

Photometers

Introduction

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Light and Color

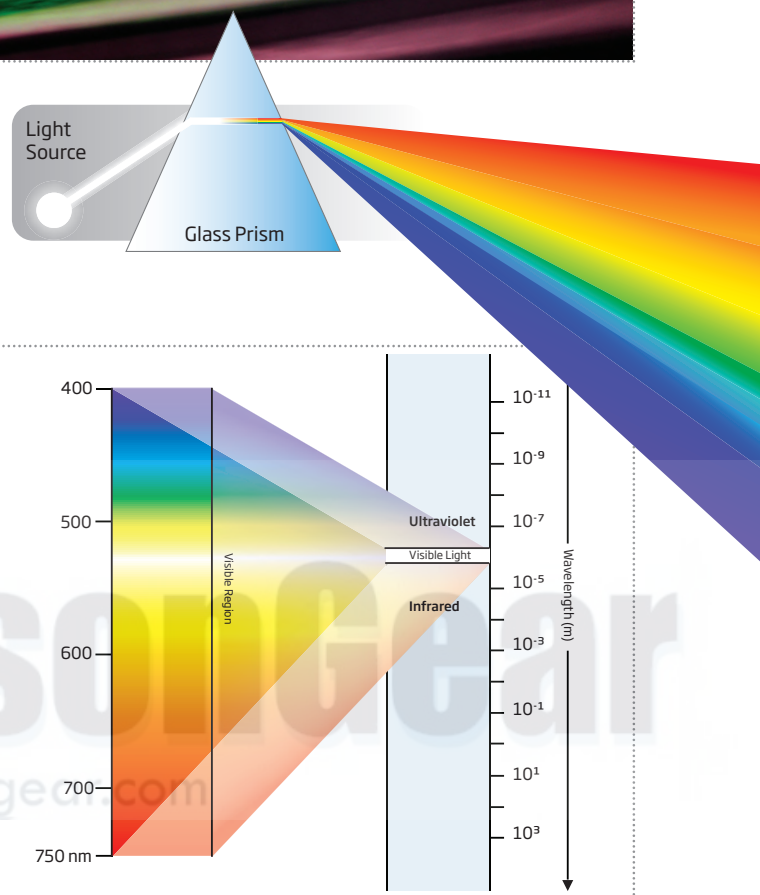
Before entering into colorimetry, we need to understand the relationship between light and color.

The simple answer is that colors are dependent on light. We do not actually see colors, what we see as color is the effect of light shining on an object. When white light shines on an object, it may be reflected, absorbed or transmitted. Glass transmits most of the light that comes into contact with it, thus it appears colorless. Snow reflects all of the light and appears white. A black cloth absorbs all light, and so appears black. A red piece of paper reflects red light better than it reflects other colors. Most objects appear colored because their chemical structure absorbs certain wavelengths of light and reflects others.

When we talk about light, we usually mean white light. A thin line of light is called a ray; a beam is made up of many rays of light. When white light passes through a prism (a triangular transparent object) the colors that make up white light disperse into seven bands of color. These bands of color are called a spectrum. Seven colors constitute white light: red, orange, yellow, green, blue, indigo, and violet. In any spectrum, the bands of color are always organized in this order from left to right.

The variation of the color of a system with change in concentration of some component is the basis of colorimetric analysis.

Suppose we shine a beam of white light at a substance that absorbs blue light. Since the blue component of the white light gets absorbed by the substance, the light that is transmitted is mostly yellow, the complementary color of blue. This yellow light reaches our eyes, and we "see" the substance as a yellow colored substance.



Wavelength (nm)	Color Absorbed	Color observed
400	Violet	Yellow-green
435	Blue	Yellow
495	Green	Purple
560	Yellow	Blue
650	Orange	Greenish blue
800	Red	Bluish green

Colorimetry

Colorimetry is simply the measurement of color. Colorimetry is concerned with the determination of the concentration of a substance by measurement of the relative absorption of light with respect to a known concentration of the substance. In visual colorimetry, natural or artificial white light is generally used as a light source, and determinations are usually made with a simple instrument termed a colorimeter, or color comparator. When the eye is replaced by a photoelectric cell the instrument is termed photoelectric colorimeter.

A colorimetric analysis is based on the principle that many substances react with each other and form a color which can indicate the concentration of the substance to be measured. When a substance is exposed to a beam of light of intensity I_0 , a portion of the radiation is absorbed by the substance's molecules and a radiation of intensity I lower than I_0 is emitted.

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The quantity of radiation absorbed is given by the Beer-Lambert Law: $A = \log \frac{I_0}{I}$

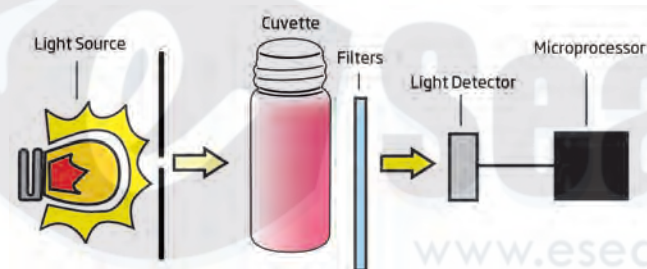
Absorbance is also given by: $A = \epsilon_\lambda \cdot C \cdot l$

where:

- A** is a dimensionless number
- ϵ_λ** the proportionality constant, is called the molar extinction coefficient or molar absorptivity; it is a constant for a given substance, provided the temperature and wavelength are constant (liter/mol · cm)
- C** concentration of the substance (mol/liter)
- l** optical distance light travels through sample (cm)

Therefore, the concentration (C) can be calculated from the absorbance of the substance determined by the emitted radiation (I), as the other factors are known.

A typical block diagram of a photometer is shown below:



Sources of light used by HANNA colorimeters:

- Tungsten lamp** an incandescent lamp having tungsten filaments
- LED** light emitting diode

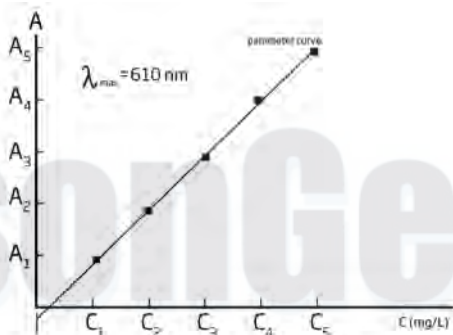
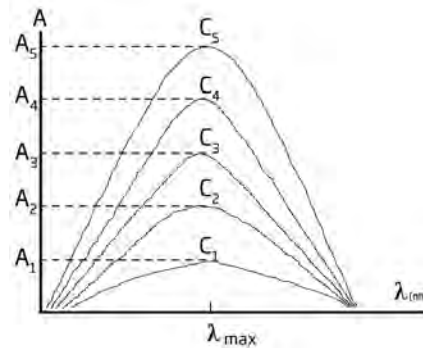
The optical distance is measured by the dimension of the cuvette containing the sample. The photoelectric cell collects the radiation (I) emitted by the sample and converts it into an electric current, producing a potential in the mV range. The microprocessor uses this potential to convert the incoming value into the desired measuring unit and to display it on the LCD.

In fact, the preparation of the solution to be measured occurs under known conditions, which are programmed into the meter's microprocessor in the form of a calibration curve. This curve is used as a reference for each measurement. It is then possible to determine unknown concentrations of a sample by inducing a colorimetric reaction, and thus obtain the mV related to the emitted

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intensity (I) (the color of the sample). By employing the calibration curve, one can determine the concentration of the sample that corresponds to the mV value.

Supposing that for one chemical substance we have one maximum absorbance at 610 nm. On the following you have one example of how the colorimeters are working:



One example of an early colorimetric analysis is Nessler's method for ammonia, which was first proposed in 1856. Nessler found that adding an alkaline solution of HgI₂ and KI to a dilute solution of ammonia produced a yellow to reddish brown colloid with the color determined by the concentration of ammonia. A comparison of the sample's color for a series of standards was used to determine the concentration of ammonia. Equal volumes of the sample and standards were transferred to a set of tubes with flat bottoms. The tubes were placed in a rack equipped at the bottom with a reflecting surface, allowing light to pass through the solution. The colors of the samples and standards were compared by looking down through the solutions. Until recently, a modified form of this method was listed as a standard method for the analysis of ammonia in water and wastewater.



Product Spotlights

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HI 83200

Multiparameter Photometer for Laboratories

10.10

HI 83200 is one of the most versatile photometers on the market. Just one meter measures up to 44 of the most important water quality parameters.

HI 83200 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI 92000 Windows® compatible software.



HI 83203

Multiparameter Photometer for Aquaculture

10.11

With the ever increasing depletion of fish stocks in the open seas, aquaculture has gained prominence and can prove essential to our future dietary needs. Monitoring and controlling parameters such as the oxygen level as well as pH and nitrate content in water is vital in ensuring profitable fish production.

Accurate control can prevent disease, increase production and even reduce the premiums on crop insurance. Research personnel, fish farm operators and wildlife specialists now have one compact and easy to use meter to keep a close tab on the most important parameters in aquaculture.

HI 83203 is a multiparameter bench meter that measures thirteen methods essential for aquaculture analysis. It has four channels allowing for a wide range of tests.



HI 83226

Multiparameter Photometer for Pools and Spas

10.22

In order to achieve ideal water conditions, swimming pool water requires testing on a daily and sometimes hourly basis for disinfection of residuals and maintaining pH levels. Equally important, calcium hardness and alkalinity levels should be monitored weekly to ensure the pool water is well balanced, thus to avoid corrosion and scale formation.

HI 83226 is a multiparameter bench meter that measures nine parameters essential for advanced pool and spa water analysis.



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Product Spotlights

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HI 96771

Chlorine, Free Ultra High Range Portable Photometer

10.38

HI 96771 has been developed to check chlorine dosing in disinfection processes with ultra high concentrations of chlorine. Thanks to the extended range from 0 to 500 mg/L (ppm), it is ideal for the food industry, such as in fruit and vegetable washing.

The HI 96771 meter measures the free chlorine (Cl_2) content in water samples and chlorine ultra high range. The methods are an adaptation of Standard Methods for the Examination of Water and Wastewater, 20th edition, 4500-Cl.

HI 96713

Phosphate LR Portable Photometers

10.59

Phosphates are particularly important for the growth and development of plant roots, and hence are one of the most common fertilizers used in agriculture.

Phosphates are also utilized in detergents and are needed, in small quantities, for heating systems. However, high concentrations of phosphates can cause environmental pollution: they are for example a primary cause of eutrophication.

For these reasons, it is necessary to closely monitor the phosphate levels present in both municipal and industrial waste water.

The HI 96713 meter measures phosphate (PO_4^{3-}) content in water, wastewater and seawater in the 0.00 to 2.50 mg/L (ppm) range.

HI 96725

Chlorine, Cyanuric Acid and pH Photometer

10.70

Legionella species is the agent that causes human Legionnaires' disease as well as the lesser form, Pontiac Fever. Transmission is facilitated by the inhalation of mist droplets containing the Legionella bacteria.

The HI 96725 measures four parameters that are crucial in monitoring for preventive maintenance or disinfection.



Comparison Guide

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Multiparameter Benchtop Photometers

Guide	HI 83200	HI 83203	HI 83205	HI 83211	HI 83209	HI 83218	HI 83206	HI 83225	HI 83215	HI 83226	HI 83216	HI 83212	HI 83210	HI 83207	HI 83213	HI 83208
Aluminum	•		•	•									•	•	•	
Alkalinity	•									•	•					
Ammonia	•	•	•	•	•	•	•	•	•			•			•	•
Bromine	•		•							•					•	
Calcium	•							•								
Chlorine Dioxide	•		•										•			
Chlorine	•	•	•		•		•			•	•	•	•	•	•	•
Chromium VI	•		•	•	•	•	•								•	•
Color of Water	•				•		•						•	•	•	
Copper	•	•	•	•	•		•			•		•		•	•	•
Cyanuric Acid	•			•			•			•	•			•		
Fluoride	•															•
Hardness	•									•	•					
Honey																
Hydrazine	•	•										•				
Iodine	•			•											•	
Iron	•		•	•						•						•
Magnesium	•							•								
Manganese	•													•		•
Maple Syrup																
Molybdenum	•		•	•			•					•		•		•
Nickel	•			•			•							•	•	•
Nitrate	•	•	•		•	•	•	•	•					•	•	•
Nitrite	•	•	•		•	•	•								•	
Nitrogen																
Oxygen, Dissolved	•	•	•		•		•						•	•	•	•
Ozone	•									•						
pH	•	•	•	•	•		•			•	•		•	•	•	•
Phosphate	•	•	•	•	•		•					•	•	•	•	•
Phosphorus	•			•	•	•	•	•	•			•		•	•	•
Potassium	•							•	•							
Silica	•		•	•	•		•					•	•		•	•
Silver	•			•	•		•					•	•	•	•	•
Sulfate	•							•								
Zinc	•		•	•	•		•						•	•		•
Page	10.10	10.11	10.12	10.13	10.14	10.15	10.16	10.17	10.18	10.22	10.23	10.24	10.26	10.27	10.28	10.29

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Multiparameter Portable Photometers

Guide	HI 96101	HI 96104	HI 96710	HI 96724	HI 96725	HI 96734	HI 96736	HI 96741	HI 96742	HI 96743	HI 96744	HI 96745	HI 96752
Bromine	•												
Calcium HR													•
Chlorine, Free	•	•	•	•	•							•	
Chlorine, Free HR						•							
Chlorine, Total	•	•	•	•	•							•	
Chlorine, Total HR						•							
Cyanuric Acid	•	•			•								
Hardness, Ca							•				•	•	
Hardness, Mg							•				•	•	
Hardness, Total							•	•			•	•	
Iodine	•												
Iron LR	•							•	•	•	•	•	
Magnesium HR													•
Manganese LR									•				
pH	•	•	•		•		•			•	•	•	
Potassium LR													
Potassium MR													
Page	10.66	10.67	10.68	10.69	10.70	10.71	10.72	10.73	10.74	10.75	10.76	10.77	10.78

Single Parameter Portable Photometers

PARAMETER	METER	PAGE
Aluminum	HI 96712	10.31
Ammonia LR	HI 96700	10.32
Ammonia MR	HI 96715	10.32
Ammonia HR	HI 96733	10.32
Anionic Surfactants	HI 96769	10.33
Bromine	HI 96716	10.34
Chloride	HI 96753	10.35
Chlorine Dioxide	HI 96738	10.36
Chlorine, Free	HI 96701	10.37
Chlorine, Free LR	HI 96762	10.37
Chlorine, Free and UHR	HI 96771	10.38
Chlorine, Free and Total	HI 96711	10.39
Chlorine, Total LR	HI 96761	10.39
Chromium VI LR	HI 96749	10.40
Chromium VI HR	HI 96723	10.40
Color of Water	HI 96727	10.41
Copper LR	HI 96747	10.42
Copper HR	HI 96702	10.42
Cyanide	HI 96714	10.43
Cyanuric Acid	HI 96722	10.44
Fluoride LR	HI 96729	10.45
Fluoride HR	HI 96739	10.45
Hardness, Ca	HI 96720	10.46
Hardness, Mg	HI 96719	10.46
Hardness, EPA	HI 96735	10.47
Honey Color	HI 96785	10.48
Hydrazine	HI 96704	10.49
Iodine	HI 96718	10.50
Iron LR	HI 96746	10.51
Iron HR	HI 96721	10.51

PARAMETER	METER	PAGE
Manganese LR	HI 96748	10.52
Manganese HR	HI 96709	10.52
Maple Syrup	HI 96759, HI 96760	10.53
Molybdenum	HI 96730	10.54
Nickel LR	HI 96740	10.55
Nickel HR	HI 96726	10.55
Nitrate, as Nitrogen	HI 96728	10.56
Nitrate	HI 96786	10.56
Nitrite LR	HI 96707	10.57
Nitrite HR	HI 96708	10.57
Oxygen, Dissolved	HI 96732	10.58
Phosphate LR	HI 96713	10.59
Phosphate HR	HI 96717	10.59
Phosphorus	HI 96706	10.60
Potassium	HI 96750	10.61
Silica	HI 96705	10.62
Silica HR	HI 96770	10.62
Silver	HI 96737	10.63
Sulfate	HI 96751	10.64
Zinc	HI 96731	10.65
Blood Plasma	HI 95765	10.79

Wine and Olive Oil Measurement Photometers

Copper in Wine	HI 83740	10.82
Iron in Wine	HI 83741	10.83
Color and Total Phenols in Wine	HI 83742	10.84
Concentration of Reducing Sugars	HI 83746	10.86
Tartaric Acid in Wine	HI 83748	10.87
Peroxide in Olive Oils	HI 83730	10.88

Multiparameter Bench Photometers

Introduction

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- Up to 45 measurement methods
- Light blocking cuvette holder
- Backlit LCD
- BEPS
(Battery Error Prevention System) Alerts users in the event a low battery could effect readings
- PC compatible via USB
- Powered by rechargeable batteries or 12 VDC
- Save and recall logged data at the touch of a button.
- On-screen tutorial
With the tutorial function enabled, short guides relating to current operation are displayed.
- HELP button
Screen specific help can viewed at the touch of a button.
- Method selection
Users can easily select parameters via the Method button.
- Setup button
Instrument preferences such as backlight intensity and screen contrast can be changed via the setup button.



The new series of HI 83xxx benchtop photometers from HANNA offers all the features from our previous popular series plus many upgrades and improvements that make these instruments much more versatile and easy to use.

These instruments have been redesigned to accommodate more sophisticated optical systems, resulting in greater reproducibility. These new casings feature a cuvette compartment door that will eliminate external light disturbances.

These photometers also feature a graphic, backlit LCD which clearly displays the method selection. Each method's measuring procedure is shown on the LCD taking the user step by step through the process. At any stage in the measurement process or during setup, context sensitive help can be displayed by pressing the help button. Additionally, the help screen also lists the required reagent sets, accessories and customer support contact information. All these features are available in a user selectable language.

Each HANNA photometer eliminates confusion by automatically converting readings to other chemical forms. Common conversions are available at the touch of a button



GENERAL ACCESSORIES

HI 731318	Cloth for wiping cuvettes (4 pcs)
HI 731321	Glass cuvettes (4 pcs)
HI 731325W	New cap for cuvette (4 pcs)
HI 740034P	Cap for 100 mL beaker (10 pcs)
HI 740036P	100 mL plastic beaker (10 pcs)
HI 740038	60 mL glass bottle and stopper
HI 740142	1 mL graduated syringe
HI 740143	1 mL graduated syringe (6 pcs)
HI 740144	Pipette tip (6 pcs)
HI 740155	Plastic pipette (20 pcs)
HI 740220	25 mL glass cylinder with caps (2 pcs)
HI 740223	170 mL plastic beaker
HI 740224	170 mL plastic beaker (12 pcs)
HI 740225	60 mL graduated syringe
HI 740226	5 mL graduated syringe
HI 740227	Filter assembly
HI 740228	Filter disc (25 pcs)
HI 740229	100 mL graduated cylinder
HI 740230	230 mL Demineralized water
HI 92000	Windows® Compatible Software
HI 920013	USB cable for PC connection
HI 93703-50	Cuvette cleaning solution, 230 mL
HI 93703-54	Dried resin (100 g)
HI 93703-55	Activated Carbon (50 pcs)

GENERAL SPECIFICATIONS FOR ALL MODELS

Light Source	up to 5 tungsten lamps with different narrow band interference filters. (see above for operating wavelengths according to methods.)
Light Detector	silicon photocell
Environment	0 to 50°C (32 to 122°F); max 90% RH non-condensing
Power Supply	external 12 VDC power adapter or built-in rechargeable battery
Dimensions	235 x 200 x 110 mm (9.2 x 7.87 x 4.33")
Weight	0.9 Kg (2 lbs.)



Application Designed Photometers

Since 1978, HANNA has introduced instruments tailored to the needs of a specific application or industry.

From this philosophy we have created **Application Designed Photometers** to satisfy the needs of your specific application or industry.

Aquaculture	HI 83203
Boilers & Cooling Towers	HI 83205
Chemical Manufacturers	HI 83211
Education	HI 83209
Environmental Apps	HI 83218
Environmental Testing	HI 83206
Honey Color Analysis	HI 83221
Laboratories	HI 83200
Laboratories, with COD	HI 83099
Nutrient Analyses	HI 83215
Pool and Spa Applications	HI 83216
Pool and Spa Applications	HI 83226
Power Plant Utilities	HI 83212
Pulp & Paper Mills	HI 83210
Wastewater Analysis	HI 83214
Wastewater Analysis	HI 83224
Wastewater, Industrial	HI 83207
Wastewater, Municipal	HI 83213
Water Conditioning	HI 83208

Narrow band Interference filter wavelengths

Aluminum	525 nm	Fluoride	575 nm	Nitrite LR	525 nm
Alkalinity	575 nm	Calcium Hardness	525 nm	Oxygen, Dissolved	420 nm
Ammonia MR	420 nm	Mg Hardness	525 nm	Ozone	525 nm
Ammonia LR	420 nm	Hydrazine	420 nm	pH	525 nm
Bromine	525 nm	Iodine	525 nm	Phosphate HR	525 nm
Calcium	466 nm	Iron HR	525 nm	Phosphate LR	610 nm
Chlorine, Free	525 nm	Iron LR	575 nm	Phosphorus	525 nm
Chlorine, Total	525 nm	Magnesium	466 nm	Potassium HR	610 nm
Chlorine Dioxide	575 nm	Manganese HR	525 nm	Potassium MR	610 nm
Chromium VI HR	525 nm	Manganese LR	575 nm	Potassium LR	610 nm
Chromium VI LR	525 nm	Molybdenum	420 nm	Silica	610 nm
Color of Water	420 nm	Nickel HR	575 nm	Silver	575 nm
Copper HR	575 nm	Nickel LR	575 nm	Sulfate	466 nm
Copper LR	575 nm	Nitrate	525 nm	Zinc	575 nm
Cyanuric Acid	525 nm	Nitrite HR	575 nm		



Cuvette holder with door

The cuvette cover aids in stopping stray light from effecting measurements.

HI 83200

Multiparameter Photometer for Laboratories

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HI 83200 is one of the most versatile photometers on the market. Just one meter measures up to 44 methods critical to analyzing water quality.

The optical system of HI 83200 is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

HI 83200 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI 92000 Windows® compatible software.



ADP
Application Designed Photometers



ORDERING INFORMATION

HI 83200-01 (115V), HI 83200-02 (230V) and HI 83200-03 (AUS plug) is supplied with sample cuvettes and caps (4 ea.), sample preparation kit, cloth for wiping cuvettes, 60 mL glass bottle for dissolved oxygen analysis, scissors, AC/DC power adapter, instruction manual.

HI 83200-100 sample preparation kit contains 10 mL cuvettes (4) with caps, 100 mL plastic beaker, 170 mL plastic beaker, 100 mL graduated cylinder, 60 mL syringe with screw rim, 5 mL syringe, funnel, filter discs (25), spoon, pipettes (2), carbon powder packets (50), demineralizer bottle with filter cap for approximately 12 liters of deionized water (dependant on hardness of water to be tested).

TEST	RANGE	METHOD	REAGENT CODE†
Alkalinity	0 to 500 mg/L (ppm) as CaCO ₃	EDTA Colorimetric	HI 93755-01
Aluminum	0.00 to 1.00 mg/L (ppm)	Aluminon	HI 93712-01
Ammonia MR	0.00 to 10.00 mg/L (ppm)	Nessler	HI 93715-01
Ammonia LR	0.00 to 3.00 mg/L (ppm)	Nessler	HI 93700-01
Bromine	0.00 to 8.00 mg/L (ppm)	DPD	HI 93716-01
Calcium	0 to 400 mg/L (ppm)	Oxalate	HI 937521-01**
Chlorine Dioxide	0.00 to 2.00 mg/L (ppm)	Chlorophenol Red	HI 93738-01
Chlorine*, Free	0.00 to 2.50 mg/L (ppm)	DPD	HI 93701-01
Chlorine*, Total	0.00 to 3.50 mg/L (ppm)	DPD	HI 93711-01
Chromium VI HR	0 to 1000 µg/L	Diphenylcarbohydrazide	HI 93723-01
Chromium VI LR	0 to 300 µg/L	Diphenylcarbohydrazide	HI 93749-01
Color of Water	0 to 500 PCU	Colorimetric Platinum Cobalt	—
Copper HR	0.00 to 5.00 mg/L (ppm)	Bicinchoninate	HI 93702-01
Copper LR	0 to 1000 µg/L	Bicinchoninate	HI 95747-01
Cyanuric Acid	0 to 80 mg/L (ppm)	Turbidimetric	HI 93722-01
Fluoride	0.00 to 2.00 mg/L (ppm)	SPADNS	HI 93729-01
Hardness, Calcium	0.00 to 2.70 mg/L (ppm) (as CaCO ₃)	Calmagite	HI 93720-01
Hardness, Magnesium	0.00 to 2.00 mg/L (ppm) (as CaCO ₃)	EDTA Colorimetric	HI 93719-01
Hydrazine	0 to 400 µg/L	p-Dimethylaminobenzaldehyde	HI 93704-01
Iodine	0.0 to 12.5 mg/L (ppm)	DPD	HI 93718-01
Iron HR	0.00 to 5.00 mg/L (ppm)	Phenanthroline	HI 93721-01
Iron LR	0 to 400 µg/L	TPTZ	HI 93746-01**
Magnesium	0 to 150 mg/L (ppm)	Calmagite	HI 937520-01**
Manganese HR	0.0 to 20.0 mg/L (ppm)	Periodate	HI 93709-01
Manganese LR	0 to 300 µg/L	PAN	HI 93748-01**
Molybdenum	0.0 to 40.0 mg/L (ppm)	Mercaptoacetic Acid	HI 93730-01
Nickel HR	0.00 to 7.00 g/L	Photometric	HI 93726-01
Nickel LR	0.000 mg/L to 1.000 mg/L (ppm)	PAN	HI 93740-01**
Nitrate	0.0 to 30.0 mg/L (ppm)	Cadmium Reduction	HI 93728-01
Nitrite HR	0 to 150 mg/L (ppm)	Ferrous Sulfate	HI 93708-01
Nitrite LR	0 to 1.15 mg/L (ppm)	Diazotization	HI 93707-01
Oxygen, Dissolved (DO)	0.0 to 10.0 mg/L (ppm)	Winkler	HI 93732-01
Ozone	0.00 to 2.00 mg/L (ppm)	DPD	HI 93757-01
pH	6.5 to 8.5 pH	Phenol Red	HI 93710-01
Phosphate HR	0.0 to 30.0 mg/L (ppm)	Amino Acid	HI 93717-01
Phosphate LR	0.00 to 2.50 mg/L (ppm)	Ascorbic Acid	HI 93713-01
Phosphorus	0.0 to 15.0 mg/L (ppm)	Amino Acid	HI 93706-01
Potassium HR	20 to 200 mg/L (ppm)	Turbidimetric Tetraphenylborate	HI 93750-01
Potassium MR	10 to 100 mg/L (ppm)	Turbidimetric Tetraphenylborate	HI 93750-01
Potassium LR	0.0 to 20.0 mg/L (ppm)	Turbidimetric Tetraphenylborate	HI 93750-01
Silica	0.00 to 2.00 mg/L (ppm)	Heteropoly blue	HI 93705-01
Silver	0.000 to 1.000 mg/L (ppm)	PAN	HI 93737-01**
Sulfate	0 to 100 mg/L (ppm)	Turbidimetric	HI 93751-01
Zinc	0.00 to 3.00 mg/L (ppm)	Zincon	HI 93731-01

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.

† Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.

* For Chlorine, liquid reagents are available. ** Reagents for 50 tests, replace -01 for -03 for 150 tests

For a complete list of Reagents, see Reagents Section 18.

Multiparameter Photometer for Aquaculture

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With the ever increasing depletion of fish stocks in the open seas, aquaculture has gained prominence and can prove essential to our future dietary needs. Monitoring and controlling parameters such as the oxygen level as well as pH and nitrate content in water is vital in ensuring profitable fish production.

Accurate control can prevent disease, increase production and even reduce the premiums on crop insurance. Research personnel, fish farm operators and wildlife specialists now have one compact and easy to use meter to keep a close tab on the most important parameters in aquaculture.

HI 83203 is a multiparameter bench meter that measures thirteen methods essential for aquaculture analysis. It has four channels allowing for a wide range of tests.

The optical system of HI 83203 is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

HI 83203 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI 92000 Windows® compatible software.

TEST	RANGE	METHOD	REAGENTS [†]
Ammonia LR	0.00 to 3.00 mg/L (ppm)	Nessler	HI 93700-01
Ammonia MR	0.00 to 10.00 mg/L (ppm)	Nessler	HI 93715-01
Chlorine free*	0.00 to 2.50 mg/L (ppm)	DPD	HI 93701-01
Chlorine total*	0.00 to 3.50 mg/L (ppm)	DPD	HI 93711-01
Copper HR	0.00 to 5.00 mg/L (ppm)	Bicinchoninate	HI 93702-01
Copper LR	0 to 1000 µg/L	Bicinchoninate	HI 95747-01
Nitrate	0.0 to 30.0 mg/L (ppm)	Cadmium Reduction	HI 93728-01
Nitrite HR	0 to 150 mg/L (ppm)	Ferrous Sulfate	HI 93708-01
Nitrite LR	0.00 to 1.15 mg/L (ppm)	Diazotization	HI 93707-01
Oxygen, Dissolved (DO)	0.0 to 10.0 mg/L (ppm)	Winkler	HI 93732-01
pH	6.5 to 8.5 pH	Phenol Red	HI 93710-01
Phosphate HR	0.0 to 30.0 mg/L (ppm)	Amino Acid	HI 93717-01
Phosphate LR	0.00 to 2.50 mg/L (ppm)	Ascorbic Acid	HI 93713-01

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.
[†] Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.

* For Chlorine measurements, liquid reagents are available

For a complete list of Reagents, see Reagents Section 18.

ADP 13
Application Designed Photometers methods



ORDERING INFORMATION

HI 83203-01 (115V) and HI 83203-02 (230V) are supplied with sample cuvettes and caps (2 ea.), cloth for wiping cuvettes, 60 mL glass bottle for dissolved oxygen analysis, scissors, AC/DC power adapter, and instruction manual.

HI 83205

Multiparameter Photometer for Boilers and Cooling Towers

www.esaseongear.com
[click to buy: www.hannameters.com](http://www.hannameters.com)

HI 83205 is a multiparameter bench meter that measures twenty-four methods essential for monitoring boiling and cooling towers. It has four channels allowing for a wide range of tests.

With just one unit, technicians can keep an eye on 24 methods needed for proper and efficient functioning of their systems. The parameters that HI 83205 monitors include: iron, whose presence can be an important indication of corrosion; chlorine to circumvent microbiological fouling; dissolved oxygen, whose presence causes corrosion; silica can point to a contamination of the feed water while phosphate is important to reduce scaling.

The optical system of HI 83205 is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

HI 83205 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI 92000 Windows® compatible software.



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methods



ORDERING INFORMATION

HI 83205-01 (115V) and HI 83205-02 (230V) are supplied sample cuvettes and caps (2 ea.), cloth for wiping cuvettes, 60 mL glass bottle for dissolved oxygen analysis, scissors, AC/DC power adapter, and instruction manual.

TEST	RANGE	METHOD	REAGENT CODE†
Aluminum	0.00 to 1.00 mg/L (ppm)	Aluminon	HI 93712-01
Ammonia MR	0.00 to 10.00 mg/L (ppm)	Nessler	HI 93715-01
Ammonia LR	0.00 to 3.00 mg/L (ppm)	Nessler	HI 93700-01
Bromine	0.00 to 8.00 mg/L (ppm)	DPD	HI 93716-01
Chlorine Dioxide	0.00 to 2.00 mg/L (ppm)	Chlorophenol Red	HI 93738-01
Chlorine*, Free	0.00 to 2.50 mg/L (ppm)	DPD	HI 93701-01
Chlorine*, Total	0.00 to 3.50 mg/L (ppm)	DPD	HI 93711-01
Chromium VI HR	0 to 1000 µg/L	Diphenylcarbohydrazide	HI 93723-01
Chromium VI LR	0 to 300 µg/L	Diphenylcarbohydrazide	HI 93749-01
Copper HR	0.00 to 5.00 mg/L (ppm)	Bicinchoninate	HI 93702-01
Copper LR	0 to 1000 µg/L	Bicinchoninate	HI 95747-01
Hydrazine	0 to 400 µg/L	p-Dimethylaminobenzaldehyde	HI 93704-01
Iron HR	0.00 to 5.00 mg/L (ppm)	Phenantroline	HI 93721-01
Iron LR	0 to 400 µg/L	TPTZ	HI 93746-01**
Molybdenum	0.0 to 40.0 mg/L (ppm)	Mercaptoacetic Acid	HI 93730-01
Nitrate	0.0 to 30.0 mg/L (ppm)	Cadmium Reduction	HI 93728-01
Nitrite HR	0 to 150 mg/L (ppm)	Ferrous Sulfate	HI 93708-01
Nitrite LR	0.00 to 0.35 mg/L (ppm)	Diazotization	HI 93707-01
Oxygen, Dissolved (DO)	0.0 to 10.0 mg/L (ppm)	Winkler	HI 93732-01
pH	6.5 to 8.5 pH	Phenol red	HI 93710-01
Phosphate HR	0.0 to 30.0 mg/L (ppm)	Amino Acid	HI 93717-01
Phosphate LR	0.00 to 2.50 mg/L (ppm)	Ascorbic Acid	HI 93713-01
Silica	0.00 to 2.00 mg/L (ppm)	Heteropoly blue	HI 93705-01
Zinc	0.00 to 3.00 mg/L (ppm)	Zincon	HI 93731-01

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.

† Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.

* For Chlorine, liquid reagents are available. ** Reagents for 50 tests

For a complete list of Reagents, see Reagents Section 18.

Multiparameter Photometer for Chemical Manufacturers

www.eseasongear.com

click to buy: www.hannameters.com



The chemical manufacturing industry creates a multitude of environmental impacts; it is one of the largest users of natural resources. In order to respect government regulation requirements, all manufacturers must monitor and control their emissions.

Chemical manufacturers use a variety of water quantities, depending on the product manufactured and production processes.

The primary uses of water are for non-contact cooling, steam applications, and product processing. The production of various chemicals requires different amounts of water. For example, producing silicon-based chemicals requires large quantities of water, yet the top manufactured chemicals by volume (including nitrogen, ammonia, phosphoric acid) require far less water during production. Throughout the industry, more than 80% of the water used for cooling and steam is recycled. Processes of water recycling varies widely, and need to be strictly monitored and controlled in order to meet regulations.

HI 83211 is a multiparameter bench meter that measures twenty-one methods essential for chemical manufacturing analysis. It has five channels allowing for a wide range of tests.

The optical system of HI 83211 is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

HI 83211 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI 92000 Windows® compatible software.

TEST	RANGE	METHOD	REAGENT CODE [†]
Aluminum	0.00 to 1.00 mg/L (ppm)	Aluminon	HI 93712-01
Ammonia LR	0.00 to 3.00 mg/L (ppm)	Nessler	HI 93700-01
Ammonia MR	0.00 to 10.00 mg/L (ppm)	Nessler	HI 93715-01
Chromium VI HR	0 to 1000 µg/L	Diphenylcarbohydrazide	HI 93723-01
Chromium VI LR	0 to 300 µg/L	Diphenylcarbohydrazide	HI 93749-01
Copper HR	0.00 to 5.00 mg/L (ppm)	Bicinchoninate	HI 93702-01
Copper LR	0 to 1000 µg/L	Bicinchoninate	HI 95747-01
Cyanuric Acid	0 to 80 mg/L (ppm)	Turbidimetric	HI 93722-01
Iodine	0.0 to 12.5 mg/L (ppm)	DPD	HI 93718-01
Iron HR	0.00 to 5.00 mg/L (ppm)	Phenantroline	HI 93721-01
Iron LR	0 to 400 µg/L	TPTZ	HI 93746-01**
Molybdenum	0.0 to 40.0 mg/L (ppm)	Mercaptoacetic Acid	HI 93730-01
Nickel HR	0.00 to 7.00 g/L	Photometric	HI 93726-01
Nickel LR	0.000 to 1.000 mg/L (ppm)	PAN	HI 93740-01**
pH	6.5 to 8.5 pH	Phenol Red	HI 93710-01
Phosphate HR	0.0 to 30.0 mg/L (ppm)	Amino Acid	HI 93717-01
Phosphate LR	0.00 to 2.50 mg/L (ppm)	Ascorbic Acid	HI 93713-01
Phosphorus	0.0 to 15.0 mg/L (ppm)	Amino Acid	HI 93706-01
Silica	0.00 to 2.00 mg/L (ppm)	Heteropoly blue	HI 93705-01
Silver	0.000 to 1.000 mg/L (ppm)	PAN	HI 93737-01**
Zinc	0.00 to 3.00 mg/L (ppm)	Zincon	HI 93731-01

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.

[†] Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.

** Reagents for 50 tests

For a complete list of Reagents, see Reagents Section 18.

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Application Designed Photometers

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ORDERING INFORMATION

HI 83211-01 (115V) and HI 83211-02 (230V) is supplied with sample cuvettes and caps (2 ea.), cloth for wiping cuvettes, scissors, AC/DC power adapter, and instruction manual.

HI 83209

Multiparameter Photometer for Education

www.esaseongear.com
[click to buy: www.hannameters.com](http://www.hannameters.com)

HI 83209 is a multiparameter bench meter dedicated to educational use. It measures twenty methods, and has four channels allowing for a wide range of tests.

HI 83209 has been designed to be used both indoors and out. In fact, with its splashproof keyboard, rechargeable battery and 12 VDC adapter, HI 83209 is as equally at home in a busy school lab as out near a pond.

The optical system of HI 83209 is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

HI 83209 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI 92000 Windows® compatible software.



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ORDERING INFORMATION

HI 83209-01 (115V) and **HI 83209-02** (230V) is supplied with sample cuvettes (3), cloth for wiping cuvettes, 60 mL glass bottle for dissolved oxygen, scissors, AD/DC power adapter, and instruction manual.

TEST	RANGE	METHOD	REAGENT CODE†
Ammonia MR	0.00 to 10.00 mg/L (ppm)	Nessler	HI 93715-01
Ammonia LR	0.00 to 3.00 mg/L (ppm)	Nessler	HI 93700-01
Chlorine*, Free	0.00 to 2.50 mg/L (ppm)	DPD	HI 93701-01
Chlorine*, Total	0.00 to 3.50 mg/L (ppm)	DPD	HI 93711-01
Chromium VI HR	0 to 1000 µg/L	Diphenylcarbohydrazide	HI 93749-01
Chromium VI LR	0 to 300 µg/L	Diphenylcarbohydrazide	HI 93723-01
Color of Water	0 to 500 PCU	Colorimetric platinum cobalt	—
Copper HR	0.00 to 5.00 mg/L (ppm)	Bicinchoninate	HI 93702-01
Copper LR	0 to 1000 µg/L	Bicinchoninate	HI 95747-01
Nitrate	0.0 to 30.0 mg/L (ppm)	Cadmium Reduction	HI 93728-01
Nitrite HR	0 to 150 mg/L (ppm)	Ferrous Sulfate	HI 93708-01
Nitrite LR	0.00 to 1.15 mg/L (ppm)	Diazotization	HI 93707-01
Oxygen, Dissolved (DO)	0.0 to 10.0 mg/L (ppm)	Winkler	HI 93732-01
pH	6.5 to 8.5 pH	Phenol Red	HI 93710-01
Phosphate HR	0.0 to 30.0 mg/L (ppm)	Amino Acid	HI 93717-01
Phosphate LR	0.00 to 2.50 mg/L (ppm)	Ascorbic Acid	HI 93713-01
Phosphorus	0.0 to 15.0 mg/L (ppm)	Amino Acid	HI 93706-01
Silica	0.00 to 2.00 mg/L (ppm)	Heteropoly blue	HI 93705-01
Silver	0.000 to 1.000 mg/L (ppm)	PAN	HI 93737-01**
Zinc	0.00 to 3.00 mg/L (ppm)	Zincon	HI 93731-01

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.

† Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.

* For Chlorine, liquid reagents are available. ** Reagents for 50 tests

For a complete list of Reagents, see Reagents Section 18.



With Great Products, Come Great Results™

Multiparameter Photometer for Environmental Analysis

www.easeongear.com

click to buy: www.hannameters.com



HI 83218 is a multiparameter bench meter that measures five parameters essential for environmental analysis. It has three channels allowing for a wide range of tests.

The HI 83218 is designed to be simple to use and offer high accuracy measurements at a low cost per test. In order to improve resolution and cover a wider range, there are dual scales for ammonia, chromium and nitrite.

The optical system of HI 83218 is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

HI 83218 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI 92000 Windows® compatible software.

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Application Designed Photometers

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TEST	RANGE	METHOD	REAGENTS [†]
Ammonia HR	0.0 to 50.0 mg/L (ppm)	Nessler	HI 93733-01
Ammonia MR	0.00 to 10.00 mg/L (ppm)	Nessler	HI 93715-01
Chromium VI HR	0 to 1000 µg/L	Diphenylcarbohydrazide	HI 93723-01
Chromium VI LR	0 to 300 µg/L	Diphenylcarbohydrazide	HI 93749-01
Nitrate	0.0 to 30.0 mg/L (ppm)	Cadmium Reduction	HI 93728-01
Nitrite HR	0 to 150 mg/L (ppm)	Ferrous Sulfate	HI 93708-01
Nitrite LR	0.00 to 1.15 mg/L (ppm)	Diazotization	HI 93707-01
Phosphorus	0.0 to 15.0 mg/L (ppm)	Amino Acid	HI 93706-01

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.
[†] Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.

For a complete list of Reagents, see Reagents Section 18.



ORDERING INFORMATION

HI 83218-01 (115V) and **HI 83218-02** (230V) is supplied with sample cuvettes and caps (2 ea.), cloth for wiping cuvettes (1), scissors, AC/DC power adapter, and instruction manual.

HI 83206

Multiparameter Photometer for Environmental Testing

www.easeongear.com
[click to buy: www.hannameters.com](http://www.hannameters.com)

HI 83206 is a multiparameter bench photometer dedicated to environmental testing. Critical environmental parameters such as pH, dissolved oxygen, nitrite, ammonia, chlorine and phosphorus or pollutants like chromium VI, nickel, silver and zinc can be monitored with this meter. This instrument measures 24 different methods, and has four measuring channels for a wide range of tests.

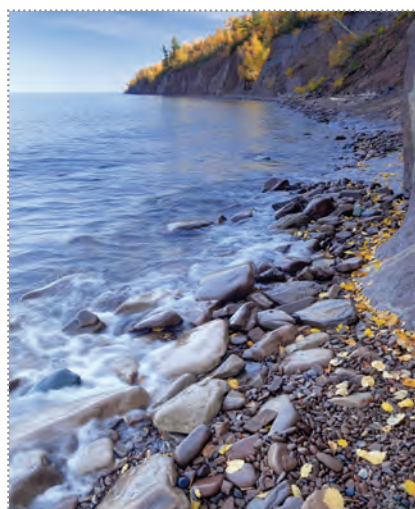
The optical system of HI 83206 is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

HI 83206 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI 92000 Windows® compatible software.



ADP
Application Designed Photometers

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ORDERING INFORMATION

HI 83206-01 (115V) and HI 83206-02 (230V) are supplied with sample cuvettes and caps (3 ea), cloth for wiping cuvettes (1), 60 mL glass bottle for dissolved oxygen (1), scissors, AC/DC power adapter and instruction manual.

TEST	RANGE	METHOD	REAGENT CODE [†]
Ammonia MR	0.00 to 10.00 mg/L (ppm)	Nessler	HI 93715-01
Ammonia LR	0.00 to 3.00 mg/L (ppm)	Nessler	HI 93700-01
Chlorine*, Free	0.00 to 2.50 mg/L (ppm)	DPD	HI 93701-01
Chlorine*, Total	0.00 to 3.50 mg/L (ppm)	DPD	HI 93711-01
Chromium VI HR	0 to 1000 µg/L	Diphenylcarbohydrazide	HI 93723-01
Chromium VI LR	0 to 300 µg/L	Diphenylcarbohydrazide	HI 93749-01
Color of Water	0 to 500 PCU	Colorimetric platinum cobalt	—
Copper HR	0.00 to 5.00 mg/L (ppm)	Bicinchoninate	HI 93702-01
Copper LR	0 to 1000 µg/L	Bicinchoninate	HI 95747-01
Cyanuric Acid	0 to 80 mg/L (ppm)	Turbidimetric	HI 93722-01
Molybdenum	0.0 to 40.0 mg/L (ppm)	Mercaptoacetic Acid	HI 93730-01
Nickel HR	0.00 to 7.00 g/L	Photometric	HI 93726-01
Nickel LR	0.000 to 1.000 mg/L (ppm)	PAN	HI 93740-01**
Nitrate	0.0 to 30.0 mg/L (ppm)	Cadmium Reduction	HI 93728-01
Nitrite HR	0 to 150 mg/L (ppm)	Ferrous Sulfate	HI 93708-01
Nitrite LR	0.00 to 1.15 mg/L (ppm)	Diazotization	HI 93707-01
Oxygen, Dissolved (DO)	0.0 to 10.0 mg/L (ppm)	Winkler	HI 93732-01
pH	6.5 to 8.5 pH	Phenol Red	HI 93710-01
Phosphate HR	0.0 to 30.0 mg/L (ppm)	Amino Acid	HI 93717-01
Phosphate LR	0.00 to 2.50 mg/L (ppm)	Ascorbic Acid	HI 93713-01
Phosphorus	0.0 to 15.0 mg/L (ppm)	Amino Acid	HI 93706-01
Silica	0.00 to 2.00 mg/L (ppm)	Heteropoly blue	HI 93705-01
Silver	0.000 to 1.000 mg/L (ppm)	PAN	HI 93737-01**
Zinc	0.00 to 3.00 mg/L (ppm)	Zincon	HI 93731-01

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.

[†] Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.

* For chlorine, liquid reagents are available. ** Reagents for 50 tests

For a complete list of Reagents, see Reagents Section 18.

Nutrient Analysis Photometer for Greenhouses and Hydroponics

www.easeongear.com

click to buy: www.hannainstruments.com



Nitrogen, phosphorus, and potassium (NPK) are often the first three factors considered when making recommendations to growers. Compared to the HI 83215, the HI 83225 provides control over three additional important growing factors: sulfur (most common as sulfates), calcium and magnesium.

HI 83225 is designed for the hydroponics and greenhouse industries to measure seven nutrients commonly present in fertilizer enriched solutions. It can measure fifteen different methods using specific liquid or powder reagents, and has four measuring channels for a wide range of tests.

The optical system of HI 83225 is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

HI 83225 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI 92000 Windows® compatible software.

TEST	RANGE	METHOD	REAGENTS
Ammonia HR	0 to 100 mg/L (ppm)	Nessler	HI 93715-01
Ammonia MR	0.0 to 50.0 mg/L (ppm)	Nessler	HI 93715-01
Ammonia LR	0.0 to 10.0 mg/L (ppm)	Nessler	HI 93715-01
Nitrate HR	0 to 300 mg/L (ppm)	Cadmium Reduction	HI 93728-01
Nitrate MR	0 to 150 mg/L (ppm)	Cadmium Reduction	HI 93728-01
Nitrate LR	0.0 to 30.0 mg/L (ppm)	Cadmium Reduction	HI 93728-01
Phosphorus HR	0 to 100 mg/L (ppm)	Amino Acid	HI 93706-01
Phosphorus MR	0.0 to 50.0 mg/L (ppm)	Amino Acid	HI 93706-01
Phosphorus LR	0.0 to 10.0 mg/L (ppm)	Amino Acid	HI 93706-01
Potassium HR	20 to 200 mg/L (ppm)	Turbidimetric	HI 93750-01
Potassium MR	10 to 100 mg/L (ppm)	Turbidimetric	HI 93750-01
Potassium LR	0.0 to 20.0 mg/L (ppm)	Turbidimetric	HI 93750-01
Calcium	0 to 400 mg/L (ppm)	Oxalate	HI 937521-01**
Magnesium	0 to 150 mg/L (ppm)	Calmagite	HI 937520-01**
Sulfate	0 to 100 mg/L (ppm)	Turbidimetric	HI 93751-01

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.
 † Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.
 * For chlorine, liquid reagents are available. ** Reagents for 50 tests (-01) and 150 tests (-03)

For a complete list of Reagents, see Reagents Section 18.

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Application Designed Photometers

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ORDERING INFORMATION

HI 83225-01 (115V) and **HI 83225-02** (230V) are supplied with sample cuvettes and caps (4 ea.), sample preparation kit, cloth for wiping cuvettes (1), scissors, AC/DC power adapter and instruction manual

HI 83225-100 kit includes 10 mL cuvettes and caps (4 ea.), 100 mL plastic beaker, 170 mL plastic beaker, 100 mL graduated cylinder, 60 mL syringe with screw rim, 5 mL syringe, funnel, filter discs (25), spoon, pipettes (2), carbon powder packets (50) and demineralizer bottle with filter cap for approximately 12 liters of deionized water.

HI 83215

Nutrient Analysis Photometer for Greenhouses and Hydroponics

www.easeongear.com
[click to buy: www.hannameters.com](http://www.hannameters.com)

Deciding which fertilizer to use can be overwhelming, but with a bit of knowledge you can be sure your garden will get the right amount of nutrients it needs. The first question you'll need to answer is, "What analysis do I need?" The analysis is actually three numbers you see usually at the middle or bottom of fertilizer packages (for example 10-20-10). These numbers represent percentages of the three major nutrients plants need: nitrogen, phosphorus and potassium (NPK for short).

HI 83215 is a multiparameter bench meter that measures twelve methods in low, medium and high ranges essential for monitoring greenhouse and hydroponics operations. It's three channels allow for a wide range of tests.

The optical system of HI 83215 is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

HI 83215 has powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI 92000 Windows® compatible software.



NPK

Nitrogen, represented by the first number from fertilizer packages, provides plants with lush green foliage growth. The second number represents phosphorus, which aids in root development, flowering ability and size. Many companies will market high phosphorus fertilizers as "bloom boosters". Potassium is represented by the third number in the N-P-K sequence. This helps guard a plant from disease and insects, as well as temperature extremes and drought.



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methods

ORDERING INFORMATION

HI 83215-01 (115V) and **HI 83215-02** (230V) is supplied with sample cuvettes and caps (4 ea.), sample preparation kit, cloth for wiping cuvettes (1), scissors, AC/DC power adapter and instruction manual

HI 83215C-100 kit includes 10 mL cuvettes with caps (4 ea.), 100 mL plastic beaker, 170 mL plastic beaker, 100 mL graduated cylinder, 60 mL syringe with screw rim, 5 mL syringe, funnel, filter discs (25), spoon, pipettes (2), carbon powder packets (50), and demineralizer bottle with filter cap for approximately 12 liters of deionized water.

TEST	RANGE	METHOD	REAGENTS [†]
Ammonia HR	0 to 100 mg/L (ppm)	Nessler	HI 93715-01
Ammonia MR	0.0 to 50.0 mg/L (ppm)	Nessler	HI 93715-01
Ammonia LR	0.0 to 10.0 mg/L (ppm)	Nessler	HI 93715-01
Nitrate HR	0 to 300 mg/L (ppm)	Cadmium Reduction	HI 93728-01
Nitrate MR	0 to 150 mg/L (ppm)	Cadmium Reduction	HI 93728-01
Nitrate LR	0.0 to 30.0 mg/L (ppm)	Cadmium Reduction	HI 93728-01
Phosphorus HR	0 to 100 mg/L (ppm)	Amino Acid	HI 93706-01
Phosphorus MR	0.0 to 50.0 mg/L (ppm)	Amino Acid	HI 93706-01
Phosphorus LR	0.0 to 10.0 mg/L (ppm)	Amino Acid	HI 93706-01
Potassium HR	20 to 200 mg/L (ppm)	Turbidimetric	HI 93750-01
Potassium MR	10 to 100 mg/L (ppm)	Turbidimetric	HI 93750-01
Potassium LR	0.0 to 20.0 mg/L (ppm)	Turbidimetric	HI 93750-01

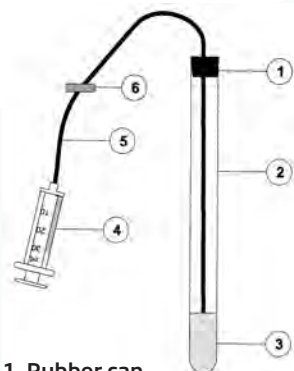
Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.
[†] Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.

For a complete list of Reagents, see Reagents Section 18.

Suction Lysimeter for Root Level Soil Monitoring

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1. Rubber cap
2. Soil solution sampler tube
3. Porous ceramic tip
4. 30 mL syringe (pump)
5. Rubber suction capillary
6. Finger clamp

HI 83900-90
90 cm (2.95')

HI 83900-60
60 cm (1.97')

HI 83900-30
30 cm (0.98')



- The perfect companion to the HI 83225 and HI 83215
- Monitor soil composition at the roots
- Easy to use

The HI 83900 suction lysimeter is built with a porous ceramic cap connected to a transparent tube for soil solution extraction. A rubber capillary is inserted in the tube passing through a rubber cap and reaching the ceramic tip.

The HI 83900 series lysimeter is an ideal tool for collecting soil solution samples and then perform quantitative chemical analysis. In this way the operator can easily monitor the level of nutrients, such as ammonia, nitrate, phosphorous and potassium, sulfate, calcium, magnesium.

The ceramic tip of the lysimeter can be used in all types of soil, and it is made of a sinterized material that does not react with nutrient elements. The soil solution, therefore, is not affected by the chemical composition of the ceramic cap resulting in precise and reliable tests.

The HI 83900 allows the extraction of a solution from the soil by creating a vacuum (negative pressure or suction) inside the sampler tube, that exceeds the soil water tension. This will establish an hydraulic gradient for the solution to flow through the porous ceramic cap and into the lysimeter tube. Typically, a vacuum of about -60 cb (centibar) should be drawn.

For better monitoring of soil solution composition throughout an entire growth period of crops, at least two lysimeters should be installed in the root zone of a representative plant, one at the upper and one in the lower part of the root zone.

For better measurement accuracy and repeatability, it is recommended to replicate installations in at least two more locations.

ORDERING INFORMATION

HI 83900-30 is comprised of 30 cm (0.98') sampler tube ending with porous ceramic tip.

HI 83900-60 is comprised of 60 cm (1.97') sampler tube ending with porous ceramic tip.

HI 83900-90 is comprised of 90 cm (2.95') sampler tube ending with porous ceramic tip.

All include capillary rubber tube with rubber cap and finger clamp, cleaning solution starter kit (120 mL), 30 mL syringe and instructions

ACCESSORIES

HI 83900-25 Cleaning solution kit, 500 mL

HI 83900-00 Cleaning solution starter kit, 120 mL

Plant Nutrition

The three elements that are most needed by plants are nitrogen (N), phosphorous (P) and potassium (K).

Nitrogen is indispensable for the plant's life and is a key factor in fertilization. Nitrogen allows the development of the vegetative activity of the plant, in particular, causes lengthening of trunks and sprouts and increases the production of foliage and fruits. An excess of nitrogen weakens the plants structure creating an unbalanced relationship between the leaves and the stalks. In addition, the plant becomes less resistant to diseases.

Phosphorous is an important element in the composition of DNA and RNA, the regulators of the energetic exchange (ATP and ADP), as well as the reserve substances in seeds and bulbs. It contributes to the formation of buds, roots, blooming, and lignification. A lack of phosphorous results in: stifling of plants, slow growth, a reduction of production, smaller fruits and a lower expansion of the roots.

Even if potassium is not a constituent of important compounds, it plays a remarkable role in many physiological activities like the control of cellular turgor and the accumulation of carbohydrates. It increases the size of fruits, their flavor, as well as yielding a positive effect on the color and fragrance of flowers. Potassium also makes plants more resistant to disease.

The Significance of Pool and Spa Water Testing

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Residual Disinfection and pH Control

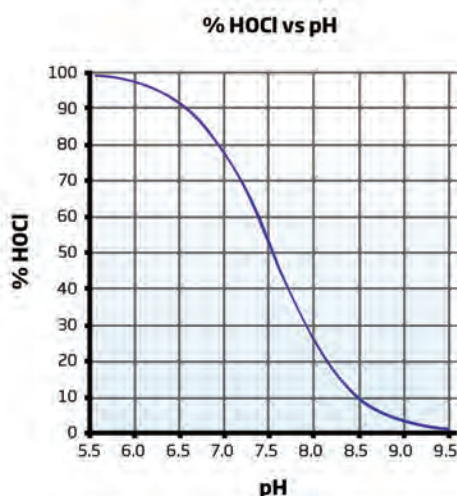
In terms of swimming pool treatment, disinfection or sanitizing basically means to rid the pool of bather pollution, destroy bacteria, and control nuisance organisms like algae, which may occur in the pool, filtration equipment, and piping.

There are a number of techniques used, namely, chlorine, bromine and ozone dosing systems, of which chlorine is the most common.

Chlorine

Chlorine is a strong oxidizing agent that destroys organic pollutants and bacteria. Chlorine combines with compounds containing nitrogen to form chloramines, during which only part of the chlorine will be used while the rest remains active, continuing its disinfecting action.

Combined chlorine is the quantity of chlorine that has already combined with nitrogen containing compounds. It is much less effective as a disinfectant than free chlorine, which has yet to make the transition. The addition of combined chlorine, and free chlorine gives total chlorine. A pool manager needs to aim for the perfect balance where free and total chlorine are proportionally equal, and thus to keep the combined chlorine levels near zero. The presence of chloramines is undesirable because of the distinctive 'swimming pool smell' as well as irritation to the eyes and mucous membranes caused by combined chlorines like dichloramines.



Commercial chlorine for disinfection may be available as a gas (Cl_2), a liquid like sodium hypochlorite or bleach (NaOCl) or in a solid state like calcium hypochlorite, chlorohydrantoin or chlorocyanuric acid compounds. These compounds, once dissolved in water, establish equilibrium between the hypochlorous acid (HOCl) and the hypochlorite ions (OCl^-). Although both forms are considered free chlorine, it is the hypochlorous acid that provides the strongest disinfecting and oxidizing characteristic of chlorine solutions. The amount of hypochlorous acid in chlorinated water depends upon the pH value of the solution. Changes in pH value will effect the HOCl equilibrium in relation to the hydrogen and hypochlorite ions.

As depicted by the graph, HOCl decreases and OCl^- increases as pH increases. At a low pH, almost all the free chlorine is in the molecular form HOCl , and at a pH of around 7.5, the ratio between HOCl and OCl^- is 50:50. Since the ionic form OCl^- is a slow acting sanitizer while the molecular HOCl is a fast acting, it is important to measure pH regularly. As a general rule a pH of about 7.2 is recommended to maintain fast acting disinfection conditions.

Bromine

In many countries bromine sanitizing has been introduced as an alternative for chlorine, although it is not as strong. The advantage of bromine lies in its stability at higher temperatures (advantageous for heated pools and hot tubs), and its maintained disinfection power at a higher pH. Furthermore, there is very little reaction between bromine and nitrogen compounds, reducing the unpleasant odor, and eye irritation problems. The main disadvantage of bromine is the slower acting disinfecting power, making it less suitable for larger pools.

Ozone

Ozone is a very strong oxidizing agent that destroys organic compounds that are especially difficult to oxidize. It allows the pool manager to very efficiently remove combined chlorine without frequently refreshing large amounts of pool water. By the time the water passes through the filter units, ozone has already completed sanitizing, and it is not effected by the pH level.

Mainly because of its strong oxidizing power, the return water may contain trace concentrations of ozone. It imperative to know that ozone is very unstable, so to ensure thorough sanitization of the water, low-level chlorination remains necessary.

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The Water Balance and Langelier Index

Pool water characteristics need to be maintained in a balanced state to avoid numerous issues. Measuring certain variables is extremely important to predict if the water is corrosive, scaling or balanced.

A saturation index developed by Dr. Wilfred Langelier is widely used to predict the balance of swimming pool waters. It represents the estimation of a solution's ability to dissolve or precipitate calcium carbonate deposits. A certain level of this precipitation (filming) is desired to insulate pipes and boilers from contact with water. When no protective filming is formed, water is considered to be corrosive. On the other hand, too much filming can develop into scaling and incrustation of the pipes.

In the treatment and monitoring of pool water, the pool manager must ensure that related parameters such as alkalinity, hardness and pH are duly taken into consideration.

Calcium

The presence of calcium in the system is desired to ensure filming on those places where the temperature is relatively high, like in boilers and pipes transporting warm water. Scaling must be avoided

The Langelier Index is a powerful tool to calculate the water balance, and to predict corrosion or scaling problems. Theoretically, a LI of zero indicates perfect water condition for swimming pools. If $LI > 0$, scaling and staining of the water is present, and if $LI < 0$ the water is corrosive and highly irritating. A tolerance of ± 0.4 is normally acceptable.

The Langelier formula is expressed as:

$$LI = pH + TF + HF + AF - 12.5$$

Where:

LI = Langelier Index (also called Saturation Index)

pH = pH of the water

TF = temperature factor

HF = hardness factor, log (Ca hardness, ppm as $CaCO_3$)

AF = alkalinity factor, log (alkalinity, ppm as $CaCO_3$)

To calculate the exact Langelier Index of your water please use the WATER INDEX reference tables.

For most pools, water is balanced if:

- The pH value is maintained within the recommended ranges of pH 7.2 - 7.6
- Ideally the Alkalinity should be maintained within a range of 80 - 125 ppm
- The Calcium Hardness should be maintained within a range of 200 - 400 ppm.

To calculate your water balance, three parameters must be measured; calcium hardness, alkalinity and pH. Find the hardness and alkalinity factor in the WATER INDEX reference tables below.

because it reduces heat transfer and pump capacity, and causes cloudiness in the water.

It is recommended to maintain the calcium hardness value within the range from 200 to 400 ppm as calcium carbonate ($CaCO_3$).

Alkalinity

Alkalinity is the measure of the total concentration of alkaline substances, mostly bicarbonates, dissolved in the water. The higher the alkalinity, the more resistant the water is to pH change. At the same time, high alkaline water is a major contributor to scaling problems like incrustation in filtration equipment, pumps, and piping.

pH

It is recommended to maintain the alkalinity value within the range from 80 to 125 ppm as calcium carbonate ($CaCO_3$).

The pH of the water is an important factor since at lower pH levels the corrosion rate increases. If the alkalinity values are sufficiently high, it will not be difficult to control the pH. Most pool managers prefer to keep the pH between 7.2 and 7.4 to best maintain low corrosion rates and a sufficient activity of chlorine.

The water temperature is, in general, maintained between $24^{\circ}C$ ($76^{\circ}F$) and $34^{\circ}C$ ($94^{\circ}F$). Assuming the temperature is kept within those ranges, an average value of 0.7 may be used.

$$\text{Water balance} = pH + TF + HF + AF$$

Water Balance	Condition	Recommendation
11.0-12.0	Corrosive	Increase pH and/or alkalinity
12.1-12.3	Acceptable Balance	Retest water frequently
12.4-12.6	Ideal Balance	Maintain
12.7-12.9	Acceptable Balance	Retest water frequently
13.0-14.0	Scale Forming	Reduce pH and/or alkalinity

Water Index Reference Table

Temperature			Calcium Hardness		Alkalinity	
$^{\circ}C$	$^{\circ}F$	TF	mg/L (as $CaCO_3$)	HF	mg/L (as $CaCO_3$)	AF
0	32	0	5	0.7	5	0.7
4	39	0.1	25	1.4	25	1.4
8	46	0.2	50	1.7	50	1.7
12	54	0.3	75	1.9	75	1.9
16	60	0.4	100	2.0	100	2.0
20	68	0.5	150	2.2	150	2.2
24	75	0.6	200	2.3	200	2.3
28	82	0.7	250	2.4	250	2.4
32	90	0.7	300	2.5	300	2.5
36	97	0.8	400	2.6	400	2.6
40	104	0.9	500	2.7	500	2.7
50	122	1.0	1000	3.0	1000	3.0

HI 83226

Multiparameter Photometer for Pools and Spas

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Around the world, swimming pool and spa facilities welcome dozens, even hundreds of people on a daily basis. A basic necessity of pool water treatment is to maintain the water in a safe and pleasant condition for the bathers.

In order to achieve ideal water conditions, swimming pool water requires testing on a daily and sometimes hourly basis for disinfection of residuals and maintaining pH levels. Equally important, calcium hardness and alkalinity levels should be monitored weekly to ensure the pool water is well balanced, thus to avoid corrosion and scale formation.

HI 83226 is a multiparameter bench meter that measures nine parameters essential for advanced pool and spa water analysis.

The optical system of HI 83226 is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

HI 83226 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI 92000 Windows® compatible software.



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methods



ORDERING INFORMATION

HI 83226-01 (115V), HI 83226-02 (230V), are supplied with sample cuvettes with caps (4 ea.), cloth for wiping cuvettes, scissors, AC/DC power adapter and instruction manual

HI 83226 TEST	RANGE	METHOD	REAGENT CODE [†]
Alkalinity	0 to 500 mg/L (ppm) as CaCO ₃	Bromocresol green	HI 93755-01
Bromine	0.00 to 10.00 mg/L (ppm)	DPD	HI 93716-01
Chlorine, Free	0.00 to 5.00 mg/L (ppm)	DPD	HI 93701-01
Chlorine, Total	0.00 to 5.00 mg/L (ppm)	DPD	HI 93711-01
Copper, Free	0.00 to 5.00 mg/L (ppm)	Bicinchoninate	HI 93702-01
Copper, Total	0.00 to 5.00 mg/L (ppm)	Bicinchoninate	HI 93702T-01
Cyanuric Acid	0 to 200 mg/L (ppm)	Turbidimetric	HI 93722-01
Hardness, Calcium	0 to 500 mg/L (ppm) as CaCO ₃	Calmagite	HI 93720-01
Iron HR	0.00 to 5.00 mg/L (ppm)	Phenantroline	HI 93721-01
Ozone	0.00 to 2.00 mg/L (ppm)	DPD	HI 93757-01
pH	6.5 to 8.5 pH	Phenol Red	HI 93710-01

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.
[†] Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.

For a complete list of Reagents, see Reagents Section 18.



With Great Products, Come Great Results™

Multiparameter Photometer for Pools and Spas

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Around the world, swimming pool and spa facilities welcome dozens, even hundreds of people on a daily basis. A basic necessity of pool water treatment is to maintain the water in a safe and pleasant condition for the bathers.

In order to achieve ideal water conditions, swimming pool water requires testing on a daily and sometimes hourly basis for disinfection residuals and maintaining pH levels. Equally important, calcium hardness and alkalinity levels should be monitored weekly to ensure the pool water is well balanced, thus to avoid corrosion and scale formation.

HI 83216 is a multiparameter bench meter that measures six different methods essential for pool and spa water analysis. It has two channels allowing for a wide range of tests.

The optical system of HI 83216 is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

HI 83216 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI 92000 Windows® compatible software.

When you need to only measure a few parameters daily, the HI 83216 can do the job quickly, accurately and at a comparable cost of chemical test kits.

HI 83216 TEST	RANGE	METHOD	REAGENT CODE ¹
Alkalinity	0 to 500 mg/L (ppm) as CaCO ₃	Bromocresol green	HI 93755-01
Chlorine, Free	0.00 to 5.00 mg/L (ppm)	DPD	HI 93701-01
Chlorine, Total	0.00 to 5.00 mg/L (ppm)	DPD	HI 93711-01
Cyanuric Acid	0 to 200 mg/L (ppm)	Turbidimetric	HI 93722-01
Hardness, Calcium	0 to 500 mg/L (ppm) as CaCO ₃	Calmagite	HI 93720-01
pH	6.5 to 8.5 pH	Phenol Red	HI 93710-01

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.
¹ Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.

For a complete list of Reagents, see Reagents Section 18.



6
methods

ORDERING INFORMATION

HI 83216-01 (115V), HI 83216-02 (230V), are supplied with sample cuvettes with caps (4 ea.), cloth for wiping cuvettes, scissors, AC/DC power adapter and instruction manual

HI 83212

Multiparameter Photometer for Power Plant Utilities

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Ammonia levels are often tested in boiler feedwater and industrial waste.

Chlorine is used to sanitize cooling towers and industrial equipment.

Copper is often added to water to hinder growth of plankton and algae.

Hydrazine has bactericidal properties and scavenges oxygen.

Molybdenum is used as a corrosion inhibitor in cooling towers while phosphate can enter water streams due to boiler blow-downs and is added to reduce scaling.

Silica, on the other hand, can be a major source of scaling while Silver is a toxic pollutant and needs to be monitored in effluents.

HI 83212 is a multiparameter bench meter that measures thirteen methods essential for power plant utilities. It has four channels allowing for a wide range of tests.

The optical system of HI 83212 is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

HI 83212 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI 92000 Windows® compatible software.



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methods



ORDERING INFORMATION

HI 83212-01 (115V) and HI 83212-02 (230V), are supplied with sample cuvettes with caps (4 ea.), cloth for wiping cuvettes, scissors, AC/DC power adapter and instruction manual



TEST	RANGE	METHOD	REAGENT CODE [†]
Ammonia MR	0.00 to 10.00 mg/L (ppm)	Nessler	HI 93715-01
Ammonia LR	0.00 to 3.00 mg/L (ppm)	Nessler	HI 93700-01
Chlorine*, Free	0.00 to 2.50 mg/L (ppm)	DPD	HI 93701-01
Chlorine*, Total	0.00 to 3.50 mg/L (ppm)	DPD	HI 93711-01
Copper HR	0.00 to 5.00 mg/L (ppm)	Bicinchoninate	HI 93702-01
Copper LR	0 to 1000 µg/L	Bicinchoninate	HI 95747-01
Hydrazine	0 to 400 µg/L	p-Dimethylamino - benzaldehyde	HI 93704-01
Molybdenum	0.0 to 40.0 mg/L (ppm)	Mercaptoacetic Acid	HI 93730-01
Phosphate HR	0.0 to 30.0 mg/L (ppm)	Amino Acid	HI 93717-01
Phosphate LR	0.00 to 2.50 mg/L (ppm)	Ascorbic Acid	HI 93713-01
Phosphorus	0.0 to 15.0 mg/L (ppm)	Amino Acid	HI 93706-01
Silica	0.00 to 2.00 mg/L (ppm)	Heteropoly blue	HI 95705-01
Silver	0.000 to 1.000 mg/L (ppm)	PAN	HI 93737-01**

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.

[†] Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.

* For Chlorine, liquid reagents are available. ** Reagents for 50 tests

For a complete list of Reagents, see Reagents Section 18.



Pulp and paper are manufactured from raw materials containing cellulose fibers generally from wood, recycled paper, and agricultural residues.

There are numerous steps in the paper manufacturing process; raw material preparation, such as wood debarking and chip making, pulp manufacturing, pulp bleaching and fiber recycling. Pulp mills and paper mills may exist separately or as integrated operations.

Pulp

Processed pulp is used as a source of cellulose for fiber manufacture and for conversion into paper or cardboard. Cellulosic pulp is manufactured from the raw materials, using chemical and mechanical means.

The manufacture of pulp for paper and cardboard employs mechanical (including thermomechanical), chemimechanical, and chemical methods. Mechanical pulping separates fibers by such methods as disk abrasion and billeting.

Chemimechanical processes involve mechanical abrasion and the use of chemicals.

Chemical pulps are made by cooking (digesting) the raw materials, using the kraft (sulfate) and sulfite processes.

In the case of chemical pulps (kraft and sulfite), the objective of bleaching is to remove the small fraction of the lignin remaining after cooking. Oxygen, hydrogen peroxide, ozone, peracetic acid, sodium hypochlorite, chlorine dioxide, chlorine, and other chemicals are used to transform lignin into an alkali-soluble form. An alkali, such as sodium hydroxide, is necessary in the bleaching process to extract the alkali-soluble form of lignin.

Pulp is washed with water in the bleaching process.

In modern mills, oxygen is normally used in the first stage of bleaching. The trend is to avoid the use of any kind of chlorine chemicals and employ "total chlorine-free" (TCF) bleaching.

TCF processes allow the bleaching effluents to be fed to the recovery boiler for steam generation; the steam is then used to generate electricity, thereby reducing the amount of pollutants discharged. Elemental chlorine-free (ECF) processes, which use chlorine dioxide, are required for bleaching certain grades of pulp.

Pulp and Paper Mill Wastewater

The significant environmental impacts of the manufacture of pulp and paper result from the pulping and bleaching processes. In some processes, sulfur compounds and nitrogen oxides are emitted into the air, and chlorinated and organic compounds, nutrients, and metals are discharged into the wastewater.

Wastewaters are discharged at a rate of 20-250 cubic meters per metric ton (m³/t) of air-dried pulp.

Wastewater from chemical pulping contains 12-20 kg of BOD/t of air-dried pulp, with values of up to 350 kg/t. The corresponding values for mechanical pulping wastewater are 15-25 kg BOD/t of air-dried pulp.

Phosphorus and nitrogen are also released into wastewaters.

The main source of nutrients, nitrogen, and phosphorus compounds is raw material such as wood. The use of peroxide, ozone, and other chemicals in bleaching makes it necessary to use a complexing agent for heavy metals.



HI 83210

Multiparameter Photometer for Pulp and Paper Mills

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Water is an indispensable medium for all stages of paper production. It is used for suspending and swelling, transport, the dissolution and the rebuilding of fiber bondings and more.

Due to shrinking water resources, and subsequently, rising costs of available water supplies, more stringent environmental legislation has been put in place, strictly regulating industrial water consumption. Amongst the many industries effected, pulp and paper mills have imposed a trend towards less water consumption. This requires precise monitoring of chemicals and water supplies.

HI 83210 is a multiparameter bench meter that measures twelve methods essential for paper production. It has four channels allowing for a wide range of tests.

The optical system of HI 83210 is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

HI 83210 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI 92000 Windows® compatible software.



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methods



ORDERING INFORMATION

HI 83210-01 (115V) and HI 83210-02 (230V), are supplied with sample cuvettes with caps (4 ea.), cloth for wiping cuvettes, 60 mL glass bottle for dissolved oxygen analysis, scissors, AC/DC power adapter and instruction manual

TEST	RANGE	METHOD	REAGENT CODE†
Aluminum	0.00 to 1.00 mg/L (ppm)	Aluminon	HI 93712-01
Chlorine Dioxide	0.00 to 2.00 mg/L (ppm)	Chlorophenol Red	HI 93738-01
Chlorine*, Free	0.00 to 2.50 mg/L (ppm)	DPD	HI 93701-01
Chlorine*, Total	0.00 to 3.50 mg/L (ppm)	DPD	HI 93711-01
Color of Water	0 to 500 PCU	Platinum Cobalt	—
Oxygen, Dissolved (DO)	0.0 to 10.0 mg/L (ppm)	Winkler	HI 93732-01
pH	6.5 to 8.5 pH	Phenol Red	HI 93710-01
Phosphate HR	0.0 to 30.0 mg/L (ppm)	Amino Acid	HI 93717-01
Phosphate LR	0.00 to 2.50 mg/L (ppm)	Ascorbic Acid	HI 93713-01
Silica	0.00 to 2.00 mg/L (ppm)	Heteropoly blue	HI 93705-01
Silver	0.000 to 1.000 mg/L (ppm)	PAN	HI 93737-01**
Zinc	0.00 to 3.00 mg/L (ppm)	Zincon	HI 93731-01

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.
† Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.

* For Chlorine, liquid reagents are available. ** Reagents for 50 tests

For a complete list of Reagents, see Reagents Section 18.

Multiparameter Photometer for Industrial Wastewater

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Pollution and excessive use seriously compromise the availability of fresh water around the world. In order to reduce the impact of industrial operators, there are numerous processes that can be used to clean up the wastewaters depending on the type and extent of contamination. Most wastewater is treated at an industrial scale at wastewater treatment plants, which may include physical, chemical and biological treatment processes.

The quality of wastewater which can be discharged by industrial users is strictly limited by regulations.

HI 83207 is a multiparameter bench meter that measures twenty methods essential for industrial wastewater analysis. It has four channels to allow a wide range of tests.

The optical system of HI 83207 is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

HI 83207 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI 92000 Windows® compatible software.

TEST	RANGE	METHOD	REAGENT CODE¹
Aluminum	0.00 to 1.00 mg/L (ppm)	Aluminon	HI 93712-01
Chlorine*, Free	0.00 to 2.50 mg/L (ppm)	DPD	HI 93701-01
Chlorine*, Total	0.00 to 3.50 mg/L (ppm)	DPD	HI 93711-01
Color of Water	0 to 500 PCU	Platinum Cobalt	-
Copper HR	0.00 to 5.00 mg/L (ppm)	Bicinchoninate	HI 93702-01
Copper LR	0 to 1000 µg/L	Bicinchoninate	HI 95747-01
Fluoride	0.00 to 2.00 mg/L (ppm)	SPADNS	HI 93729-01
Manganese HR	0.0 to 20.0 mg/L (ppm)	Periodate	HI 93709-01
Manganese LR	0 to 300 µg/L	PAN	HI 93748-01**
Molybdenum	0.0 to 40.0 mg/L (ppm)	Mercaptoacetic Acid	HI 93730-01
Nickel HR	0.00 to 7.00 g/L	Photometric	HI 93726-01
Nickel LR	0.000 to 1.000 mg/L (ppm)	PAN	HI 93740-01**
Nitrate	0.0 to 30.0 mg/L (ppm)	Cadmium Reduction	HI 93728-01
Oxygen, Dissolved (DO)	0.0 to 10.0 mg/L (ppm)	Winkler	HI 93732-01
pH	6.5 to 8.5 pH	Phenol Red	HI 93710-01
Phosphate HR	0.0 to 30.0 mg/L (ppm)	Amino Acid	HI 93717-01
Phosphate LR	0.00 to 2.50 mg/L (ppm)	Ascorbic Acid	HI 93713-01
Phosphorus	0.0 to 15.0 mg/L (ppm)	Amino Acid	HI 93706-01
Silver	0.000 to 1.000 mg/L (ppm)	PAN	HI 93737-01**
Zinc	0.00 to 3.00 mg/L (ppm)	Zincon	HI 93731-01

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.
 ¹ Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.
 * For Chlorine, liquid reagents are available. ** Reagents for 50 tests

For a complete list of Reagents, see Reagents Section 18.

ADP 20
 Application Designed Photometers methods



ORDERING INFORMATION

HI 83207-01 (115V) and HI 83207-02 (230V) are supplied with sample cuvettes with caps (4 ea.), cloth for wiping cuvettes, 60 mL glass bottle for dissolved oxygen analysis, scissors, AC/DC power adapter and instruction manual

HI 83213

Multiparameter Photometer for Municipal Wastewater

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With the beginning of the new millennium, water is becoming a strategic resource. Water has been and will continue to be a major factor for our survival, and the continuation of our way of life. Because of the limited resources of fresh water, careful use of it, as well as frequent reuse (after appropriate treatment) are requirements for sustainable development.

HI 83213 is a multiparameter bench meter that measures twenty-four methods essential for municipal wastewater analysis. It has four channels allowing for a wide range of tests.

The optical system of HI 83213 is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

HI 83213 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI 92000 Windows® compatible software.



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ORDERING INFORMATION

HI 83213-01 (115V) and HI 83213-02 (230V) are supplied with sample cuvettes with caps (4 ea.), cloth for wiping cuvettes, 60 mL glass bottle for dissolved oxygen analysis, scissors, AC/DC power adapter and instruction manual

TEST	RANGE	METHOD	REAGENT CODE [†]
Aluminum	0.00 to 1.00 mg/L (ppm)	Aluminon	HI 93712-01
Ammonia MR	0.00 to 10.00 mg/L (ppm)	Nessler	HI 93715-01
Ammonia LR	0.00 to 3.00 mg/L (ppm)	Nessler	HI 93700-01
Bromine	0.00 to 8.00 mg/L (ppm)	DPD	HI 93716-01
Chlorine*, Free	0.00 to 2.50 mg/L (ppm)	DPD	HI 93701-01
Chlorine*, Total	0.00 to 3.50 mg/L (ppm)	DPD	HI 93711-01
Chromium VI HR	0 to 1000 µg/L	Diphenylcarbohydrazide	HI 93723-01
Chromium VI LR	0 to 300 µg/L	Diphenylcarbohydrazide	HI 93749-01
Color of Water	0 to 500 PCU	Platinum Cobalt	—
Copper HR	0.00 to 5.00 mg/L (ppm)	Bicinchoninate	HI 93702-01
Copper LR	0 to 1000 µg/L	Bicinchoninate	HI 95747-01
Iodine	0.0 to 12.5 mg/L (ppm)	DPD	HI 93718-01
Nickel HR	0.00 to 7.00 g/L	Photometric	HI 93726-01
Nickel LR	0.000 to 1.000 mg/L (ppm)	PAN	HI 93740-01**
Nitrate	0.0 to 30.0 mg/L (ppm)	Cadmium Reduction	HI 93728-01
Nitrite HR	0 to 150 mg/L (ppm)	Ferrous Sulfate	HI 93708-01
Nitrite LR	0.00 to 1.15 mg/L (ppm)	Diazotization	HI 93707-01
Oxygen, Dissolved (DO)	0.0 to 10.0 mg/L (ppm)	Winkler	HI 93732-01
pH	6.5 to 8.5 pH	Phenol Red	HI 93710-01
Phosphate HR	0.0 to 30.0 mg/L (ppm)	Amino Acid	HI 93717-01
Phosphate LR	0.00 to 2.50 mg/L (ppm)	Ascorbic Acid	HI 93713-01
Phosphorus	0.0 to 15.0 mg/L (ppm)	Amino Acid	HI 93706-01
Silver	0.000 to 1.000 mg/L (ppm)	PAN	HI 93737-01**
Zinc	0.00 to 3.00 mg/L (ppm)	Zincon	HI 93731-01

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.

[†] Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.

* For Chlorine, liquid reagents are available. ** Reagents for 50 tests

For a complete list of Reagents, see Reagents Section 18.

Multiparameter Photometer for Water Conditioning

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TEST	RANGE	METHOD	REAGENT CODE ¹
Ammonia MR	0.00 to 10.00 mg/L (ppm)	Nessler	HI 93715-01
Ammonia LR	0.00 to 3.00 mg/L (ppm)	Nessler	HI 93700-01
Chlorine*, Free	0.00 to 2.50 mg/L (ppm)	DPD	HI 93701-01
Chlorine*, Total	0.00 to 3.50 mg/L (ppm)	DPD	HI 93711-01
Copper HR	0.00 to 5.00 mg/L (ppm)	Bicinchoninate	HI 93702-01
Copper LR	0 to 1000 µg/L	Bicinchoninate	HI 95747-01
Fluoride	0.00 to 2.00 mg/L (ppm)	SPADNS	HI 93729-01
Iron HR	0.00 to 5.00 mg/L (ppm)	Phenantroline	HI 93721-01
Iron LR	0 to 400 µg/L	TPTZ	HI 93746-01**
Manganese HR	0.0 to 20.0 mg/L (ppm)	Periodate	HI 93709-01
Manganese LR	0 to 300 µg/L	PAN	HI 93748-01**
Molybdenum	0.0 to 40.0 mg/L (ppm)	Mercaptoacetic Acid	HI 93730-01
Nickel HR	0.00 to 7.00 g/L	Photometric	HI 93726-01
Nickel LR	0.000 to 1.000 mg/L (ppm)	PAN	HI 93740-01**
Nitrate	0.0 to 30.0 mg/L (ppm)	Cadmium Reduction	HI 93728-01
Oxygen, Dissolved (DO)	0.0 to 10.0 mg/L (ppm)	Winkler	HI 93732-01
pH	6.5 to 8.5 pH	Phenol Red	HI 93710-01
Phosphate HR	0.0 to 30.0 mg/L (ppm)	Amino Acid	HI 93717-01
Phosphate LR	0.00 to 2.50 mg/L (ppm)	Ascorbic Acid	HI 93713-01
Phosphorus	0.0 to 15.0 mg/L (ppm)	Amino Acid	HI 93706-01
Silica	0.00 to 2.00 mg/L (ppm)	Heteropoly blue	HI 93705-01
Silver	0.000 to 1.000 mg/L (ppm)	PAN	HI 93737-01**
Zinc	0.00 to 3.00 mg/L (ppm)	Zincon	HI 93731-01

Reagents are available in liquid or powder form, and the amount of each reagent is precisely dosed to ensure maximum repeatability.
¹ Unless noted otherwise, all reagent codes ending with -01 are for 100 tests. Replace the -01 with -03 for 300 tests.
 * For Chlorine, liquid reagents are available. ** Reagents for 50 tests

For a complete list of Reagents, see Reagents Section 18.

The global distribution of freshwater resources varies greatly from region to region, and only 3% of global water resources are defined as freshwater.

The definition of freshwater is water containing less than 1000 mg/L of dissolved solids, most often salt.

The HI 83208 was developed to measure the most common parameters in water quality monitoring:

Ammonia detection in water treatment systems is particularly important for aquarium owners and fish farm operators. Ammonia is highly soluble in water and extremely toxic to fish.

Chlorine and chlorine-release compounds are used extensively as water purifiers or surface disinfectants.

Phosphates are present in natural waters, and at normal concentrations do not pose any specific health threats to humans. Phosphate contamination that comes from agricultural fertilizer run off can promote excessive algae.

HI 83208 is a multiparameter bench meter that measures twenty-three methods essential for water conditioning.

The optical system of HI 83208 is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

HI 83208 has a powerful interactive user support that assists the user during the analysis process. A full tutorial is available in the Setup Menu, and the Help Menu provides assistance for every step in the measurement process. This meter can be connected to a PC via a USB cable, where the data can be managed with optional HI 92000 Windows® compatible software.

ADP
Application Designed Photometers

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ORDERING INFORMATION

HI 83208-01 (115V), HI 83208-02 (230V) and HI 83208-03 (AUS plug) are supplied with sample cuvettes with caps (2 ea.), cloth for wiping cuvettes, 60 mL glass bottle for dissolved oxygen analysis, scissors, AC/DC power adapter and instruction manual