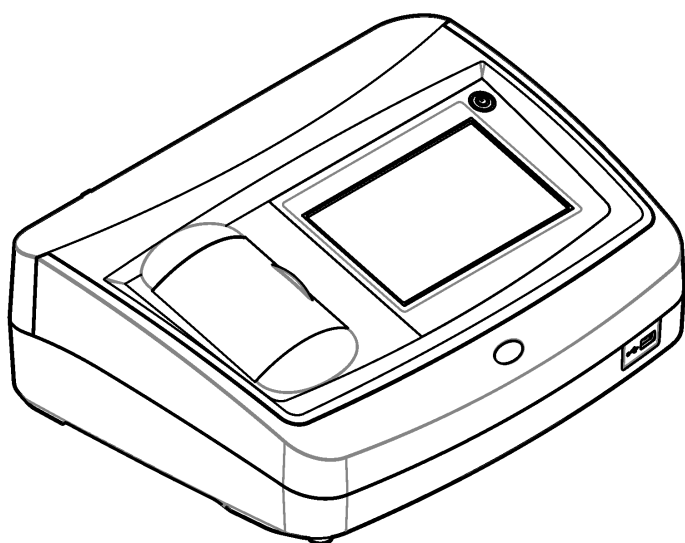DOC022.98.80533

TL2300

07/2016, Edition 2

Basic User Manual
Basis-Bedienungsanleitung
Manuale di base per l'utente
Manuel d'utilisation de base
Manual básico del usuario
Manual básico do utilizador
Základní návod k použití
Basisgebruikershandleiding
Grundlæggende brugerhåndbog
Podstawowa instrukcja obsługi
Grundläggande bruksanvisning
Peruskäyttöohje
Основно ръководство за потребителя
Alapvető felhasználói útmutató
Manual de utilizare de bază
Bendroji naudotojo instrukcija
Начальное руководство пользователя
Temel Kullanım Kılavuzu
Základný návod na použitie
Osnovni uporabniški priročnik
Osnovni korisnički priručnik
Βασικό εγχειρίδιο χρήσης
Kokkuvõtlik kasutusjuhend

Table of contents

Specifications

Specifications are subject to change without notice.

Specification	Details
Measurement method	Nephelometric
Regulatory	Meets EPA Method 180.1 ASTM D7315 - Standard Test Method for Determination of Turbidity Above 1 Turbidity Unit (TU) in Static Mode ASTM D6655 - Standard Test Method for Determination of Turbidity Below 5 NTU in Static Mode
Dimensions (W x D x H)	39.5 x 30.5 x 15.3 cm (15.6 x 12.0 x 6.02 in.)
Weight	3.0 kg (6.6 lb)
Enclosure	IP30; indoor use only
Protection Class	External power supply: Protection Class I; instrument: Protection Class II
Pollution degree	2
Installation category	External power supply: Category II; instrument: Category I
Power requirements	Instrument: 12 VDC, 3.4 A; power supply: 100–240 VAC, 50/60 Hz
Operating temperature	0 to 40 °C (32 to 104 °F)
Storage temperature	–20 to 60 °C (–4 to 140 °F)
Humidity	5 to 95% relative humidity, non-condensing
Display	17.8 mm (7 in.) color touch screen
Light source	Tungsten filament lamp
Measurement units	NTU and EBC
Range	NTU (Ratio on): 0–4000 NTU (Ratio off): 0–40 EBC (Ratio on): 0–980 EBC (Ratio off): 0–9.8
Accuracy[1, 2, 3]	Ratio on: ±2% of reading plus 0.01 NTU from 0–1000 NTU, ±5% of reading from 1000–4000 NTU based on formazin primary standard Ratio off: ±2% of reading plus 0.01 NTU from 0–40 NTU
Resolution	Turbidity: 0.001 NTU/EBC (on lowest range)

[1] Turbidity specifications identified using USEPA filter assembly, recently prepared formazin standard and matched 1-inch sample cells.

[2] Intermittent electromagnetic radiation of 3 volts/meter or greater may cause slight accuracy shifts.

[3] Reference conditions: 23 (± 2) °C, 50 (± 10)% RH noncondensing, 100–240 VAC, 50/60 Hz

Specification	Details
Repeatability	±1% of reading or 0.01 NTU, whichever is greater (under reference conditions)
Response time	Signal averaging off: 6.8 seconds Signal averaging on: 14 seconds (when 10 measurements are used to calculate the average)
Stabilization time	Ratio on: 30 minutes after start-up Ratio off: 60 minutes after start-up
Reading modes	Single, continuous, Rapidly Settling Turbidity™, signal averaging on or off, ratio on or off
Communication	USB
Interface	2 USB-A ports for USB flash drive, external printer, keyboard and barcode scanner
Datalog	Maximum 2000 total logs, includes reading log, verification log and calibration log
Air purge	Dry nitrogen or instrument grade air (ANSI MC 11.1, 1975) 0.1 scfm at 69 kPa (10 psig); 138 kPa (20 psig) maximum Hose barb connection for $1/_8$-inch tubing
Sample cells	Round cells 95 x 25 mm (3.74 x 1 in.) borosilicate glass with rubber-lined screw caps *Note: Smaller sample cells (less than 25 mm) can be used when a cell adapter is used.*
Sample requirements	25 mm sample cell: 20 mL minimum 0 to 70 °C (32 to 158 °F)
Certification	CE, KC, RCM
Warranty	1 year (EU: 2 years)

General information

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

Additional information

Additional information is available on the manufacturer's website.

Safety information

NOTICE
The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

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

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

Use of hazard information

⚠ **D A N G E R**
Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ **W A R N I N G**
Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

⚠ **C A U T I O N**
Indicates a potentially hazardous situation that may result in minor or moderate injury.

N O T I C E
Indicates a situation which, if not avoided, may cause damage to the instrument. 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. A symbol on the instrument is referenced in the manual with a precautionary statement.

⚠	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
🗑	Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems. Return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.

Certification

EN 55011/CISPR 11 Notification Warning

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Canadian Radio Interference-Causing Equipment Regulation, IECS-003, Class A:

Supporting test records reside with the manufacturer.

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

Cet appareil numérique de classe A répond à toutes les exigences de la réglementation canadienne sur les équipements provoquant des interférences.

FCC Part 15, Class "A" Limits

Supporting test records reside with the manufacturer. The device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

1. The equipment may not cause harmful interference.
2. The equipment must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this equipment 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 their expense. The following techniques can be used to reduce interference problems:

1. Disconnect the equipment from its power source to verify that it is or is not the source of the interference.
2. If the equipment is connected to the same outlet as the device experiencing interference, connect the equipment to a different outlet.
3. Move the equipment away from the device receiving the interference.
4. Reposition the receiving antenna for the device receiving the interference.
5. Try combinations of the above.

Korean certification

㎢ 업무용을 위한 EMC 등급 A 장치에 대한

사용자 지침

사용자안내문

A 급 기기 (업무용 방송통신기자재)

이 기기는 업무용 (A 급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며 , 가정 외의 지역에서 사용하는 것을 목적으로 합니다 .

Product overview

⚠ CAUTION
Fire hazard. This product is not designed for use with flammable liquids.

The TL2300 laboratory turbidimeter measures the scattered light from water samples to determine the turbidity value of the samples. In the ratio-on mode, the instrument uses multiple detectors at different angles to correct for interferences and to increase the measurement range. In the ratio-off mode, the instrument uses one detector at a 90-degree angle from the light source. The user can calibrate the instrument and verify the calibration at regular intervals.

The user interface uses a touch screen display. A printer, USB flash drive or keyboard can connect to the USB ports. Refer to Figure 1. The real-time clock with battery puts a time-date stamp on all of the data that is transmitted or recorded (i.e., reading log, calibration log and verification log).

Figure 1 Product overview
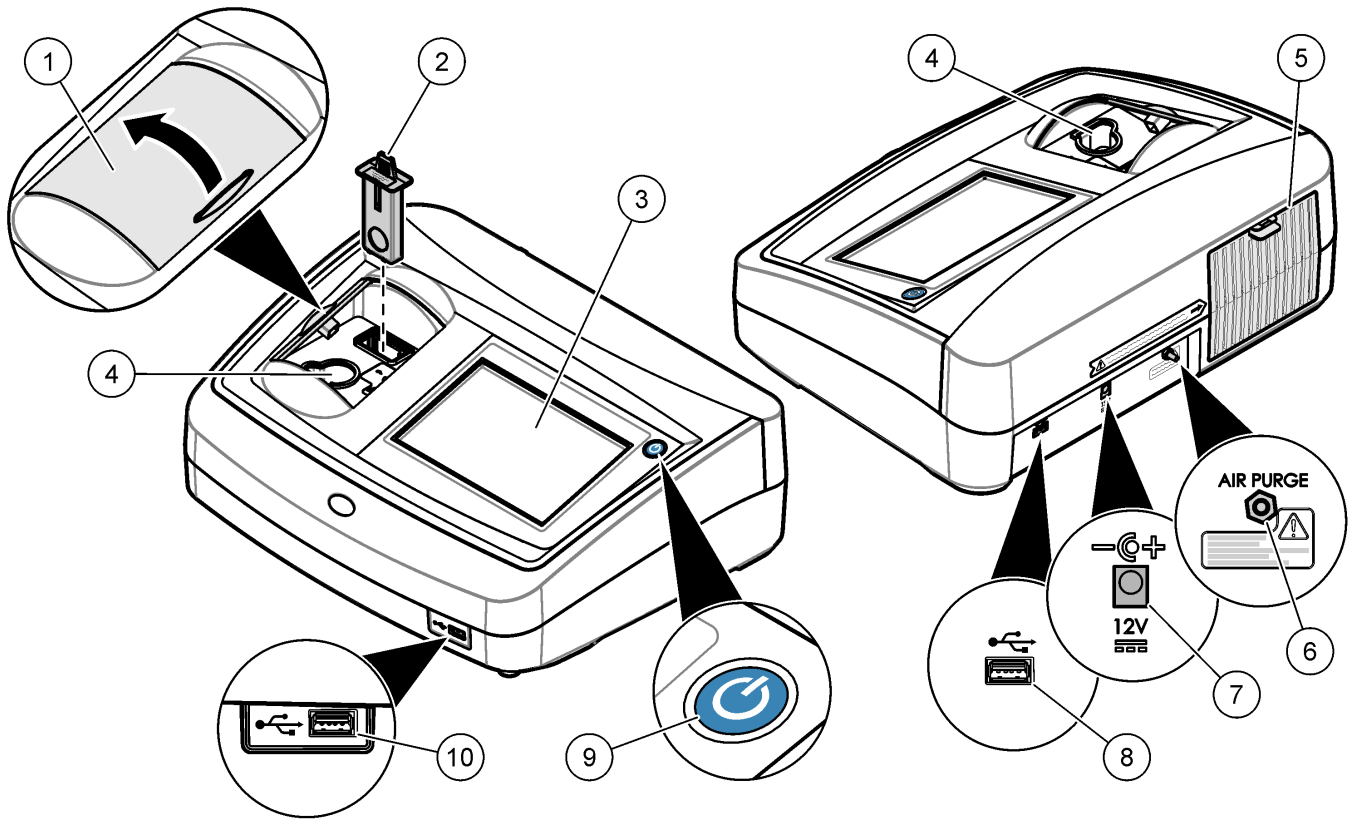
1	Sample compartment lid	6	Air purge
2	EPA filter	7	Power connection
3	Touch screen display	8	USB port
4	Sample cell holder	9	Power button
5	Lamp cover	10	USB port

Product components

Make sure that all components have been received. Refer to Figure 2. If any items are missing or damaged, contact the manufacturer or a sales representative immediately.

Figure 2 Instrument components
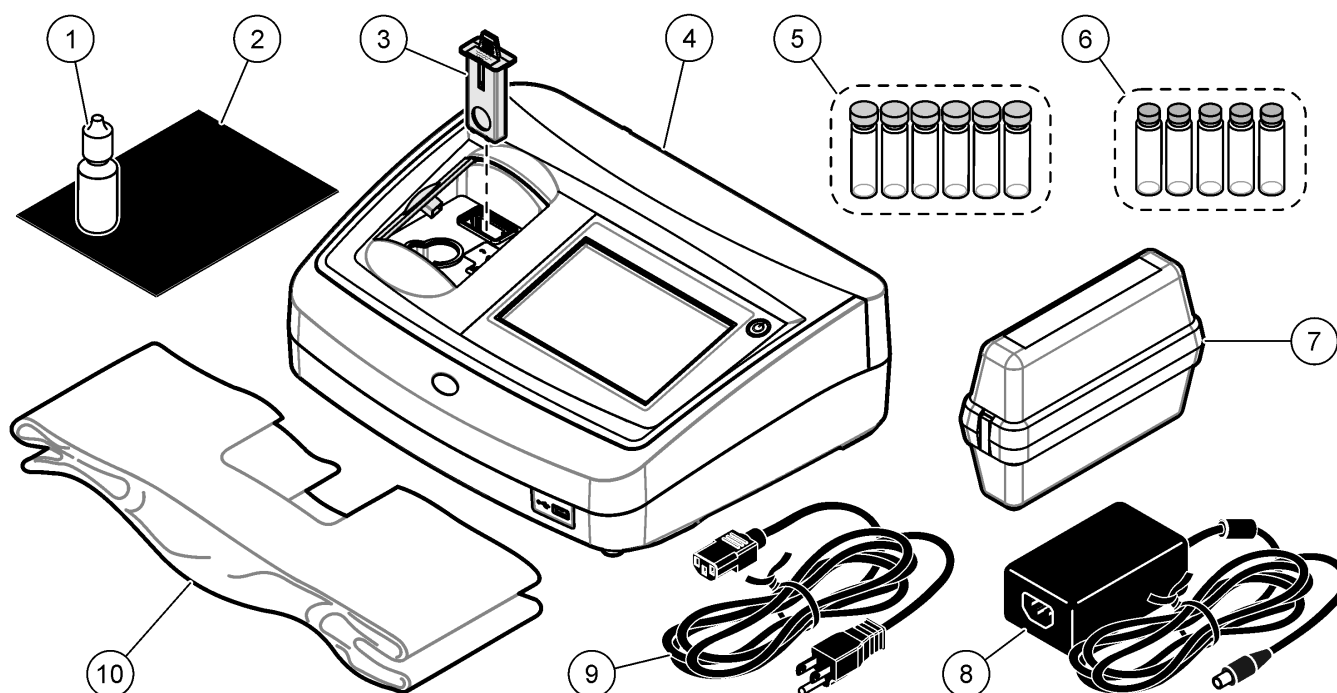
1	Silicone oil	6	Gelex secondary turbidity standardization kit
2	Oiling cloth	7	StablCal Calibration kit
3	USEPA filter assembly	8	Power supply
4	TL2300 turbidimeter	9	Power cord
5	1-inch sample cells (30 mL) with caps (6x)	10	Dust cover

Installation

<div align="center">⚠ CAUTION</div>

⚠ Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

This instrument is rated for an altitude of 3100 m (10,710 ft) maximum. Use of this instrument at an altitude higher than 3100 m can slightly increase the potential for the electrical insulation to break down, which can result in an electric shock hazard. The manufacturer recommends that users with concerns contact technical support.

Installation guidelines

Install the instrument:

* On a level surface
* In a clean, dry, well ventilated, temperature controlled location
* In a location with minimum vibrations that has no direct exposure to sunlight
* In a location where there is sufficient clearance around it to make connections and to do maintenance tasks
* In a location where the power button and power cord are visible and easily accessible

Connect to external devices (optional)

Use the USB ports to connect the instrument to a printer, barcode handset scanner, USB flash drive or keyboard. Refer to Figure 1 on page 7. The maximum length of a connected USB cable is 3 m (9.8 ft). As an alternative to the touchscreen, use a keyboard to enter text into text boxes on the display (e.g., passwords and sample IDs).

User interface and navigation

The instrument display is a touch screen. Only use a clean, dry finger tip to navigate the functions of the touch screen. Do not use writing tips of pens or pencils or other sharp objects to make selections on the screen or damage to the screen will occur.

Refer to Figure 3 for an overview of the home screen.

Figure 3 Display overview
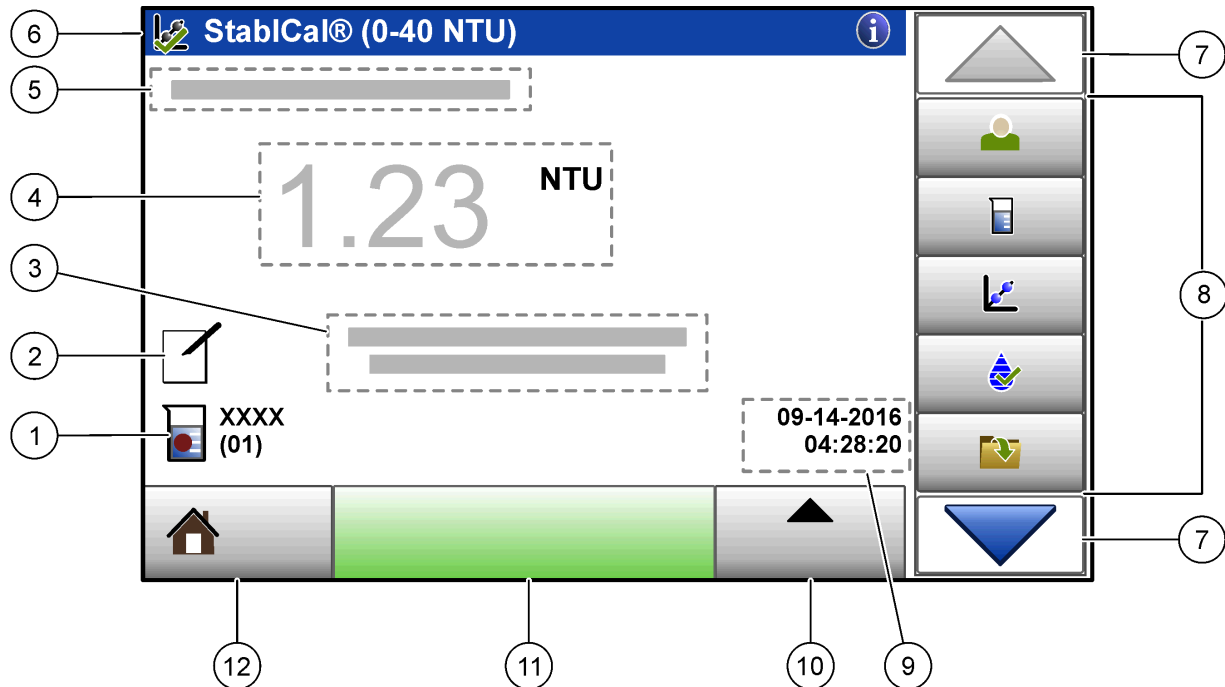
1	Sample ID and measurement number[4]	**7**	UP/DOWN navigation arrows
2	User comments	**8**	Sidebar menu (refer to Table 1)
3	Instructions	**9**	Time and date
4	Turbidity value, unit and reading mode	**10**	Options button
5	Warning or error message	**11**	Read button
6	Calibration status icon and calibration curve	**12**	Home/Instrument information button

Table 1 Sidebar menu icons

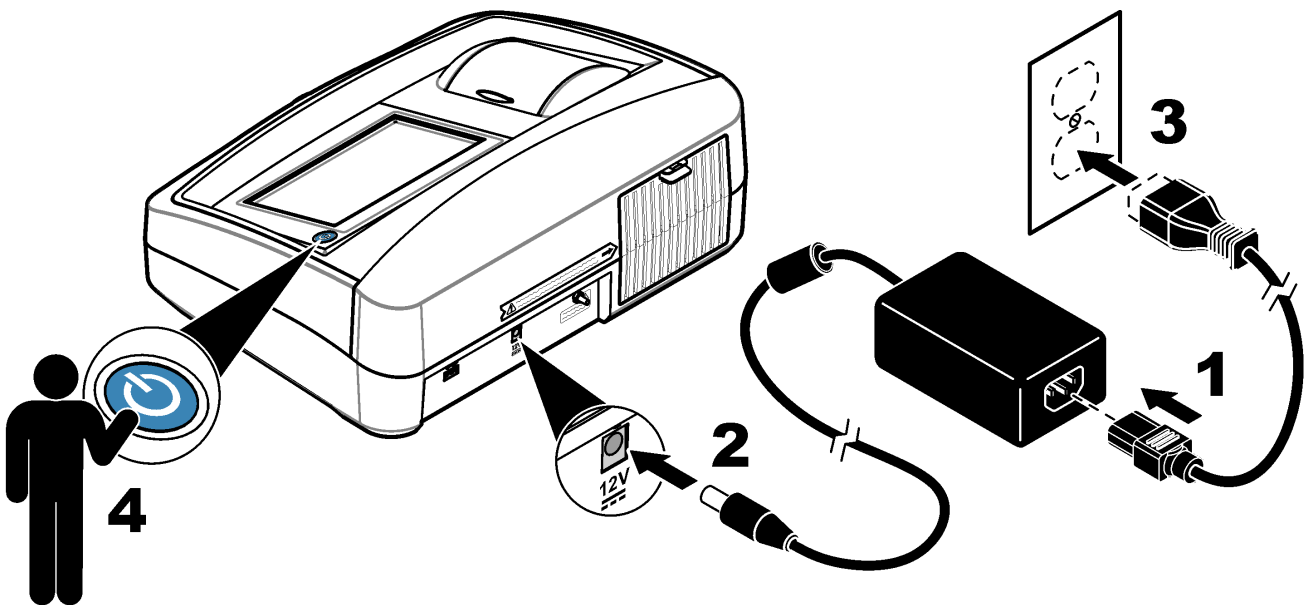| Icon	Description
Login	Logs in or logs out an operator. To log in, select an operator ID and then push **Login**. To log out, push **Logout**. *Note: When an operator is logged in, the Login icon changes to the icon selected for the operator ID (e.g., fish, butterfly or soccer ball) and the text "Login" changes to the operator ID.*
Sample ID	Selects the sample ID.
Calibration	Starts a calibration.

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[4] The measurement number increases by one each time a measurement is completed.

Table 1 Sidebar menu icons (continued)

Icon	Description
Verification	Starts a verification.
Data Log	Shows the reading log, calibration log and verification log. Refer to Show the recorded data on page 19.
Setup	Configures the instrument settings. Refer to Configure the instrument settings on page 11.
Diagnostics	Shows the firmware information, instrument backup, instrument updates, signaling information and factory service data.
Timer	Sets a timer.

Startup

Refer to the illustrated steps that follow to supply power to the instrument and start the instrument. The self-check will start.

Operation

Configure the instrument settings

1. Push ▼, then push **Setup**.
2. Select an option.

Option	Description
Location	Sets the location name of the instrument. The location is sent with measurements to the USB drive. The location is not saved to the data log.
Date & Time	Sets the date format, the time format and the date and time. Enter the current date and time. **Date Format**—Sets the date format. Options: dd-mm-yyyy (default), yyyy-mm-dd, dd-mm-yyyy or mm-dd-yyyy. **Time Format**—Sets the time format. Options: 12 or 24 hours (default).
Security	Enables or disables password protection for the settings and tasks in the security list. **Security Password**—Sets or changes the security (administrator) password (10 characters maximum). Passwords are case sensitive. **Security List**—Sets the security level for each setting and task in the security list. • **Off**—All operators can change the setting or do the task. • **One key**—Only operators with a one-key or two-key security level can change the setting or do the task. Refer to Add operator IDs on page 12. • **Two keys**—Only operators with a two-key security level can change the setting or do the task. *Note: The Security setting is not set to on until Close is pushed.*
Sound Settings	Enables or disables the sound settings for individual events. To enable or disable all of the sound settings, select All and then push **Setup**.
Peripherals	Shows the connection status of attached devices such as a printer, USB memory (flash drive) or keyboard.
Power Management	Sets when the instrument is automatically set to sleep mode or off after a period of no activity. **Sleep Timer**—Sets when the instrument is set to sleep mode. Options: OFF, 30 minutes, 1 (default), 2 or 12 hours.

Configure the measurement settings

Select the reading mode, measurement units, data log settings and more.

1. At the main reading screen, push **Options**>**Reading Setup**.
2. Select an option.

Option	Description
Reading Mode	Sets the reading mode to single, continuous or RST mode. **Single (default)**—The measurement stops when the reading is stable. **Continuous**—The measurement continues until the user pushes **Done**. **RST**—The Rapidly Settling Turbidity (RST) mode calculates and continuously updates the turbidity reading of the sample to a confidence of 95%, based on the accumulated trend of the real time measured values. The RST mode is best used on samples that settle rapidly and continuously change in value. The reading is based on a correctly prepared sample that is homogeneous at the beginning of the reading. It is best applied to samples that are greater than 20 NTU. The sample must be mixed thoroughly by inversion immediately before inserting it into the instrument. **Signal Avg**—The turbidity reading that shows on the display is an average of the values measured during the time interval selected. Options: For single measurement mode, 5 to 15 seconds. For continuous measurement mode, 5 to 90 seconds.
Unit	Selects the measurement units that show on the display and that are recorded to the data log. Options: NTU (default), EBC.

Option	Description
Ratio	Sets the ratio mode to on (default) or off. When set to off, an indicator shows on the reading window. *Note: The ratio off mode is only valid for turbidity measurements that are less than 40 NTU.*
Bubble Reject	Sets the bubble reject to on (default) or off. When set to on, high turbidity readings caused by bubbles in the sample are not shown or saved to the data log.
Data Log Setup	Sets the data log settings. **Auto Store**—Measurement data is automatically recorded in the reading log. Default: On. If Auto Store is off, push Options>Store to manually save a reading in the data log. **Send Data Format**—Sets the output format of measurement data that is sent to external devices (CSV, XML or BMP). Default: XML. **Print Format**—Sets the output format of measurement data that is sent to a printer (Quick Print or Detailed Print (GLP)). **Comments**—Lets users add comments to log entries. **Auto Send**—Measurement data is automatically sent to all of the devices (e.g., printer and USB flash drive) that are connected to the instrument after each measurement. Options: Off, new file or continue file: off—do not auto send data, new file—send data and save it in a new file, continue file—send data and save all data in one file.

Add operator IDs

Add a unique operator ID for each person who will measure samples (30 maximum). Select an icon, operator password and security level for each operator ID.

1. Push **Login**.
2. Push **Options**>**New**.
3. Enter a new operator ID (20 characters maximum), then push **OK**.
4. Push the **LEFT** and **RIGHT** arrows to select the icon for the operator ID (e.g., fish, butterfly or soccer ball).
5. Push **Operator Password**, then enter a password for the operator ID.
   Note: Passwords are case sensitive.
6. Push **Security Level**, then select the security level for the operator ID.

   - **Off**—The operator cannot change the settings or do the tasks in the Security settings that have a security level of one key or two keys.
   - **One key**—The operator can change all the settings and do all the tasks in the Security settings that have a security level of off or one key.
   - **Two keys**—The operator can change all the settings and do all the tasks in the Security settings.

   Note: Before a security level can be selected, the Security setting must be set to on. Refer to Configure the instrument settings *on page 11.*
7. Push **OK**>**Close**.
8. To edit an operator ID, select the operator ID and then push **Options**>**Edit**.
9. To delete an operator ID, select the operator ID and then push **Options**>**Delete**>**OK**.

Add sample IDs

Add a unique sample ID for each sample (1000 maximum). The sample ID identifies the sample location or other sample specific information.

As an alternative, import sample IDs from a spreadsheet file to the instrument. Refer to the expanded user manual on the manufacturer's website to import sample IDs.

1. Push **Sample ID**.
2. Push **Options**>**New**.
3. Enter a new sample ID (20 characters maximum).
4. Push **OK**.

5. Select an option.

Option	Description
Add Date/Time	Adds the date and time that the sample was collected to the sample ID (optional). The date and time entered for each sample ID show on the Sample ID menu.
Add Number	Adds a measurement number to the sample ID (optional). Select the first number used for the measurement number (0 to 999). The measurement number shows in parenthesis after the sample ID on the home screen. Refer to User interface and navigation on page 9.
Add Color	Adds a colored circle to the sample ID icon (optional). The sample ID icon shows before the sample ID on the home screen. Refer to User interface and navigation on page 9.

6. Push **OK**>**Close**.
7. To edit a sample ID, select the sample ID and then push **Options**>**Edit**>**OK**.
8. To delete a sample ID, select the sample ID and then push **Options**>**Delete**>**OK**.

   *Note: To delete all sample ID's, select the sample ID and then push **Options**>**Delete All Sample IDs**>**OK**.*

Calibrate the turbidimeter with StablCal Standards

Calibrate the turbidimeter before it is used for the first time using the StablCal sealed vial standards provided.

Calibrate the turbidimeter at least every 3 months or as specified by the regulating authority when data is used for USEPA reporting.

The instrument is ready for calibration 60 minutes after start-up. Keep the instrument on 24 hours a day if the instrument is used regularly.

Note: Unknown results may occur if standards other than the recommended calibration points are used. The recommended calibration points (< 0.1, 20, 200, 1000 and 4000 NTU) provide the best calibration accuracy. Use of standards other than StablCal, or user-prepared formazin, may result in less accurate calibrations. The manufacturer cannot guarantee the performance of the instrument if calibrated with co-polymer styrenedivinylbenzene beads or other suspensions.

Calibration notes

- Make sure that the instrument is in the same ambient conditions as where it is used.
- Make sure that the standards are at the same ambient temperature as the instrument before use.
- Use only the provided silicone oil. This silicone oil has the same refractive index as the vial glass and masks minor glass differences and scratches.
- Store the oiling cloth in a plastic storage bag to keep the cloth clean.
- If power is lost during calibration, the new calibration data is lost and the last calibration data is used.
- In Calibration mode, automatic range and signal averaging on are selected. When calibration is completed, all operational modes go back to the last settings.
- All nephelometric (turbidity units of measure) calibrations are done at the same time.
- Ratio-on and Ratio-off calibration data is measured and recorded at the same time.
- Clean the USEPA filter assembly before doing a primary calibration, or at least every 3 months (which is the USEPA-recommended primary calibration interval).

Configure the calibration settings

Change the calibration settings as necessary before the instrument is calibrated. The instrument must be calibrated when the calibration curve is changed.

1. Push **Calibration**.
2. Push **Options**>**Calibration Setup**.

3. Select the calibration curve range and type of calibration standard.

Option	Description
StablCal RapidCal (0–40 NTU)	Calibration with 20-NTU StablCal standard (default). *Note: The dark current in the instrument is used as the zero point of the calibration curve. The calibration curve is linear from 0-40 NTU, thus low turbidity measurements are very accurate.*
StablCal (0–4000 NTU)	Full-range calibration (<0.1 NTU, 20 NTU, 200 NTU, 1000 NTU, 4000 NTU) with StablCal.
Formazin RapidCal (0–40 NTU)	Calibration with 20-NTU formazin standard. *Note: The dark current in the instrument is used as the zero point of the calibration curve. The calibration curve is linear from 0-40 NTU, thus low turbidity measurements are very accurate.*
Formazin (0–4000 NTU)	Full-range calibration (20 NTU, 200 NTU, 1000 NTU, 4000 NTU and dilution water) with formazin.
SDVB (0–4000 NTU)	Full-range calibration (20 NTU, 200 NTU, 1000 NTU, 4000 NTU and dilution water) with spherical styrene divinylbenzene.
EU Pharm (0–30 NTU)	Full-range calibration (<0.1 NTU, 3 NTU, 6 NTU, 18 NTU, 30 NTU).
Custom Calibration	The user can enter a custom calibration for turbidity. The user selects the number of calibration standards and the value of each calibration standard. Use a custom calibration when smaller sample cells are used with a sample cell adapter.

4. Select the remaining calibration options.

Option	Description
Verify after Cal.	Sets the instrument to start a verification immediately after the instrument is calibrated. When set to on, the verification standard is measured immediately after a calibration is done. Default: ON. The value of the verification standard shows on the display as the last standard during calibration.
Calibration Reminder	Sets the time interval between calibrations. When a calibration is due, the display will show a reminder and a question mark on the calibration icon at the top of the display. Options: Off (default), 1 day, 7 days, 30 days or 90 days. When a calibration is done, the calibration time is set to zero.
Reset to Factory Calibration	Sets the calibration settings to the factory defaults.

Prepare the StablCal standards

When received and at intervals:

1. Clean the exterior surface of the StablCal vials with laboratory glass cleaning detergent.
2. Rinse the vials with distilled or deionized water.
3. Dry the vials with a lint-free cloth.

Note: Never shake or invert the < 0.1 NTU standard. If the standard has been mixed or shaken, do not move the vial for 15 minutes or more before using.

*Note: Do not remove the caps from the sealed vials.*

Make sure that the StablCal standards are at ambient instrument temperature before use (and no greater than 40 °C (104 °F)).

Invert the standards (except < 0.1 NTU) before use. Refer to the user instructions that are supplied with the StablCal standards.
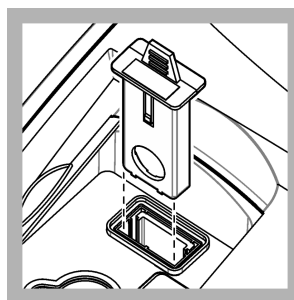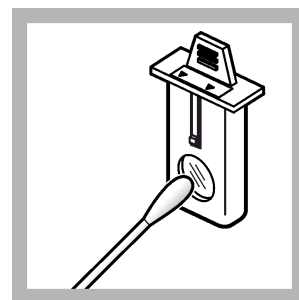
StablCal calibration procedure
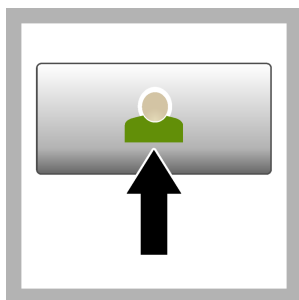
1. Push **Login** and select the applicable Operator ID. If login is not necessary, go to step 3.
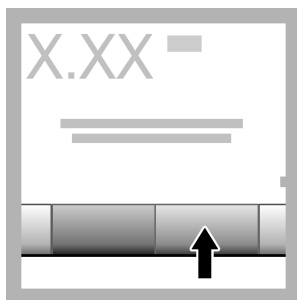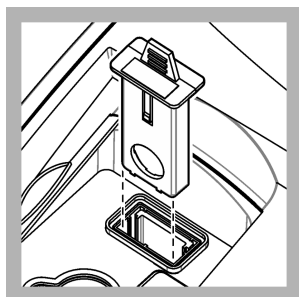

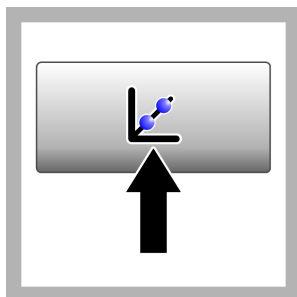**2.** Push **Login** and enter the password. Push **OK**.

3. Remove the filter assembly.

4. Clean the lens of the USEPA filter assembly. Refer to Clean the filter assembly on page 20.


5. Hold the tab of the USEPA filter assembly so that the arrows point toward the front of the instrument. Push the filter assembly fully in the housing.

6. Push **Calibration**. The standard values for the selected calibration curve (and verification standard, if Verify after Cal is on) show on the display. To select a different calibration curve, refer to Configure the calibration settings on page 13.

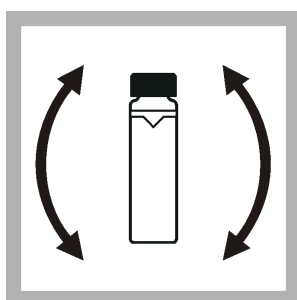**7.** Get the StablCal standard that shows on the display. Clean the vial with a soft, lint-free cloth to remove water spots and fingerprints.
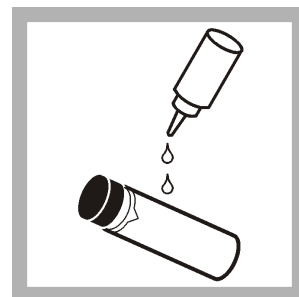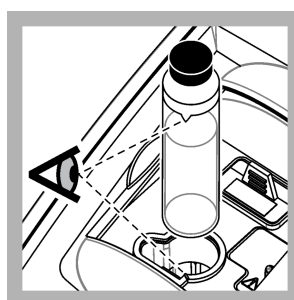

**8.** Apply a small drop of silicone oil from the top to the bottom of the vial.

9. Use the oiling cloth to apply the oil equally to the surface of the vial. Remove most of the oil. Make sure that the vial is almost dry.


10. Carefully and slowly invert the vial to fully mix the standard (do not invert the <0.1 NTU vial). Be careful not to add air bubbles.
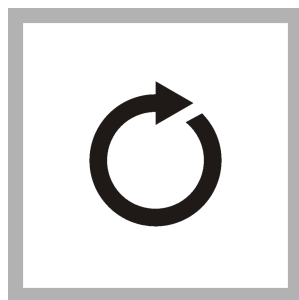

11. Put the vial in the sample cell holder with the triangle on the vial aligned with the reference mark on the sample cell holder. Push the lid closed until a click is heard.
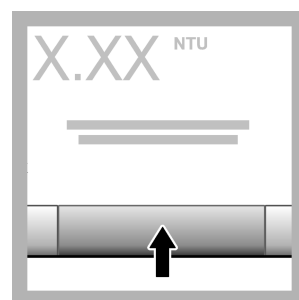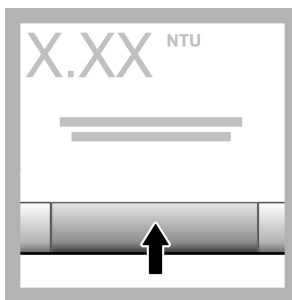

12. Push **Read**. Wait 1 minute for the instrument to complete the measurement.
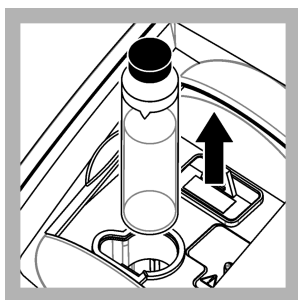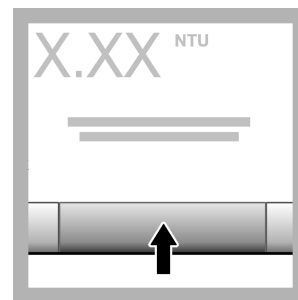
13. Open the lid and remove the vial from the sample cell holder.

14. Do steps 7–13 for the other StablCal vials (from lowest to highest NTU standard). When complete, the measured values are shown.

15. If Verify after Cal is set to on, the value of the verification standard shows. Push **Read** to measure the verification standard.

16. Push **Store** to save the new calibration data.

Verification procedure

Use the verification procedure to measure the same Gelex or StablCal vial at regular intervals to determine if the reading stays within the acceptance range. Use the Verification Setup menu to set a reminder for the verification.
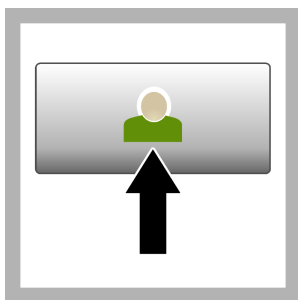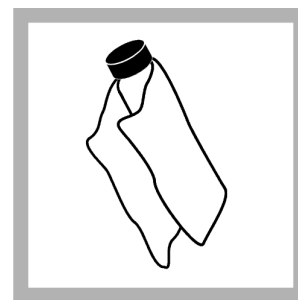
1. Push **Login** and select the applicable Operator ID. If login is not necessary, go to step 3.
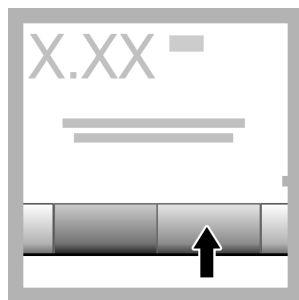
2. Push **Login** and enter the password. Push **OK**.
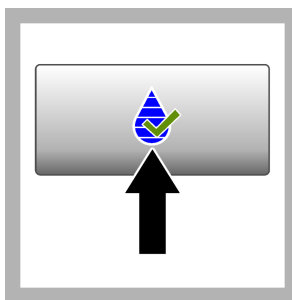
3. Push **Verification**. The verification standard value is shown. Push **Options>Verification Setup** to change the value of the verification standard.

4. Clean the Gelex vials with a soft, lint-free cloth to remove water spots and fingerprints.

5. Apply a small drop of silicone oil from the top to the bottom of the vial.

6. Use the oiling cloth to apply the oil equally to the surface of the vial. Remove most of the oil. Make sure that the vial is almost dry.
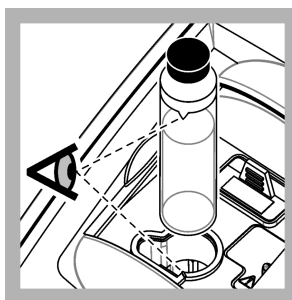
7. Put the vial in the sample cell holder with the triangle on the vial aligned with the reference mark on the sample cell holder. Push the lid closed until a click is heard.
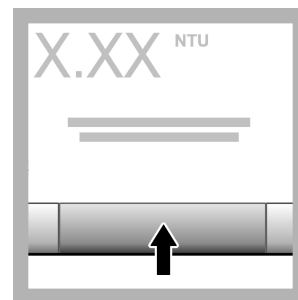
8. Push **Read**. The value and pass or fail status shows. The data is automatically stored in the instrument.

Turbidity measurement

For accurate turbidity readings use clean sample cells and remove air bubbles.

Measurement notes

Proper measurement techniques are important in minimizing the effects of instrument variation, stray light and air bubbles. For accurate and repeatable measurements:

Instrument

- Make sure that the instrument is on a level, stationary surface that is free of vibration during the measurement.
- The USEPA filter assembly is required for turbidity measurements reported for United States Environmental Protection Agency (USEPA), National Primary Drinking Water Regulations (NPDWR) or National Pollutant Discharge Elimination System (NPDES) permits.
- Turn the instrument on 30 minutes (Ratio on) or 60 minutes (Ratio off) before measurement. Keep the instrument on 24 hours a day if the instrument is used regularly.
- Always close the sample compartment lid during measurement, calibration and verification.
- Remove the sample cell from the instrument and turn off the instrument if the instrument is stored for an extended time period (more than a month).
- Keep the sample compartment lid closed to keep dust and dirt out.

Sample cells

- Always cap the sample cell to prevent spillage of the sample into the instrument.
- Always use clean sample cells in good condition. Dirty, scratched or damaged cells can result in readings that are not accurate.
- Make sure that cold samples do not "fog" the sample cell.
- Store sample cells filled with distilled or deionized water and cap tightly.
- For the best accuracy, use a single sample cell for every measurement or a flow cell.

Note: As an alternative, matched sample cells may be used for measurements but do not provide as good of accuracy or precision as a single indexed sample cell or flow cell. When using matched sample cells, align the orientation mark on the sample cell with the reference mark on the sample cell holder.

Measurement

- Measure samples immediately to prevent temperature changes and settling. Before a measurement is taken, always make sure that the sample is homogeneous throughout.
- Avoid sample dilution when possible.
- Avoid instrument operation in direct sunlight.

Turbidity measurement procedure

To include an operator ID and sample ID with the measurement data, refer to Add sample IDs on page 12 and Add operator IDs on page 12.
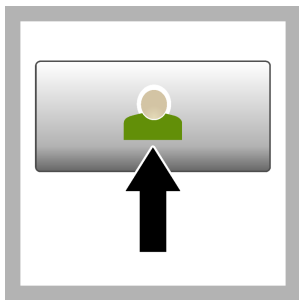
1. Push **Login** and select the applicable Operator ID. If login is not necessary, go to step 3.

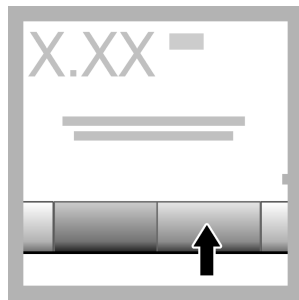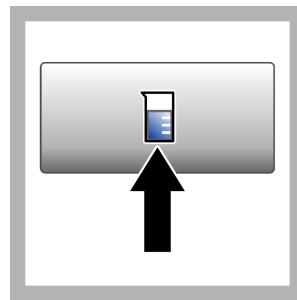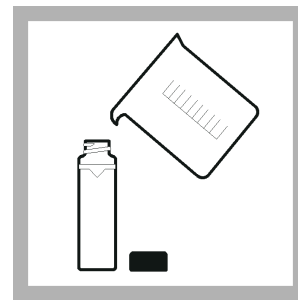**2.** Push **Login** and enter the password. Push **OK**.

3. Push **Sample ID**. Select the applicable sample ID, then push **Select**. The selected sample ID shows on the display.

4. Rinse a clean, empty sample cell two times with the solution to be measured and drain to waste. Fill to the line (about 30 mL) with sample and immediately put the cap on the sample cell.

5. Clean the sample cells with a soft, lint-free cloth to remove water spots and fingerprints.

6. Apply a small bead of silicone oil from the top to the bottom of the sample cells.

7. Use the oiling cloth provided to apply the oil equally to the surface of the sample cells. Remove the excess oil. Make sure that the sample cells are almost dry.
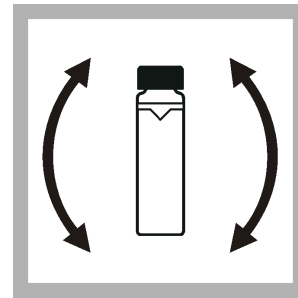
8. Gently and slowly invert the sample cell to fully mix the sample. Be careful not to add air bubbles.
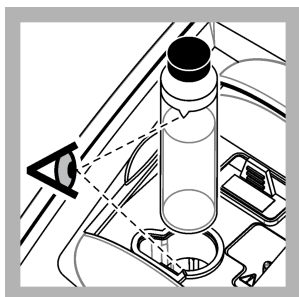
9. Put the sample cell in the sample cell holder with the triangle on the sample cell aligned with the reference mark on the sample cell holder. Push the lid closed until a click is heard.
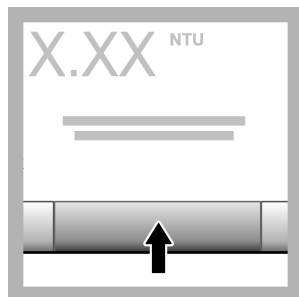
10. Push **Read** (or **Done** if in continuous mode). Wait for the instrument to read the sample.

Note: *If auto store is off, push **Options > Store** to save the data.*

Data management

Show the recorded data

All the recorded data is kept in the data log. There are three types of data logs:

- **Reading log**—Shows the recorded measurements.
- **Calibration log**—Shows the calibration history.
- **Verification log**—Shows the verification history.

1. Push **Data Log** and select the applicable data log.
2. To show the details of a log entry, select the log entry and then push **View Details**.
   Note: To add a comment to the log entry, push the comments icon.
3. To show only some of the data, push **Filter**, then select On. The Filter Settings window opens.
4. Select an option.

Option	Description
Time Interval	Selects only the data that was stored during a specific time interval.
Operator ID	Selects only the data that was stored with a specific operator ID.
Sample ID	Selects only the data from the Reading Log that was stored with a specific sample ID.

Send data to a connected device

The instrument can send data to a USB memory device or printer. For best results, use only USB 2.0 memory devices. The instrument makes a logger folder on the device and saves the data as a .bmp, .csv or .xml file.
Use only the printers that are shown in the expanded version of this manual.

1. Connect a USB memory device or cable to a USB port on the instrument.
2. Connect the other end of the cable to the printer, if applicable.
3. Go to **Setup>Peripherals**. The connection status shows Connected. If the status shows Not Connected, make sure to use the recommended devices.
4. Push **Data Log** and select the applicable log.
5. To send only some of the data, use the filter settings or select a single data point. Refer to Show the recorded data on page 19.
6. Push **Options>Send Data Log**. Select single data point, filtered data or all data. Push **OK**.
   The instrument sends the selected data to the connected devices.

Delete data from the data log

The instrument automatically deletes the oldest data record when the data log is full. The user can also delete data manually. Make sure to save the data to an external device, then delete the data in the data log.

1. Push **Data Log** and select the applicable log.
2. To delete only some of the data, use the filter settings. Refer to Show the recorded data on page 19.
3. To delete the data, push **Options>Delete Data**. Select single data point, filtered data or all data. Push **OK**.
   The instrument deletes the selected data from the data log.

Maintenance

⚠ C A U T I O N

Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

Clean spills

⚠ C A U T I O N

Chemical exposure hazard. Dispose of chemicals and wastes in accordance with local, regional and national regulations.

1. Obey all facility safety protocols for spill control.
2. Discard the waste according to applicable regulations.

Clean the instrument

Clean the exterior of the instrument with a moist cloth, and then wipe the instrument dry.

Clean the filter assembly

Note: Be careful not to push the lens out of the filter assembly.

1. Clean both sides of the lens of the filter assembly with glass cleaner, lens cleaner or isopropyl alcohol, and a cotton-tipped swab or lens tissue.
2. Inspect the filter glass for scratches or other damage.
3. If a cloudy circle is seen around the edge of the filter, the filter material is delaminating. Replace the filter assembly.

Replace the lamp

⚠ C A U T I O N

Wear protective eye wear when the lamp is turned on and the lamp cover is removed.

⚠ C A U T I O N

Burn hazard. The lamp must be cool before removal from the instrument.

Notes:

- Replace the lamp with the same size, style and electrical rating.
- Do not touch the lamp as oil from skin will damage the lamp. Clean the lamp with alcohol as necessary.
- Either lamp lead can be put in either terminal block position.
- Turn the instrument on 30 minutes (Ratio on) or 60 minutes (Ratio off) before measurement or calibration.
- Calibrate the instrument after the lamp is replaced.

To replace the lamp, refer to the documentation that is supplied with the lamp.

Instrument utilities

1. Push **Home** to see the instrument model, version, serial number and location name.
2. Push **Diagnostics**.
3. Select an option.

Option	Description
Factory Service	For factory/service use only.
Instrument Backup	**Store**—Saves a backup of all the instrument settings and log files to a USB flash drive. **Restore**—Copies the instrument settings and log files from a USB flash drive to the instrument. Overwrites all the instrument settings.
Instrument Update	Installs an instrument update on the instrument from a USB flash drive.
Service Time	Shows the date entered for the last service date and for the next service date. When set to on, a service reminder shows on the display when service is due.

Troubleshooting

Message	Solution
Startup	
The self-check stopped. Hardware error.	Set the power to off, wait 20 seconds and then set the power to on again. If the self check is not successful, record the error number and contact technical support. Error numbers: 0: RTC; 1: Touch IC; 3: Dark voltage—Close the door until a click is heard. Start the instrument again. 4: Amplifier coefficient—Make sure that the power supply is connected to an electrical outlet that has a protective earth ground. 7: Lamp voltage—Make sure that the correct power supply is used. 8: Transmission voltage drift—If the lamp was replaced, calibrate the instrument. If a vial was in the sample compartment during the self-test at startup, remove the vial. 9: SDRAM; 10: NOR flash; 11: SPI flash; 12: Battery voltage; 13: Power supply voltage—Make sure that the correct power supply is used.
Next calibration is due!	Calibrate the instrument. Refer to Calibrate the turbidimeter with StablCal Standards on page 13. *Note: The calibration reminder is set to on. Refer to Configure the calibration settings on page 13.*
Next service is due!	Contact technical support. *Note: The service reminder is set to on. Refer to Instrument utilities on page 21.*
Next verification is due!	Do a calibration verification. Refer to the expanded user manual on the manufacturer's website. *Note: The verification reminder is set to on.*
Reading	
Hardware error / instrument error	Set the power to off, wait 20 seconds and then set the power to on again. If the problem continues, contact technical support.
The calibration range is exceeded.	The measured turbidity is more than the calibration range of the instrument. Select a calibration curve for the full measurement range. Refer to Configure the calibration settings on page 13.
The measurement range is exceeded.	The measured turbidity is more than the measurement range of the instrument.
Calibration/Verification	
Instrument error	Examine the standards. Start the calibration or verification again. If calibration (or verification) is not successful, contact technical support.

Message	Solution
The standard is not stable.	Use the correct calibration standards. Invert the standard until no bubbles or large particles show.
The standard value is out of the measurement range.	Use the correct calibration standards. Invert the standards. Make sure to measure the standards in ascending order.
The standard value is too low.	The wrong calibration standard is in the vial compartment. Make sure that the standard has not expired. Put the correct calibration standard in the vial compartment. Make sure to invert the standard.
The standard value is too high.	The wrong calibration standard is in the vial compartment. Make sure that the standard has not expired. Put the correct calibration standard in the vial compartment.
Verification failed.	Examine the verification standard. Calibrate the instrument. Refer to Calibrate the turbidimeter with StablCal Standards on page 13. If verification is not successful after calibration, contact technical support.
Instrument update	
Copy from USB Memory failed	Remove large files from the USB flash drive that use too much space. Start the instrument update procedure again. Remove the instrument update files from the USB flash drive. Save the instrument update files again to the USB flash drive. Connect the USB flash drive to the instrument. Start the instrument update procedure again.
Instrument update file is missing	Remove the instrument update files from the USB flash drive. Save the instrument update files again to the USB flash drive.
Instrument update file is corrupt	Connect the USB flash drive to the instrument. Start the instrument update procedure again.
Not enough memory to update the instrument	Contact technical support.
USB memory is not connected.	Connect a USB flash drive to the instrument. Make sure that the file system "FAT32" is installed on the USB flash drive. Set the power to off, wait 20 seconds and then set the power to on again. Connect the USB flash drive. Start the instrument update procedure again.
Read/Write to USB flash drive	
Cannot write to USB memory	Connect a USB flash drive to the instrument. Make sure that the file system "FAT32" is installed on the USB flash drive.
Cannot read from USB memory	Set the power to off, wait 20 seconds and then set the power to on again. Look for remaining space on the USB flash drive. Set the power to off, wait 20 seconds and then set the power to on again. Connect the USB flash drive to the instrument.
Restore backup	
No instrument backup is available.	Connect a USB flash drive to the instrument. Make sure that the file system "FAT32" is installed on the USB flash drive.
Not able to restore the backup	Set the power to off, wait 20 seconds and then set the power to on again. Connect the USB flash drive. Start the instrument update procedure again.
Security	
Invalid password	Enter the correct password. If the password is lost, contact technical support.

Message	Solution
Send data	
Connect a receiving device.	Examine the device connections. Set the Auto Send setting to off. Refer to Configure the measurement settings on page 11.
Add sample IDs from list	
No valid data found	No sample ID file was found on the USB flash drive.
Not able to read sampling date.	Make sure that the date and time format is dd.mm.yyyy hh:mm.
The instrument cannot read the Sample ID	Examine the text strings. Refer to the expanded user manual on the manufacturer's website.
Problem/Error: Incorrect date Possible cause: The wrong date format.	Make sure that the date and time format is dd.mm.yyyy hh:mm.
The sample ID list full. Data has not been added.	Remove the sample IDs that are not used. Add a new sample ID.