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# 1 Overview

## 1.1 Overview of the instrument

Front of the instrument

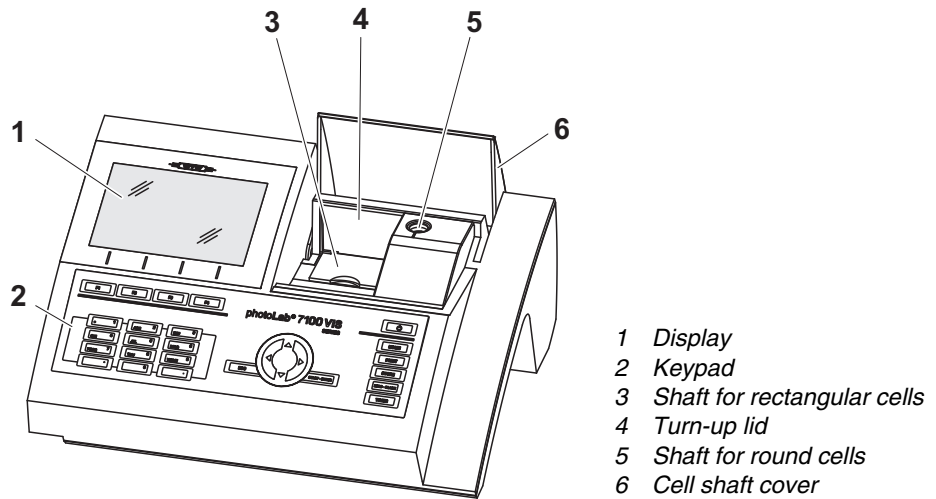


Fig. 1-1 Front of the instrument with operating elements

Socket field on the rear panel

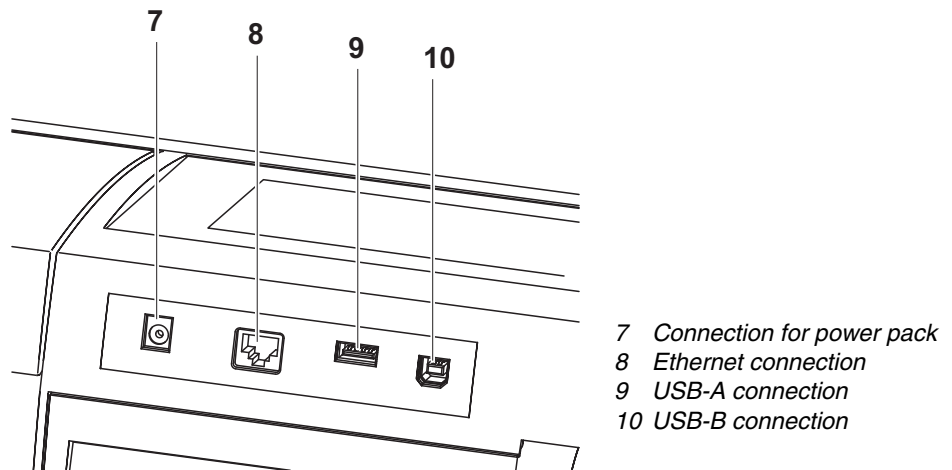


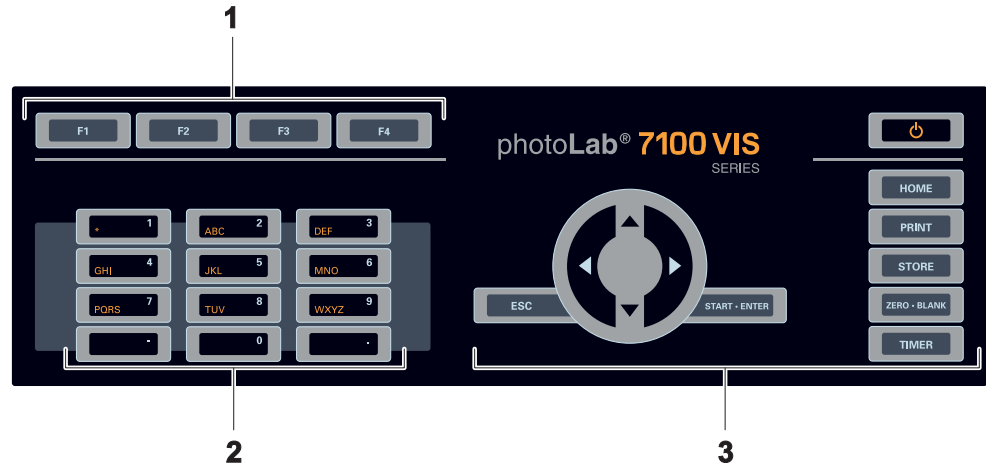
Fig. 1-2 Rear panel with socket field



All connections comply with SELV.

## 1.2 Keypad

### Overview



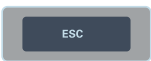
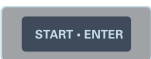

- 1 Function keys F1 to F4 (function menu-dependent)
- 2 Alphanumeric keypad
- 3 Keys with dedicated function

Fig. 1-3 Keypad

### Key functions

The keys on the right side of the keypad have the following functions:

Key	Designation	Functions
	<ON/OFF>	– Switches on and off the photometer
	<HOME>	– Switches to the main menu from any operating situation. Actions that are not completed are canceled.
	<PRINT>	– Downloads the displayed value to an interface.
	<STORE>	– Saves a displayed value or spectrum
	<ZERO-BLANK>	– Starts one of the following measurements, depending on the operating situation: - Zero adjustment - Blank value measurement - Baseline measurement - User calibration
	<TIMER>	– Opens the menu, <i>Timer</i> .

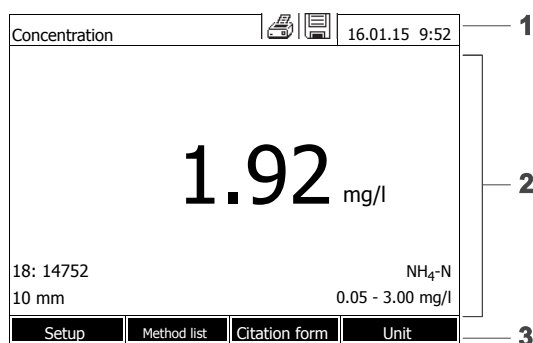
Key	Designation	Functions
	<ESC>	<ul style="list-style-type: none"> <li>– Cancels the running action. Entries that have not yet been accepted are discarded.</li> <li>– Switches to the next higher menu level.</li> </ul>
	<START-ENTER>	<ul style="list-style-type: none"> <li>– Starts an action (e.g. measurement)</li> <li>– Opens a selected menu</li> <li>– Confirms a selection or entry</li> </ul>
 (Arrow keys)	<▲><▼>	– Moves the selection in menus and lists one position up or down
	<◀>	<ul style="list-style-type: none"> <li>– Deletes the character left of the cursor during character entries</li> <li>– Moves the cursor to the left in a spectrum or kinetic diagram</li> </ul>
	<▶>	– Moves the cursor to the right in a spectrum or kinetic diagram

### Function keys

The function keys F1 to F4 have different functions depending on the operating situation. The current functions are displayed in the function key menu at the bottom edge of the display (see section 4.2.1).

## 1.3 Display



### Display elements



- 1 Status line (current state, date and time)
- 2 Display range for menus and measurement results
- 3 Function keys menu

Fig. 1-4 Display

**Symbols in the  
status line**

<b>Symbol</b>	<b>Designation</b>	<b>Function</b>
	<i>Save</i>	The < <b>STORE</b> > key is active. With < <b>STORE</b> >, you can save the displayed data.
	<i>Printer</i>	The < <b>PRINT</b> > key is active. You can output to an interface the displayed data with < <b>PRINT</b> >.



## 2 Safety

### 2.1 Safety information

#### 2.1.1 Safety information in the operating manual

This operating manual provides important information on the safe operation of the product. Read this operating manual thoroughly and make yourself familiar with the product before putting it into operation or working with it. The operating manual must be kept in the vicinity of the product so you can always find the information you need.

Important safety instructions are highlighted in this operating manual. They are indicated by the warning symbol (triangle) in the left column. The signal word (e.g. "CAUTION") indicates the level of danger:



#### **WARNING**

indicates a possibly dangerous situation that can lead to serious (irreversible) injury or death if the safety instruction is not followed.



#### **CAUTION**

indicates a possibly dangerous situation that can lead to slight (reversible) injury if the safety instruction is not followed.

#### **NOTE**

*indicates a situation where goods might be damaged if the actions mentioned are not taken.*

#### 2.1.2 Safety signs on the product

Note all labels, information signs and safety symbols on the product. A warning symbol (triangle) without text refers to safety information in this operating manual.

#### 2.1.3 Further documents providing safety information

The following documents provide additional information, which you should observe for your safety when working with the measuring system:

- Operating manuals of other components of the photoLab® 7100 VIS (accessories)
- Safety datasheets for chemicals.

## 2.2 Safe operation

### 2.2.1 Authorized use

The authorized use of the photometer consists exclusively of the carrying out of photometric measurements according to this operating manual. Follow the technical specifications of the cells in chapter 7 TECHNICAL DATA. Any other use is considered **unauthorized**.

### 2.2.2 Requirements for safe operation

Note the following points for safe operation:

- The product may only be operated according to the authorized use specified above.
- The product may only be supplied with power by the energy sources mentioned in this operating manual.
- The product may only be operated under the environmental conditions mentioned in this operating manual.
- The product may not be opened.

### 2.2.3 Unauthorized use

The product must not be put into operation if:

- it is visibly damaged (e.g. after being transported)
- it was stored under adverse conditions for a lengthy period of time (storing conditions, see chapter 7 TECHNICAL DATA).

## 2.3 User qualification

Carrying out photometric determinations with the aid of test sets frequently requires the handling of hazardous substances.

We assume that the operating personnel know how to handle hazardous substances due to their professional training and experience. The operating personnel must particularly be able to understand and correctly implement the safety labels and safety instructions on the packages and inserts of the test sets.

## 2.4 Handling of hazardous substances

When developing test sets, WTW carefully sees that the tests can be carried out as safely as possible. Some hazards by dangerous substances, however, cannot always be avoided.

If self-produced tests or solutions are used, the responsibility concerning any risks caused by those tests or solutions lies with the user (personal responsibility).



### **WARNING**

**Improper handling of certain reagents can cause damage to your health.**

**In any case follow the safety labels on the packing and the safety instructions of the package insert. Protective measures specified there have to be followed exactly.**

### **Safety datasheets**

The safety datasheets of the chemicals comprise all instructions on safe handling, occurring hazards, preventive actions and actions to take in hazardous situations. Follow these instructions in order to work safely.

## 3 Commissioning

### 3.1 General notes on handling

The photoLab® 7100 VIS photometer is an optical precision meter. Therefore, it should always be handled with care, especially in mobile use. Always protect the meter from conditions that could damage the mechanical, optical and electronic components. Heed the following points especially:

- The temperature and humidity during operation and storage must be within the limits specified in chapter 7 TECHNICAL DATA.
- The following influences always have to be avoided with the meter:
  - Extreme dust, moisture and wetness
  - Exposure to intensive light and heat
  - Fumes that are corrosive or contain high concentrations of solvents.
- For measuring, the meter must be placed on a flat surface.
- Spilled liquid or other material should be removed immediately (see section 5.3 CLEANING).
- If a cell has broken in the cell shaft, the cell shaft should be cleaned immediately (see section 6.1 ACTIONS IN THE CASE OF A BROKEN CELL).
- The cell shaft should always be closed when the photometer is not used.
- For the instrument to be transported the cell shaft has to be empty.
- For mobile used we recommend using the suitable transport case FC spectral 6000 .

### 3.2 Initial commissioning

Perform the following activities:

- Insert the buffer batteries (see section 3.2.1)
- Connect the power supply (see section 3.2.2)
- Switch on the photometer (see section 3.2.3)
- Set the language (see section 3.2.3)
- Set the date and time (see section 3.2.4)
- Carry out a zero adjustment (see section 4.3)

#### Packing

This photometer is sent out in a protective transport packing.



#### CAUTION

**Keep the original packing including the inner packing to protect the instrument against hard shocks if it has to be transported.**

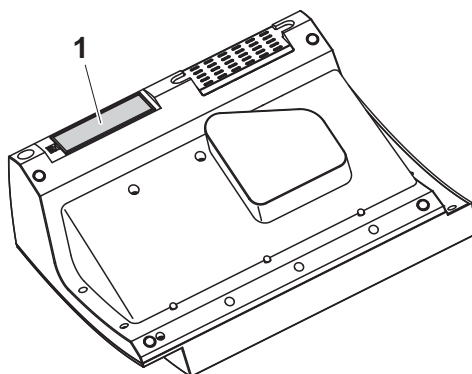
The original packing is also required for the proper return of the instrument if it has to be repaired.

Note that damage caused by improper transport voids all warranty claims.

### 3.2.1 Inserting the buffer batteries

The buffer batteries supply the integrated clock while the photometer is switched off. Four alkaline manganese batteries (type AA or Mignon) separately included in the scope of delivery are used as the buffer batteries.

Insert the batteries as follows:



- 1 Turn the photometer upside down and place it on a soft surface.
- 2 Open the lid of the battery compartment (1).
- 3 Insert the four batteries in the battery compartment. Make sure that the poles of the batteries are in the correct position. The  $\pm$  signs on the batteries must correspond to the  $\pm$  signs in the battery compartment.
- 4 Close the lid of the battery compartment.

### 3.2.2 Connecting the power supply

The power is supplied with the aid of the enclosed plug-in power pack. The power pack supplies the photometer with low voltage (12 VDC).

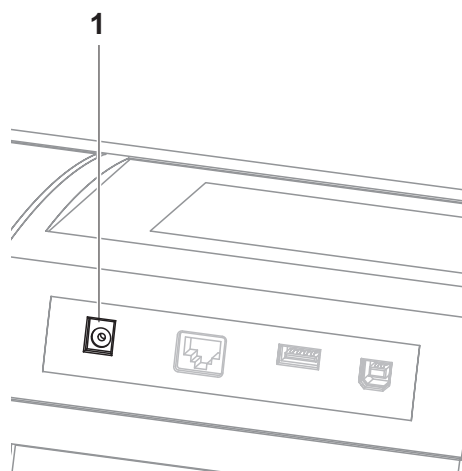


#### CAUTION

The line voltage of the usage location must fulfill the specifications stated on the power pack (the specifications are also given in chapter 7 TECHNICAL DATA). Always use the supplied 12 V original power pack only.

Before plugging in the power cable check whether it is undamaged. If the power cable is damaged, the instrument must not be operated.

### Connect the power pack



- 1 Connect the miniplug of the power pack to the socket (1) of the photometer.
- 2 Connect the power pack to an easily accessible power socket.

### 3.2.3 Switching on the photometer and setting the language

During the initial commissioning the photometer automatically guides you to the setting of the meter language after switching on (<ON/OFF>).

General setup	16.01.15 9:52
3 German	
English	
Français	
Español	
Italiano	
Bulgarian/Български	
Česko	
Simplified Chinese/??	
Traditional Chinese/	
Greek/Ελληνικά	

- 1 Select a language with <▲><▼>.
- 2 Confirm the selected language with <START·ENTER>.

The language has been set.

The currently selected language has a checkmark.

The display switches to the setting of *Date* and *Time*.

After the initial commissioning, you can change the language in the *General setup / Language* menu at any time.

### 3.2.4 Setting the date and time

During the initial commissioning, the instrument automatically guides you to the setting of the time and date after the setting of the language.

Date/Time	16.01.15 9:52
Date	16.01.2015
Time	9:52:09
OK	

The *Date/Time* menu is open.

Using <▲><▼>, select a menu item and confirm or open it with <START·ENTER>.

- 1 Select and confirm *Date*.

The input field for the current date pops up.

Date/Time	16.01.15 9:52
Date	16.01.2015
Time	9:52:09
OK	

Date  
 16 .01.2015

- 2 Enter the current date with <0...9> and confirm.

The input field closes.  
The date is accepted.

- 3 Select and confirm *Time*.

The input field for the current time pops up.

Date/Time	16.01.15 9:52
Date	16.04.2007
Time	9:52:09
OK	

Time  
 09 : 52 : 09

- 4 Enter the current time with <0...9> and confirm.

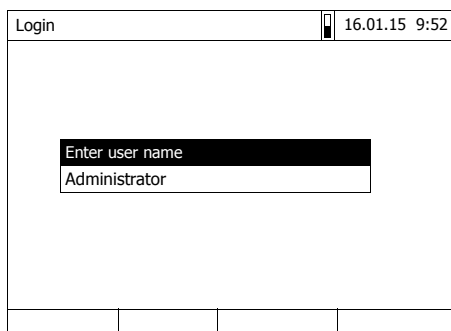
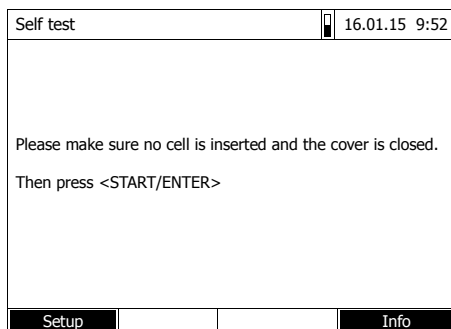
The input field closes.  
The time is accepted.

After the initial commissioning, you can change the date and time in the *General setup / Date/Time* menu at any time.

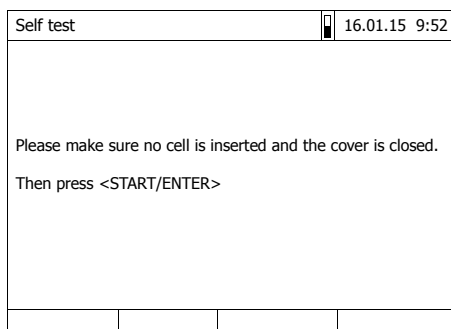
## 4 Operation

### 4.1 Switching on or off the photometer

#### Switching on



#### Starting the *Self test*



- 1 Switch the photometer on with **<ON/OFF>**.

The display shows

- the *Self test* dialog (if the user management is not active).

or

- the *Login* dialog (if the user management is active).

With activated user management:

- 2 Login

Enter user name and password or log in as a guest.

Then the *Self test* dialog is displayed.

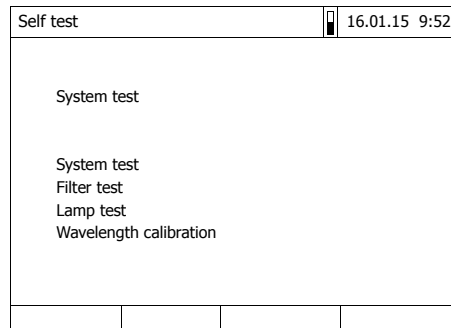
- 3 Remove all cells and close the cell shaft cover.

- 4 Start the self-test with **<START·ENTER>**.

The photometer carries out the self-test.



**Self test** During the self-test, all cells must be removed and the cell shaft cover closed.



The self-test includes:

- the test of the memory, processor, internal interfaces, filter and lamp
- a calibration for each wavelength

After the self-test is completed, the main menu is displayed.

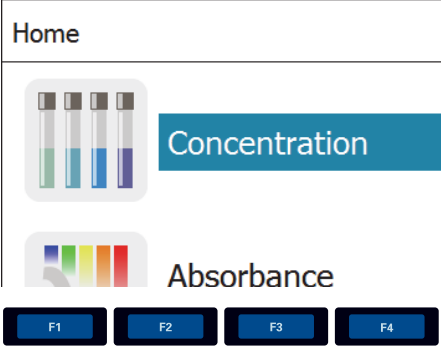


The result of the self-test can be viewed and printed with the *[Info]* function key.

**Switching off** To switch the photometer off, keep the **<ON/OFF>** key depressed until the photometer is switched off.

## 4.2 General operating principles

### 4.2.1 Navigating with function keys and menus



Home

Concentration

Absorbance

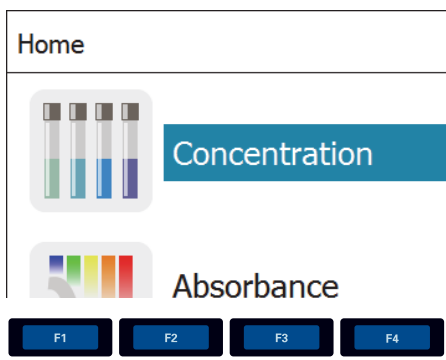
F1 F2 F3 F4

Press the <▲><▼> <◀><▶> key.

The menu selection moves in the corresponding direction.

<▲><▼>  
<◀><▶>

→



Home

Concentration

Absorbance

F1 F2 F3 F4

Press the function key <F1> ([Setup]).  
The *General setup* submenu pops up.

<F1>

Press the <START·ENTER> key.  
This has confirmed the current selection. A new menu pops up.

<START·ENTER>

General setup	16.01.15 9:52
Language	
Date/Time	
Display settings	
User management	
Measured value memory	
Software/methods update	
Reset	
Data transfer/Printer	
Exchange methods/profiles	
Save data to USB memory device	
Unlock application packages	

F1 F2 F3 F4

Concentration	16.01.15 9:52
Please select method for measuring or insert a barcoded cell or insert AutoSelector.	
Setup	Method list
Last method	New Method

F1 F2 F3 F4

To navigate further, use <▲><▼>  
<◀><▶> and <START·ENTER>

Further navigation with function keys (here: F1 and F2)

The current menu selection is displayed in reverse video.  
 The assignment of the function key menu is adapted to the current operating situation.  
 The functions of the function key menu are started with the function keys (F1 ... F4).

**Use of the function keys**

The function keys F1 to F4 are below the display. Their functions change depending on the operating situation and mode. The current functions are displayed in the function key menu at the bottom edge of the display.

Apart from navigation, the function keys are also used for other operations:

- Opening a selection list or input field
- Executing a command (directly or with intermediate query)
- Switch over between two display options, such as absorbance ↔ transmission

**Navigation with arrow keys (<▲><▼>) and <START·ENTER>**

These operating elements are used to select an item from a menu or list. The current selection is displayed in reverse video. Pressing of <START·ENTER> confirms the selection.

Apart from navigation, the <START·ENTER> key is also used for other operations:

- Opening a selection list or input field
- Confirming a selection
- Confirming entries of text and numerals
- Executing a command (directly or with intermediate query)
- Activating an item in a selection list (✓ = active)

#### 4.2.2 Display of navigation paths in short form

In this operating manual, the introductory navigation steps leading to individual menus or dialogs are clearly shown in a gray box. The box indicates a section of the menu tree.

Starting point of the description is always the main menu, which can be reached with the <HOME> key from any operating situation. From there navigation takes place downward.

**Operating example:  
Navigation to the  
setting menu for the  
language**

The following example shows the elements of the menu tree with the relevant operating steps:

```

<HOME>
[General setup]
|
|_ Language
  
```

Bold letters and angle brackets indicate a key on the photometer (except function keys).

- ∅ Press the "Home" key.  
The main menu is called up.

Square brackets in this operating manual indicate a function key F1 to F4. The text between the brackets corresponds to the assignment according to the function key menu on the bottom edge of the display.

- ∅ Press the function key with the assignment "Settings"

Text without brackets stands for a menu item indicated on the display (list item).

- ∅ Select the menu item with the arrow keys <▲><▼>. The current selection is displayed in reverse video.
- ∅ Then press <START-ENTER>.

Further navigation options:

- The <ESC> key moves you one level up in the menu tree.
- The <HOME> key directly calls up the main menu.



If you are "lost" in a menu, press <HOME> and restart navigating from the main menu.

### 4.2.3 Entry of numerals, letters and characters

Numerals, letters, punctuation marks and special characters are entered with the alphanumeric keypad of the meter or using an external keyboard.



The numerals and characters (except for the small letters) assigned to the keys of the alphanumeric keypad are printed on the keys. Example: With the <7/PQRS> key you can enter the following characters: 7, P, Q, R, S, p, q, r, s.

Select the required character by pressing the key several times (similar to a mobile phone). When pressing a key that is assigned to several characters once, the respective numeral appears first. To enter a numeral, one key-pressing is always sufficient.

When pressing the key for the first time a line pops up that displays all characters possible with this key. The currently selected character is highlighted.

A character is taken over in the input field if

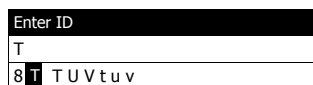
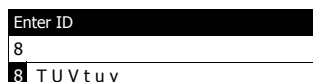
- the character is highlighted for more than one second,
- the character is confirmed with <START·ENTER>,
- another alphanumeric key is pressed.

#### Special characters

Special characters are entered with the <1/\*> key.

#### Operating example: Entering the ID

The *Enter ID* input field appears if you press the <STORE> key while the storing symbol is visible. In the following example a measurement dataset with the ID "Test" is stored.



- 1 Press <8/TUV> several times until "T" appears in the input line.

Below the input field, a selection line pops up with all characters that are available for this key, e.g. 8 T U V t u v.

The currently selected character is highlighted.

After approx. one second the character is taken over and the selection line closed.

- 2 Complete the ID with <A...9> and confirm.

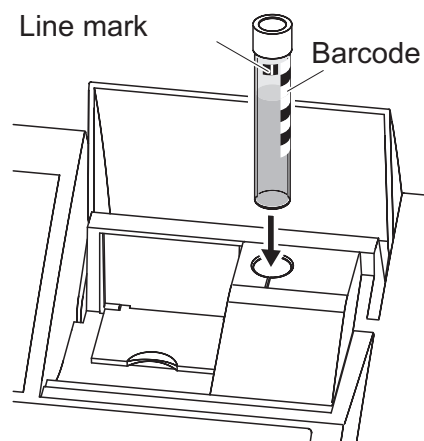
#### Correcting incorrect entries

Using <◀>, erase all characters until you have reached the incorrect digit and repeat the entry from there.

#### 4.2.4 Inserting a cell

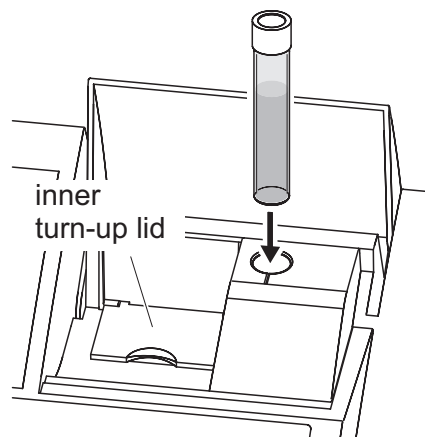
##### Round cells (with and without barcode)

Inserting a cell with barcode starts the measurement; with methods without barcode you have to select the method manually.



- 1 Open the cell shaft cover.
- 2 Close the inner turn-up lid.
- 3 Insert the barcoded round cell in the round cell shaft so it touches the bottom. When doing so, align the line mark with the notch at the front of the round cell shaft.

The photometer selects the method based on the bar code and automatically starts measurement.



With cells without barcode: Select the method manually in the instrument.

Close the inner turn-up lid.

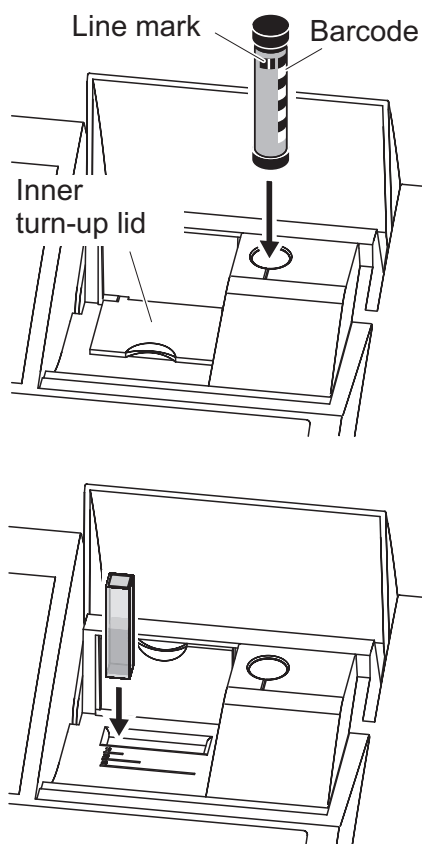
Insert the round cell in the round cell shaft so that it touches the bottom.



If the inner turn-up lid is opened too wide, a message prompts you to close the inner turn-up lid.

##### Rectangular cells (with or without AutoSelector)

The AutoSelector, which is included in the test sets for rectangular cells, has on one side a bar code encoding a method number. When the AutoSelector is inserted in the round cell shaft, the bar code is automatically read and the relevant method selected by the photometer. User-defined methods and reagent-free methods normally do not have an AutoSelector and therefore, no automatic method recognition. In this case, select the method manually and then insert the cell.



- 1 Open the cell shaft cover.
- 2 Insert the AutoSelector in the round cell shaft so it touches the bottom. When doing so, align the line mark with the notch at the front of the round cell shaft.
  - The photometer selects the correct method with the aid of the barcode.

With methods without AutoSelector: Select the method manually in the instrument.

- 3 Open the inner turn-up lid.
- 4 Insert the rectangular cell vertically so it touches the bottom and left edge of the cell shaft. The opaque sides of the rectangular cell must point to the front and back.

If an AutoSelector is used, the correct measuring range is automatically selected when the rectangular cell (1, 2, 5 cm) is inserted.

The photometer has an external light recognition. If there is too much external light, a message prompts you to close the cell shaft cover.

#### 4.2.5 Usable cells

Depending on the wavelength range, different kinds of cells are suitable. Apart from round cells, all rectangular cells made of glass, quartz or plastic with opaque lateral surfaces are suitable (see section 8.1). Cells with clear or serrated lateral surfaces are not reliably recognized by the automatic cell recognition.

Especially with plastic single-use cells we recommend you test them for suitability prior to carrying out large-scale series of measurements.

For measurements in the UV range below 320 nm, glass cells and commercial PS plastic cells are not suitable; below 280 nm, commercial PMMA plastic cells are not suitable due to their transmission characteristics. Therefore, use quartz cells or tested single-use cells (plastic) for applications in the UV range.



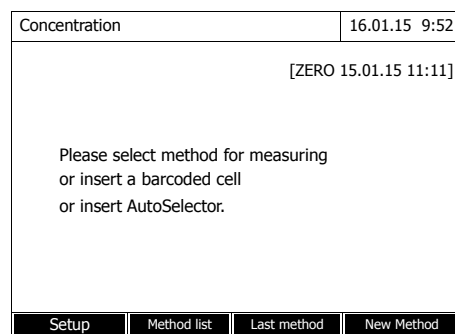
Details on the minimum filling level and minimum filling volume are given in chapter 7 TECHNICAL DATA.

### 4.3 Zero adjustment

A valid zero adjustment is required for the calculation of measured values in the modes, *Concentration*, *Absorbance / % Transmission*, *Special / Multi wavelengths*, *Kinetics* and *OptRF*. With a zero adjustment, the absorbance of a cell filled with distilled water ("zero cell") is measured and stored.

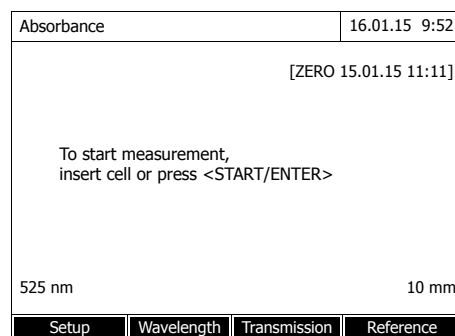
#### Factory zero adjustment for concentration measurements

For all measurements with WTW test sets (*Concentrationmode*), a factory zero adjustment is available in the delivery condition. We recommend replacing it with a zero adjustment of your own. If a zero adjustment exists already for a method, the date and time of the last zero adjustment are displayed in the top right area of the display.



#### Zero adjustment for absorbance measurements

In the *Absorbance* mode, the zero adjustment has to be carried out separately for each cell type and each used wavelength. If a zero adjustment exists already for the inserted cell type at the selected wavelength, the date and time of the last zero adjustment are displayed in the top right area of the display.





If no zero adjustment is available, the photometer will prompt you to carry out a zero adjustment.



The cells must be absolutely clean and free of scratches. Always use a cell of the same type for zero adjustment and measurement of the sample.

### Notes on zero adjustment

#### Zero adjustment with round cells:

- Only use clean, scratch-free round cells with distilled water. The minimum filling level is 20 mm. A ready-filled zero cell is included in the scope of delivery of the instrument.
- A zero cell can, in principle, be used any number of times. Regularly check the zero cell for visible contamination and scratches. Refill or exchange it if necessary (at least every 24 months).

#### Zero adjustment with rectangular cells:

- For rectangular cells, the zero adjustment must be carried out with the same cell type (manufacturer and material [e.g. optical glass, quartz glass, plastic]) that is used for measurement. This is important because cells of different manufacturers have different absorption behavior. When changing the cell type repeat the zero adjustment with the new type.
- Prior to zero adjustment, clean the rectangular cell and fill it with distilled water. The minimum filling level is 20 mm.
- Rectangular cells always have to be inserted in the cell shaft with the same orientation for measurement and zero adjustment (e.g. cell printing on the left side).

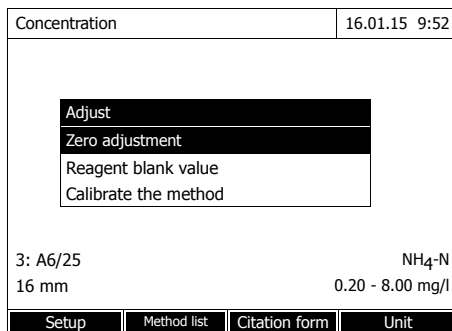


General requirements of the cells are given in chapter 7 TECHNICAL DATA. Note that the spectral transparency of the cell must be suitable for the intended application (example, quartz cell for UV range).

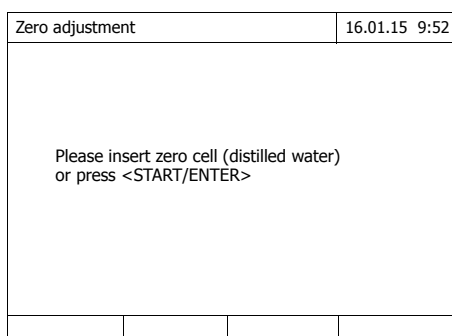
### Carrying out a zero adjustment

The zero adjustment takes place similarly in the *Concentration*, *Absorbance / % Transmission*, *Special / Multi wavelengths*, *Kinetics* and *OptRF* modes.

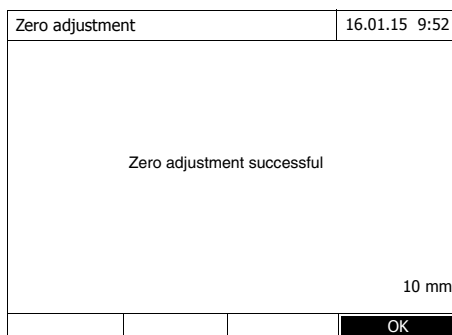
- 1 In the respective mode, press the **<ZERO-BLANK>** key.



**2** In *Concentration* mode only:  
Select and confirm *Zero adjustment*.



The zero adjustment window pops up.



**3** Insert the zero cell  
(see section 4.2.4 INSERTING A CELL).

The photometer automatically starts the zero adjustment and subsequently stores the value.

**4** After a successful zero adjustment switch to measurement with [OK].

**Validity of the zero adjustment**

The data of the zero adjustment is stored in the photometer separately for each cell type. As long as the data is valid, it is automatically used again after a temporary change to a different cell type. The validity depends on the respective mode:

Mode	Validity of the zero adjustment
<i>Concentration</i> (permanently programmed methods)	<ul style="list-style-type: none"> <li>● Till the next zero adjustment</li> </ul>
<i>Absorbance / % Transmission</i>	<ul style="list-style-type: none"> <li>● Till the next zero adjustment with the same wavelength *</li> </ul>

Mode	Validity of the zero adjustment
<i>Concentration</i> (user-defined methods) and <i>Special / Multi wavelengths</i>	<ul style="list-style-type: none"> <li>● Till the next zero adjustment for the same method *</li> </ul>
<i>Kinetics</i>	<ul style="list-style-type: none"> <li>● Till another kinetic profile is loaded</li> <li>● Till the <i>Kinetics</i> mode is exited or the photometer is switched off</li> </ul>

\* After the wavelength or method respectively was temporarily exited the photometer displays that a zero adjustment is available and the time it was carried out. You can then decide whether to use this zero adjustment or carry out a new zero adjustment.

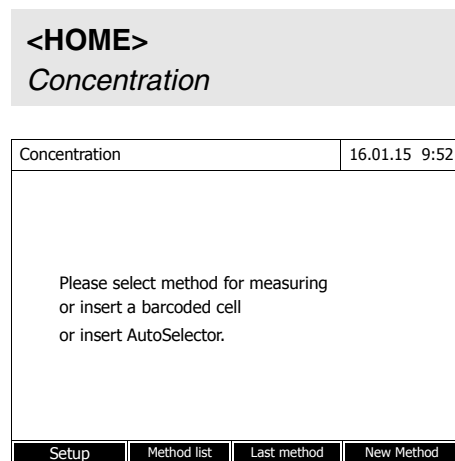
### When to repeat the zero adjustment?

We recommend to repeat the zero adjustment in the following cases:

- If the photometer was subject to mechanical stress such as strong shock or transport
- If the ambient temperature changed by more than 5 °C since the last zero adjustment
- After the lamp was replaced
- At least once per week
- If a new cell type (different manufacturer, different glass type is used)
- Basically each time you want to measure with the highest possible accuracy.

## 4.4 Measuring in *Concentration* mode

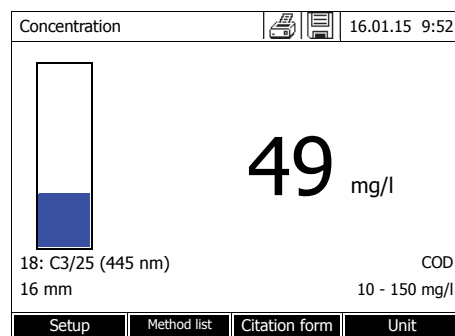
### 4.4.1 Measuring cell tests with barcode



Inserting a cell with barcode starts a measurement.

- 5 Insert the barcoded round cell in the round cell shaft so it touches the bottom. When doing so, align the line mark with the notch at the front of the round cell shaft (see section 4.2.4 INSERTING A CELL).

The photometer selects the method based on the bar code and automatically starts measurement.

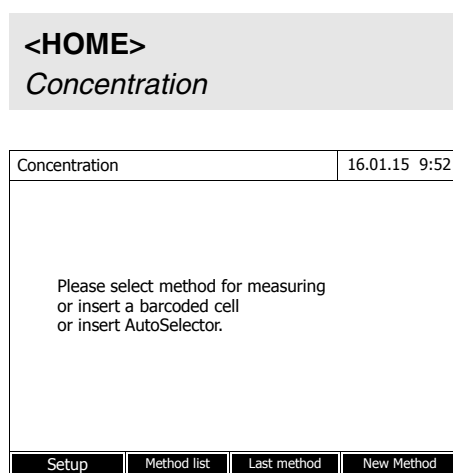


- 6 Further options:

- Select a different citation form with *[Citation form]*, (e.g.  $\text{NH}_4 \leftrightarrow \text{NH}_4\text{-N}$ ).
- Select a different measuring unit with *[Unit]*, (e.g.  $\text{mg/l} \leftrightarrow \text{mmol/l}$ ).
- Make further settings with *[Setup]*.

#### 4.4.2 Measuring reagent tests with AutoSelector

On one side, the AutoSelector has a bar code encoding a method number. When the AutoSelector is inserted in the round cell shaft, the bar code is automatically read and the relevant method selected by the photometer.

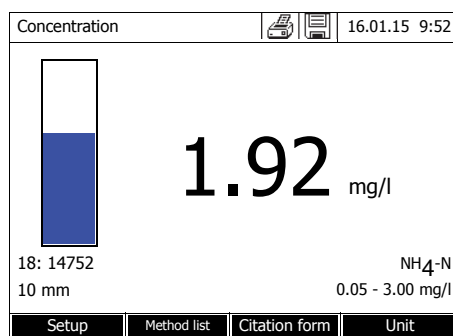


1 Open the cell shaft cover.

2 Insert the AutoSelector in the round cell shaft so it touches the bottom. When doing so, align the line mark with the notch at the front of the round cell shaft (see section 4.2.4 INSERTING A CELL). The photometer selects the correct method with the aid of the bar-code.

3 Insert the rectangular cell. The correct measuring range is automatically selected when the rectangular cell (1, 2, 5 cm) is inserted.

The photometer starts measuring automatically.



4 Further options:

- Select a different citation form with *[Citation form]*, (e.g.  $\text{NH}_4 \leftrightarrow \text{NH}_4\text{-N}$ ).
- Select a different measuring unit with *[Unit]*, (e.g.  $\text{mg/l} \leftrightarrow \text{mmol/l}$ ).
- Make further settings with *[Setup]*.

## 4.5 Measuring the Absorbance / % Transmission

### 4.5.1 General information

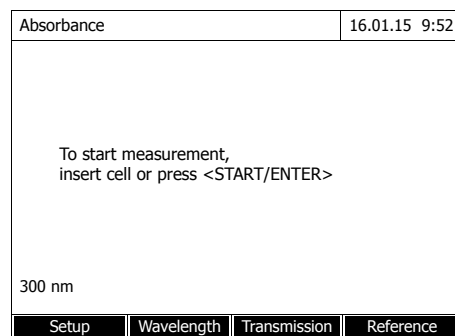
The absorbance or transmission respectively is measured without the use of any methods or profiles. All settings are configured during measurement.

#### Measuring against the Reference absorbance

The absorbance or transmission can alternatively be measured against the absorbance of the zero adjustment or against a *Reference absorbance* determined by yourself.

### 4.5.2 Measuring the absorbance or transmission

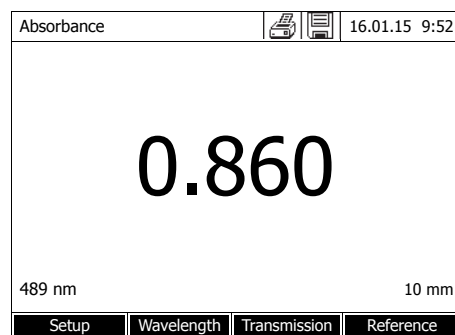
**<HOME>**  
Absorbance / % Transmission

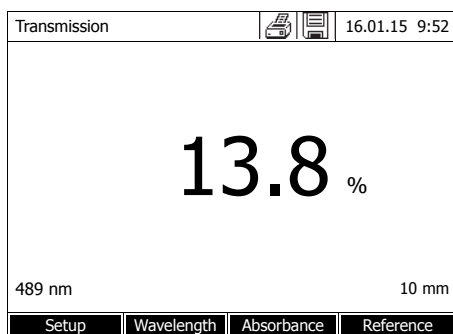


The settings of the last measurement are active.

- 1 Using *[Wavelength]*, change the wavelength as necessary.
- 2 Using *[Absorbance]* ↔ *[Transmission]*, you can switch over between absorbance and transmission measurement.
- 3 If necessary, use a reference measurement with *[Reference]* or measure a new one.
- 4 Insert the cell (rectangular or round) (see section 4.2.4 INSERTING A CELL).

The photometer starts measuring automatically.





- 5 Using *[Absorbance]* <-> *[Transmission]*, switch over the display from *Absorbance* to *Transmission* or vice versa.

## 5 Maintenance and cleaning

### 5.1 Replacing the lamp

#### Service life of the tungsten halogen lamp

The tungsten halogen lamp is a wear part with a certain average service life (see chapter 7 TECHNICAL DATA). It has to be replaced if defective. The photometer has a service hour counter for the lamp module.



#### Note

The replacement lamp is readily assembled as a lamp module and optically adjusted in the factory. Therefore, treat it with utmost care. Fingerprints on the glass will shorten the service life of the lamp. Do not touch the bulb of the new lamp module with your bare fingers. If you have touched the bulb inadvertently, carefully clean it with a clean cloth soaked in alcohol.

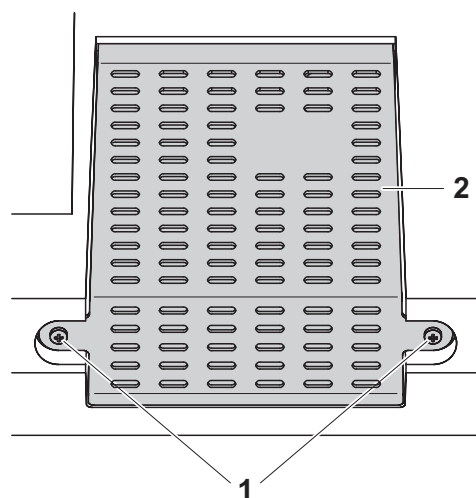
#### Replacing the lamp module

The lamp module is behind a cover (aluminium sheet) on the rear panel of the photometer. Proceed as follows:



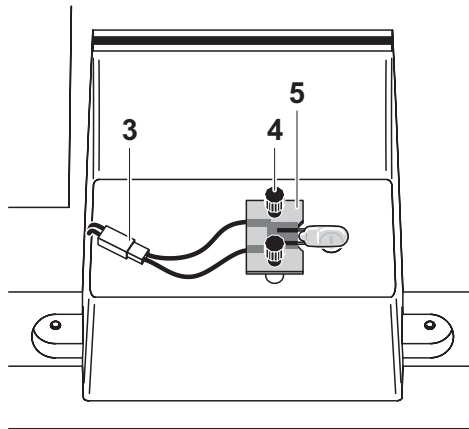
#### CAUTION

**The lamp becomes very hot during operation. Do not touch the hot lamp because it can cause burns! The lamp should cool down for approx. 10 minutes before it is exchanged.**



- 1 Switch off the photometer and disconnect it from the power supply.
- 2 Unscrew the two screws (1) and remove the lamp cover (2).





- 3** Disconnect the electrical plug connection (3). Disconnecting it may take a lot of effort.
- 4** Unscrew the two knurled-head screws (4) and remove the defective lamp module (5).
- 5** Fix the new lamp module with the knurled-head screws. When doing so, the metal-plated side of the PCB must point outward, i. e. toward the knurled-head screws.
- 6** Reconnect the electrical plug connection.
- 7** Fix the lamp cover.
- 8** Reset the service hour counter for the lamp module.

**Note**

After recommissioning, carry out a new zero adjustment for all measurements.



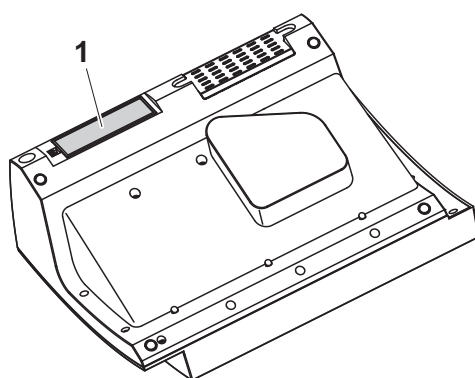
## 5.2 Exchanging the buffer battery

### CAUTION

There is a risk of explosion if unsuitable batteries are used. Only use leakproof alkaline manganese batteries.



If you leave the photometer switched on during the exchange or insert the new batteries within a minute after taking out the old ones, the date and time are retained in the photometer.



- 1 Turn the photometer upside down and place it on a soft surface.
- 2 Open the lid of the battery compartment (1).
- 3 Remove the old batteries from the battery compartment.
- 4 Insert the four new batteries in the battery compartment. Make sure that the poles of the batteries are in the correct position. The  $\pm$  signs on the batteries must correspond to the  $\pm$  signs in the battery compartment.
- 5 Close the lid of the battery compartment.

### Battery service life

The power consumption of the clock is very low. The lifetime of high quality batteries is at least 5 years.

### Disposal of batteries

Dispose of the batteries at a suitable facility according to local legal requirements. It is illegal to dispose of the batteries with household refuse.

Within the European Union, the batteries are removed at a specialized treatment center at the instrument's end of life. The instruments are taken to one of those specialized treatment centers via the recycling system set up for this purpose.

## 5.3 Cleaning

Especially after a cell has broken or after a reagent accident, the photometer should immediately be cleaned (see also section 6.1 ACTIONS IN THE CASE OF A BROKEN CELL).

### 5.3.1 Cleaning the enclosure

#### NOTE

*The housing components are made out of synthetic materials (ABS, PMMA and PC). Thus, avoid contact with acetone, ethyl alcohol and similar detergents that contain solvents. Remove any splashes immediately.*

Clean the photometer enclosure as follows:

- If the housing surface is dirty, wipe it with a soft cloth and mild soapy water.
- Remove any chemicals splashes as soon as possible.
- For disinfection, you can use isopropanol for cleaning for a short time.

### 5.3.2 Cleaning the cell shaft

#### NOTE

*The surface areas of the cell shaft are made of synthetic material (PPO/PS, PMMA). Thus, avoid contact with acetone, ethyl alcohol and similar detergents that contain solvents. Remove any splashes immediately.*



If a cell has broken, the cell shaft has to be cleaned immediately. To do so, proceed as described in section 6.1.

Normally, it is not required to clean the cell shaft routinely. Remove dust and slight contamination with a moist, lint free cloth. Use isopropanol briefly to remove persistent coatings (e.g. reagent remains). Especially clean the bottom parts of the lateral surfaces of the rectangular cell shaft where the light barriers for the automatic cell recognition are located.

### 5.3.3 Cleaning the detector lens

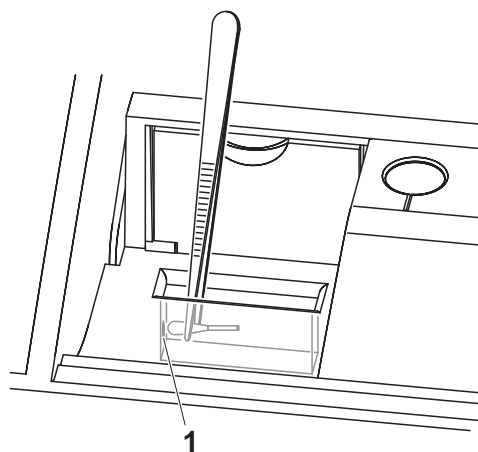
Normally, it is not required to clean the detector lens routinely. Cleaning the detector lens can be necessary in the following cases:

- If the lens is visibly smudged, e.g. after a cell has broken or after a reagent accident (see also section 6.1 ACTIONS IN THE CASE OF A BROKEN CELL).
- If, due to environmental influences or reagent contamination, the photometer displays the message, *Wavelength calibration* during the self-test after being switched on (see section 6.2)



If the lens is often smudged (error, *Wavelength calibration* during the self-test), check whether the correct operating conditions are observed. Follow the details in section 3.1 for this purpose.

Proceed as follows to clean the detector lens:



The detector lens is on the front left side of the rectangular cell shaft (pos. 1).

- 1 Switch off the photometer.
- 2 Cut off one end of a customary cotton swab (approx. 2 cm).
- 3 Grasp the cut-off end with the tip of a pair of tweezers or small pliers. Clean the lens with the dry head of the cotton swab. To do so, move the head from the center of the lens outward in circles. If there are persistent coatings, moisten the cotton swab with a little deionized water or isopropanol.



After recommissioning, carry out the photometer monitoring for all measurements (AQA1).

## 6 What to do if...

### 6.1 Actions in the case of a broken cell



#### WARNING

Cells can contain dangerous substances. If the contents are released, follow the safety instructions of the package insert. If necessary, take corresponding protective measures (protective goggles, protective gloves etc.).



#### CAUTION

Do not turn the photometer upside down to remove the liquid! When doing so, the liquid could come into contact with electronic components and damage the photometer.

The photometer has a drain device through which the contents of a broken cell can drain off without causing any damage.

#### Proceeding after a cell has broken

- 1 Switch off the photometer and disconnect it from the power supply.
- 2 Let the liquid drain off into a suitable container and dispose of it properly according to the instructions of the reagent package.
- 3 Carefully remove all broken glass, e.g. with tweezers.
- 4 Carefully clean the cell shaft using a moist, lint-free cloth. If there are persistent coatings, use isopropanol for a short time. Especially clean the bottom parts of the lateral surfaces of the rectangular cell shaft where the light barriers for the automatic cell recognition are located.
- 5 Let the cell shaft dry.




After recommissioning, carry out the photometer monitoring for all measurements.

If, after recommissioning, an error occurs during the wavelength calibration, the detector lens is probably smudged. In this case, clean the lens as

described in section 5.3.3 CLEANING THE DETECTOR LENS.

## 6.2 Error causes and remedies

<b>Meter does not react to keystroke</b>	<p><b>Cause</b></p> <ul style="list-style-type: none"> <li>– Operating condition undefined or EMC load unallowed</li> </ul>	<p><b>Remedy</b></p> <ul style="list-style-type: none"> <li>– Processor reset: Press the &lt;ON/OFF&gt; and &lt;ESC&gt; key simultaneously.</li> </ul>
<b>Audio signal on keystroke</b>	<p><b>Cause</b></p> <ul style="list-style-type: none"> <li>– The key does not have any function in the current operating state</li> </ul>	<p><b>Remedy</b></p> <ul style="list-style-type: none"> <li>– Press a different key</li> </ul>
<b>Measuring range undercut or exceeded</b>	<p><b>Cause</b></p> <ul style="list-style-type: none"> <li>– Method not suitable</li> </ul>	<p><b>Remedy</b></p> <ul style="list-style-type: none"> <li>– Select method with suitable measuring range</li> <li>– Dilute the sample</li> </ul>
		
<p>In <i>Concentration</i> mode you can display the current absorbance value as additional information (<i>[Setup]/Display absorbance</i>).</p>		
<p><b>Self-test does not start.</b>  <b>The instrument displays</b>  <i>Please remove cell</i></p>	<p><b>Cause</b></p> <ul style="list-style-type: none"> <li>– A cell is inserted in one of the cell shafts</li> <li>– A foreign object is inserted in one of the cell shafts</li> <li>– Occasionally, the instrument carries out an automatic readjustment for the rectangular cell recognition. The informative message <i>Please remove cell</i> is displayed even when no cell is inserted.</li> </ul>	<p><b>Remedy</b></p> <ul style="list-style-type: none"> <li>– Remove the cell</li> <li>– Then press the &lt;START·ENTER&gt; key</li> <li>– Remove foreign object</li> <li>– Then press the &lt;START·ENTER&gt; key</li> <li>– Press the &lt;START·ENTER&gt; key.</li> </ul>

	<b>Cause</b>	<b>Remedy</b>
	– The cell shaft is contaminated	– Clean the cell shaft (see section 5.3.2 and section 6.1) – Restart the instrument – If necessary, confirm the <i>Please remove cell</i> message with <b>&lt;START·ENTER&gt;</b> .
	– Instrument defective	– Please contact the service department.
<b>Obviously incorrect measured values</b>	<b>Cause</b>	<b>Remedy</b>
	– Cell contaminated	– Clean the cell
	– Dilution set incorrectly	– Set the dilution
	– Selected method not suitable	– Select different method
	– Zero measurement incorrect	– Perform zero measurement
	– Blank value incorrect	– Remeasure the blank value
	– Lamp module exchanged	– Reset the service hour counter for the lamp module.
<b>Fluctuating measured values</b>	<b>Cause</b>	<b>Remedy</b>
	– Cell shaft cover open	– Close the cell shaft cover
	– Lamp replacement	– Reset the service hour counter for the lamp module.
<b>Self test failed.</b>	<b>Cause</b>	<b>Remedy</b>
	– <i>System test</i> : Instrument defective	– Please contact the service department.
	– <i>Filter test</i> : Instrument defective	– Please contact the service department.

Cause	Remedy
<ul style="list-style-type: none"> <li>- <i>Lamp test:</i> <ul style="list-style-type: none"> <li>- If <u>no light</u> leaks out at the rear side of the photometer: Lamp defective</li> <li>- If light does leak out at the rear side of the photometer:</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- Replace the lamp (see section 5.1)</li> <li>- Carry out software update</li> </ul>
<ul style="list-style-type: none"> <li>- <i>Wavelength calibration:</i> <ul style="list-style-type: none"> <li>- Foreign particle in the cell shaft</li> <li>- Lamp defective</li> <li>- Lens smudged</li> <li>- Instrument defective</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- Remove foreign object</li> <li>- Replace the lamp (see section 5.1)</li> <li>- Clean the lens (see section 5.3.3 or section 6.1). If this happens repeatedly, check the operating conditions (see section 3.1)</li> <li>- Please contact the service department.</li> </ul>

**Connected printer does not print**

Cause	Remedy
<ul style="list-style-type: none"> <li>- Printer not suitable</li> </ul>	<ul style="list-style-type: none"> <li>- Connect a printer that is able to interpret one of the required printer control languages (PCL 3, PCL 3 Enhanced, PCL 5, PCL 5c, PCL 5e, PCL 6 Standard)</li> </ul>

**Data transmission to USB memory device does not work**

Cause	Remedy
<ul style="list-style-type: none"> <li>- Connected USB memory device was not recognized</li> <li>- The USB memory device has been formatted to a file system which is not supported, e. g. NTFS</li> </ul>	<ul style="list-style-type: none"> <li>- Use other USB memory device</li> <li>- Format the USB memory device to the FAT 32 file system</li> </ul>



## 7 Technical data

### 7.1 Measurement characteristics

**Measuring principle** Spectrophotometer with reference beam technology

<b>Light source</b>	Lamp type	Tungsten halogen lamp
	Average lifetime	approx. 1000 h

<b>Monochromator</b>	Type	Grating monochromator with step motor
	Wavelength range	320 - 1100 nm
	Max. scan speed	approx. 800 nm/min
	Wavelengths calibration	Automatic
	Accuracy	± 1 nm
	Reproducibility	± 0.5 ± nm (checkable, e.g. with holmium oxide filter)
	Resolution	1 nm
	Spectral band width	4 nm

<b>Photometric measurement</b>	Light sensor	Photo diode
	Measuring range	A = -3.300 to A = +3.300
	Linearity	< 1 % for A ≤ 2.000 in the range 340 ... 900 nm
	Accuracy*	± 0.003 A for A < 0.600 ± 0.5 % of the reading for 0.600 ≤ A ≤ 2.000
	Reproducibility *	± 0.002 at A = 1.000
	Resolution	ΔA = 0.001
	Stray light	< 0.1 % transmission at 340 and 408 nm

\* in the range 330 nm ... 1100 nm













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We're a global team unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

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