



LANGE 

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LICO 150

USER MANUAL

April 2008 Edition 1

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Section 1 Specifications

Specifications are subject to change without notice.

Operating mode	Color measurement
Colorimetric evaluation	DIN 6162 Iodine color value ISO 6271 Hazen color value ISO 4630 Gardner color value ASTM D 1209 Saybolt color value ASTM D 1500 Mineral oil color value
Source lamp	Gas-filled Tungsten (visible)
Wavelength range	400–700 nm
Wavelength accuracy	± 2 nm
Wavelength calibration	Automatic
Wavelength range for color measurement	400 to 700 nm
Photometric accuracy	5 mAbs at 0.0 to 0.5 Abs 1% at 0.50 to 2.0 Abs
Photometric linearity	< 0.5% to 2 Abs < = 1% at > 2 Abs with neutral glass at 546 nm
Stray light	> 3.0 Abs. at 500 nm with OG570/3
Data log	200 color measurements
Width	220 mm (8.6 in.)
Height	135 mm (5.3 in.)
Depth	330 mm (12.9 in.)
Weight	4.06 kg (8.95 lbs) without battery 4.38 kg (9.66 lbs) with battery
Operating requirements	10–40 °C (50–104 °F), max. 80% relative humidity (non-condensing)
Storage requirements	–40–60 °C (–40–140 °F) max. 80% relative humidity (non-condensing)
Mains connection	15 V- / 30VA Plug-in power supply unit: (100–240 V/50–60 Hz)
Interfaces	Use only screened cables with maximum length of 3 meters. 1 x USB type A 1 x USB type B
Enclosure rating	IP 41 with closed lid IP 42 with Protective Cover in place
Protection Class	Safety class II

Section 2 General Information

2.1 Safety information

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

To 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.

2.1.1 Use of hazard information

DANGER

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

WARNING

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.

Important Note: Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

Note: Information that supplements points in the main text.

2.1.2 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, if noted on the instrument, will be included with a danger or caution statement in the manual.

	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 public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of life equipment to the Producer for disposal at no charge to the user. Note: For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories and all auxiliary items for proper disposal.

2.1.3 Chemical and Biological Safety

DANGER

Potential Chemical/ Biological Exposure Hazards. Handling chemical samples, standards and reagents can be dangerous. Users of this product are advised to familiarize themselves with safety procedures and the correct use of chemicals, and to carefully read all relevant Material Safety Data Sheets.

Normal operation of this instrument may involve the use of hazardous chemicals or biologically harmful samples.

- The user must observe all cautionary information printed on the original solution containers and safety data sheet prior to their use.
- All waste solutions must be disposed in accordance with local and national law.
- The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

2.2 Overview of product

The LICO 150 is a color measuring instrument for determining the color values of transparent, optically clear liquids. The instrument comes with a complete set of application programs and multi-language support.

The LICO 150 can carry out an exact colorimetric evaluation in conformity with ISO/ASTM standards with just a single measurement and display the result in terms of traditional color systems such as Iodine, Hazen or Gardner color numbers.

WARNING

Electrical and Fire Hazards. Use only the provided power supply. Only qualified personnel should conduct the tasks described in this section of the manual.

3.1 Unpack the instrument

The LICO 150 comes packaged with the following items:

- LICO 150
- Dust cover
- External power supply, including 4 adapter for EU, UK, USA and AUS/China
- cuvette/cell adapter Z
- LICO 150 user manual
- Quick start guide LICO 150

Note: If any of these items are missing or damaged, contact the manufacturer or a sales representative immediately.

3.2 Environment considerations

The following conditions are necessary to make sure correct instrument operation and accurate results:

- Place the instrument firmly on an even surface. Do not push any objects under the instrument.
- Maintain an ambient temperature of 10 to 40 °C (50 to 104 °F) for proper instrument operation.
- The relative humidity should be less than 80%; moisture should not condense on the instrument.
- Leave at least a 15 cm (6 in.) clearance at the top and on all sides for air circulation to avoid overheating of electrical parts.
- Do not operate or store the instrument in extremely dusty, damp or wet locations.
- Keep the surface of the instrument, the cell compartment and all accessories clean and dry at all times. Splashes or spills on and in the instrument should be cleaned up immediately (see [section 7.1 on page 49](#)).
- After a continuous operating time of more than 24 hour without switching off the instrument we recommend to perform a new calibration with a distilled water cuvette/sample cell.
- After a continuous operating time of more than 7 days without switching off the instrument we recommend to switch off and on the instrument to perform a new system check with filter adjustment and lambda-calibration

Important Note: Protect the instrument from temperature extremes, including heaters, direct sunlight and other heat sources.

3.3 Power connections

Install the correct adapter plug on the supplied external power supply (Figure 1). Slide the adapter on until it "clicks" into position. Correctly mounted, both housing of power supply and plug are in line. Plug the external power supply cord into the connector on the back panel of the instrument, then plug the supply into a power outlet (100–240 V~ / 50–60 Hz). Press the power switch on the back of the instrument to initialize power (Figure 2 on page 11).

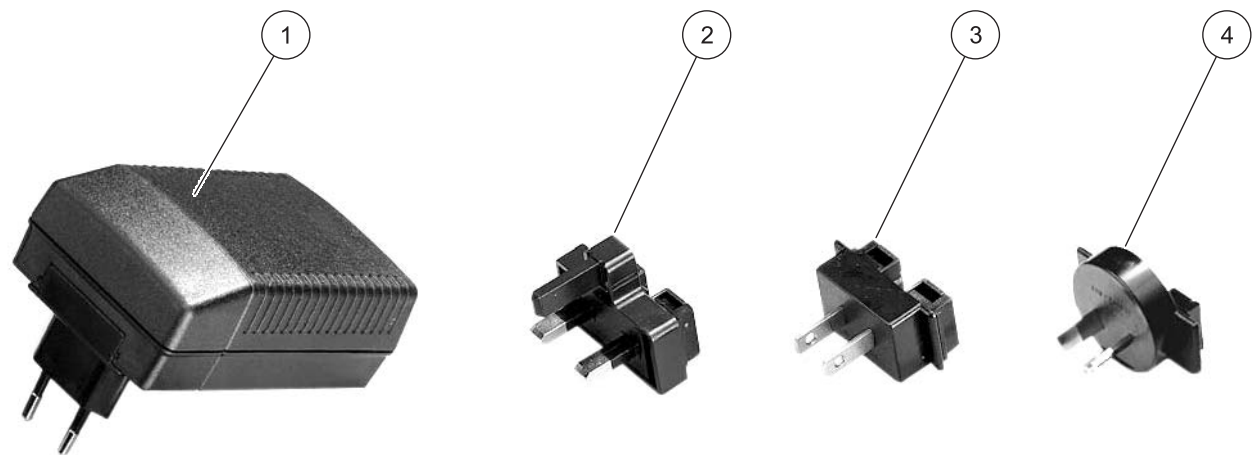


Figure 1 Power adapter

1	Power supply with EU adapter plug installed	3	USA adapter plug
2	UK adapter plug	4	AUS/China adapter plug

3.4 Connection

The LICO 150 has two USB interfaces as a standard feature, located on the back of the instrument ([Figure 2](#)).

The USB Type A interface is used for communications with a printer, USB memory stick or keyboard. A USB memory stick is used to update instrument software.

The USB Type B interface is used for communications with a PC. The optional Hach Data Trans software (see [Section 9 on page 59](#)) must be installed on the PC for this use.

A USB hub may be used to connect several accessories at a time.

Note: *USB cables must not be longer than 3 meters (10 feet).*

These USB interfaces enable data and graphics to be output to a Printer and a PC and upgrade instrument software (see [section 6.1.2 on page 40](#)).

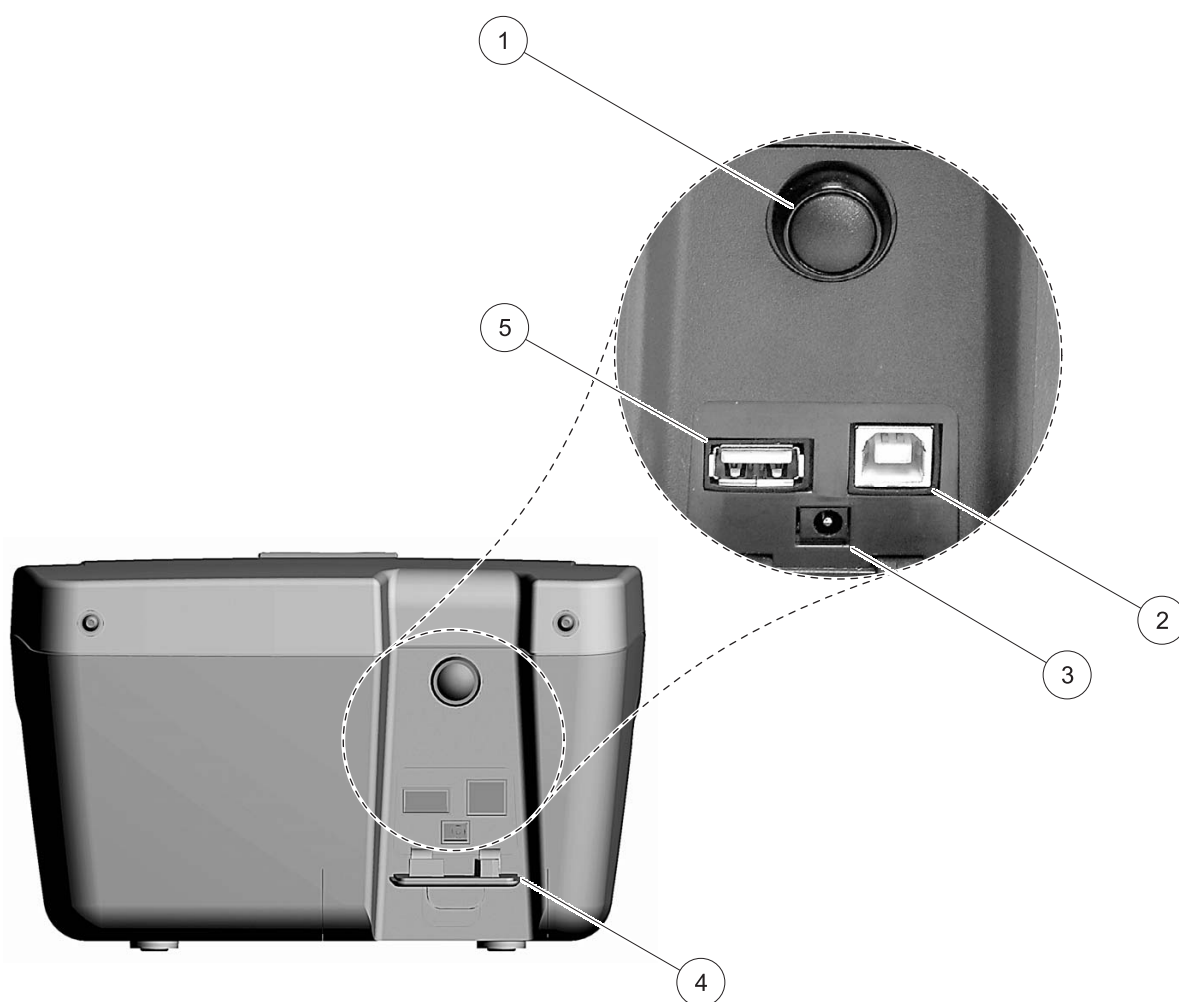


Figure 2 Interfaces

1 On/Off switch	4 Cover
2 USB type B	5 USB type A
3 Plug in power supply	

3.5 Cell compartments and cell adapter

3.5.1 Cell compartments and adapter

The LICO 150 has two cell compartments (Figure 3). Only one cuvette/sample cell type at a time can be used for a measurement.

Cell compartment #1

- 11-mm round cuvettes/sample cells
For measurements with 11 mm round cuvettes/sample cells in cell compartment #1 insert the adapter Z into cell compartment #2.

Cell compartment #2

Cell compartment #2 uses adapters to accommodate different cuvette/sample cell types.

- 50-mm rectangular cuvettes/sample cells (can be inserted directly into the cell compartment without using an adapter).
- 10-mm square cuvettes/sample cells (can be inserted with the adapter Z)

Important Note: Be sure that the adapter Z is inserted proper into the cell compartment. Press the adapter down until it snap into the compartment.



Figure 3 Cell compartments

1	Cell compartment #1
2	Cell compartment #2

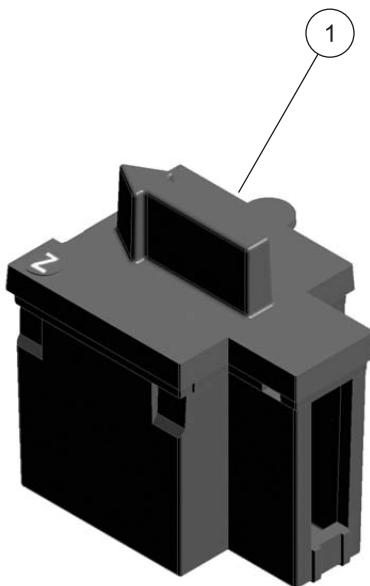


Figure 4 Cell adapter Z

1	Adapter Z: 10 mm square cell adapter
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3.5.2 Installation of the cell adapter

1. Open the cell compartment.
2. Insert the adapter for measurements with the round cuvette/sample cell (11 mm) and/or 10 mm square cuvette/sample cell so the arrow on top of the adapter points to the left (Figure 4) and the orientation tab fits the groove in the compartment opening.

Note: The arrow on top of the adapter indicates the direction of the light beam path.

Section 4 Start Up

4.1 Power the instrument on and off

1. Plug in to the power supply (laboratory analysis) or insert the battery (field analysis).
2. The push-button switch on the back of the instrument switches the instrument on (press for about 1 second) and off (press for about 3 to 5 seconds). An acoustic signal confirms that the instrument has been switched off.

Note: Do not turn the instrument off and on in rapid succession. Always wait about **20 seconds** before turning the instrument on again, otherwise the electronic and mechanical systems will be damaged.

4.2 Language selection



The LICO 150 software includes several language options. The first time the instrument is turned on, the language selection screen will appear.

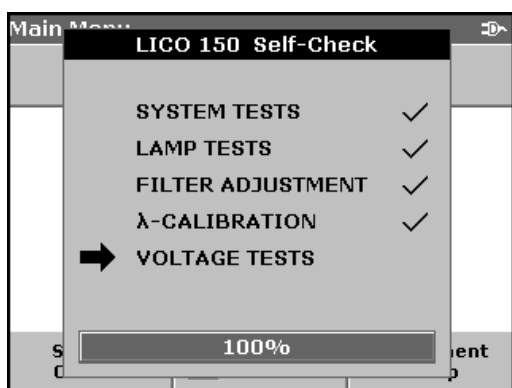
1. Select the desired language.
2. Press **OK** to confirm. The self-check will start automatically.

Changing the language setting

The instrument functions in the selected language until the option is changed.

1. While turning the instrument on, touch the screen at any point until the list for selecting a language appears (about 30 seconds).
2. Select the required language.
3. Press OK to confirm. The self-check will start automatically.

4.3 Self-Check



Each time the instrument is powered, a series of diagnostic tests are performed automatically to make sure operation of major system components.

This procedure, which takes approximately two minutes, checks the system, lamp, filter adjustment, wavelength calibration and voltage. Each test which functions correctly is confirmed with a check mark.

Note: For further error messages during self-check, see [Section 8 on page 57](#).

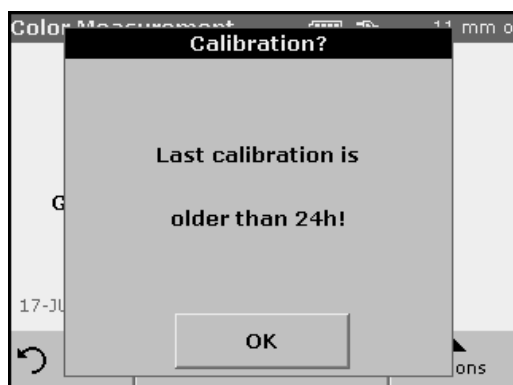


The Color Measurement Menu is displayed when diagnostics are completed. Insert a cuvette/sample cell with distilled water to calibrate. The calibration starts automatically when the LICO 150 recognizes a 11 mm round vial in the cell compartment #1. For the use of square cuvettes/sample cells in the cell compartment #2, press **Start** to start the calibration.

Insert the sample cuvette/cell. For the use of 11 mm round vials the measurement starts automatically. For the use of square cuvettes/sample cells in the cell compartment #2, press **Measure** to start the measurement.

See section [5.1.3 Main Menu on page 18](#) for a detailed description.

4.4 Characteristics in continuous operation



After a continuous operating time of more than 24 hour without switching off the instrument we recommend to perform a new calibration with a distilled water cuvette/sample cell.



After a continuous operating time of more than 7 days without switching off the instrument we recommend to switch off and on the instrument to perform a new system check with filter adjustment and lambda-calibration.

Section 5 Standard Operations

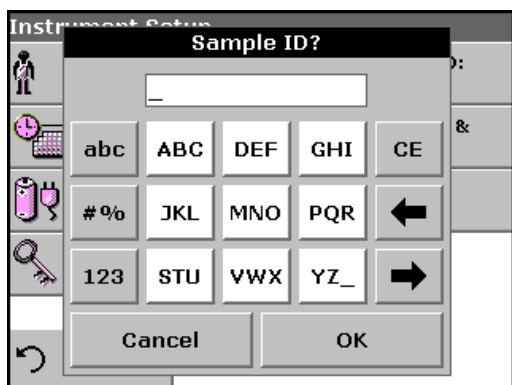
5.1 Overview

5.1.1 Tips for the use of the touch screen

The entire screen is touch-activated. To make a selection, press the screen with a fingernail, fingertip, pencil eraser or a stylus. Do not press the screen with a sharp object, such as the tip of a ball point pen.

- Do not place anything on top of the screen, to prevent damage or scratching on the screen.
- Press keys, words or icons to select them.
- Use scroll bars to move up and down long lists very quickly. Press and hold the scroll bar, then move up or down to move through the list.
- Highlight an item from a list by pressing it once. When the item has been successfully selected, it will be displayed as reversed text (light text on a dark background).

5.1.2 Use of the alphanumeric keypad



This display is used to enter letters, numbers and symbols as needed when programming the instrument. Unavailable options are disabled (grayed out). The icons on the right and left of the screen are described in [Table 1](#).

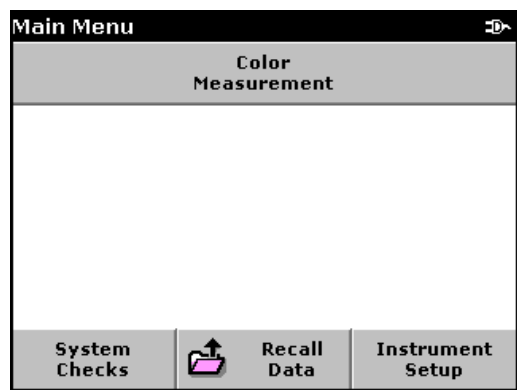
The central keypad changes to reflect the selected entry mode. Press a key repeatedly until the desired character appears on the screen. A space can be entered by using the underscore on the **YZ_** key.

Note: A USB keyboard (with US keyboard layout) or a USB Barcode handset scanner can be used for input (see [Section 9 on page 59](#)).

Table 1 Alphanumeric keypad

Icon / key	Description	Function
ABC/abc	Alphabetic	When entering alphabetic characters (ex. user-entered units), this key allows to toggle between upper and lower case letters.
# %	Symbols	Punctuation, symbols and numerical sub- and superscripts may be entered.
123	Numeric	For entering regular numbers.
CE	Clear Entry	Clear the entry.
Left Arrow	Backspace	Moves back one position. This deletes the character previously entered in the new position.
Right Arrow	Advance	Moves to the next space in an entry when two adjacent characters occur on the same key.

5.1.3 Main Menu

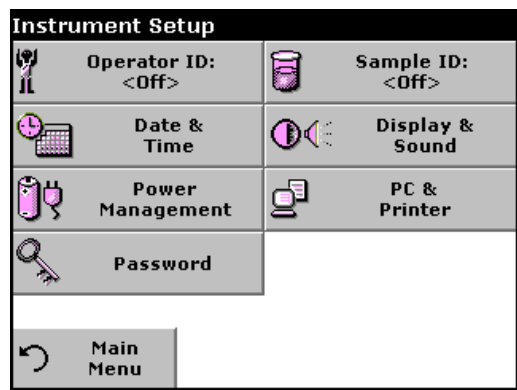


A variety of modes may be selected from the **Main Menu**. [Table 2](#) briefly describes each menu option.

Table 2 Main Menu options

Option	Function
Color Measurement	The COLOR MEASUREMENT mode is used to determine visual color values like Hazen, Gardner and Saybolt
System Checks	The system checks menu offers a number of options, including optical checks, output checks, lamp history, instrument update, service time and instrument backup.
Recall Data	Stored data can be recalled, filtered, sent to Printer, Memory stick or PC and deleted.
Instrument Setup	In this mode, user-specific or method-specific settings can be entered: Operator-ID, Sample-ID, Date & Time, Display & Sound, PC & Printer, Password

5.2 Instrument Setup mode

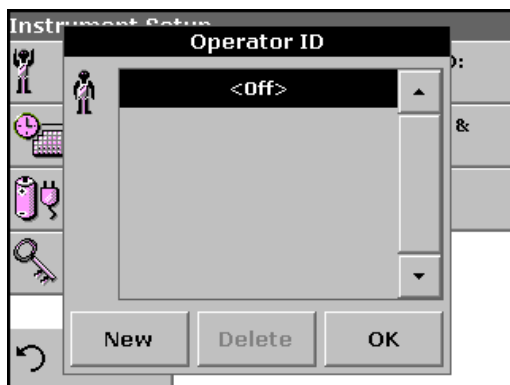


1. Select **Instrument Setup** in the Main Menu.

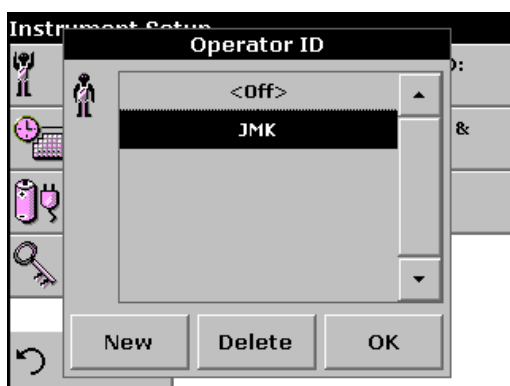
A selection of configuration options appear.

5.2.1 Operator ID

Use this option to enter up to 30 sets of operator initials (up to five characters each). Also the color can assigned for each Operator ID. This feature helps record which operator measured each sample.



1. Press **Operator ID** in the Instrument Setup.
2. Press **New** to enter a new Operator ID.
3. Use the alphanumeric keypad to enter a new Operator ID.
4. Press **OK** to confirm.



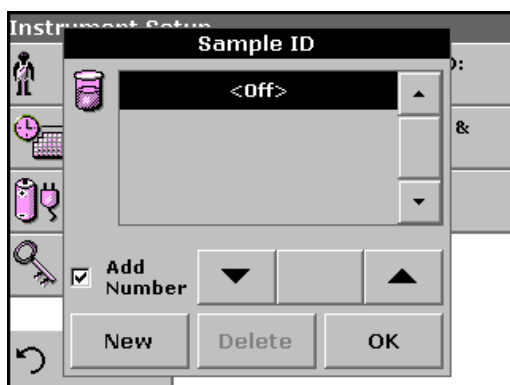
5. The display shows the selected Operator ID.
6. Press **OK** to return to Instrument Setup.
7. The selected Operator ID is activated.

Note: Press **Delete** to remove an Operator ID from the list.

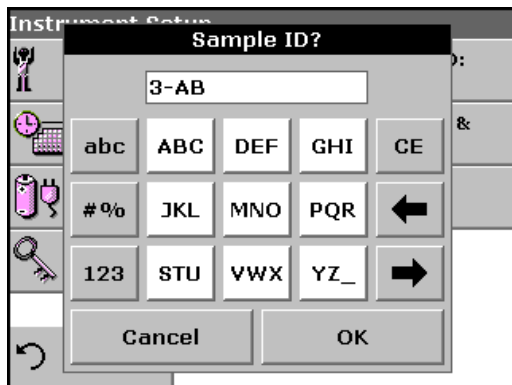
Note: Alternatively, enter or change an Operator ID in measurement mode. In the results screen, press **Options>More>Instrument Setup** or if an Operator ID is already assigned, select the Operator ID symbol immediately in the results screen.

5.2.2 Sample ID

Use this option to enter up to 100 Sample Identification tags (up to 13 characters each) into the instrument. Sample IDs can be used to specify the sample location or other sample specific information.



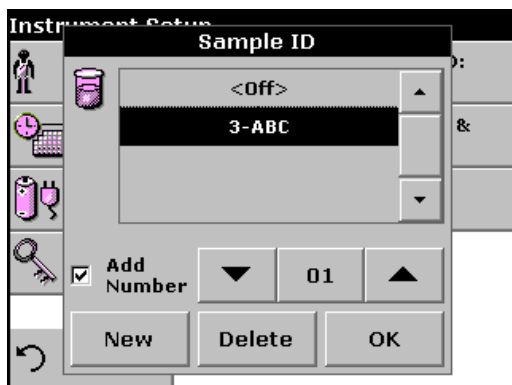
1. Press **Sample ID** in the Instrument Setup.
2. Press **New** to enter a new Sample ID.



3. Use the alphanumeric keypad to enter a new Sample ID.

Note: If a USB Barcode handset scanner (see [Section 9 on page 59](#)) is connected, Sample IDs can also be scanned.

4. Press **OK** to confirm.



5. To number the Sample IDs sequentially (e.g. Inflow (01 etc.)), select **Add Number**.

- Use the arrow keys to specify the first number of the sequence.
- Use the key between the arrow keys to enter the first number of the sequence using the alphanumeric keypad.

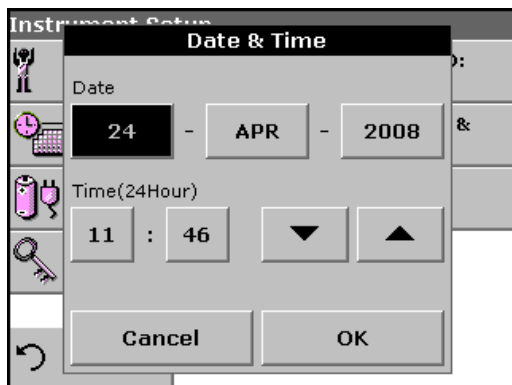
6. Press **OK** to return to Instrument Setup.

7. The Sample ID is activated. Each Sample ID is automatically numbered in ascending order after a measurement. The number is shown in parentheses behind the Sample ID.

Note: To remove a Sample ID, highlight the ID and press **Delete**.

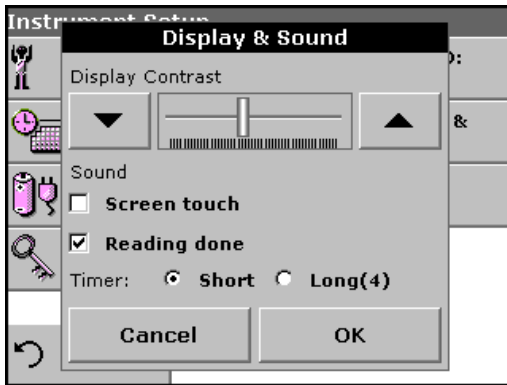
Note: A Sample ID can be entered or changed in measurement mode. In the results screen, press **Options>More>Instrument Setup**. If a Sample ID is already assigned, select the Sample ID symbol in the results screen.

5.2.3 Date and time



1. Press **Date & Time** in the Instrument Setup.
2. The date and time are subdivided over a number of fields. Press the appropriate field and use the arrow keys to change the value.
3. Press **OK** to return to Instrument Setup.

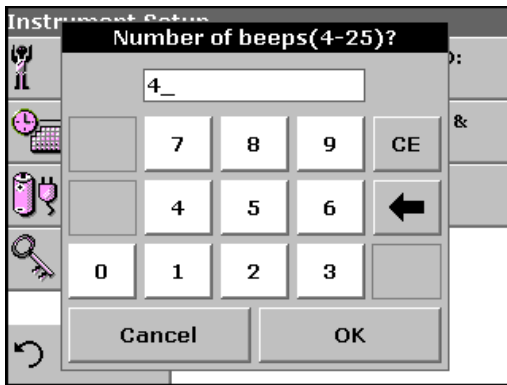
5.2.4 Display and sound preferences



1. Press **Display & Sound** in the Instrument Setup.

The following options will be displayed:

- **Display Contrast**—Adjusts the display brightness to suit lighting conditions.
- **Screen touch**—Activates//Deactivates a short beep each time the screen is pressed (Default:off).
- **Reading done**—Activates/Deactivates a sound when a reading is complete (Default: short beep every time a reading is complete).
- **Timer**—Adjusts the length of the timer sound. Select Short or Long. Long beeps are recommended for noisy environments.



2. Select **Long** to change the number of audio signals.

Use the alphanumeric keypad to enter/specify the number of audio signals (4–25).

Note: A high number of audio signals increases the duration of the tones and a small number of audio signals reduces the duration of the tones.

3. Press **OK** to confirm. The selected number of the audio signals sounds as a corresponding acoustic signal.
4. Press **OK** to return to Instrument Setup.

5.2.5 Power Management

The LICO 150 can run on mains or battery power.

Note: The battery is **not** part of the standard scope of delivery.



1. Select **Power Management** in the "Instrument Setup" menu.

The battery symbol indicates the charge status of the battery in %.

Note: The timer settings in the **Power Management** menu are only active when the instrument is running on battery power.



2. Select one of the options under **Standby mode** to set the length of the idle period that can elapse before the instrument switches to the Standby mode when running on battery power.

Note: In standby mode, the backlighting of the screen is switched off. Touching the display causes the lighting to switch on again.



3. Select one of the options under **Auto off** to set the length of the idle period that can elapse before the instrument automatically switches off when running on battery power.

After the instrument switches itself off automatically, you have to press the push-button switch on the back of the instrument to start it again.

5.2.6 PC and printer

The LICO 150 is provided with 2 USB interfaces, which are located on the back of the instrument (see [Figure 2 on page 11](#)). These interfaces can be used for exporting data and graphics to a printer, updating data and for data communication to a personal computer. These interfaces can be used for the connection of a USB stick, an external USB keyboard or a USB Barcode handset scanner.

Note: A USB hub may be used to connect several accessories at a time.

A USB memory stick is used to upgrade data, see [section 6.1.2 on page 40](#).

Important Note: A screened **USB cable** must not be longer than **3 m!**

Table 3 USB connector

USB Interfaces	Description
USB (Type B)	This USB interface is only intended for the LICO 150 to PC connection (with installation of the HACH Data Trans Software).
USB (Type A)	This USB port can be used to connect a printer, a USB memory stick and keyboard.



1. Press **PC & Printer** in the Instrument Setup.
- A list with information about the connections opens.

5.2.6.1 Printer setup



For reasons of compatibility, the printer language must be **HP PCL 3**.

1. Press **Printer**.
2. Press **Setup** to display the Printer Setup screen.



Printer Setup:

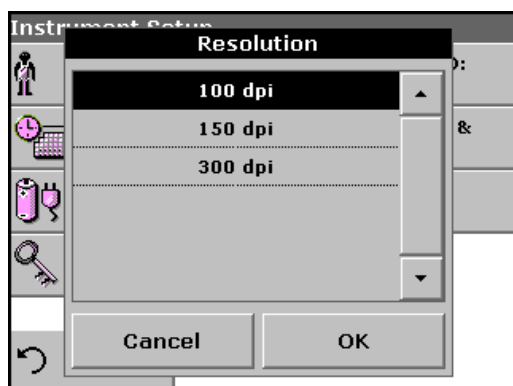
- Resolution: Font size
- Paper: Paper size

Note: If an optional Thermal Printer is connected, the function "Auto Send" on/off is available.



3. Select **Auto-Send: On** to send all measured data automatically to the Thermal printer.

Note: The option Auto-Send is **not** available for any other printer (e.g. ink jet printer).



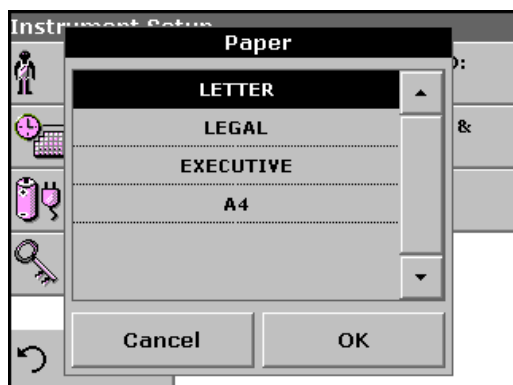
4. Press **Resolution** to select the print quality.

Select between

- 100 dpi
- 150 dpi
- 300 dpi

5. Press **OK** to confirm.

Note: Press **OK** again to return to the **Instrument Setup** menu.



6. Press **Paper** to select the paper size.

Select between

- Letter
- Legal
- Executive
- A4

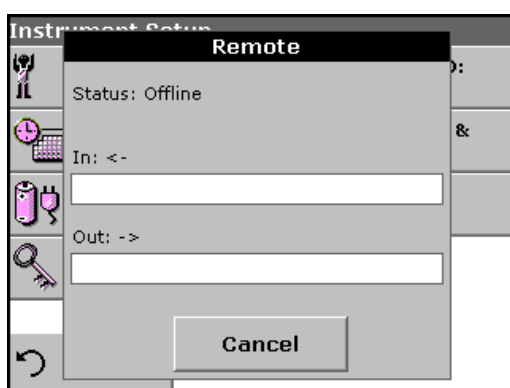
7. Press **OK** to confirm.

Note: Press **OK** again to return to the **Instrument Setup** menu.

5.2.6.2 PC setup

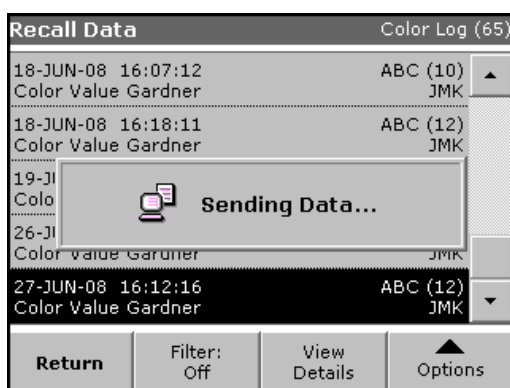


1. Press **PC**.
2. Press **Setup** to display the PC Setup screen.
3. With Auto-Send **ON** selection each measurement result will be automatically sent to a PC.



4. Select **Remote** to establish a bi-directional PC connection to send and receive commands and data (reserved for advanced application).

5.2.6.3 Print data



1. Press **Recall Data** in the Main Menu.
2. Select the data source, where the data to be printed are stored.
3. A list is displayed. Data can be filtered. For more information see [5.3.2 Recall stored data from the data log on page 28](#).
4. Press the **Printer** icon.
5. Highlight **Single point** or **Filtered data** or **All data** and press **OK** to confirm.
6. **Sending Data** is displayed until the data have been printed.

5.2.7 Password

The Password menu contains a variety of security settings to control access to various functions. For example, prevent unauthorized changes to stored programs or instrument configurations.



1. Press **Password** in the Instrument Setup menu.
2. In order to highlight the **Security List** assign a password. Press **Set Password**.



3. Use the alphanumeric keypad to enter a new Password (up to 10 characters each) and press **OK** to confirm.

The access to the Security List is activated.



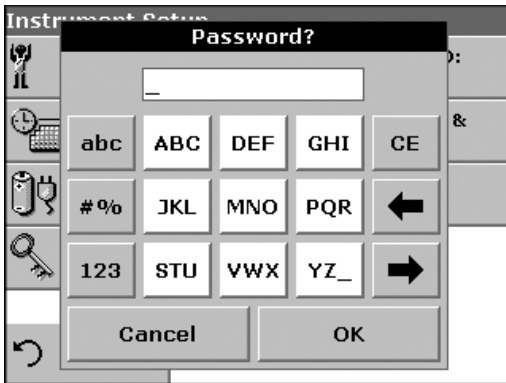
4. Press **Security List** to lock various functions for unauthorized users.



5. Highlight the desired functions to control.
6. Confirm the **Security List** with **OK** to return to the Password menu.
7. Press **On** to highlight the new settings of the Security List.
8. Enter the new Password again to confirm.
9. Press **OK** to return to Instrument Setup.

Note: The alphanumeric keypad to the Password inquiry appears when a user tries to reach a locked setting.

5.2.7.1 Deactivate a password



1. Press **Password** in the Instrument Setup.
2. Use the alphanumeric keypad to enter the former Password and press **OK** to confirm.



3. Press **Off** to deactivate the settings of the Security List.
4. Press **OK** to return to Instrument Setup.

Note: Use this function to delete the former Password or to enter a new one.

5.3 Store, recall, send and delete data

Recall Data		Color Log (5)
24-APR-08 11:59:24	3-ABC (01)	▲
Color Value Hazen	JMK	
24-APR-08 11:59:48	3-ABC (02)	
Color Value Hazen	JMK	
24-APR-08 12:00:05	3-ABC (03)	
Color Value Hazen	JMK	
24-APR-08 12:00:19	3-ABC (04)	
Color Value Hazen	JMK	
24-APR-08 12:00:40	3-ABC (05)	▼
Color Value Hazen	JMK	
↶ Main Menu	Filter: Off	View Details Options ▲

The **Data Log** will store up to 200 color measurments taken in the Color Measurements modes.

A complete record of the analysis is stored, including the Date, Time, Results, Sample ID and Operator ID.

5.3.1 Auto/manual data storage

The data storage parameter indicates whether data are to be stored automatically or manually (in which case the user has to decide which data to store).

Color Measurement		11 mm o
JMK	3-ABC(06)	
Color Value Hazen		More...
H = 170	1000 0	Store: On
24-APR-2008 12:09:07		Color Scale
↶ Main Menu	Measure	Options ▼

1. Press **Store: On/Off** in the Options menu.

- **Store On** setting: All measurement data are stored automatically.
- **Store Off** setting: No measurement data are stored. However, this setting can be changed to **Store On** in the result display through Configuration. The reading currently shown in the display is then stored.

***Note:** When the instrument memory (data log) is full, the oldest data are automatically deleted allowing the new data to be stored.*

5.3.2 Recall stored data from the data log

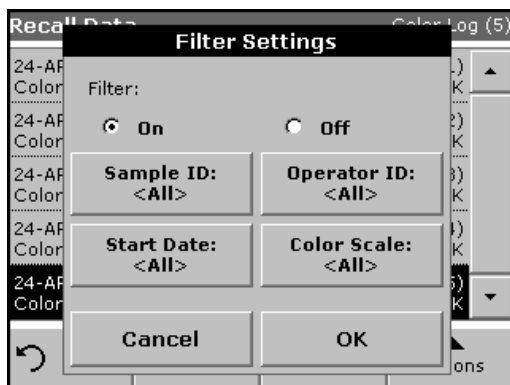
Recall Data		Color Log (5)
24-APR-08 11:59:24	3-ABC (01)	▲
Color Value Hazen	JMK	
24-APR-08 11:59:48	3-ABC (02)	
Color Value Hazen	JMK	
24-APR-08 12:00:05	3-ABC (03)	
Color Value Hazen	JMK	
24-APR-08 12:00:19	3-ABC (04)	
Color Value Hazen	JMK	
24-APR-08 12:00:40	3-ABC (05)	▼
Color Value Hazen	JMK	
↶ Main Menu	Filter: Off	View Details Options ▲

1. Press **Recall Data** in the Main Menu.

2. Press **Data Log**.

A listing of the stored data is displayed.

3. Press **Filter: On/Off**.

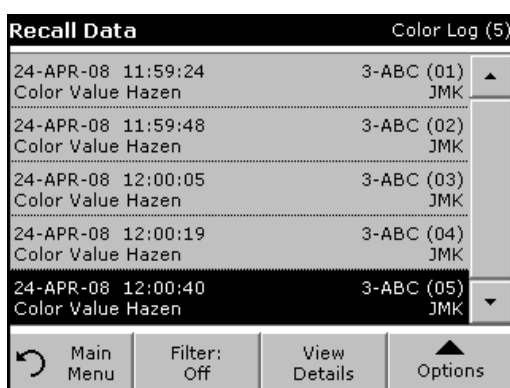


4. The function **Filter Settings** is used to search for specific items.

5. Highlight **On** to turn on the filters to select data by

- Sample ID
- Operator ID
- Start Date
- Color Scale

or any combination of the four.



6. Press **OK** to confirm the selection. The selected items are listed.

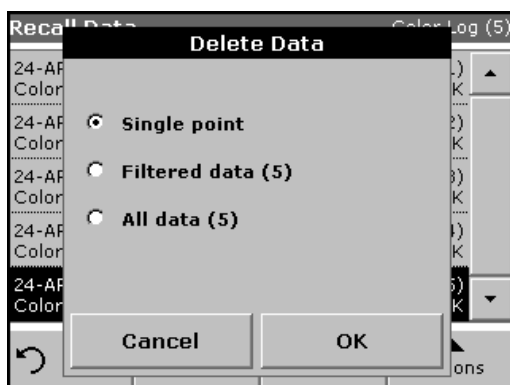
7. Press **View Details** to get more information.

8. Turn on the filter to select data by **Color Scale**.

5.3.3 Send data from the data log

Data is sent from the data log as CSV (Comma Separated Value) files through a USB memory stick to a file named DATALOG. The file can then be processed using a spreadsheet program. The file name will be formatted as: DLYear_Month_Day_Hour_Minute_Second.CSV.

To send data to a Printer, see section [5.2.6.3 on page 25](#).



1. Plug in the USB device ([Figure 2 on page 11](#)).

2. Press **Recall Data** from the Main Menu. Press **Options** and then the **PC & Printer** icon.

3. Select the data to send to the memory stick and press **OK**.

Note: The number in parenthesis is the total number of data sets assigned to this selection.

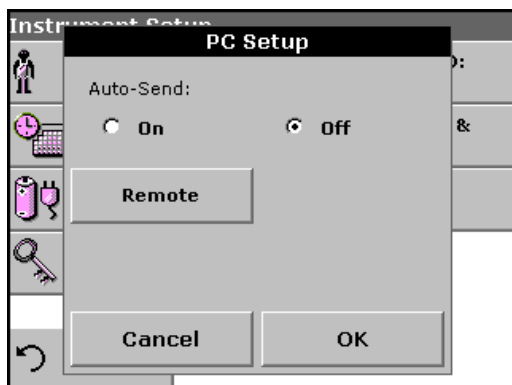
To send measurement data to a PC:

The optional HACH Data Trans software must be installed on the PC for the subsequent to process for measurement data.



1. Press **PC & Printer** in the Instrument Setup.
2. Select **PC**.
3. Press **Setup** to display the PC Setup screen.

For further installation instructions, refer to the HACH Data Trans user manual.

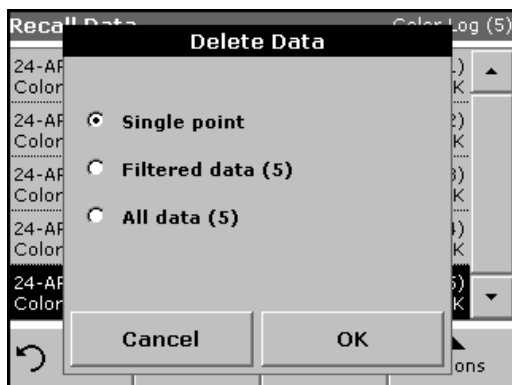


4. Select **Auto-Send: On** to send all measured data automatically to the PC.

Note: If **Auto-Send: Off** is selected, the "PC & Printer" key must be pressed, in order to send data to the PC.

The remote function is only for monitoring the data transfer.

5.3.4 Delete stored data from the data log



1. Press **Recall Data** in the Main Menu.
2. Press **Data Log**, then **Options>Delete**.
3. Highlight **Single Point** or **Filtered data** or **All data** and press **OK** to confirm.

Note: The number in parentheses is the total number of data sets assigned to this selection.

5.4 Sampling and sample preparation

Take a representative sample from the product you want to measure in accordance with DIN EN ISO 15528 (or ASTM D3925-02).

If the material shows any visual haziness, remove the haze by either filtration, centrifugation, heating, ultrasonic treatment or suitable means.

Heat partly solid samples before measuring in order to dissolve the solid material in the liquid. The preparation must not cause any chemical changes in the sample.

Make sure that during the measurement are no bubbles in the sample.

There are three cuvette/sample cell types available for color measurement with the LICO 150, differing by material (glass, PS and PMMA) and path length (10 mm, 11 mm and 50 mm). Fill the cuvette/sample cell to approximately 2 cm. The light beam passes through the cuvette/sample cell around 0.5 cm to 1.5 cm above the base of the cuvette/sample cell.

The program calculates and displays Iodine, Hazen, Gardner, Saybolt, Klett and ASTM D 1500 color values automatically, taking into account the cuvette/sample cell type.

A dry thermostat is available for the 11 mm disposable round glass cuvettes/sample cells. The dry thermostat heats the cuvettes/sample cells to any temperature between ambient and 150 °C.

Important Note: *The samples must be clear and free of turbidities. If products in paste or solid form cannot be measured directly, the product must be melted before being transferred to the cuvettes/sample cells. Make sure the cuvettes/sample cells do not contain any air bubbles.*

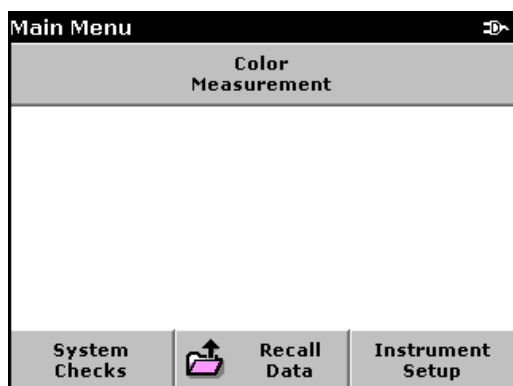
- Always hold the cuvette/sample cell close to the top, to make sure that there are no fingerprints in the measurement zone of the cuvette/sample cell. Use suitable transfer pipettes to introduce samples into the cuvettes/sample cells.
- Slowly add samples to the cuvettes/sample cells to make sure air bubbles do not form on the cuvette/sample cell wall and in the sample. Air bubbles will cause false readings.
- If air bubbles are entrapped, remove them by heat, vacuum, ultrasonic treatment or other suitable means.
- Clean the outside of the cuvettes/sample cells thoroughly before inserting them in the cell compartment.

Important Note: *Before using disposable cuvettes/sample cells made by PS (Polystyrene) or PMMA (Polymethyl methacrylate) be sure that the cuvettes/sample cells will not be destroyed by samples, otherwise the cell compartment can be damaged.*

5.5 Color measurement

Proper sample preparation is extremely important for accurate color measurement. To make sure an accurate measurement is taken, refer to the following sample preparation guidelines:

- Always clean the glass cuvettes/sample cells immediately after use.
- Only use optically preferred samples for measurement. Make sure the cuvette/sample cell are clean and show no signs of opaqueness.
- Slowly fill the liquid into the cuvette/sample cell to prevent air bubbles in the sample.
- Refer to section [5.4 on page 31](#) for more sample and sampling preparation information.



The Color Measurement mode is used to determine absolute color values in the Hazen or Gardner.

The LICO 150 uses an independent calibration data set for each type of cuvette/sample cell size (11 mm round vial and 50 mm rectangular cells).

It is possible to calibrate the instrument with one, two or three types of cuvettes/sample cells and to use these different cuvette/sample cell types in parallel.



For the use of the 10 mm square cuvette/sample cell and 11 mm round vials it is necessary to insert the adapter Z into the cell compartment #2. For measurements with 50 mm rectangular cuvettes/sample cells please remove the adapter.

The cell compartment #1 has an automatic cell detection. For use of the 11 mm round vial in the cell compartment #1 the measurement starts automatically.

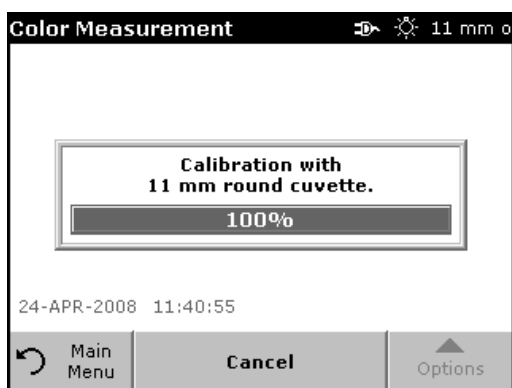
For the use of square cuvettes/sample cells in the cell compartment #2, press **Start** or **Measure** to start the measurement.

5.5.1 Take a color measurement

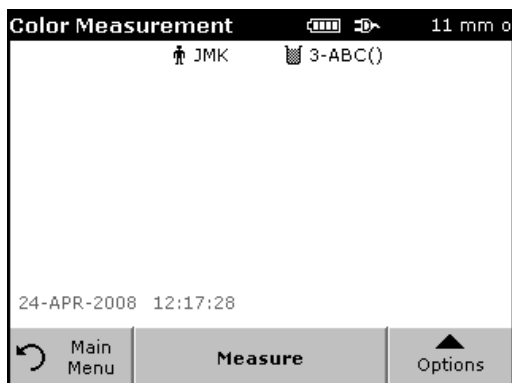


1. Press **Color Measurement**.
2. Insert a cuvette/sample cell with distilled water to calibrate.

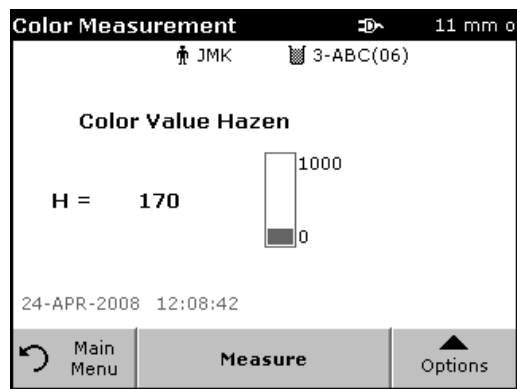
Important Note: Carried out the calibration always very carefully, as a faulty calibration can cause inaccurate results to be obtained.



3. The calibration starts automatically when the LICO 150 recognizes a 11 mm round vial in the cell compartment #1. For the use of square cuvettes/sample cells in the cell compartment #2, press **Start** to start the calibration.
4. The type of cuvette/sample cell and the actual progress of calibration is shown in a separat window.



5. After the calibration is done the screen shows an empty measurement window. In the upper right corner of the window the selected cuvette/sample cell size is displayed. The middle button changes to **Measure**.



- 6. Insert the sample cuvette/cell.
For the use of 11 mm round vials the measurement starts automatically.
For the use of square cuvettes/sample cells in the cell compartment #2, press **Measure** to start the measurement.
- 7. The result of the color calculation is displayed.

***Note:** The control bar displayed on the right of the displayed result shows the relationship of the measurement result to the measuring range.*
- 8. For the next measurement, remove the cuvette/sample cell and insert the next sample cuvette/cell or press **Measure** to measure the same sample again.

5.5.1.1 Touch-sensitive areas on the measurement window

On the screen are touch-sensitive areas where the user has immediate access to special software options.

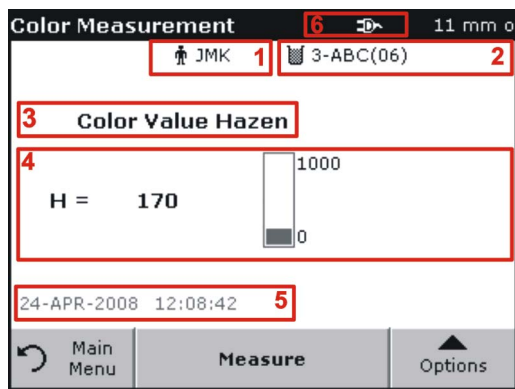


Figure 5 Touch-sensitive areas on the measurement window

1	Open Operator ID to change or add operator ID (see section 5.2.1 on page 18)	4	Change the displayed color scale to the next color system which is selected in the Operator ID color scale list for display. (see section 5.5.1.3 on page 35)
2	Open Sample ID to change or add sample ID (see section 5.2.2 on page 19)	5	Change Date & Time (see section 5.2.3 on page 20)
3	Open Select Color Scale and select scale for display (see section 5.5.1.3 on page 35)	6	Open Power Management to indicate the charge status of the battery in %. (see section 5.2.5 on page 21)

5.5.1.2 Parameter setup options

Press **Option** for Parameter Setup.

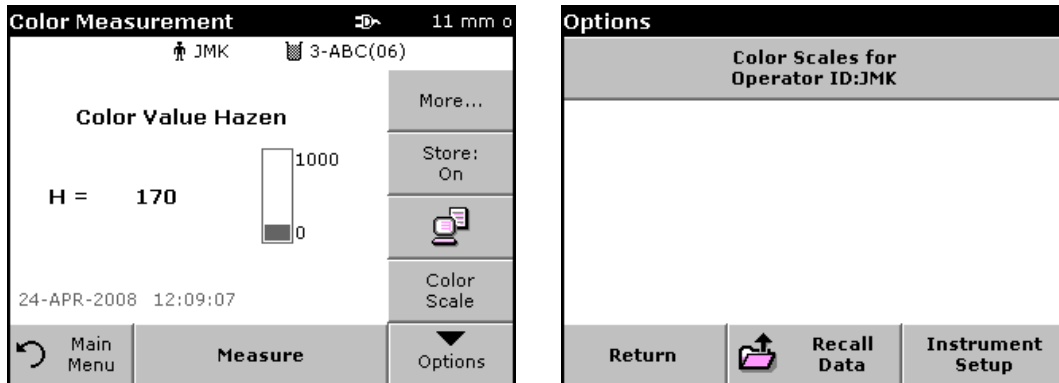
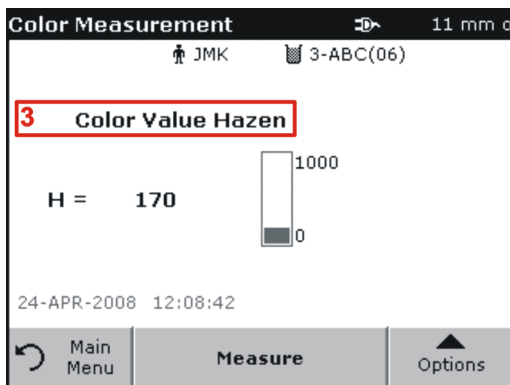


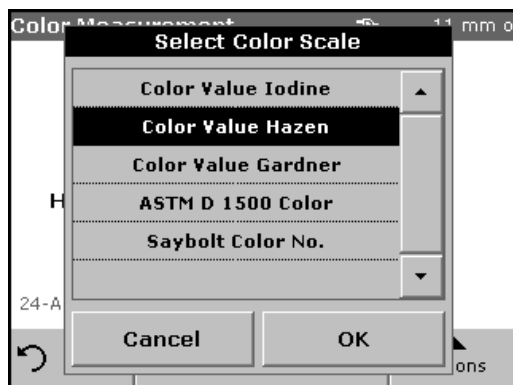
Table 4 Stored programs options

Options	Description
More	For further Options
Store: On	With the STORE ON setting, all measurement data are stored automatically. With the STORE OFF setting, no measurement data are stored.
Send Data	To send data to a printer, computer or USB memory stick (Type A)
Color Scale	Select the color scale
Send Data	To send data to a printer, computer or USB memory stick (Type A)
Color Scales for Operator ID	Configure the color scale for the display and for print.

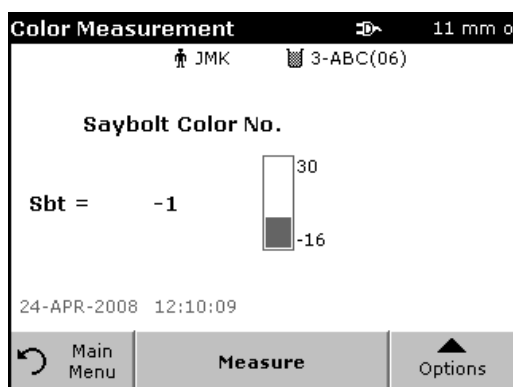
5.5.1.3 Change the color scale after a measurement



1. Press the touch-sensitive area 3, e.g. **Color Value Hazen**.



2. A list of all color scales is displayed.
3. Select the required scale.
4. Press **OK** to confirm.



5. The current result of the actual reading and all further measurements will be displayed in the selected color scale.

5.5.2 Determine the Iodine color value

DIN 6162 defines the Iodine color value as mg of iodine per 100 mL of potassium iodide solution. Color matching with the Iodine color determines the depth of color of clear liquids like solvents, plasticisers, resins, oils and fatty acids, whose color is similar to that of a solution of iodine and potassium iodide of the same thickness.

For iodine color values of less than or approximately 1, the determination of the Hazen value according to DIN-ISO 6271 is to be preferred. Sampling and preparation are described in [section 5.4 on page 31](#). The Iodine value can be accurately determined using an 11 mm round glass cuvette/sample cell.

5.5.3 Determine the Hazen color value (Pt-Co or APHA-method)

The Hazen color value (ISO 6271, also known as "APHA-method" or Platinum-Cobalt Scale) is defined as mg of platinum per 1 litre of solution. The Hazen parent solution is composed of 1.246 g of potassium hexachloroplatinate (IV) and 1.00 g of cobalt(II)chloride dissolved in 100 ml of hydrochloric acid and filled up to 1000 ml with distilled water.

The Hazen-color scale is used to evaluate the colors of nearly water-clear products. It has narrower gradations in the light yellow range than the Iodine scale and extends to water-clear color casts.

Note: Samples with Hazen values between 50 and 1000 can be measured with sufficient accuracy in 10 mm square and 11 mm round

cuvettes/sample cells. Hazen values below 50 are measured in 50 mm cuvettes/sample cells. Hazen values below 10 are only be measured with the 50 mm cuvette/sample cell used for calibration, because nearly water-clear products can easily give faulty measuring results due to cuvette/sample cell tolerances.

5.5.4 Determine the Gardner color value

The Gardner color value is defined in DIN-ISO 4630. The lighter Gardner color values (1 to 8) are based on potassium-chloroplatinate solutions, while the darker ones (9 to 18) are based on solutions of iron(III)chloride, cobalt(II)chloride and hydrochloric acid. The LICO 150 can determine Gardner values at all cuvette/sample cell path lengths (only values 0 to 4 in 50 mm cuvettes/sample cells).

The 10 mm and 11 mm cuvettes/sample cells provide sufficient accuracy.

5.5.5 Mineral oil color value (ASTM D 1500 and ISO 2049)

The mineral oil color scale is used to evaluate the color of mineral oil products such as lubricating oils, fuel oil, diesel fuel and paraffin. The color scale starts at color value 0 for water-white, non-colored oils and ends at 8 for very dark brown oils. Substances are visually evaluated in multiples of 0.5 (0.5 1.0 1.5 etc.). The LICO 150 displays the results in multiples of 0.1. For samples whose color value is higher than 8, *** is displayed.

Note: *Because of the intensive color of the ASTM D 1500 color value, it is calculated only for 11 mm round or 10 mm square cuvettes/sample cells. No calculation is carried out for the 50 mm path length.*

5.5.6 Determine the Saybolt color number (ASTM D 156)

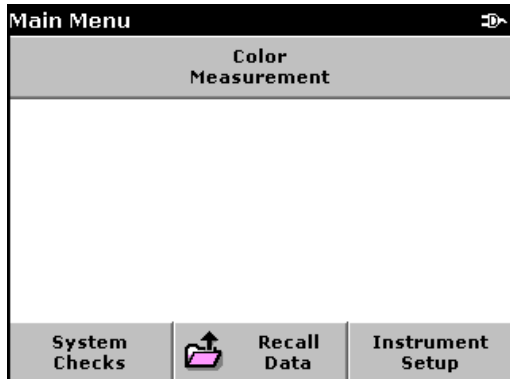
The Saybolt color scale is used to evaluate refined oil products such as petrol and kerosene, as well as for petroleum waxes and pharmaceutical white oils.

The Saybolt color properties are comparable to those of the Hazen scale (APHA). The Saybolt color scale starts at color number +30 (lightest color, equivalent to approximately 8 to 10 Hazen) and ends at -16 (strongest color, equivalent to approximately 350 Hazen).

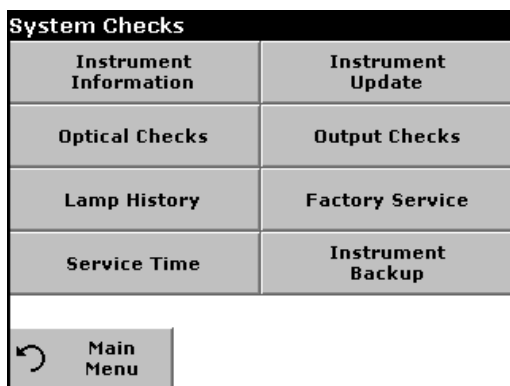
Note: *The measurements can be carried out with 10 mm, 11 mm or 50 mm cuvette/sample cell path lengths. A longer path length increases the degree of accuracy associated with the measurements (50 mm recommended).*

Section 6 Advanced Operations

6.1 System checks



1. Press **System Checks** in the Main Menu.



The System Checks menu contains instrument information and various performance tests.

6.1.1 Instrument information



1. Press **Instrument Information** in the System Checks menu.
2. The model, serial number and software version are displayed.

6.1.2 Upgrade of the instrument software

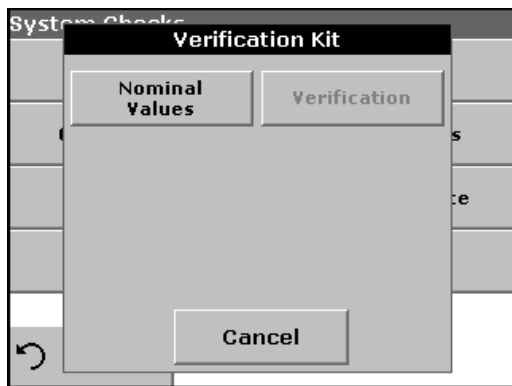
To obtain the software for the update from the Internet at www.hach-lange.com.



1. Go to <http://www.hach-lange.com>
2. Select the country and go to **Download>Software**.
3. Enter **LICO 150** in "Search for documents".
4. Locate the appropriate download and follow the prompts for saving the file(s) to the USB memory stick ([Section 9 on page 59](#)) or to the PC.
5. Unpack the ZIP file and save the files to the USB memory stick.
6. Press **Instrument Update** in the System Checks menu.
7. Connect the USB memory stick to the USB interface (type A) on the instrument, see [section 3.4 on page 11](#).
8. Press **OK**. The link is established automatically and the software is updated.
9. Press **OK** to return to the System Checks menu.

Note: When the instrument software has been updated, a prompt to restart the instrument is displayed.

6.1.3 Optical checks



1. Press **Optical Checks** in the System Checks menu.

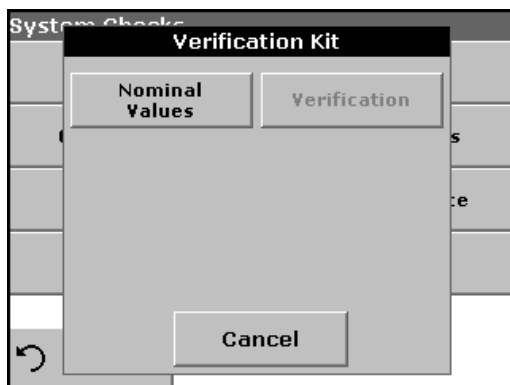
The Optical Checks menu for checking the wavelength accuracy, stray light and photometric accuracy.

An test filter set (Verification Kit) ([Section 9 on page 59](#)) containing four precision glass filters, target values and instructions is available as an aid for carrying out comprehensive in-house instrument checks.

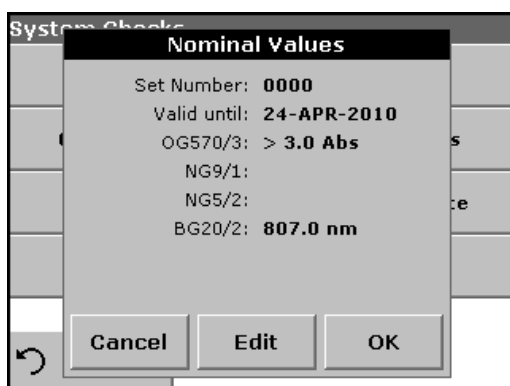
6.1.3.1 Verification kit

The Verification Kit (see [Section 9 on page 59](#)) is designed for periodic monitoring of scattered light, photometric accuracy and the wavelength accuracy of the spectrophotometers.

When results exceed allowable tolerances (given in the quality control certificate to the test record), contact the manufacturer.



1. Press **Nominal Values**.

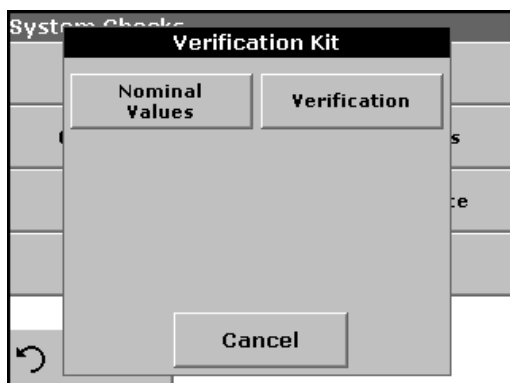


2. Press **Edit**.

An automatic menu guidance queries values (filters, wavelength, nominal values and tolerances) given in the quality control certificate, to the following specifications:

- Stray Light
- Photometrical accuracy
- Wavelength accuracy

3. Press **OK** when all values are entered and the overview is displayed.



4. Press **Verification**.

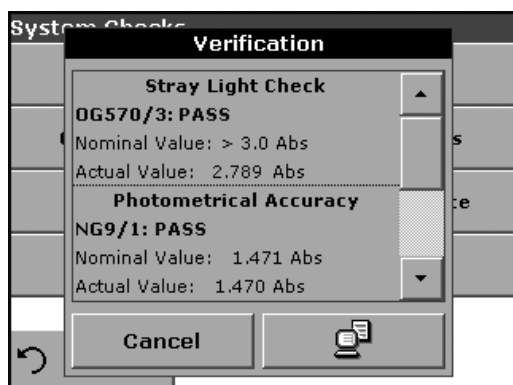
5. Insert the adapter Z ([Figure 4 on page 13](#)) in cell compartment #2.



6. Remove any cuvettes/sample cells from the cell compartment and press **Start**.



7. Insert the different filter in the given order one after the other. Press **Next** after inserting a filter.



After the last measurement the results are displayed.

8. Press **PC & Printer** icon to send the data to a USB memory stick, PC or to a printer.

The files will be stored automatically as CSV file (Comma Separated Value). The file name will be formatted as "Verification.csv".

6.1.4 Output checks

If a printer is connected a test printing of the current screen will be printed.

6.1.5 Lamp history

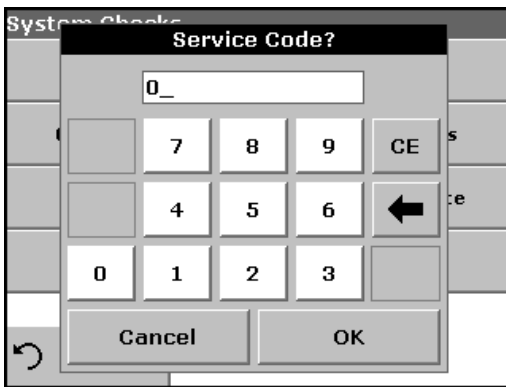
The Lamp History menu provides the amount of time that the lamp has been on (Hours).



After a lamp is replaced, the display of the total operating time is reset to 0.

1. Press **Lamp History** in the System Checks menu.
2. Press **Reset VIS** and the Visible Lamp will be reset.
3. Press **OK** to return to System Checks.

6.1.6 Factory service



The Factory Service menu is password protected. This menu is not intended for customer use.

6.1.7 Service time

In order to make sure a regular inspection, an automatic memory reference for the service times can be entered. After switching the instrument on this memory reference will be activated and indicated at the appropriate time.



1. Press **Service Time** in the System Checks menu.
2. Select **On** and then **Last Service** to enter the date of the last inspection.
3. Press **OK** to confirm.



4. Select **Next Service** to determine a specific period of time up to the next inspection.
5. Press **OK** to confirm.



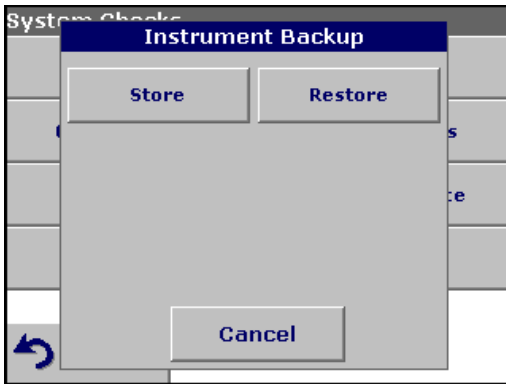
If the next service is due, the message "**Next service is due!**" is displayed after switching on the instrument.

6. Press **OK** to return to the Main Menu.

Contact the manufacturer to arrange an appointment for the next service.

6.1.8 Instrument backup

Before the next service date the Instrument Backup menu offers the possibility to store all programs, measuring data, Operator ID, Sample ID, passwords and all adjustable data on a USB stick.



1. Press **Instrument Backup** in the System Checks menu.
2. Connect the USB memory stick ([section 3.4 on page 11](#)).
3. Press **Store** to start a Backup.



Note: If the USB stick is not connected, the message "Please insert USB Memory" is displayed. Connect a USB stick, in order to store the data. Press **OK** to confirm and press **Store** again.

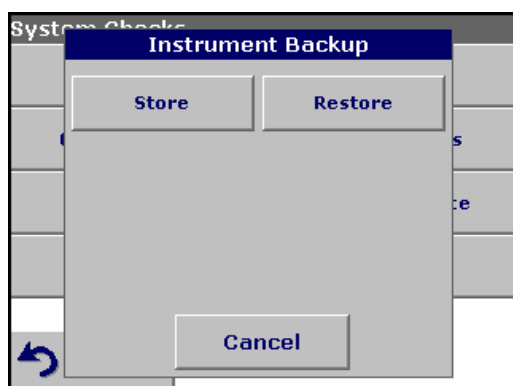


Note: If the Backup was already stored before, the message "Data already exists. Overwrite?" is displayed. Press **OK** to overwrite the data.



If the file was stored the message Instrument Backup is stored to USB stick will be displayed.

4. Press **OK** to return to the System Checks menu.



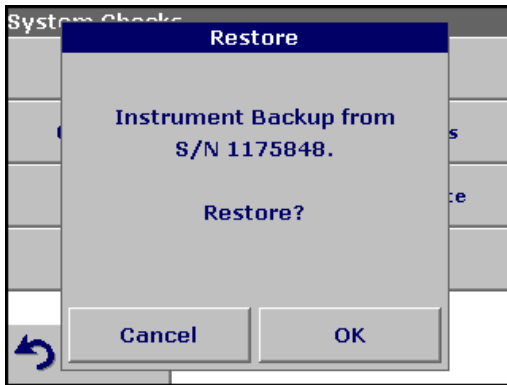
Restore backup data:

Important Note: All current data will be overwritten when restoring the Backup file!

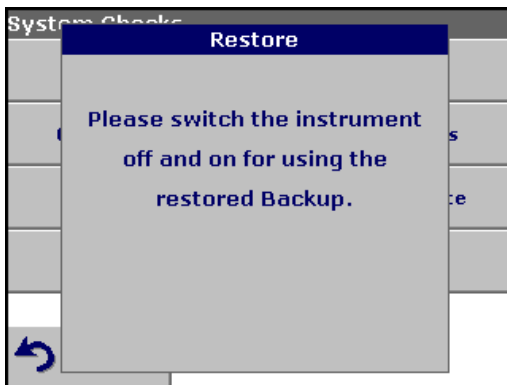
1. Press **Instrument Backup** in the System Checks menu.
2. Connect the USB memory stick containing the Backup ([section 3.4 on page 11](#)).
3. Press **Restore** to pass back the data.



Note: If the USB stick is not connected, the message "Please insert USB Memory" is displayed. Connect a USB stick, in order to store the data. Press **OK** to confirm and press **Restore** again.



4. Press **OK** to confirm after the message "Instrument Backup from S/N XXXXXXXX. Restore?" is displayed.



5. After the backup start the instrument again.

CAUTION

Potential Chemical, Biological Eye and Skin Hazards.

Only qualified personnel should conduct the tasks described in this section of the manual.

Important Note: Remove any cuvettes/sample cells that are still in the instrument and dispose of cuvettes/sample cells or its contents using an approved disposal method.

7.1 Cleaning requirements

CAUTION

Potential Pinch, Eye, Burn and Chemical Hazards.

Always disconnect power from the instrument before attempting any cleaning operations.

Important Note: Under no circumstances should the instrument, display or the accessories be cleaned with solvents such as white spirit, acetone, etc.

7.1.1 Housing and cell compartment

- Clean the enclosure, cuvette/sample cell compartments and all accessories with a soft damp cloth. A mild soap solution can also be used. Do not get excess water in the cuvette/sample cell compartments. Do not insert a brush or sharp object into Cell Compartment #1 to avoid damaging the mechanical components.
- Dry the cleaned parts carefully with a soft cotton cloth.

7.1.2 Display

- Take care not to scratch the display. Do not touch the screen with ball pens, pencils or similar pointed objects.
- Clean the display with a soft, lint-free and oil-free cotton cloth. Diluted window cleaner liquid can also be used.

7.1.3 Cuvettes/sample cells

CAUTION

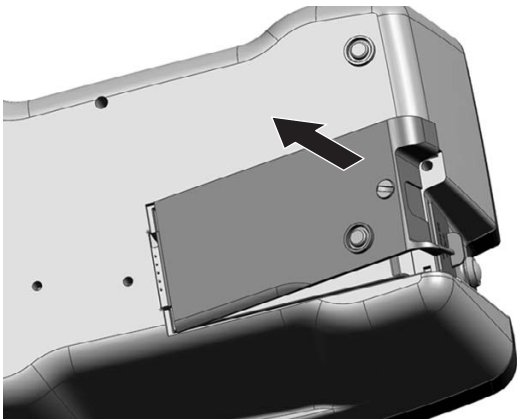
Potential Chemical/ Biological Exposure Hazards.

Use proper laboratory practices whenever there is a risk of chemical exposure.

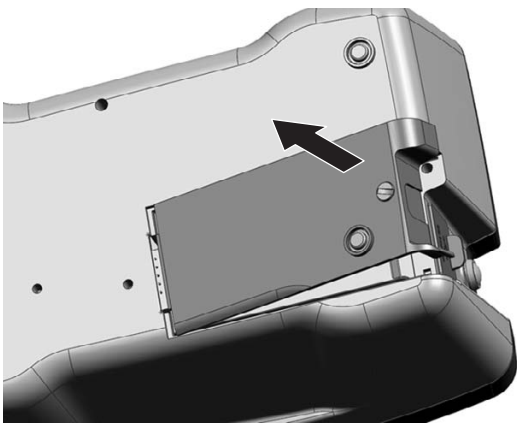
1. After performing a procedure, clean glass cuvettes/sample cells with cleaning agents.
2. Afterwards, rinse the cuvettes/sample cells several times with tap water and then thoroughly with deionized water.

Important Note: Glass cuvettes/sample cells that have been used for organic solvents (such as chloroform, benzene, toluene, etc.) must be rinsed with acetone before being treated with cleaning agents. In addition, another rinse with acetone is necessary as a final treatment step before the cuvettes/sample cells are dried.

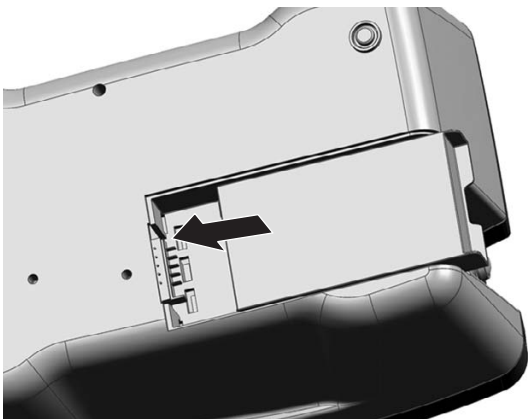
7.2 Insert or change of the battery



1. Remove the cuvette from the cell compartment.
2. Switch the instrument off.
3. Unplug the power cord.
4. Turn the instrument over carefully and place it on a soft surface.



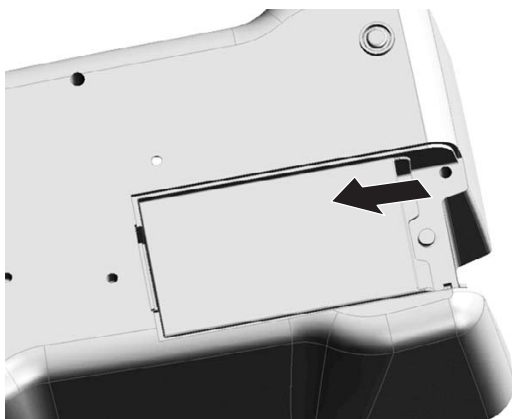
5. Use a screwdriver or a coin to remove the screw from the cover.
6. Remove the cover and place it to one side.



CAUTION

For quality and safety reasons, only the manufacturer's lithium batteries (LZV551) should be used for this instrument. Use of non-instrument-specific battery types may impair the functioning of and/or damage the instrument electronics by overloading them, or depending on battery types can even result in fire or explosion hazards.

7. Carefully push the battery from right to left into the compartment, with the labeled face upward.



8. Push in the battery so that the contacts of the instrument can be plugged into the socket of the battery.

Important Note: Take care that the battery contacts are always clean. Soiled contacts can result in contact heating and voltage drop, interfering with the proper operation of the spectrophotometer.

9. Use a screwdriver or a coin to replace the screw securing the cover.
10. Carefully stand the instrument upright.
11. Plug in power supply again – the Instrument is now ready for use. The battery charges up.

7.2.1 Information about using the battery

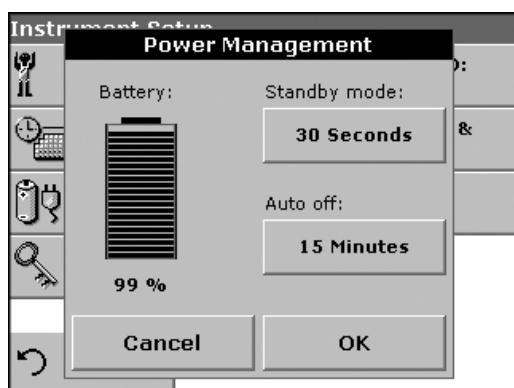
7.2.1.1 Recycle the lithium battery

A lithium battery allows the LICO 150 to be used as a portable instrument.

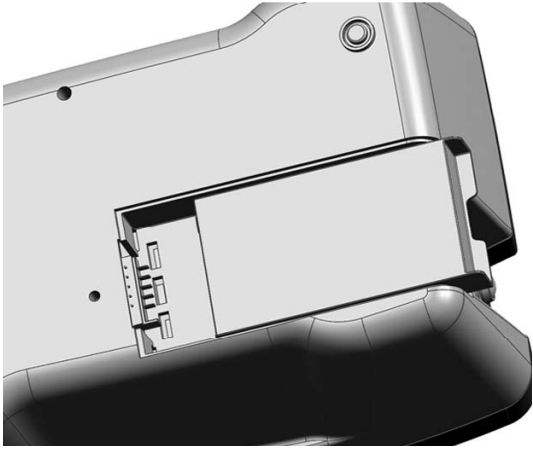
Disposal: At the end of their lifespan, batteries should be returned to the manufacturer to ensure that they are disposed of properly:

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**Environment Center
Willstätterstr. 11
D-40549 Düsseldorf
Germany**



Please return the batteries individually, in a plastic bag or the original packaging, to the manufacturer (information about the charge status of the battery can be found in the "Instrument Setup" menu under [5.2.5 Power Management on page 21](#)).



CAUTION

Pay special attention to the following information for the Lithium battery pack:

- Do not short-circuit the contacts.
- Keep the battery away from fire.
- Do not expose the battery to temperatures above 60°C (such temperatures may occur, for example, in a car left in the sun, or in direct sunlight).
- Take care that the battery does not become wet.
- Take care that the battery is not exposed to impacts, blows, etc. Do not drop it. Do not step on it by accident.
- Do not take the battery apart or modify it in any way.
- The performance of the battery decreases with the temperature.

7.2.1.2 Optimal operation of the battery

The battery is charged automatically when the plug-in power supply on the back of the instrument is connected and is plugged into a mains socket (100–240 Volt/50–60 Hz).

CAUTION

Use only the manufacturer's specified external power supply to operate the instrument and charge the internal lithium battery pack. The specified power supply and its plug shape, its voltage rating (12V, 2A) and its electromagnetic characteristics are critical to assuring the LICO 150's performance and the safety of the user.

Important Note: We advise charging the battery at an ambient temperature between 10°C and 30°C, as this is the range in which it can be most effectively charged to 100%.

7.2.1.3 Lifespan of the battery

The battery has a limited lifespan. The more it is used, the more its capacity is reduced. If a fully charged battery only allows the instrument to be used for a relatively short time, replace the battery with a new one.

Note: You need not run down the battery completely before recharging it. If you recharge the battery when it still has some residual charge, this does not reduce its capacity!

7.2.1.4 Load the battery/Operating time

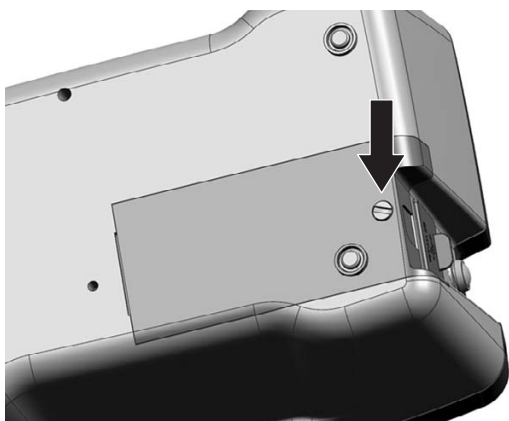
The time required to charge a newly installed battery is about 3.5 hours.

Operating time of a fully charged battery:

Charge: If a battery is charged to 100% capacity, and the user carries out 10 measurements per day, and the instrument is left on after each measurement for the full 15 minutes before it

automatically switches off, the battery can be used for 6 to 7 days before it needs recharging.

7.3 Lamp replacement



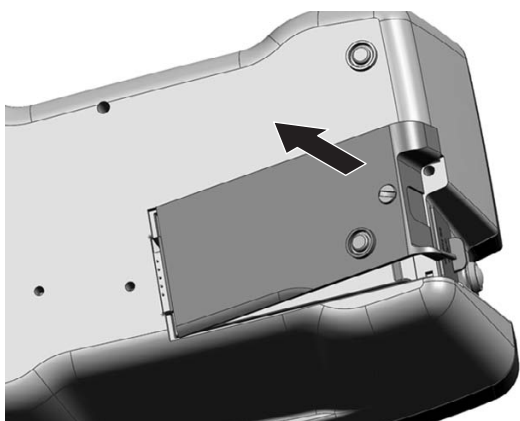
CAUTION

To avoid a possible electric shock, disconnect the instrument from the power source before servicing the lamp.

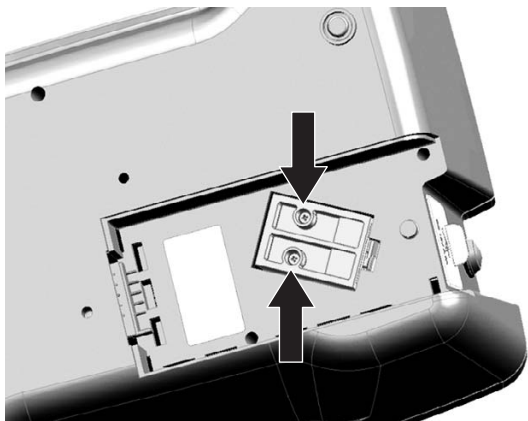
1. Remove the cuvette from the cell compartment.
2. Switch the instrument off.
3. Unplug the power cord.

WARNING

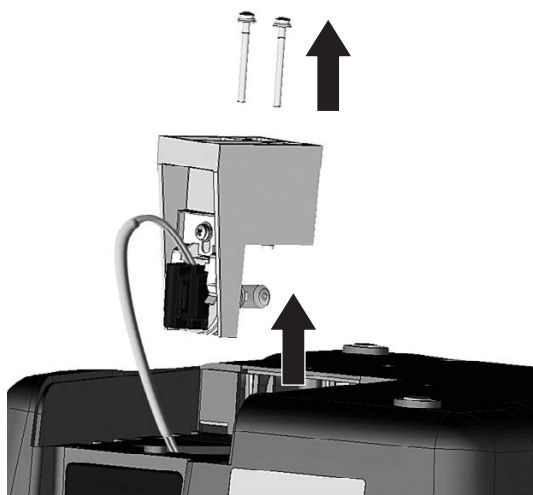
Burn Hazard. Wait until the lamp cools down. Contact with the hot lamp can cause burns.



4. Turn the instrument over carefully and place it on a soft surface.
5. Use a screwdriver or a coin to remove the screw from the cover.
6. Remove the cover and place it to one side.
7. If there is a battery in the instrument, push it out and put it to one side too, see [section 7.2.1 on page 51](#).



8. Use a screwdriver (slotted or cross-headed) to remove the screws from the lamp fitting.

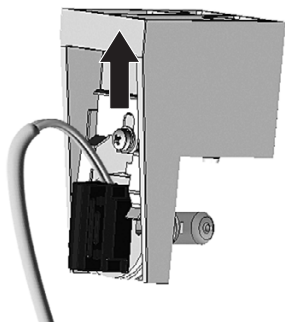


WARNING

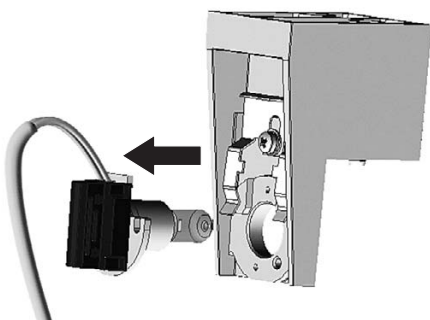
Burn Hazard. Wait until the lamp cools down. Contact with the hot lamp can cause burns.

9. Lift the lamp fitting carefully.

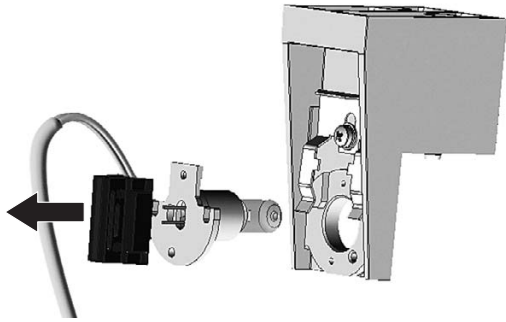
10. Put both screws to one side.



11. Push up on the pressure spring.



12. Remove the halogen lamp complete with the plug panel.



13. Carefully unplug the halogen lamp from the plug panel.

Important Note: Hold the lamp by the fitting only. Avoid touching the glass, as substances on the skin can bake onto the lamp bulb and thus accelerate the aging process of the lamp.

14. Plug a new halogen lamp to the panel.

15. Insert the halogen lamp with the half rounded part pointing down.

16. Press the plug with slight pressure into the direction of the halogen lamp and push the pressure spring down, so that it will engage.

17. Carefully insert the lamp fitting again.

18. Use a screwdriver (slotted or cross-headed) to replace the screws to secure the lamp fitting.

19. Put the battery back in place, see [section 7.2.1 on page 51](#).

20. Use a screwdriver or a coin to screw the back cover to the instrument.

21. Carefully stand the instrument upright.

22. Plug in the power supply.

23. Reset the Lamp History, see [section 6.1.5 on page 42](#).

Section 8 Troubleshooting

	Likely Cause	Action
Please insert adapter Z.	For measurements with 11mm round cells the adapter Z is required.	Insert the adapter Z into cell compartment #2. Press OK .
Color = ***	Sample coloring outside the measuring range.	Dilute the sample or select appropriate color scale.
Error Selfcheck stopped. Please check the lamp. Please close the lid. Error [xx]	Self-Check Test stops while starting the instrument	Check the lamp and replace, if necessary. Close the lid. Press Start Again .
Error Selfcheck stopped. Please remove the cuvette. Please close the lid.	Self-Check Test stops while starting the instrument	Remove the cuvette/sample cell from the cell compartment. Press OK .
Error Selfcheck stopped. Hardware error. Error [x]	Electronic defect	Contact the manufacturer or a sales representative and indicate the error number
Error Too much ambient light! Move device into shade or close the lid!	The instrument sensors detects too much ambient light.	Reduce ambient light. (Avoid direct sun light.) Close the lid.

Section 9 Replacement Parts

9.1 Replacement parts

Description	Catalog No.
Rechargeable lithium battery	LZV551
Tungsten Lamp	LZV565
Adapter Z	LZM353
Power supply, external	LZV610
Power line EU	LZV739
Power line UK	LZV740
Power line USA	LZV741
Power line China/Australia	LZV742
USB-Memory Stick	LZV568
USB-Interface Cable (1 m)	LZV567
USB-Keyboard (keyboard layout: US)	LZV582
USB-Barcode Scanner (hand-held scanner)	LZV566
Hach Data Trans (PC software for data transfer)	LZY274
Certified test filter set for self-checks (Verification Kit) 4 precision glass filters with nominal values	LZM363
Dust cover	HYH019
Certified Testing solution set "Addista-color", consisting of 6 certified test solutions	LZM282
Round cuvettes/sample cells 11 mm, glass, disposable, pk/500	LYY621
Rectangular cuvette/sample cell 50 x 10 mm, plastic , disposable, pK/50	LZM130
Rectangular cuvette/sample cell 50 x 10 mm with caps, plastic , disposable, pK/10	LZP341
Rectangular cuvette/sample cell 50 x 10 mm, glass, pK/1	LZP167
Rectangular cuvette/sample cell 10 x 10 mm, glass, pk/3	LZP045

Section 10 Contact Information

HACH Company World Headquarters

P.O. Box 389
Loveland, Colorado
80539-0389 U.S.A.
Tel (800) 227-HACH
(800) -227-4224
(U.S.A. only)
Fax (970) 669-2932
orders@hach.com
www.hach.com

Repair Service in the United States:

HACH Company
Ames Service
100 Dayton Avenue
Ames, Iowa 50010
Tel (800) 227-4224
(U.S.A. only)
Fax (515) 232-3835

Repair Service in Canada:

Hach Sales & Service
Canada Ltd.
1313 Border Street, Unit 34
Winnipeg, Manitoba
R3H 0X4
Tel (800) 665-7635
(Canada only)
Tel (204) 632-5598
Fax (204) 694-5134
canada@hach.com

Repair Service in Latin America, the Caribbean, the Far East, Indian Subcontinent, Africa, Europe, or the Middle East:

Hach Company World
Headquarters,
P.O. Box 389
Loveland, Colorado,
80539-0389 U.S.A.
Tel +001 (970) 669-3050
Fax +001 (970) 669-2932
intl@hach.com

HACH LANGE GMBH

Willstätterstraße 11
D-40549 Düsseldorf
Tel. +49 (0)2 11 52 88-320
Fax +49 (0)2 11 52 88-210
info@hach-lange.de
www.hach-lange.de

HACH LANGE LTD

Pacific Way
Salford
GB-Manchester, M50 1DL
Tel. +44 (0)161 872 14 87
Fax +44 (0)161 848 73 24
info@hach-lange.co.uk
www.hach-lange.co.uk

HACH LANGE LTD

Unit 1, Chestnut Road
Western Industrial Estate
IRL-Dublin 12
Tel. +353(0)1 46 02 5 22
Fax +353(0)1 4 50 93 37
info@hach-lange.ie
www.hach-lange.ie

HACH LANGE GMBH

Hütteldorferstr. 299/Top 6
A-1140 Wien
Tel. +43 (0)1 9 12 16 92
Fax +43 (0)1 9 12 16 92-99
info@hach-lange.at
www.hach-lange.at

DR. BRUNO LANGE AG

Juchstrasse 1
CH-8604 Hegnau
Tel. +41(0)44 9 45 66 10
Fax +41(0)44 9 45 66 76
info@hach-lange.ch
www.hach-lange.ch

HACH LANGE FRANCE S.A.S.

33, Rue du Ballon
F-93165 Noisy Le Grand
Tél. +33 (0)1 48 15 68 70
Fax +33 (0)1 48 15 80 00
info@hach-lange.fr
www.hach-lange.fr

HACH LANGE SA

Motstraat 54
B-2800 Mechelen
Tél. +32 (0)15 42 35 00
Fax +32 (0)15 41 61 20
info@hach-lange.be
www.hach-lange.be

DR. LANGE NEDERLAND B.V.

Laan van Westroijen 2a
NL-4003 AZ Tiel
Tel. +31(0)344 63 11 30
Fax +31(0)344 63 11 50
info@hach-lange.nl
www.hach-lange.nl

HACH LANGE APS

Åkandevej 21
DK-2700 Brønshøj
Tel. +45 36 77 29 11
Fax +45 36 77 49 11
info@hach-lange.dk
www.hach-lange.dk

HACH LANGE AB

Vinthundsvägen 159A
SE-128 62 Sköndal
Tel. +46 (0)8 7 98 05 00
Fax +46 (0)8 7 98 05 30
info@hach-lange.se
www.hach-lange.se

HACH LANGE S.R.L.

Via Riccione, 14
I-20156 Milano
Tel. +39 02 39 23 14-1
Fax +39 02 39 23 14-39
info@hach-lange.it
www.hach-lange.it

HACH LANGE S.L.U.

Edif. Arteaga Centrum
C/Larrauri, 1C- 2ª Pl.
E-48160 Derio/Vizcaya
Tel. +34 94 657 33 88
Fax +34 94 657 33 97
info@hach-lange.es
www.hach-lange.es

HACH LANGE LDA

Av. do Forte nº8
Fracção M
P-2790-072 Carnaxide
Tel. +351 214 253 420
Fax +351 214 253 429
info@hach-lange.pt
www.hach-lange.pt

HACH LANGE SP.ZO.O.

ul. Opolska 143 a
PL-52-013 Wrocław
Tel. +48 (0)71 342 10-83
Fax +48 (0)71 342 10-79
info@hach-lange.pl
www.hach-lange.pl

HACH LANGE S.R.O.

Lešanská 2a/1176
CZ-141 00 Praha 4
Tel. +420 272 12 45 45
Fax +420 272 12 45 46
info@hach-lange.cz
www.hach-lange.cz

HACH LANGE S.R.O.

Roľnícka 21
SK-831 07 Bratislava –
Vajnory
Tel. +421 (0)2 4820 9091
Fax +421 (0)2 4820 9093
info@hach-lange.sk
www.hach-lange.sk

HACH LANGE KFT.

Hegyalja út 7-13.
H-1016 Budapest
Tel. +36 (06)1 225 7783
Fax +36 (06)1 225 7784
info@hach-lange.hu
www.hach-lange.hu

HACH LANGE S.R.L.

Str. Căminului nr. 3
Sector 2
RO-021741 București
Tel. +40 (0) 21 205 30 03
Fax +40 (0) 21 205 30 03
info@hach-lange.ro
www.hach-lange.ro

HACH LANGE

8, Kr. Sarafov str.
BG-1164 Sofia
Tel. +359 (0)2 963 44 54
Fax +359 (0)2 866 04 47
info@hach-lange.bg
www.hach-lange.bg

HACH LANGE SU ANALİZ SİSTEMLERİ LTD.ŞTİ.

Hilal Mah. 75. Sokak
Arman Plaza No: 9/A
TR-06550 Çankaya/ANKARA
Tel. +90 (0)312 440 98 98
Fax +90 (0)312 442 11 01
bilgi@hach-lange.com.tr
www.hach-lange.com.tr

Contact Information

HACH LANGE D.O.O.

Fajfarjeva 15
SI-1230 Domžale
Tel. +386 (0)59 051 000
Fax +386 (0)59 051 010
info@hach-lange.si
www.hach-lange.si

HACH LANGE E.Π.Ε.

Αυλίδος 27
GR-115 27 Αθήνα
Τηλ. +30 210 7777038
Fax +30 210 7777976
info@hach-lange.gr
www.hach-lange.gr

HACH LANGE E.P.E.

27, Avlidos str
GR-115 27 Athens
Tel. +30 210 7777038
Fax +30 210 7777976
info@hach-lange.gr
www.hach-lange.gr

Section 11 **Warranty, liability and complaints**

The manufacturer warrants that the product supplied is free of material and manufacturing defects and undertakes the obligation to repair or replace any defective parts at zero cost.

The warranty period for instruments is 24 months. If a service contract is taken out within 6 months of purchase, the warranty period is extended to 60 months.

With the exclusion of the further claims, the supplier is liable for defects including the lack of assured properties as follows: all those parts that can be demonstrated to have become unusable or that can only be used with significant limitations due to a situation present prior to the transfer of risk, in particular due to incorrect design, poor materials or inadequate finish will be improved or replaced, at the supplier's discretion. The identification of such defects must be notified to the supplier in writing without delay, however at the latest 7 days after the identification of the fault. If the customer fails to notify the supplier, the product is considered approved despite the defect. Further liability for any direct or indirect damages is not accepted.

If instrument-specific maintenance and servicing work defined by the supplier is to be performed within the warranty period by the customer (maintenance) or by the supplier (servicing) and these requirements are not met, claims for damages due to the failure to comply with the requirements are rendered void.

Any further claims, in particular claims for consequential damages cannot be made.

Consumables and damage caused by improper handling, poor installation or incorrect use are excluded from this clause.

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