grade Water⁽¹⁾, Sucrose Calibration Standards⁽²⁾ and Calibration Oils⁽³⁾ were employed to check the accuracy of the instrument specified above:

Sample Type	Certified Value % Brix (g/100g)	Sample Lot / Batch	Test Result ⁽⁴⁾
Analytical Grade Water	0.00 ± 0.0299	111220530	Pass
Sucrose Calibration Standard	30.00 ± 0.15	80362	Pass

(1) Refractive index values for Water are obtained from "Revised Formulation for the Refractive Index of Water and Seawater as a Function of Wavelength, Temperature and Density", adopted by the International Association for the Properties of Water and Steam (IAPWS) and available as part of NIST Standard Reference Database. (2) Refractive indices calculated from the formulation are absolute refractive indices, correction to refractive index against air requires division by the respective absolute refractive index of air (NIST Engineering Handbook, Fundamentals).

(3) B + S Sucrose Calibration Standards are prepared within our UKAS accredited calibration laboratory no. 0834, accredited to ISO/IEC 17025:2005 using high purity analytical grade (Food) F030M40100 Water and Sucrose. Specifications represent maximum permitted levels of impurities, and not optical analysis, ensuring a consistent degree of quality. Certificates of traceability for samples used are available on request.

(4) B + S Calibration Oils are mineral oils analysed using a high accuracy refractometer with measurement taken at 20°C then at 25°C following BS 15 Laboratory Procedure Q2-100.

(5) This certificate is a valid document.

Snap-on illuminator flap facilitates easy replacement

Certificate of Calibration

Food, Beverage, Sugar & General Models

Code	Description	Range	Scale Division
45-01	Sugar % (°Brix)	0-15	0.1
45-02	Sugar % (°Brix)	0-30	0.2
45-07	Sugar % (°Brix)	0-32	0.2
45-03	Sugar % (°Brix)	0-50	0.5
45-08	Sugar % (°Brix)	28-65	0.2
45-05	Sugar % (°Brix)	45-80	0.2
45-06	Sugar % (°Brix)	72-95	0.2
45-22	Wine - °Zeiss (ABV)	10-135	1
45-27	Water-in-Honey (%)	10-30	0.2
45-81	Low Volume (Nectar <1-micro-litre)	0-50	0.5
45-82	Low Volume (Nectar <1-micro-litre)	45-80	0.2



Smooth helical focusing eyepiece seals against moisture ingress.



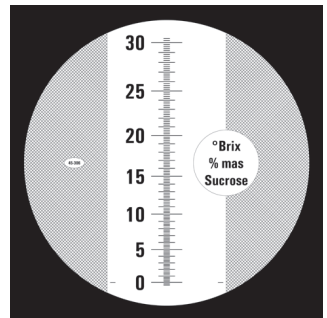
Wide rubber coated body for safe handling in harsh environments

Metal prism housing quickly stabilises hot samples

- All metal construction
- Rubber handgrip for insulation
- Robust ergonomics for easy handling
- Anti-roll supports
- High precision, clear scale
- Sample 'dribble' feed
- Zero adjust with lock
- Push on prism flap
- Ideal for hot & cold samples
- Serial numbered
- Certificate of Calibration

Industrial Models

Code	Description	Range	Scale Division
45-26	Starch (%)	0-30	0.2
45-41	Refractive Index	1.330-1.420	0.001
45-44	Antifreeze - °C Protection - Battery acid SG	0 to -40 1.1-1.35	5 0.05
45-45	Antifreeze - °F Protection - Battery acid SG	30 to -40 1.1-1.35	5 0.05
45-46	Antifreeze - % Ethylene Glycol - % Propylene Glycol	0-60 0-60	2.5 2.5
45-65	Salinity (% NaCl)	0-28	0.2



High definition easy to read scale.

Spare Illuminator Flaps (5)

Code 45-003

E-line Economy Optical Refractometers

The E-Line Automatic Temperature Compensation (ATC) Range of hand-held refractometers offers versatility at a low price. They are ideal for use in many applications including: fruit, beverage, sugar, food and industrial applications where concentration measurements are required within a light industrial environment.



- Low cost model
- All metal construction
- Rubber handgrip for insulation

Standard Models

Code	Description	Scale Division
44-801	0-10 Sugar % (°Brix)	0.1
44-802	0-18 Sugar % (°Brix)	0.1
44-803	0-32 Sugar % (°Brix)	0.2
44-804	28-62 Sugar % (°Brix)	0.2
44-805	45-82 Sugar % (°Brix)	0.5
44-812	10-30 Water-in-Honey (%)	0.1

Spare Illuminator Flaps (5)

Code 44-881

Special Application Models

44-808	E-line Aquatic	
	0-100 % Saline	1
	1.000-1.070 Saline (SG)	0.001
44-820	E-line Glycol Heat Transfer	
	0-70 EG/PG % vol/vol	5
	0 to -50 EG/PG °C Protection	5
44-821	E-line Automotive	
	0 to -50 EG/PG Protection (°C)	5
	1.1 to 1.4 Battery (SG)	0.05
	0 to -40 Windscreen (°C)	0.2
44-825	E-line Veterinary	
	1.33-1.360 RI	0.0005
	1.000-1.050 Urine (SG)	0.005
	0-12 Serum Protein g/100ml	0.2
44-828	1.3330-1.3848 RI	0.0001
44-829	1.435-1.520 RI	0.001

E-Line 80 Refractometer

The E-line 80 refractometer offers a relatively wide measuring range when compared to conventional hand held refractometers and so facilitates the measurement of a wider range of samples without the need to carry multiple instruments. The instrument has two optical inputs that allows measurement in transmitted or, for solid samples, reflected modes and is supplied with conversion tables for refractive index measurement.



Wine Models

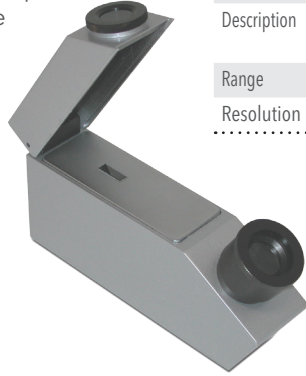
44-809	0-40 % Mass (°Brix)	0.2
	0-25 Alcohol Probable (AP)	0.2
44-817	0-32 % Mass (°Brix)	0.2
	0-140 Oechsle (German)	1
44-818	0-140 Oechsle	1
	0-27 Babo (KMW)	0.2
	0-32 % Mass (°Brix)	0.2
44-819	0-20 Baume	0.2
	0-25 Alcohol Probable (AP)	0.2

Specifications E-Line 80

Code	44-807	
Range:	Scale One	0-50 °Brix
	Scale Two	50-80 °Brix
Scale Division	1	
ATC type	Manual	

E-Line Gemological Refractometer

Refractive Index is one of the most important optical parameters used to identify and authenticate polished precious and semi-precious gemstones. The E-Line Gemological refractometer is a low cost, lightweight measuring instrument used by jewellers and traders of gemstones. The Gemological refractometer can also be used to identify whether a particular stone is Isotropic or Anisotropic (uniaxial or biaxial).



Specification

Code	44-861
Description	E-Line Gemological Refractometer
Range	1.30-1.81
Resolution	0.01

Test Kits

Bellingham + Stanley supply a number of portable test kits for specific industrial applications, including those for monitoring concentration and oil contamination of Diesel Exhaust Fluids such as AdBlue® as well as an alcohol test kit for determining the strength of beer, wine and cider used by manufacturers and trading standards officers alike.

Diesel Exhaust Fluid Test Kits

Code	Description	Range
38-65	OPTi Duo Digital Refractometer Automotive (DEF Antifreeze)	0-50 % Urea 0 to -50 °C Protection (EG)
44-862	DEF Hydrometer	GO/NO GO
44-865	DEF Hydrometer (SG)	1.086-1.093
44-863	Oil in Water Test Strips (pack of 100 strips)	



ABV Test Kit Components

Code	Description	Range	Scale Division
38-49	OPTi Duo Digital Refractometer Brew (ABV/Wort)	10-135 Zeiss 0-30 °Plato	1 0.1
45-22	ABV Eclipse Refractometer	10-135 Zeiss	1
44-839	Hydrometer (SG)	0.980 -1.050	0.001
44-838	Hydrometer Jar		





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