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You can read the recommendations in the user guide, the technical guide or the installation guide for HANNA INSTRUMENTS HI 83203. You'll find the answers to all your questions on the HANNA INSTRUMENTS HI 83203 in the user manual (information, specifications, safety advice, size, accessories, etc.). Detailed instructions for use are in the User's Guide.

User manual HANNA INSTRUMENTS HI 83203

User guide HANNA INSTRUMENTS HI 83203

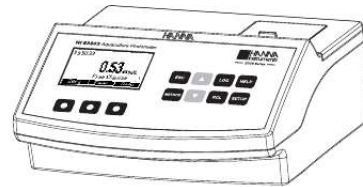
Operating instructions HANNA INSTRUMENTS HI 83203

Instructions for use HANNA INSTRUMENTS HI 83203

Instruction manual HANNA INSTRUMENTS HI 83203

Instruction Manual

HI 83203
Multiparameter Bench
Photometer
for Aquaculture



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..... 10 OPERATIONAL GUIDE

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..... 47 ABBREVIATIONS °C: EPA: °F: g/L: HR: LR: mg/L: mL: MR: g/L: PAN: TPTZ: degree Celsius US Environmental Protection Agency degree Fahrenheit grams per liter (ppt) high range low range milligrams per liter (ppm) milliliter medium range micrograms per liter (ppb) 1-(2-pyridylazo)-2-naphthol 2,4,6-tri-(2-pyridyl)-1,3,5-triazine GENERAL DESCRIPTION HI 83203 is a multiparameter bench photometer dedicated for Aquaculture analysis.

It can measure 13 different methods using specific liquid or powder reagents. The amount of reagent is precisely dosed to ensure maximum reproducibility. HI 83203 bench photometer can be connected to a PC via an USB cable. The optional HI 92000 Windows ® Compatible Software helps users manage all their results. All rights are reserved.

Reproduction in whole or in part is prohibited without the written consent of the copyright owner, Hanna Instruments Inc., Woonsocket, Rhode Island, 02895, USA. 2 3 SPECIFICATIONS Life of the instrument Silicon Photocell 0 to 50°C (32 to 122°F); max 90% RH non-condensing Power Supply external 12 Vdc power adapter built-in rechargeable battery Dimensions 235 x 200 x 110 mm (9.2 x 7.87 x 4.33") Weight 0.9 Kg For specifications related to each method (e.g. range, precision, etc.) refer to the related measurement section. Light Life Light Detector

Environment **PRECISION AND ACCURACY** Precision is how closely repeated measurements agree with each other. Precision is usually expressed as standard deviation (SD). Accuracy is defined as the nearness of a test result to the true value. Although good precision suggests good accuracy, precise results can be inaccurate. The figure explains these definitions.

For each method, the precision is expressed in the related measurement section as standard deviation at a specific concentration value of the analyte. The standard deviation is obtained with a single instrument using a representative lot of reagents. Where: $-\log I/I_0 = \text{Absorbance (A)}$ $I_0 = \text{intensity of incident light beam}$ $I = \text{intensity of light beam after absorption}$ $\epsilon = \text{molar extinction coefficient at wavelength}$ $c = \text{molar concentration of the substance}$ $d = \text{optical path through the substance}$ Therefore, the concentration "c" can be calculated from the absorbance of the substance as the other factors are known. Photometric chemical analysis is based on the possibility to develop an absorbing compound from a specific chemical reaction between sample and reagents. Given that the absorption of a compound strictly depends on the wavelength of the incident light beam, a narrow spectral bandwidth should be selected as well as a proper central wavelength to optimize measurements. 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. Four measuring channels allow a wide range of tests. Instrument block diagram (optical layout) A microprocessor controlled special tungsten lamp emits radiation which is first optically conditioned and beamed to the sample contained in the cuvette. The optical path is fixed by the diameter of the cuvette. Then the light is spectrally filtered to a narrow spectral bandwidth, to obtain a light beam of intensity $-I_0$ or $-I$.

The photoelectric cell collects the radiation $-I$ that is not absorbed 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. The measurement process is carried out in two phases: first the meter is zeroed and then the actual measurement is performed. The cuvette has a very important role because it is an optical element and thus requires particular attention. It is important that both the measurement and the calibration (zeroing) cuvette are optically identical to provide the same measurement conditions.

Most of methods use the same cuvette for both, so it is important that measurements take place in the same optical point. The instrument and the cuvette cap have special marks that must be aligned in order to obtain better reproducibility. The surface of the cuvette must be clean and not scratched. This is to avoid measurement interference due to unwanted reflection and absorption of light. It is recommended not to touch the cuvette walls with hands.

Furthermore, in order to maintain the same conditions during the zeroing and the measurement phases, it is necessary to close the cuvette to prevent any contamination. **5 PRINCIPLE OF OPERATION** Absorption of Light is a typical phenomenon of interaction between electromagnetic radiation and matter. When a light beam crosses a substance, some of the radiation may be absorbed by atoms, molecules or crystal lattices. If pure absorption occurs, the fraction of light absorbed depends both on the optical path length through the matter and on the physical-chemical characteristics of substance according to the Lambert-Beer Law: $-\log I/I_0 = \epsilon c d$ or $A = \epsilon c d$ **4 FUNCTIONAL DESCRIPTION INSTRUMENT DESCRIPTION KEYPAD DESCRIPTION** The keypad contains 8 direct keys and 3 functional keys with the following functions: Press to perform the function displayed above it. The functions are screen related. ESC Press to exit the current screen. Press to access the select method menu. Press to move up in a menu or a help screen, to increment a set value, to access second level functions. Press to move down in a menu or a help screen, to decrement a set value, to access second level functions. Press to log the current reading.

RCL Press to recall the log. Press to display the help screen. Press to access the setup screen. **HELP SETUP NEED TO KNOW** HI 83203 has a powerful interactive user support that assists the user during the analysis process.



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Each step in the measurement process is help supported. A tutorial mode is available in the Setup Menu. TIPS FOR AN ACCURATE MEASUREMENT 1) 2) 3) 4) 5) 6) Cuvette Lid LiqAC/DC adapter) REAGENT BLANK CORRECTION · Some methods require a "reagent blank correction". The blank and the sample are prepared exactly in the same way, only the blank is deionized water instead of sample. A blank cuvette may be used more than once: stability and storing conditions are described for each method in the related chapter. INTERFERENCES · In the method measurement section the most common interferences that may be present in an average wastewater matrix have been reported.

It may be that for a particular treatment process other compounds do interfere with the method of analysis. · battery capacity (no external adapter) · battery Low (no external adapter) HEALTH & SAFETY The chemicals contained in the reagent kits may be hazardous if improperly handled. Read the Material Safety Data Sheet (MSDS) before performing tests. Safety equipment: Wear suitable eye protection and clothing when required, and follow instructions carefully. Reagent spills: If a reagent spill occurs, wipe up immediately and rinse with plenty of water.

If reagent contacts skin, rinse the affected area thoroughly with water. Avoid breathing released vapors. · battery Dead (no external adapter) METHOD REFERENCE TABLE HI 83203 - AQUACULTURE Method 1 2 3 4 5 6 7 Method description Ammonia MR Ammonia LR Free Chlorine Total Chlorine Copper HR Copper LR Nitrate Page 16 18 20 23 26 28 30 Method 8 9 10 11 12 13 Method description Nitrite HR Nitrite LR Dissolved Oxygen pH Phosphate HR Phosphate LR Page 32 34 36 38 40 42 METHOD SELECTION · Turn ON the instrument via the ON/OFF power switch. · The meter will perform an autodiagnostic test. During this test, the Hanna Instrument logo will appear on the LCD.

After 5 seconds, if the test was successful, the last selected method will appear on the display. · In order to select the desired method press METHOD and a screen with the available methods will appear. · Press keys to highlight the desired method. Press Select. 10 11 · After the desired method was selected, follow the measurement described in the related section. · Before performing a test you should read all the instructions carefully. SETUP In the Setup mode the instrument's parameters can be changed. Some parameters affect the measuring sequence and others are general parameters that change the behavior or appearance of the instrument. Press SETUP to enter the setup mode. Press ESC or SETUP to return to the main screen.

A list of setup parameters will be displayed with currently configured settings. Press HELP for additional information. Press the keys to select the parameter and select a new value as follows: DATA MANAGEMENT The instrument features a data log function to help you keep track of all your analysis. The data log can hold 200 individual measurements. Storing, viewing and deleting the data is possible using LOG and RCL keys. · Storing data: You can store only a valid measurement. Press LOG and the last valid measurement will be stored in a stack as a record with date and time stamps. Backlight Values: 0 to 8. Press Modify functional key to access the backlight value.

Use the functional keys or the keys to increase/ decrease the value. Press Accept functional key to confirm or ESC to return to the setup menu without saving the new value. Viewing and deleting: You can view and delete the data log by pressing the RCL key. Deleting is based on the LIFO (last in, first out) scheme. Additionally, you can delete the data records all at once.

Contrast Values: 0 to 20. This option is used to set the display's contrast. Press Modify functional key to change the display's contrast. Use the functional keys or the keys to increase/ decrease the value. Press Accept functional key to confirm the value or ESC to return to the setup menu without saving the new value. CHEMICAL FORM Chemical form conversion factors are pre-programmed into the instrument and are method specific. In order to view the displayed result in the desired chemical form press the or to access to the second level of functions and then press the Chem Frm functional key to toggle between the existing chemical forms for the selected method. 12 13 Date / Time This option is used to set the instrument's date and time. Press Modify functional key to change the date/time. Press the functional keys to highlight the value to be modified (year, month, day, hour, minute or second). Use the keys to change the value. Press Accept functional key to confirm or ESC to return to the setup without saving the new date or time. Instrument ID Option: 0 to 9999. This option is used to set the instrument's ID (identification number). The instrument ID is used while exchanging data with a PC.

Press Modify functional key to access the instrument ID screen. Press the keys in order to set the desired value. Press Accept functional key to confirm the value or ESC to return to the setup menu without saving the new value. Time format Option: AM/PM or 24 hour. Press the functional key to select the desired time format. Meter information Press "Select" functional key to view the Instrument model, firmware version, language version and instrument serial number. Press ESC to return to the Setup mode. Date format Press Modify functional key to change the Date Format. Use the keys to select the desired format. Press Accept functional key to confirm or ESC to return to the setup menu without saving the new format.

Language Press the corresponding functional key to change the option. If the new selected language cannot be loaded, the previously selected language will be reloaded. H E L P MODEE HELP M O D HI 83203 offers an interactive contextual help mode that assists the user at any time. To access help screens press HELP. The instrument will display additional information related to the current screen.

To read all available data, scroll the text using the keys. Press Support functional key to access a screen with Hanna service centers and their contact details. Press Accessories functional key to access a page with instrument accessories. To exit support or accessories screens press ESC and the instrument will return to the previous help screen. To exit help mode just press HELP or ESC key again and the meter will display the last screen the user was in before entering help mode.

Tutorial Option: Enable or Disable. If enabled this option will provide the user short guides, related to the current screen. Press the functional key to enable/disable the tutorial mode. Beeper Option: Enable or Disable. When enabled, a short beep is heard every time a key is pressed. A long beep alert sounds when the pressed key is not active or an error condition is detected. Press the functional key to enable/disable the beeper.



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14 15 AMMONIA MEDIUM RANGE SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0.00 to 10.00 mg/L 0.

01 mg/L ± 0.05 mg/L $\pm 5\%$ of reading ± 0.01 mg/L Tungsten lamp with narrow band interference filter @ 420 nm Adaptation of the ASTM Manual of Water and Environmental Technology, D1426-92, Nessler method. The reaction between ammonia and reagents causes a yellow tint in the sample. Description First Reagent Second Reagent Quantity 4 drops (6 drops for seawater) 4 drops (10 drops for seawater) · Remove the cuvette. · Add 4 drops of HI 93715A-0 First reagent (6 drops for seawater analysis). Replace the cap and mix the solution. $\times 4$ · Add 4 drops of HI 93715B-0 Second reagent (10 drops for seawater analysis). Replace the cap and mix the solution. $\times 4$ REQUIRED REAGENTS Code HI 93715A-0 HI 93715B-0 · Reinsert the cuvette into the instrument. REAGENT SETS HI 93715-01 Reagents for 100 tests HI 93715-03 Reagents for 300 tests For other accessories see page 46. · Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 3 minutes and 30 seconds and press READ. When the timer ends the meter will perform the reading. The instrument displays the results in mg/L of ammonia nitrogen (NH₃-N). MEASUREMENT PROCEDURE · Select the Ammonia MR method using the procedure described in the Method Selection section (see page 11).

@@ · Place the cuvette into the holder and close the lid. · Press the or to access the second level of functions. · Press the Chem Frm functional key to convert the result in mg/L of ammonia (NH₃) and ammonium (NH₄⁺). · Press ZERO key. The display will show "-0.0-" when the meter is zeroed and ready for measurement. · Press the or to go back to the measurement screen. INTERFERENCES Interference may be caused by: acetone, alcohols, aldehydes, glycine, hardness above 1 g/L, iron, organic chloramines, sulfide, various aliphatic and aromatic amines. Ammonia MR 16 17 Ammonia MR AMMONIA LOW RANGE SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0.00 to 3.00 mg/L 0.01 mg/L ± 0.04 mg/L $\pm 4\%$ of reading ± 0.01 mg/L Tungsten lamp with narrow band interference filter @ 420 nm Adaptation of the ASTM Manual of Water and Environmental Technology, D1426-92, Nessler method. The reaction between ammonia and reagents causes a yellow tint in the sample.

@@@ · When the timer ends the meter will perform the reading. @@@ · Place the cuvette into the holder and close the lid. · Press the or to access the second level of functions. @@@ · When the timer ends the meter will perform the reading. The instrument displays the results in mg/L of free chlorine. REAGENT SETS HI 93701-F Reagents for 300 tests (liquid) HI 93701-01 Reagents for 100 tests (powder) HI 93701-03 Reagents for 300 tests (powder) For other accessories see page 46. MEASUREMENT PROCEDURE · Select the Free Chlorine method using the procedure described in the Method Selection section (see page 11). 10 mL Liquid reagents procedure · To an empty cuvette add 3 drops of HI 93701A-F DPD1 indicator and 3 drops of HI 93701B-F DPD1 buffer. Swirl gently to mix, and immediately add 10 mL of unreacted sample. @@@ · When the timer ends the meter will perform the reading.

· Remove the cuvette. Powder reagents procedure · Add 1 packet of HI 93711-0 DPD reagent. Replace the cap and shake gently for 20 seconds (or 2 minutes for seawater analysis). · Reinsert the cuvette into the instrument. · Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 2 minutes and 30 seconds and press READ.

When the timer ends the meter will perform the reading. The instrument displays the results in mg/L of total chlorine. · The instrument displays the results in mg/L of total chlorine. Note: free and total chlorine have to be measured separately with fresh unreacted samples following the related procedure if both values are requested. INTERFERENCES Interference may be caused by: Bromine, Iodine, Ozone, Oxidized forms of Chromium and Manganese.

@@@ · To resolve this, neutralize the sample with diluted HCl or NaOH. Liquid reagents procedure · To an empty cuvette add 3 drops of HI 93701A-T DPD1 indicator, 3 drops of HI 93701B-T DPD1 buffer and 1 drop of HI 93701C DPD3 solution. Swirl gently to mix and immediately add 10 mL of unreacted sample. Replace the cap and shake gently again. $\times 3 \times 3 \times 1$ · Reinsert the cuvette into the instrument. Total Chlorine 24 25 Total Chlorine COPPER HIGH RANGE SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0.00 to 5.00 mg/L 0.01 mg/L ± 0.02 mg/L $\pm 4\%$ of reading ± 0 .

01 mg/L Tungsten lamp with narrow band interference filter @ 575 nm Adaptation of the EPA method. The reaction between copper and the bicinchoninate reagent causes a purple tint in the sample. Description Bicinchoninate Quantity 1 packet · Remove the cuvette. · Add the content of one packet of HI 93702-0 Bicinchoninate. Replace the cap and shake gently for about 15 seconds. · Reinsert the cuvette into the instrument. REQUIRED REAGENTS Code HI 93702-0 · Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 45 seconds and press READ. When the timer ends the meter will perform the reading. REAGENT SETS HI 93702-01 Reagents for 100 tests HI 93702-03 Reagents for 300 tests For other accessories see page 46. MEASUREMENT PROCEDURE · Select the Copper HR method using the procedure described in the Method Selection section (see page 11).

@@ · Place the cuvette into the holder and close the lid. · Press ZERO key. The meter will show "-0.0-" when the meter is zeroed and ready for measurement. 10 ml · The instrument displays the results in mg/L of copper.

INTERFERENCES Interference may be caused by: Silver Cyanide For samples overcoming buffering capacity of reagent (around pH 6.8), pH should be adjusted between 6 and 8. Copper HR 26 27 Copper HR COPPER LOW RANGE SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 0 to 1000 g/L 1 g/L ± 10 g/L $\pm 5\%$ of reading ± 1 g/L Tungsten lamp with narrow band interference filter @ 575 nm Adaptation of the EPA method. The reaction between copper and the bicinchoninate reagent causes a purple tint in the sample. Description Bicinchoninate Quantity 1 packet · Remove the cuvette.

· Add the content of one packet of HI 93747-0 Bicinchoninate. Replace the cap and shake gently for about 15 seconds. · Reinsert the cuvette into the instrument. · Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 45 seconds and press READ.



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When the timer ends the meter will perform the reading. **REQUIRED REAGENTS** Code HI 93747-0 **REAGENT SETS** HI 93747-01 Reagents for 100 tests HI 93747-03 Reagents for 300 tests For other accessories see page 46. The instrument displays the results in mg/L of copper. **MEASUREMENT PROCEDURE** · Select the Copper LR method using the procedure described in the Method Selection section (see page 11). @@ · Place the cuvette into the holder and close the lid. · Press ZERO key.

The meter will show "-0.0-" when the meter is zeroed and ready for measurement. 10 ml **INTERFERENCES** Interference may be caused by: Silver Cyanide For samples overcoming buffering capacity of reagent (around pH 6.8), pH should be adjusted between 6 and 8. Copper LR 28 29 Copper LR NITRATE **SPECIFICATIONS** Range Resolution Accuracy Typical EMC Deviation Light Source Method 0.0 to 30.0 mg/L 0.1 mg/L ± 0.5 mg/L $\pm 10\%$ of reading ± 0.1 mg/L Tungsten lamp with narrow band interference filter @ 525 nm Adaptation of the cadmium reduction method.

The reaction between nitrate and the reagent causes an amber tint in the sample. Description Powder reagent Quantity 1 packet **REQUIRED REAGENTS** Code HI 93728-0 · Replace the cap and immediately shake vigorously up and down for exactly 10 seconds. Continue to mix by inverting the cuvette gently for 50 seconds, while taking care not to induce air bubbles. Powder will not completely dissolve. Time and way of shaking could sensitively affect the measurement.

· Reinsert the cuvette into the instrument, taking care not to shake it. · Press **TIMER** and the display will show the countdown prior to the measurement or, alternatively, wait for 4 minutes and 30 seconds and press **READ**. When the timer ends the meter will perform the reading. The instrument displays the results in mg/L of nitrate-nitrogen. **REAGENT SETS** HI 93728-01 Reagents for 100 tests HI 93728-03 Reagents for 300 tests For other accessories see page 46. **MEASUREMENT PROCEDURE** · Select the Nitrate method using the procedure described in the Method Selection section (see page 11). · Using the pipette, fill the cuvette with 6 ml of sample, up to half of its height, and replace the cap. · Place the cuvette into the holder and close the lid. · Press ZERO key. The display will show "-0.0-" when the meter is zeroed and ready for measurement. 6 mL · Press the or to access the second level of functions. · Press the Chem Frm functional key to convert the result in mg/L of nitrate (NO₃⁻). · Press the or to go back to the measurement screen. **INTERFERENCES** Interference may be caused by: Ammonia and amines, as urea and primary aliphatic amines Chloride above 100 ppm Chlorine above 2 ppm Copper Iron(III) Strong oxidizing and reducing substances Sulfide must be absent 31 Nitrate · Remove the cuvette and add the content of one packet of HI 93728-0 reagent.

Nitrate 30 **NITRITE HIGH RANGE SPECIFICATIONS** Range Resolution Accuracy Typical EMC Deviation Light Source Method 0 to 150 mg/L 1 mg/L ± 4 mg/L $\pm 4\%$ of reading ± 1 mg/L Tungsten lamp with narrow band interference filter @ 575 nm Adaptation of the Ferrous Sulfate method. The reaction between nitrite and the reagent causes a greenish-brown tint in the sample. Description Powder reagent Quantity 1 packet · Reinsert the cuvette into the instrument. · Press **TIMER** and the display will show the countdown prior to the measurement or, alternatively, wait for 10 minutes and press **READ**. When the timer ends the meter will perform the reading. The instrument displays concentration in mg/L of nitrite. **REQUIRED REAGENTS** Code HI 93708-0

REAGENT SETS HI 93708-01 Reagents for 100 tests HI 93708-03 Reagents for 300 tests For other accessories see page 46. **MEASUREMENT PROCEDURE** · Select the Nitrite HR method using the procedure described in the Method Selection section (see page 11). · Fill the cuvette up to the mark with 10 mL of unreacted sample and replace the cap. · Place the cuvette into the holder and close the lid.

· Press ZERO key. The display will show "-0.0-" when the meter is zeroed and ready for measurement. 10 mL · Press the or to access the second level of functions. · Press the Chem Frm functional key to convert the result in mg/L of nitrogen-nitrite (NO₂-N) and sodium nitrite (NaNO₂). · Press the or to go back to the measurement screen. · Remove the cuvette. · Add the content of one packet of HI 93708-0 reagent. Replace the cap and shake gently until completely dissolved. Nitrite HR 32 33 Nitrite HR **NITRITE LOW RANGE SPECIFICATIONS** Range Resolution Accuracy Typical EMC Deviation Light Source Method 0.

00 to 0.35 mg/L 0.01 mg/L ± 0.02 mg/L $\pm 4\%$ of reading ± 0.01 mg/L Tungsten lamp with narrow band interference filter @ 525 nm Adaptation of the EPA Diazotization method 354.1. The reaction between nitrite and the reagent causes a pink tint in the sample. Description Powder reagent Quantity 1 packet · Reinsert the cuvette into the instrument. · Press **TIMER** and the display will show the countdown prior to the measurement or, alternatively, wait for 6 minutes and press **READ**. When the timer ends the meter will perform the reading.

The instrument displays concentration in mg/L of nitrite. **REQUIRED REAGENTS** Code HI 93707-0 **REAGENT SETS** HI 93707-01 Reagents for 100 tests HI 93707-03 Reagents for 300 tests For other accessories see page 46. **MEASUREMENT PROCEDURE** · Select the Nitrite LR method using the procedure described in the Method Selection section (see page 11). · Fill the cuvette up to the mark with 10 mL of unreacted sample (up to the mark) and replace the cap. · Place the cuvette into the holder and close the lid. · Press ZERO key. The display will show "-0.0-" when the meter is zeroed and ready for measurement. 10 mL · Press the or to access the second level of functions. · Press the Chem Frm functional key to convert the result in mg/L of nitrogen-nitrite (NO₂-N) and sodium nitrite (NaNO₂).

· Press the or to go back to the measurement screen. **INTERFERENCES** Interference may be caused by the following ions: ferrous, ferric, cupric, mercurous, silver, antimonious, bismuth, auric, lead, metavanadate and chloroplatinate. Strongly reducing and oxidizing reagents. High levels of nitrate (above 100 mg/L) could yield falsely high readings due to a minute amount of reduction to nitrite that could occur at these levels. · Remove the cuvette.

· Add the content of one packet of HI 93707-0 reagent. Replace the cap and shake gently for about 15 seconds. Nitrite LR 34 35 Nitrite LR **DISSOLVED OXYGEN SPECIFICATIONS** Range Resolution Accuracy Typical EMC Deviation Light Source Method 0.



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0 to 10.0 mg/L 0.

1 mg/L ± 0.4 mg/L $\pm 3\%$ of reading ± 0.1 mg/L Tungsten lamp with narrow band interference filter @ 420 nm Adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, Azide modified Winkler method. The reaction between dissolved oxygen and the reagents causes a yellow tint in the sample. Description Reagent A Reagent B Reagent C Quantity 5 drops 5 drops 10 drops · Let the sample stand and the flocculent agent will start to settle. · After approximately 2 minutes, when the upper half of the bottle becomes limpid, add 10 drops of HI 93732C-0. x 10 · Replace the cap and invert the bottle until the settled flocculent dissolves completely. The sample is ready for measurement when it is yellow and completely limpid. REQUIRED REAGENTS Code HI 93732A-0 HI 93732B-0 HI 93732C-0 · Fill the cuvette up to the mark with 10 mL of the unreacted (original) sample, and replace the cap. This is the blank.

· Place the cuvette into the holder and close the lid. · Press ZERO key. The display will show "-0.0-" when the meter is zeroed and ready for measurement. 10 mL REAGENT SET HI 93732-01 Reagents for 100 tests HI 93732-03 Reagents for 300 tests For other accessories see page 46. MEASUREMENT PROCEDURE · Select the Dissolved Oxygen method using the procedure described in the Method Selection section (see page 11). · Fill one 60 mL glass bottle completely with the unreacted sample. · Replace the cap and ensure that a small part of the sample spills over. · Remove the cap and add 5 drops of HI 93732A-0 and 5 drops of HI 93732B-0. · Add more sample, to fill the bottle completely.

Replace the cap again and ensure that a part of the sample spills over. This is to make sure that no air bubbles have been trapped inside, which could alter the reading. · Invert several times the bottle. The sample becomes orange-yellow and a flocculent agent will appear. Dissolved Oxygen x5 x5 · Remove the cuvette.

· Fill another cuvette up to the mark with 10 mL of the reacted sample and replace the cap. · Reinsert the cuvette into the instrument. · Press READ to start the reading. The instrument will display the results in mg/L of dissolved oxygen. INTERFERENCES Interferences may be caused by reducing and oxidizing materials.

37 Dissolved Oxygen 36 pH SPECIFICATIONS Range Resolution Accuracy Typical EMC Deviation Light Source Method 6.5 to 8.5 pH 0.1 pH ± 0.1 pH ± 0.1 pH Tungsten lamp with narrow band interference filter @ 525 nm Adaptation of the Phenol Red method. The reaction with the reagent causes a yellow to red tint in the sample. Description Phenol Red Indicator Quantity 5 drops · Reinsert the cuvette into the instrument. · Press the READ key to start the reading. The instrument displays the pH value.

REQUIRED REAGENTS Code HI 93710-0 REAGENT SETS HI 93710-01 Reagents for 100 pH tests HI 93710-03 Reagents for 300 pH tests For other accessories see page 46. MEASUREMENT PROCEDURE · Select the pH method using the procedure described in the Method Selection section (see page 11). @@ · Place the cuvette into the holder and close the lid. · Press ZERO key. The display will show "-0.0-" when the meter is zeroed and ready for measurement. 10 mL · Remove the cuvette and add 5 drops of HI 93710-0 Phenol Red Indicator. Replace the cap and mix the solution. x5 pH 38 39 pH PHOSPHATE HIGH RANGE SPECIFICATIONS Range Resolution Accuracy Typical EMC Dev. Light Source Method 0.

0 to 30.0 mg/L 0.1 mg/L ± 1 mg/L $\pm 4\%$ of reading ± 0.1 mg/L Tungsten lamp with narrow band interference filter @ 525 nm Adaptation of the Standard Methods for the Examination of Water and Wastewater, 18th edition, Amino Acid method. The reaction between phosphate and reagents causes a blue tint in the sample.

Description Molybdate Reagent B Quantity 10 drops 1 packet · Add the content of one packet of HI 93717B-0 Phosphate HR Reagent B to the cuvette. Replace the cap and shake gently until completely dissolved. · Reinsert the cuvette into the instrument. · Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 5 minutes and press READ. When the timer ends the meter will perform the reading.

The instrument displays the results in mg/L of phosphate (PO₄³⁻). REQUIRED REAGENTS Code HI 93717A-0 HI 93717B-0 REAGENT SETS HI 93717-01 Reagents for 100 tests HI 93717-03 Reagents for 300 tests For other accessories see page 46. MEASUREMENT PROCEDURE · Select the Phosphate HR method using the procedure described in the Method Selection section (see page 11). @@ · Place the cuvette into the holder and close the lid. · Press ZERO key. The display will show "-0.0-" when the meter is zeroed and ready for measurement. 10 mL · Press the or to access the second level of functions. · Press the Chem Frm functional key to convert the result in mg/L of phosphorus (P) and phosphorus pentoxide (P₂O₅). · Press the or to go back to the measurement screen.

INTERFERENCES Sulfide Chloride above 150000 mg/L) Calcium above 10000 mg/L as CaCO₃ Magnesium above 40000 mg/L as CaCO₃ Ferrous iron above 100 mg/L x 10 · Remove the cuvette. · Add 10 drops of HI 93717A-0 Molybdate reagent. Phosphate HR 40 41 Phosphate HR PHOSPHATE LOW RANGE SPECIFICATIONS Range Resolution Accuracy Typical EMC Dev. Light Source Method 0.00 to 2.50 mg/L 0.01 mg/L ± 0.04 mg/L $\pm 4\%$ of reading ± 0.01 mg/L Tungsten lamp with narrow band interference filter @ 610 nm Adaptation of the Ascorbic Acid method. The reaction between phosphate and the reagent causes a blue tint in the sample.

Description Powder reagent Quantity 1 packet · Reinsert the cuvette into the instrument. · Press TIMER and the display will show the countdown prior to the measurement or, alternatively, wait for 3 minutes and press READ. When the timer ends the meter will perform the reading. The instrument displays concentration in mg/L of phosphate (PO₄³⁻). REQUIRED REAGENTS Code HI 93713-0 REAGENT SETS HI 93713-01 Reagents for 100 tests HI 93713-03 Reagents for 300 tests For other accessories see page 46.

MEASUREMENT PROCEDURE · Select the Phosphate LR method using the procedure described in the Method Selection section (see page 11). · Rinse, cap and shake the cuvette several times with unreacted sample. Fill the cuvette with 10 mL of sample up to the mark and replace the cap. · Place the cuvette into the holder and close the lid. · Press ZERO key.

The display will show "-0.0-" when the meter is zeroed and ready for measurement. 10 mL · Press the or to access the second level of functions. · Press the Chem Frm functional key to convert the result in mg/L of phosphorus (P) and phosphorus pentoxide (P₂O₅).



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· Press the or to go back to the measurement screen. INTERFERENCES Interference may be caused by: Iron above 50 mg/L Silica above 50 mg/L Silicate above 10 mg/L Copper above 10 mg/L Hydrogen sulfide, arsenate, turbid sample and highly buffered samples also interfere. · Remove the cuvette and add the content of one packet of HI 93713-0 reagent. Replace the cap and shake gently (for about 2 minutes) until the powder is completely dissolved. Phosphate LR 42 43 Phosphate LR ERRORS AND WARNINGS The instrument shows clear warning messages when erroneous conditions appear and when measured values are outside the expected range. These messages are described below.

No Light: The light source is not functioning properly. DATA MANAGEMENT The analyzed data can be managed using Hanna's product HI 92000, Windows® Compatible Software. Light Leak: There is an excess amount of ambient light reaching the detector. Inverted cuvettes: The sample and the zero cuvettes are inverted. Battery Low: The battery capacity is lower than 10%. STANDARD METHODS Light Low: The instrument cannot adjust the light level. Please check that the sample does not contain any debris. Ammonia MR Ammonia LR Chlorine, Free Chlorine, Total Copper HR Copper LR Nitrate Nitrite HR Nitrite LR Oxygen, Dissolved pH Phosphate HR Phosphate LR Description Light High: There is too much light to perform a measurement. Please check the preparation of the zero cuvette. 0.

00 to 10.00 mg / L 0.00 to 3.00 mg / L 0.00 to 2.50 mg / L 0.00 to 3.50 mg / L 0.00 to 5.00 mg/L 0 to 1000 g/L 0.0 to 30.0 mg / L 0 to 150 mg/L 0.00 to 0.35 mg/L 0.0 to 10.0 mg/L 6.5 to 8.5 pH 0.0 to 30.0 mg/L 0.

00 to 2.50 mg/L Range Nessler Nessler DPD DPD Bicinchoninate Bicinchoninate Cadmium Reduction Ferrous Sulfate Diazotization Winkler Phenol Red Amino Acid Ascorbic Acid Method 44 45 ACCESSORIES REAGENT SETS HI 93700-01 100 ammonia LR tests HI 93700-03 300 ammonia LR tests HI 93701-01 100 free chlorine tests (powder) HI 93701-03 300 free chlorine tests (powder) HI 93701-F 300 free chlorine tests (liquid) HI 93701-T 300 total chlorine tests (liquid) HI 93702-01 100 copper HR tests HI 93702-03 300 copper HR tests HI 93707-01 100 nitrite LR tests HI 93707-03 300 nitrite LR tests HI 93708-01 100 nitrite HR tests HI 93708-03 300 nitrite HR tests HI 93710-01 100 pH tests HI 93710-03 300 pH tests HI 93711-01 100 total chlorine tests (powder) HI 93711-03 300 total chlorine tests (powder) HI 93713-01 100 phosphate LR tests HI 93713-03 300 phosphate LR tests HI 93715-01 100 ammonia MR tests HI 93715-03 300 ammonia MR tests HI 93717-01 100 phosphate HR tests HI 93717-03 300 phosphate HR tests HI 93728-01 100 nitrate tests HI 93728-03 300 nitrate tests HI 93732-01 100 dissolved oxygen tests HI 93732-03 300 dissolved oxygen tests HI 93747-01 100 copper LR tests HI 93747-03 300 copper LR tests OTHER ACCESSORIES HI 731318 Cloth for wiping cuvettes (4 pcs) HI 731321 glass cuvettes (4 pcs) HI 731325W new cap for cuvette (4 pcs) HI 740034 cap for 100 mL beaker (6 pcs) HI 740036 100 mL plastic beaker (6 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 740157 plastic refilling pipette (20 pcs) HI 740220 25 mL glass cylinders with caps (2 pcs) HI 740226 5 mL graduated syringe HI 92000 Windows Compatible Software HI 920013 PC connection cable HI 93703-50 cuvette cleaning solution (230 mL) 46 WARRANTY All Hanna Instruments meters are warranted for two years against defects in workmanship and materials when used for its intended purpose and maintained according to the instructions. This warranty is limited to repair or replacement free of charge. Damages due to accident, misuse, tampering or lack of prescribed maintenance are not covered. If service is required, contact your dealer. @@@@To validate your warranty, fill out and return the enclosed warranty card within 14 days from the date of purchase. Recommendations for Users Before using these products, make sure that they are entirely suitable for your specific application and for the environment in which they are used. Operation of these instruments may cause unacceptable interferences to other electronic equipments, this requiring the operator to take all necessary steps to correct interferences. Any variation introduced by the user to the supplied equipment may degrade the instruments' EMC performance. To avoid damages or burns, do not put the instrument in microwave ovens.

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