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PORTABLE TURBIDIMETER

Model 2100P ISO

Instrument manual

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Hach Company certifies this instrument was tested thoroughly, inspected and found to meet its published specifications when it was shipped from the factory.

The Model 2100P ISO Portable Turbidimeter has been tested and is certified as indicated to the following instrumentation standards:

Product Safety:

External Power Supplies Only:
115 V ac Supply, UL Listed & CSA Certified, or
230 V ac Supply, CE Marked per 73/23/EEC, VDE Listed

EMI Immunity:

Instrument Tested with external 230 V, 50 Hz Power Supply:
Per 89/336/EEC EMC: EN 61326:1998 (Electrical Equipment for measurement, control and laboratory use—EMC requirements) Supporting test records by Hach Company, certified compliance by Hach Company.

Standards include:
IEC 1000-4-2:1995 (EN 61000-4-2:1995) Electro-Static Discharge Immunity (Criteria B)

IEC 1000-4-3:1995 (EN 61000-4-3:1996) Radiated RF Electro-Magnetic Field Immunity (Criteria B)

IEC 1000-4-4:1995 (EN 61000-4-5:1995) Electrical Fast Transients/Burst (Criteria B)

IEC 1000-4-5:1995 (EN 61000-4-5:1995) Surge (Criteria B)

IEC 1000-4-6:1996 (EN 61000-4-6:1996) Conducted Disturbances Induced by RF Fields (Criteria A)

IEC 1000-4-11:1994 (EN 61000-4-11:1994) Voltage Dip/Short Interruptions (Criteria B)

Emissions

Instrument Tested with the external 230 V, 50 Hz Power Supply:
Per 89/336/EEC EMC: EN 61326:1998 (Electrical Equipment for measurement, control and laboratory use—EMC requirements) Class “B” emission limits. Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01) certified compliance by Hach Company.

Standards include:
EN 61000-3-2 Harmonic Disturbances Caused by Electrical Equipment

EN 61000-3-3 Voltage Fluctuation (Flicker) Disturbances Caused by Electrical Equipment

Additional Emissions Standard/s include:
EN 55011 (CISPR 11) Class “B” emission limits

Canadian Interference-causing Equipment Regulation, IECS-003:
Class “A” emission limits. Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01), certified compliance by Hach Company.

This Class A digital apparatus meets all requirements of the Canadian Interference-causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Reglement sur le matériel brouilleur du Canada.

FCC Part 15: Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01), certified compliance by Hach Company.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense. The following techniques of reducing the interference problems are applied easily.Externes Netzteil vom Gerät trennen, um sicherzugehen, dass die Störung nicht durch das Messgerät verursacht wird.

1. Disconnect the external power supply or remove the batteries from the 2100P ISO Portable Turbidimeter to determine whether it is the source of the interference.

2. Move the 2100P ISO Portable Turbidimeter and its power supply away from the device receiving the interference.

3. Move the device receiving the interference to a different location.

4. Try combinations of the above.

SAFETY PRECAUTIONS

Please read this entire manual before unpacking, setting up, or operating this instrument. Pay particular attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that which is specified in this manual.

Use of Hazard Information

If multiple hazards exist, this manual will use the signal word (Danger, Caution, Note) corresponding to the greatest hazard.

DANGER
Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION
Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTE
Information that requires special emphasis.

Precautionary Labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed.

 This symbol, if noted on the instrument, references the instruction manual for operational and/or safety information.

Specifications are subject to change without notice. Operating specifications applicable at 25 °C unless noted. Program software copyrighted by Hach Company, 1991.

Measurement Method: Ratio Nephelometric signal (90°) scatter light ratio to transmitted light

Range: 0–1000 FNU with automatic decimal point placement or manual range selection of 0–9.99, 0–99.9 and 0–1000 FNU

Accuracy: ± 2% of reading plus stray light from 0–1000 FNU

Resolution: 0.01 FNU on lowest range

Repeatability: ± 1% of reading or 0.01 FNU, whichever is greater

Response Time: 6 seconds for full step change without signal averaging in constant reading mode

Stray Light: <0.04 FNU

Standardization: StablCal® Stabilized Formazin primary standards or Formazin primary standards

Display: Four-digit liquid crystal; 10.16 mm high digits with custom icons

Light Source: T860 nm LED lamp

Detectors: Silicon photovoltaic

Signal Averaging: Operator selectable on or off

Sample Cells: (Height X width) 60.0 X 25 mm Borosilicate glass with screw caps, marking band and fill line

Sample Required: 15 mL

Storage Temperature: –40 to 60 °C (instrument only)

Operating Temperature: 0 to 50 °C (instrument only)

Operating Humidity Range: 0 to 90% RH noncondensing at 30 °C;
0 to 80% RH noncondensing at 40 °C;
0 to 70% RH noncondensing at 50 °C

Power Requirements: Four AA Alkaline cells or optional battery eliminator

Battery Life: Typically 300 tests with signal average mode off; 180 tests with signal average mode on

Battery Eliminator (optional): For 120 V eliminator: CSA and UL approved for 120 V ac ± 10%, 60 Hz, 6 V at 800 mA dc output
For 230 V eliminator: CE (VDE) approval pending for 230 V ac ± 10%, 50 Hz, 6 V at 900 mA dc output

Enclosure: High impact ABS plastic

Dimensions: 22.2 X 9.5 X 7.9 cm

Instrument Weight: 520 kg

Shipping Weight: 3.1 kg

OPERATION

DANGER

Handling chemical samples, standards, and reagents can be dangerous. Review the necessary Material Safety Data Sheets and become familiar with all safety procedures before handling any chemicals.

DANGER

La manipulation des échantillons chimiques, étalons et réactifs peut être dangereuse. Lire les Fiches de Données de Sécurité des Produits (FDSP) et se familiariser avec toutes les procédures de sécurité avant de manipuler tous les produits chimiques.

PELIGRO

La manipulación de muestras químicas, estándares y reactivos puede ser peligrosa. Revise las fichas de seguridad de materiales y familiarícese con los procedimientos de seguridad antes de manipular productos químicos.

GEFAHR

Das Arbeiten mit chemischen Proben, Standards und Reagenzien ist mit Gefahren verbunden. Es wird dem Benutzer dieser Produkte empfohlen, sich vor der Arbeit mit sicheren Verfahrensweisen und dem richtigen Gebrauch der Chemikalien vertraut zu machen und alle entsprechenden Materialsicherheitsdatenblätter aufmerksam zu lesen.

PERIGO

A manipulação de amostras, padrões e reagentes químicos pode ser perigosa. Reveja a folha dos dados de segurança do material e familiarize-se com todos os procedimentos de segurança antes de manipular quaisquer produtos químicos.

PERICOLO

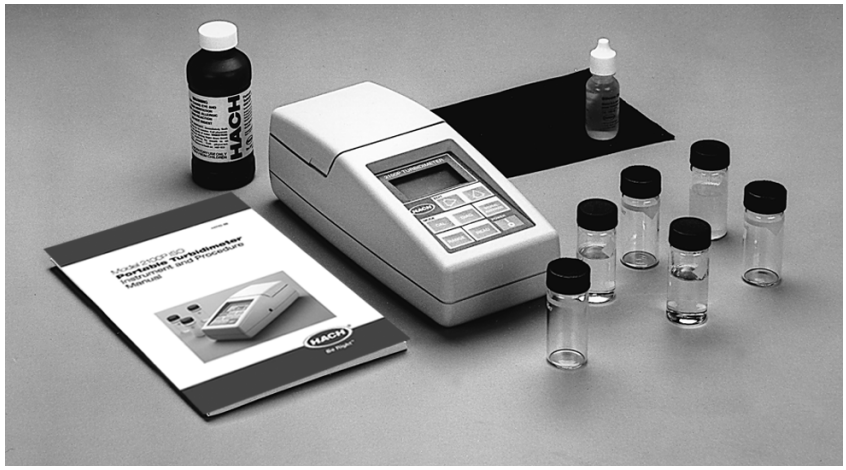
La manipolazione di campioni, standard e reattivi chimici può essere pericolosa. La preghiamo di prendere conoscenza delle Schede Techniche necessarie legate alla Sicurezza dei Materiali e di abituarsi con tutte le procedure di sicurezza prima di manipolare ogni prodotto chimico.

Section 1 Description

1.1 General Description

The Hach Model 2100P ISO Portable Turbidimeter (Figure 1) measures turbidity from 0.01 to 1000 FNU. The instrument operates on four AA alkaline batteries or with an optional battery eliminator. Rechargeable nickel-cadmium cells may be used, but cannot be recharged in the instrument. The carrying case holds teh instrument, all standard accessories, and the optional battery eliminator.

Figure 1 2100P ISO Turbidimeter and Accessories



Note: *Avoid prolonged exposure to ultraviolet light and sunlight.*

Note: *When taking a reading, place the instrument on a level, stationary surface. It should not be held in the hand during measurement.*

1.2 Accessories

Accessories supplied with the turbidimeter include six sample cells; one sealed vial each of: <0.1-FNU, 20-FNU, 100-FNU, and 800-FNU StablCal® Stabilized Formazin Standards; 4 AA alkaline batteries; 15 mL of silicone oil; oiling cloth; carrying case; instrument manual; and quick reference card.

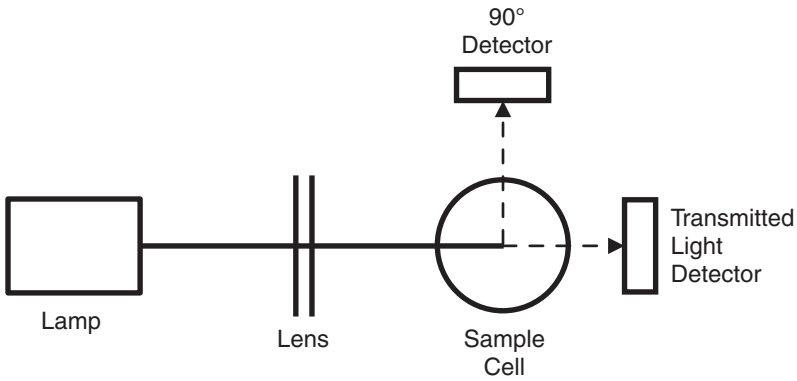
1.3 Principle of Operation

The Model 2100P ISO Portable Turbidimeter operates on the nephelometric principle of turbidity measurement. This instrument meets the design criteria specified by DIN ISO 7027.

The ratio optical system (Figure 2) includes an LED lamp, a 90° detector to monitor scattered light, and a transmitted light detector. The microprocessor calculates the

ratio of the signals from the 90° and transmitted light detector. This ratio technique corrects for interferences from color and/or light absorbing materials (such as activated carbon) and compensates for fluctuations in lamp intensity, providing long-term calibration stability. The optical design also minimizes stray light, increasing measurement accuracy.

Figure 2 Ratio Optical System



1.4 Preparation for Use

1.4.1 Battery Installation

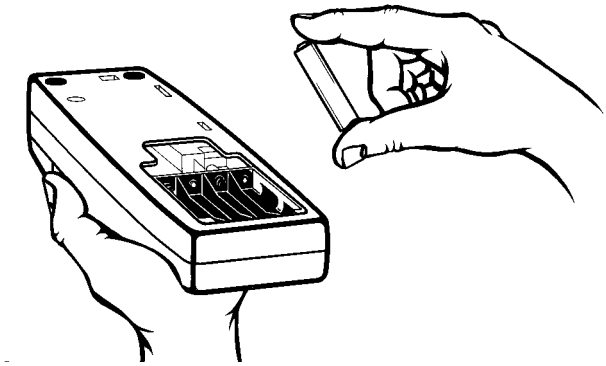
The instrument is shipped without the batteries installed. Before use, install the four AA alkaline batteries (Figure 3) or connect the battery eliminator. For battery operation:

1. Remove the battery compartment cover on the instrument bottom.

2. Install the batteries.

3. Correct battery polarity is shown on the battery holder. Reinstall the battery compartment cover.

Figure 3 Battery Installation



1.4.2 Using the Battery Eliminator and Rechargeable Batteries

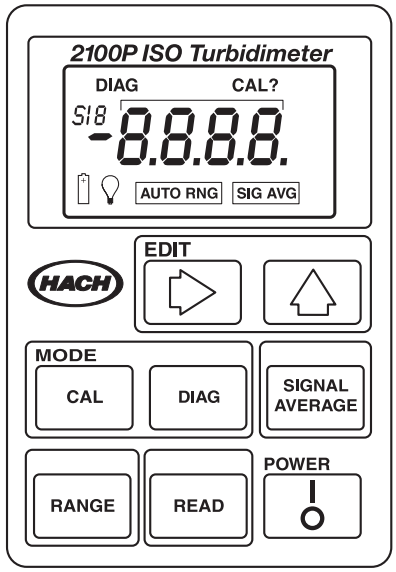
Plug the eliminator jack into the connector on the turbidimeter side. The optional battery eliminator may be used with or without the batteries installed. The eliminator will not charge batteries. Rechargeable batteries may be used in the instrument, but must be removed for recharging. See HOW TO ORDER on page 34 for ordering information. To prolong battery life, the instrument lamp turns on temporarily when the **READ** key is pressed.

1.4.3 Calibration

The 2100P ISO Portable Turbidimeter is calibrated with Formazin Primary Standard at the factory and does not require recalibration before use. See Calibration 2.3 on page 19 for calibration instructions.

Section 2 OPERATION

2.1 Operational Controls and Indicators



Key	Description
I O	Power key turns instrument on and off. If no keys are pressed for 5.5 minutes, the instrument turns off automatically.
READ	Performs a measurement. To conserve battery power, the lamp turns on only when READ is pressed. A reading is displayed about 12 seconds after the key is pressed. After the reading is displayed, the lamp turns off and the reading continues to be displayed. After a measurement is taken, there is a 4-second recovery time before another can be started. If Read is pressed during the recovery time, the display will flash but the lamp will not turn on until the recovery time is complete. If no key strokes occur for 5.5 minutes, the meter turns off. Hold this key for continuous reading if the meter is not in the Signal Averaging mode. After the initial delay, the reading is updated every 1.2 seconds.
CAL	Performs a calibration or review calibration data. Also terminates a calibration or calibration review and returns to the 2100P ISO measurement mode.
△	Edits a flashing digit in the calibration mode, or scrolls through the calibration standards (S0,S1, S2, S3) or diagnostic menu.
▷	Moves the editing cursor to the digits being edited in the calibration mode or initiate editing of a standard value.
SIGNAL AVERAGE	Turns the signal averaging function on or off.
DIAG	Selects the diagnostic mode.

Key	Description
RANGE	Scrolls between Auto Range, Manual Range, 0.00–9.99 FNU range, 10–99.9 FNU range, and 100–1000 FNU range. The range selection cannot be changed when a reading or calibration is in progress. When the meter is turned on it defaults to the last used range mode and measurement range.

Key	Description
DIAG	Turns on after DIAG is pressed. A number displayed under the DIAG icon (1–9) indicates which diagnostic function is active.
CAL	Turns on after CAL is pressed and remains on during the calibration.
CAL?	Appears after calibration if a value entered during calibration is outside an acceptable range. May indicate an operator error or possible instrument malfunction. Flashing CAL? indicates the default calibration coefficients are being used (even after a user-calibration has been done) or that no calibration data is currently stored.
S__	Appears during calibration. The S is followed by a number to indicate which standard value is currently being edited or displayed. The flashing number is prompting user for measurement of S0, S1, S2 or S3 to establish a calibration. Steady number identifies which standard value is being displayed.
	Flashes when the battery voltage drops to 4.4 volts indicating to change batteries. At <4.0 volts, the instrument automatically shuts off.
	Appears constantly when the lamp is on and flashes after a reading if a marginal light level reaches the transmitted light detector. When flashing, it indicates the sample may be too turbid (not within measurement range) and needs dilution or the lamp needs replacing.
SIG AVG	Indicates the signal averaging mode is on. The icon turns off if signal averaging is not selected.
AUTO RNG	Indicates instrument is in automatic range mode. The icon turns off when manual range mode is selected.
8888	The 4-digit display is active when the instrument is on (measurements are displayed to three digits). After the **READ** key is pressed - - - - is displayed during wait periods.

2.2 Signal Averaging

Signal averaging measures and averages ten measurements while displaying intermediate results. The initial value is displayed after about 11 seconds and the display is updated every 1.2 seconds until all ten measurements are taken (about 22 seconds). Afterwards, the lamp turns off, but the final measured turbidity value continues to be displayed until another key is pressed.

When signal averaging is off, the instrument takes three measurements, the microprocessor averages them, then displays the average. If the READ key is held

during measurement, the initial value is displayed in 12 seconds and is updated every 1.2 seconds as long as the READ key is held.

When the instrument is turned on, the instrument defaults to the signal averaging mode which was used during the last measurement.

2.3 Calibration

Calibration of the 2100P ISO Turbidimeter is based on formazin, the primary standard for turbidity. The electronic and optical design provide long-term stability and minimize the need for frequent calibration. The two-detector ratioing system compensates for most fluctuations in lamp output. A formazin recalibration should be performed at least once every three months, more often if experience dictates. When calibration is necessary, use a primary standard such as StablCal™ Stabilized Standards or formazin standards.

For Hach turbidimeters, use only StablCal® Stabilized Formazin or formazin standards. Hach Company cannot guarantee the performance of the turbidimeter if calibrated with co-polymer styrene divinylbenzene beads or other suspensions.

2.3.1 StablCal Stabilized Formazin Standards

2.3.1.1 Storing and Handling StablCal Stabilized Standards

For optimum results when using StablCal Stabilized Standards, adhere to the following recommendations:

- Do not transfer the standard to another container for storage.
- Do not return standard from the sample cell back into the its original container. Standard contamination will result.
- Store standards between 0 and 25 °C.
- For long-term storage, refrigeration at 5 °C is recommended. Do not store above 25 °C.
- Allow the standard to acclimate to ambient instrument conditions before use (not to exceed 40 °C).

- Store away from direct sunlight. Store vials in their respective kit or shipping box with the cover in place.

2.3.1.2 Preparing Bulk StablCal Stabilized Standards

Bulk standards that have been sitting undisturbed for longer than a month must be shaken to break the condensed suspension. Start at step 1 for these standards. If the standards are used on at least a weekly interval, start at step 3.

Note: *When using <0.1-FNU StablCal Standards, do not shake or invert.*

1. Shake the standard vigorously for 2–3 minutes to suspend particles.

2. Allow the standard to stand undisturbed for 5 minutes.

3. Gently invert the bottle of StablCal 5 to 7 times.

4. Rinse the sample cell at least once with the standard and discard the rinse.

5. Immediately fill the sample cell with the standard. Cap the sample cell and let it stand for one minute. The standard is now ready for use in the calibration procedure, Section 2.3.3 on page 22.

2.3.1.3 Preparing StablCal Stabilized Standards in Sealed Vials

Sealed vials that have been sitting undisturbed for longer than a month must be shaken to break the condensed suspension into its original particle size. Start at step 1 for these standards. If the standards are used on at least a weekly interval, start at step 3.

Note: *When using <0.1-FNU* StablCal Standards do not shake or invert.*

1. Shake the standard vigorously for 2–3 minutes to suspend particles.

2. Allow the standard to stand undisturbed for 5 minutes.

3. Gently invert the vial of StablCal 5 to 7 times.

4. Let the vial stand for one minute. The standard is now ready for use in the calibration procedure, see Calibrating the Turbidimeter on page 21.

2.3.2 Correcting for Turbidity of Dilution Water

The 2100P ISO Turbidimeter automatically compensates for turbidity contributed by dilution water when calculating the true value of the lowest formazin standard. Use high quality distilled or deionized water less than 0.5 FNU. The instrument will display "E 1" after calibration if the dilution water turbidity is greater than 0.5 FNU. In this case, prepare the water as directed below.

The value of the dilution water can be arbitrarily forced to zero using the calibration procedure. This is not recommended for most applications and, if done, should be done only if the dilution water turbidity is less than 0.2 FNU.

2.3.2.1 Preparing Dilution Water

Note: *Use the same dilution water for all dilutions and the sample blank.*

Collect at least 1000 mL of high quality dilution water (distilled or deionized water). The 2100P ISO Turbidimeter, as received from the factory, is precalibrated and may be used to check the dilution water turbidity. If the turbidity is greater than 0.5 FNU, filter the water with the Sample Filtration and Degassing Kit (Cat. No. 43975-10) or equivalent. When measuring low range turbidity, clean all glassware with 1:1 hydrochloric acid and rinse several times with dilution water. If the glassware is not used immediately, use stoppers to prevent contamination from small particles.

2.3.3 Calibrating the Turbidimeter

NOTES

- If the I/O key is pressed during calibration, the new calibration data is lost and the old calibration will be used for measurements. Once in calibration mode, only the READ, I/O, ⇧, and ⇨ keys function. Signal averaging and range mode must be selected before entering the calibration mode.

- If "E 1" or "E 2" are displayed, an error occurred during calibration. Check the standard preparation and review the calibration; repeat the calibration if necessary. Press DIAG to cancel the error message (E 1 or E 2). To continue without repeating the calibration, press I/O twice to restore the previous calibration. If "CAL?" is displayed, an error may have occurred during calibration. The previous calibration may not be restored. Either recalibrate or use the calibration as is.

- To review a calibration, press CAL and then ⇧ to view the calibration standard values. As long as READ is never pressed and CAL is not flashing, the calibration will not be updated. Press CAL again to return to the measurement mode.

Note: *For accuracy, use the same sample cell or four matched sample cells for all measurements during calibration. Always insert the cell so the orientation mark placed on the cell during the matching procedure is correctly aligned.*

1. Rinse a clean sample cell several times with dilution water. Fill the cell to the line (about 15 mL) with dilution water or use StablCal <0.1 FNU standard.

Note: *The same dilution water used for preparing the standards must be used in this step.*

2. Insert the sample cell in the cell compartment by aligning the orientation mark on the cell with the mark on the front of the cell compartment. Close the lid. Press I/O.

3. Choose signal average mode option (on or off) before pressing CAL. The SIGNAL AVERAGE key is not functional in calibration mode.

4. Press CAL. The CAL and S0 icons will appear (the 0 will flash). The 4-digit display will show the value of the S0 standard for the previous calibration. If the blank value was forced to 0.0, the display will be blank. Press the right key to get a numerical display.

5. Press READ. The meter will count from 60 to 0, (67 to 0 if signal average is on), read the blank, and use it to calculate a correction factor for the 20 FNU standard measurement. If the dilution water is >0.5 FNU, E1 will appear when the calibration is calculated (See Preparing Dilution Water on page 21 for more dilution water information). The display will automatically increment to the next standard.

6. Remove the sample cell from the cell compartment.
The turbidity of the dilution water can be "forced" to zero by pressing the ⇨ key rather than reading the dilution water. The display will show "S0 FNU". Press the ⇧ key to continue with the next standard.

7. The display will show “S1” (with the 1 flashing) and 20 FNU or the value of the S1 standard for the previous calibration. If the value is incorrect, edit using the arrow keys.

8. Fill a clean sample cell to the line with well mixed 20 FNU StablCal Standard or 20 FNU formazin standard. Insert the sample cell into the cell compartment by aligning the orientation mark on the cell with the mark on the front of the cell compartment. Close the lid.

9. Press **READ**. The instrument will count from 60 to 0 (67 to 0 if signal average is on). The display will automatically increment to the next standard.

10. Remove the sample cell from the cell compartment.

11. The display will show “S2” (with the 2 flashing) and “100 FNU” or the value of the S2 standard for the previous calibration. If the value is incorrect, edit using the arrow keys.

12. Fill a clean sample cell to the line with well mixed 100 FNU StablCal Standard or 100 FNU formazin standard. Insert the sample cell into the cell compartment by aligning the orientation mark on the cell with the mark on the front of the cell compartment. Close the lid.

13. Press **READ**. The instrument will count from 60 to 0 (67 to 0 if signal average is on). The display will automatically increment to the next standard.

14. Remove the sample cell from the cell compartment.

15. The display will show “S3” (with the 3 flashing) and “800 FNU” or the value of the S3 standard for the previous calibration. If the value is incorrect, edit using the arrow keys.

16. Fill a clean sample cell to the line with well mixed 800 FNU StablCal Standard or 800 FNU formazin standard. Insert the sample cell into the cell compartment by aligning the orientation mark on the cell with the mark on the front of the cell compartment. Close the lid.

17. Press READ. The instrument will count from 60 to 0 (67 to 0 if signal average is on). The display will increment back to the S0 display. Remove the sample cell from the cell compartment.

18. Press CAL to accept the calibration. The instrument will return to measurement mode automatically.

Note: *If calibration errors occurred during calibration, error messages will appear after CAL is pressed.*

Note: *The standards must have a difference of at least 60 FNU.*

Section 3 TURBIDITY MEASURE

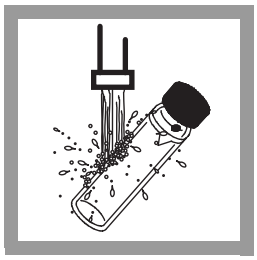
3.1 Turbidity Measurement

Measurements may be made with the signal average mode on or off and in manual or automatic range selection mode.

With signal average mode off, the final value is displayed after approximately 12 seconds.

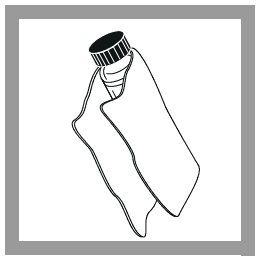
Accurate turbidity measurement depends on good measurement technique by the analyst, such as using clean sample cells in good condition and removing air bubbles (degassing).

3.1.1 Turbidity Measurement Procedure

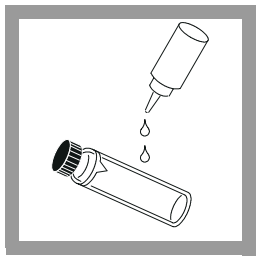


1. Thoroughly clean the sample cell.

2. Collect a representative sample in a clean container. Fill a sample cell to the line (about 15 mL), taking care to handle the sample cell by the top. Cap the cell.

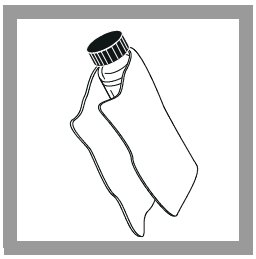


3. Wipe the cell with a soft, lint-free cloth to remove water spots and fingerprints.



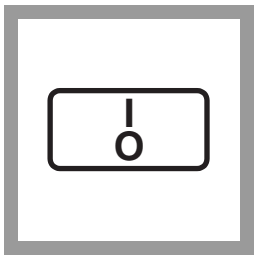
4. Apply a thin film of silicone oil. Wipe with a soft, lint-free cloth to obtain an even film over the entire surface.

Note: *Applying a thin coat of silicone oil will mask minor imperfections and scratches which may contribute to turbidity or stray light. Use silicone oil equivalent to Hach Cat. No. 1269-36, which has the same refractive index as glass.*



5. Wipe off the excess so that only a thin coat of oil is left. Excess oil may retain dirt and contaminate the instrument cell compartment.
The cell should appear nearly dry with little or no visible oil.

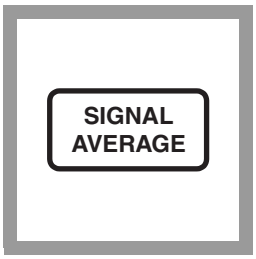
Note: *Soft, lint-free cloth (velvet) works well for oiling. Store the oiling cloth with the sample cells and keep it free of dirt. After a few applications of oil, the cloth will contain enough residual oil that simply wiping the cell with the oiled cloth will provide a sufficient oil coat on the sample cell. Periodically, add a small amount of oil to the sample cell surface to replenish the oil in the cloth.*



6. Press: **I/O**.

7. Insert the sample cell in the instrument cell compartment so the diamond or orientation mark aligns with the raised orientation mark in front of the cell compartment. **Close the lid.**

8. Press: **RANGE**. Select mannual or automatic range mode.



9. Press: **SIGNAL AVERAGE**.

10. Press: **READ**
The display will show the turbidity in FNU. Record the turbidity after the lamp symbol turns off.

Note: *The instrument defaults to the last operating mode selected. If automatic range mode and signal averaging were used on the previous measurements, these options will automatically be selected for subsequent samples.*

MAINTENANCE

Some of the following manual sections contain information in the form of warnings, cautions and notes that require special attention. Read and follow these instructions carefully to avoid personal injury and damage to the instrument. Only personnel qualified to do so, should conduct the maintenance tasks described in this portion of the manual.

Certains des chapitres suivants de ce mode d'emploi contiennent des informations sous la forme d'avertissements, messages de prudence et notes qui demandent une attention particulière. Lire et suivre ces instructions attentivement pour éviter les risques de blessures des personnes et de détoriation de l'appareil. Les tâches d'entretien décrites dans cette partie du mode d'emploi doivent être seulement effectuées par le personnel qualifié pour le faire.

Algunos de los capítulos del manual que presentamos contienen muy importante información en forma de alertas, notas y precauciones a tomar. Lea y siga cuidadosamente estas instrucciones a fin de evitar accidentes personales y daños al instrumento. Las tareas de mantenimiento descritas en la presente sección deberán ser efectuadas únicamente por personas debidamente cualificadas.

Einige der folgenden Abschnitte dieses Handbuchs enthalten Informationen in Form von Warnungen, Vorsichtsmaßnahmen oder Anmerkungen, die besonders beachtet werden müssen. Lesen und befolgen Sie diese Instruktionen aufmerksam, um Verletzungen von Personen oder Schäden am Gerät zu vyyyermeiden. In diesem Abschnitt beschriebene Wartungsaufgaben dürfen nur von qualifiziertem Personal durchgeführt werden.

Algumas das seguintes secções do manual contêm informações em forma de advertências, precauções e notas que requerem especial atenção. Leia e siga atentamente as presentes instruções para evitar ferimentos pessoais e não danificar o instrumento. As tarefas de manutenção descritas nesta parte do manual só poderão ser executadas por pessoal qualificado.

Section 4 MAINTENANCE

4.1 Lamp Replacement

The procedure below explains lamp installation and electrical connections. Use a small screwdriver to remove and install the lamp leads in the terminal block. The instrument requires calibration after lamp replacement.

1. Orient the instrument so it is upside down and the top faces away from you. Remove the battery cover and at least one battery.

2. Remove the lamp assembly by grasping the tab on the left side of the assembly and remove the old lamp leads.

3. Insert the new lamp at the same way.

4. Replace the batteries and battery cover.

5. Insert the 800 FNU formazin standard into the sample cell. Press and hold **READ**. Then press **I/O**. Release the **READ** key after the software version number disappears from the display.

6. Adjust the scattered light amplifier output by inserting a small flat-blade screwdriver into the trimpot hole (located on bottom). Adjust the display to read 2.5 ± 0.3 volts.

7. Press **I/O** to exit gain adjust mode.

8. Perform a formazin calibration according to Calibrating the Turbidimeter on page 21.

Section 5 TROUBLE SHOOTING

5.1 Instrument Diagnostics

5.1.1 Display Test

Pressing and holding the I/O key turns on all the display icons and elements so you can determine if all the elements and icons are functioning. The display test sequence will cycle as long as the key is held down.

5.2 Error Messages

Error messages indicate sample interferences and/or instrument malfunction.

5.2.1 Flashing Numeric Display

If the highest value in the range selected is flashing in the display, the sample is too turbid (or overrange) for the selected range. In automatic or manual range, 1000 flashes if the sample is over the instrument range. In manual range mode, select the next higher range mode if 9.99 or 99.9 flashes. The display will stop flashing if a sample within range is inserted and read.

5.2.2 Error Messages

An error message indicates either an instrument failure or an operation cannot be performed. An error message can be cleared by pressing DIAG (display will return to previous measurement or calibration value). The meter continues to operate as best it can. If the message occurs during a calibration, calibration can continue. If the error message occurs when a calibration is being calculated, the instrument will discard the new calibration and retain the old calibration. Error messages and corrective actions are listed below.

5.2.3 CAL?

A flashing CAL? appears when the instrument is using the default calibration programmed at the factory. CAL? (not flashing) appears when a calibration has questionable validity.

Message	Probable Cause	Corrective Action
E1	Dilution water is ≥ 0,5 FNU.	Start calibration over with better quality dilution water or use a membrane filter to filter the water before use.
E2	Two standards have the same value or their difference is less than 60 FNU. Not all standards were read during the calibration. Standard 1 is too low (<10 FNU).	Recheck preparation of standards and repeat calibration.
E3	Low light error.	Re-read measurement. Check lamp Check for obstructed light path. Dilution may be necessary.
E4	EEPROM malfunction.	Check sum failed. Press I/O. If E4 reappears, call Hach service. If CAL? appears, recalibrate.
E5	A/D overrange.	Check for obstructed light path.
E6	A/D underrange.	Check for open lid during reading and re-read. Check for obstructed light path. If persists, call Hach Service.
E7	Light Leak.	Close lid before pressing READ.
E8	Bad lamp circuit.	Reinsert lamp leads at terminal block-make sure the lead ends are not touching each other.If this fails, call Hach Service.

REPLACEMENT PARTS

Description	Cat. No.
AA Batteries, 4/pkg	1938004
Battery Door	4600500
Carrying Case	4650600
Lamp Assembly, LED	4460200
Oiling Cloth	4707600
Sample Cells, 1 inch, with cap, 6/pkg	2434706
Silicone Oil, 15 mL	126936

OPTIONAL ACCESSORIES AND REAGENTS

Deionized Water, 3.78 L	27217
Bath, Ultrasonic, 2.8 L (0.75-gal), w/heater	2489500
Battery Charger, 120 V	4647900
Battery Charger, 230 V	4647901
Battery Eliminator, 120 V	4607900
Battery Eliminator, 230 V	4608000
Filter, 0.2 micron, 10/pkg	2323810
Formazin, 4000 FNU, 500 mL	246149
Formazin, 4000 FNU,100 mL	246142
Hexamethylenetetramine, 100 g	187826
Hexamethylenetetramine, 500 g	187834
Hydrazine Sulfate, 20 g	74246
Hydrazine Sulfate, 100 g	74226
NiCad Rechargeable Battery (4 required)	1607700
Pipet, serologic, 1.00 mL	53235
Pipet, TenSette®, 1-10 mL	1970010
Pipet Tips, for 1-10 mL TenSette Pipet, 50/pkg	2199796
Pipet Tips, for 1-10 mL TenSette Pipet, 1000/pkg	2199728
Pipet, Volumetric, Class A, 1.00 mL	1451535
Pipet, Volumetric, Class A, 5.00 mL	1451537
Pump, Vacuum, Hand-Operated	1428300
Pump, Vacuum, 115 V, 60 Hz	1469700
Pump, Vacuum, 230 V, 50 Hz	1469702
Sample Degassing Kit	4397500
Sample Filtration and Degassing Kit	4397510

StablCal® Calibration Set for 2100P ISO Turbidimeter
<0.1, 20, 100, 800 FNU, 500 mL each 2659400
<0.1, 20, 100, 800 FNU, 100 mL each 2659410
<0.1, 20, 100, 800 FNU, sealed vials 2659405
<0.1 FNU StablCal®Stabilized Formazin Standard, 100 mL 2659742
20 FNU StablCal® Stabilized Formazin Standard, 100 mL 2660142
100 FNU StablCal® Stabilized Formazin Standard, 100 mL 2660242
800 FNU StablCal® Stabilized Formazin Standard, 100 mL 2660542
StablCal® Calibration Set for 2100P ISO,sealed vials,
< 0.1 FNU, 20 FNU, 100 FNU, and 800 FNU 2659405
Triton-X Solution, 118 mL (4 oz) 1409632
Volumetric Flask, 100 mL 1457442
Volumetric Flask, 200 mL 1457445

HOW TO ORDER

By Telephone:
6:30 a.m. to 5:00 p.m. MST
Monday through Friday
(800) 227-HACH
(800-227-4224)
By FAX: (970) 669-2932

By Mail:
Hach Company
P.O. Box 389
Loveland, CO 80539-0389
U.S.A.

Ordering information by E-mail: orders@hach.com

Information Required

- Hach account number (if available)
- Your name and phone number
- Purchase order number
- Brief description or model number
- Billing address
- Shipping address
- Catalog number
- Quantity

In Europe, the Middle East, or Mediterranean Africa:
Dr. Bruno Lange GmbH & Co KG
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Fax: +49/(0)211.52.88.231
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www.hach-lange.com

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Fax: +44(0) 12 56 33 07 24
info@hach-lange.co.uk
www.hach-lange.com

Authorization must be obtained from Hach Company before sending any items for repair. Please contact the HACH Service Center serving your location.

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WARRANTY

Hach Company warrants this product to the original purchaser against any defects that are due to faulty material or workmanship for a period of one year from date of shipment.

In the event that a defect is discovered during the warranty period, Hach Company agrees that, at its option, it will repair or replace the defective product or refund the purchase price, excluding original shipping and handling charges. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original product warranty period.

This warranty does not apply to consumable products such as chemical reagents; or consumable components of a product, such as, but not limited to, lamps and tubing.

Contact Hach Company or your distributor to initiate warranty support. Products may not be returned without authorization from Hach Company.

Limitations

This warranty does not cover:
damage caused by acts of God, natural disaster, labor unrest, acts of war (declared or undeclared), terrorism, civil strife or acts of any governmental jurisdiction

- damage caused by misuse, neglect, accident or improper application or installation
- damage caused by any repair or attempted repair not authorized by Hach Company
- any product not used in accordance with the instructions furnished by Hach Company
- freight charges to return merchandise to Hach Company
- freight charges on expedited or express shipment of warranted parts or product
- travel fees associated with on-site warranty repair

This warranty contains the sole express warranty made by Hach Company in connection with its products. All implied warranties, including without limitation, the warranties of merchantability and fitness for a particular purpose, are expressly disclaimed.
Some states within the United States do not allow the disclaimer of implied warranties and if this is true in your state the above limitation may not apply to you. This warranty gives you specific rights, and you may also have other rights that vary from state to state.

This warranty constitutes the final, complete, and exclusive statement of warranty terms and no person is authorized to make any other warranties or representations on behalf of Hach Company.

Limitation of Remedies

The remedies of repair, replacement or refund of purchase price as stated above are the exclusive remedies for the breach of this warranty. On the basis of strict liability or under any other legal theory, in no event shall Hach Company be liable for any incidental or consequential damages of any kind for breach of warranty or negligence.