Spectroquant® **Multy**

en

Operating manual

de

Bedienungsanleitung

fr

Mode d'emploi

es

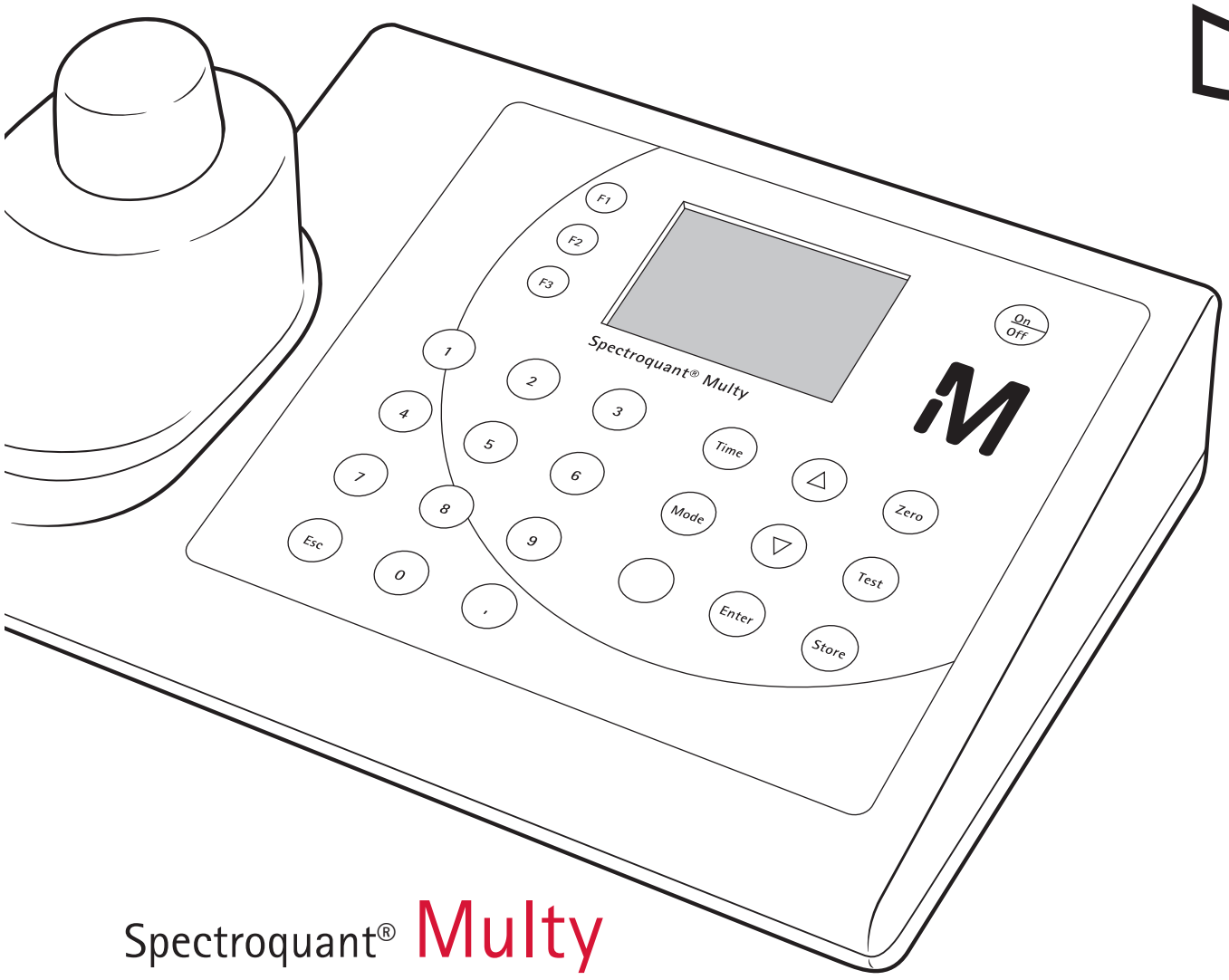
Modo de empleo

it

Manuale d'uso

en

Operating manual



Spectroquant® Multy

en

Table of contents

1 Getting started 7

1.1 Package contents 7
1.2 Inserting the rechargeable batteries/lithium powerpack 8
1.2.1 Lithium powerpack – Important information 9
1.2.2 Charging the battery pack 9
1.2.3 Using nonrechargeable batteries 10
1.2.4 Using the protective caps 10
1.3 Overview of the key functions 11
1.4 Starting the colorimeter the first time 12
1.5 Overview of the mode menu 12
1.6 Setting the language 14
1.7 Deleting data 14
1.8 Setting the date and time 15
1.9 Time and date display 15
1.10 Automatic switch-off 15

2 Operating mode 16

2.1 Selecting the method 16
2.2 Measuring with test kits 17
2.3 Differentiation 21
2.4 Altering the citation form 22
2.5 Measuring absorbances 23
2.6 User countdown (timer function) 24
2.7 Saving measurement results 25
2.8 Retrieving saved measurement results 26
2.8.1 Retrieving all saved measurement results 26
2.8.2 Retrieving saved measurement results from a defined date range 27
2.8.3 Retrieving saved measurement results from a defined code-No. range 28
2.8.4 Retrieving saved measurement results from a defined method 30
2.9 Deleting saved measurement results 31

3 Other functions 32

3.1 User-specific method list **32**
3.1.1 Processing the user-specific method list **32**
3.1.2 User-specific method list: Activate all methods **34**
3.1.3 User-specific method list: Deactivate all methods **34**
3.2 Profi mode **35**
3.3 Acoustic signals **36**
3.3.1 Activating/deactivating the key beep **36**
3.3.2 Activating/deactivating the signal beep **36**
3.3.3 Activating/deactivating the countdown function (observance of reaction times) **37**
3.4 Setting the display contrast **38**
3.5 System info **38**

4 Trouble-shooting 39

4.1 User messages on the display / Error messages **39**
4.2 Other potential sources of error **42**
4.3 Avoiding errors in photometric measurements **43**

en

5 Contents of CD-ROM see enclosed CD

5.1 Overview of preprogrammed methods and analytical procedures

5.2 Standard solutions

5.2.1 Use of Spectroquant® CombiCheck and ready-to-use standard solutions

5.2.2 Preparation of standard solutions

5.3 Printing measurement results

5.3.1 Setting the print parameters

5.3.2 Printing all measurement results

5.3.3 Printing measurement results from a defined date range

5.3.4 Printing measurement results from a defined code-No. range

5.3.5 Printing measurement results from a defined method

5.4 Transferring data to a PC

5.5 Software update via the internet

5.6 User methods

5.6.1 User concentration method

5.6.2 User polynomials

5.6.3 Deleting a user method

5.6.4 Printing data for a user method

5.6.5 Initializing the user-method system

5.7 User-specific calibration

5.7.1 Saving the user-specific calibration

5.7.2 Deleting the user-specific calibration

5.8 Calculating the Langelier saturation index

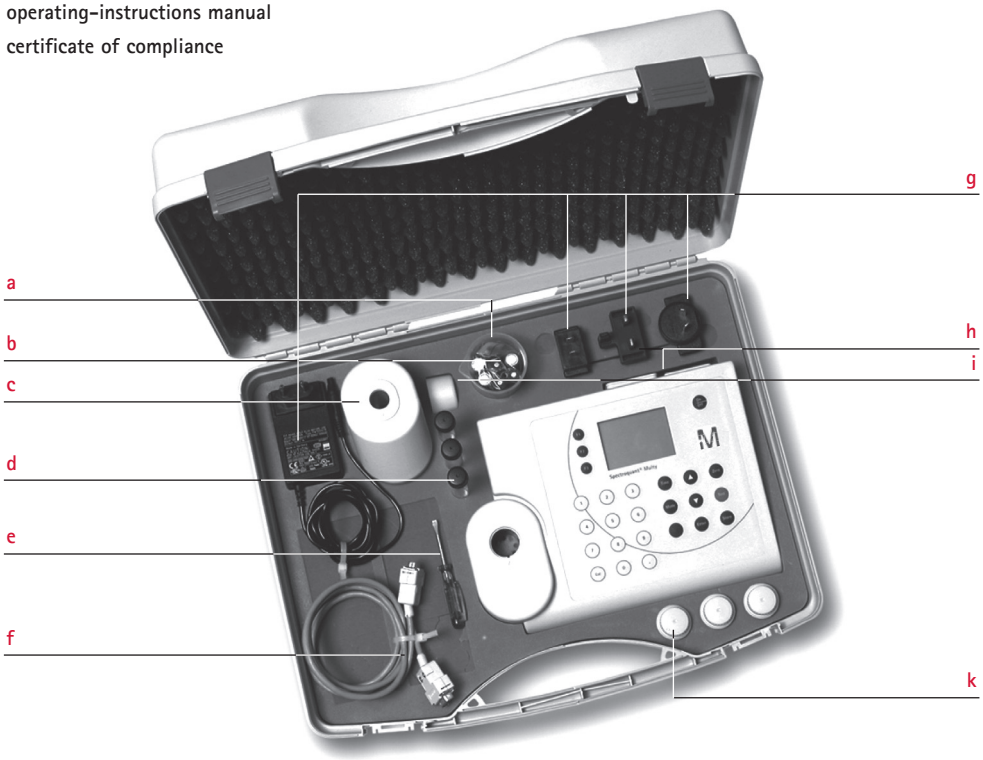
5.9 Technical specifications

1 Getting started

1.1 Package contents

The standard contents of the Spectroquant® Multy Colorimeter package comprise the following items:

1 colorimeter in a plastic carrying case
1 beaker (plastic) 100 ml (a)
1 set of rechargeable batteries (7 nickel-cadmium batteries; type AA) (b)
1 adapter for 16-mm ø round cells (c)
3 round cells with lids, ø 16 mm (d)
1 screwdriver (e)
1 cable for connection with a PC or printer (f)
1 mains adapter, 100 – 240 V, 50 – 60 Hz
with 4 wall-socket adapters (EU, UK, USA, AUS) (g)
2 protective caps for connection terminals on the back (h)
1 lid for adapter (i)
1 lithium battery (CR 2032; 3V)
3 round cells with lids, ø 24 mm (k)
1 operating-instructions manual
1 certificate of compliance

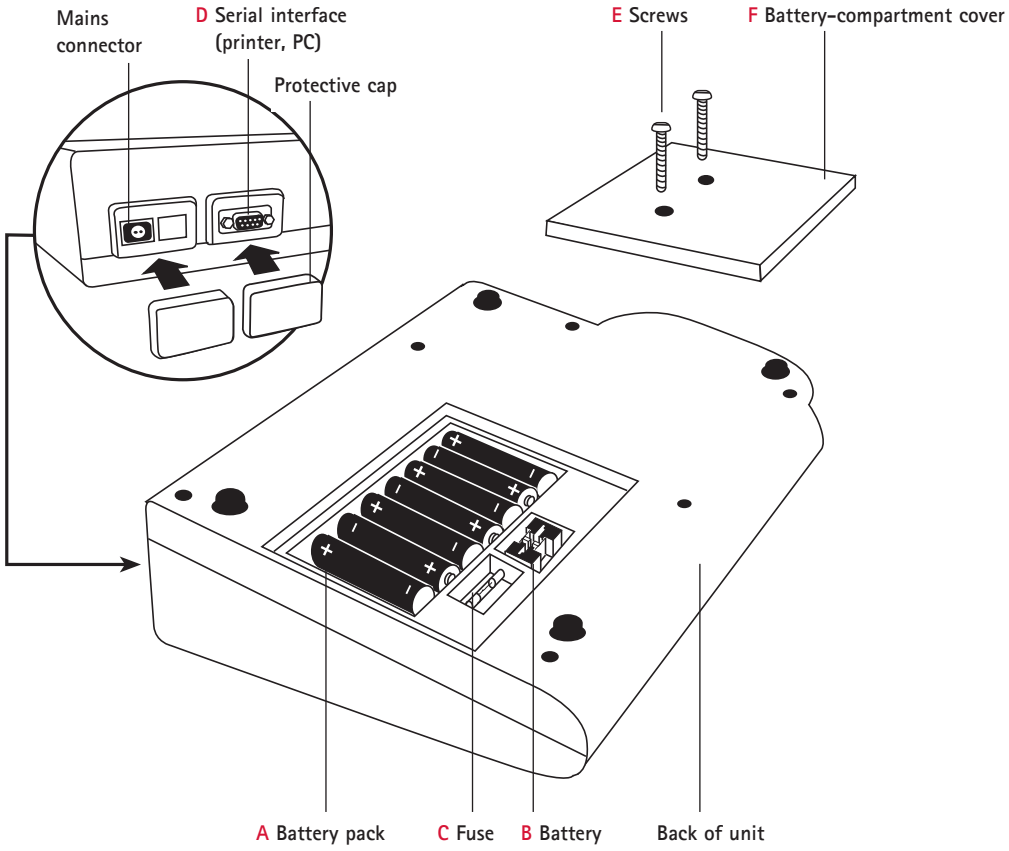


1.2 Inserting the rechargeable batteries/lithium powerpack

en

Before operating the system for the first time, the rechargeable batteries and the lithium powerpack included in the package must be installed.
The batteries enclosed in the package are not charged.

A	Battery pack:	7 nickel-cadmium batteries (type AAe, 750 mAh)
B	Battery:	lithium battery (type CR 2032, 3V)
C	Fuse:	1 A, delayed-action, 20 mm



1. Ensure that the Spectroquant® Multy Colorimeter is switched off.
2. Remove, where applicable, the cell from the measurement compartment.
3. Place the unit on its front on a clean, flat surface.
4. Remove the two screws (E) on the battery-compartment cover (F) on the bottom of the unit.
5. Remove the batteries cover (F).
6. Remove any old batteries (A) and/or the lithium powerpack (B).
7. Insert 7 new rechargeable batteries and/or the lithium powerpack .
   Make sure that the batteries are inserted correctly!
8. Attach the battery-compartment cover.
9. Replace the screws and tighten with moderate pressure.

Dispose of used batteries and/or the lithium powerpack in accordance with the local regulations.

1.2.1 Lithium powerpack – Important information

The lithium powerpack (B) serves to save all important data (saved measurement results, settings) for approx. ½ year when the unit is not being supplied with power by the battery pack or the mains supply.

As long as the colorimeter is being supplied with mains or battery power, it does not draw any power from the lithium powerpack. Since lithium powerpacks have a very long life, it will in all probability not be necessary to exchange the one supplied. All the same, to ensure proper functioning it is recommended to replace the lithium powerpack every five years.

Note
When neither the mains adapter nor the battery pack are supplying power, removal of the lithium powerpack will result in a complete loss of data (saved measurement results and settings). For this reason we strongly recommend that the unit is connected to the mains power supply while replacing the lithium powerpack.

1.2.2 Charging the battery pack

The rechargeable batteries (A) remain in place in the photometer for recharging. Once the mains power supply is established, the batteries start to be charged.

Charge the rechargeable batteries in the instrument **for 5 days** (working with power from mains is possible). Now use the instrument without mains until the first battery warning comes up. Charge again, 4 days this time. Repeat usage to battery warning and charging four times.

Approximately 10 charging/discharging cycles are required until the batteries reach their full capacity.

The unit can be operated with mains power supply with or without the batteries in place. For this you must attach the country-specific wall-socket adapter to the mains adapter.

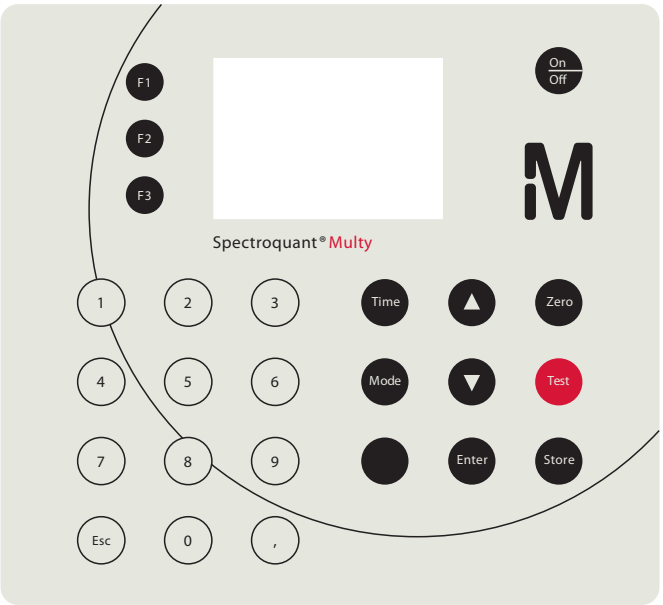
1.2.3 Using nonrechargeable batteries

In principle it is also possible to operate the unit using conventional batteries – in this case, however, they must **never** be used in combination with the mains adapter. The charging process would start automatically as soon as the colorimeter is connected to the mains power supply. Conventional batteries are destroyed by the charging current, resulting in severe damage to the unit. This also involves the risk of fire and explosion.

1.2.4 Using the protective caps

To protect the connection terminals on the unit from damage (e.g. corrosion) due to environmental influences such as e.g. dust or water splashes, the supplied protective caps should be attached over the connection points (D) when these are not being used.

1.3 Overview of the key functions

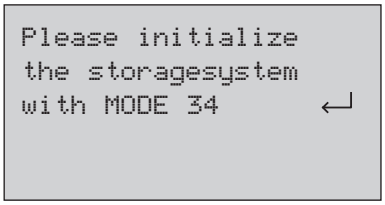


On / Off	Switching the unit on and off
F1	Function key: Function explained at the corresponding place in the text
F2	Function key: Function explained at the corresponding place in the text
F3	Function key: Function explained at the corresponding place in the text
Esc	Back to method selection / to parent menu
Enter	Confirmation of selections (visible on the display as the "↵" symbol)
Mode	Menu for settings and other functions
▲ ▼	Moves cursor (visible on the display as the ">>" symbol) up or down
Store	Save a displayed result
Zero	Zero-calibration function
Test	Run a measurement
Time	Display of date and time / user countdown

1.4 Starting the colorimeter the first time

Switch on the colorimeter by pressing the **[On/Off]** button.
The unit runs an electronic self-check test.

The display then shows:

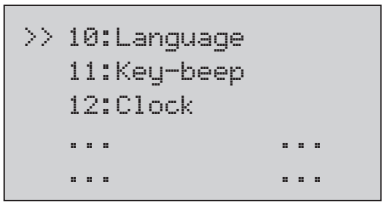


Pressing the **[Enter]** key takes the colorimeter to method selection.
Any data already saved in the unit must be deleted (mode 34, see chapter 1.7, **"Delete data"**), the user-method system must be initialized (mode 69, see section 5.6.5, **"Initializing the user-method system (concentration and polynomials)"**), and the date and time should be reset. (See below for details.)

The Spectroquant® Multy is supplied with English preset as the standard language setting. Before making the first measurement you should therefore reset the unit to the language of your choice. To do this go from the method list and change to the mode menu by pressing the **[Mode]** key.

The display shows:

After a short time the selection list appears:



1.5 Overview of the mode menu

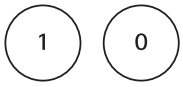
Mode No.	Mode function	Brief description	Section
10	Language	Setting the language	1.6
11	Key-beep	Activating the acoustic key-acknowledgment tone	3.3.1
12	Clock	Setting the date and time	1.8
13	Countdown	Activating/deactivating the countdown for reaction times	3.3.3
14	Signal-beep	Activating/deactivating the acoustic signal at the end of a measurement	3.3.2
20	Print	Printing all saved measurement results	5.3.2
21	Print, date	Printing measurement results from a defined date range	5.3.3
22	Print, code No.	Printing measurement results from a defined code-No. range	5.3.4

Mode No.	Mode function	Brief description	Section
23	Print, method	Printing measurement results from a defined method	5.3.5
29	Print params.	Setting the printer options	5.3.1
30	Storage	Viewing all saved measurement results	2.8.1
31	Stor., date	Viewing measurement results from a defined date range	2.8.2
32	Stor., code No.	Viewing measurement results from a defined code-No. range	2.8.3
33	Stor., method	Viewing measurement results from a defined method	2.8.4
34	Delete data	Deleting saved measurement results	2.9
45	User calibration	Saving user-specific calibration	5.7.1
46	Clear calibr.	Deleting user-specific calibration	5.7.2
50	Profi-Mode	Activating the expert-user function (laboratory function)	3.2
60	Method list	Processing the method list	3.1.1
61	Mlist all on	User-specific method list, activate all methods	3.1.2
62	Mlist all off	User-specific method list, deactivate all methods	3.1.3
64	User concentr.	User methods, Entry of a concentration method	5.6.1
65	User polynoms	User methods, Entry of a user polynomial	5.6.2
66	User m. clear	User methods, Deleting a user method	5.6.3
67	User m. print	User methods, Printing data for a user method	5.6.4
69	User m. init.	User methods, Initializing the user-method system	5.6.5
70	Langelier	Calculation of the Langelier saturation index	5.8
71	Temperature	Setting the temperature (°C or °F) for Langelier mode 70	5.8
80	LCD contrast	Setting the display contrast	3.4
91	System-Info	Information on the SQ Multy, e.g. current unit configuration	3.5

en

The individual mode functions are selected in the following manner:

Enter the digits for the desired function, e.g.: **[1] [0]** for setting the language, or



press the **[▲]** or **[▼]** arrow keys to select the desired function from the display list.

Confirm your selection by pressing **[Enter]**.

Make your settings as described in the respective sections of this manual.

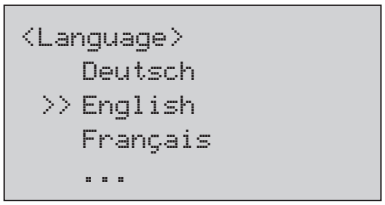
Press the **[Esc]** key to exit the mode menu.

1.6 Setting the language

Press the keys **[Mode]** **[1]** **[0]** in succession.

Confirm your selection by pressing **[Enter]**.

The display now shows:



Select the desired language using the arrow keys **[▲]** or **[▼]**.

Confirm your selection by pressing **[Enter]**.

(Pressing the **[Esc]** key takes you back to the method-selection menu.)

1.7 Deleting data

Press the keys **[Mode]** **[3]** **[4]** in succession to delete any stored data.

Confirm by pressing **[1]** and **[Enter]**.

Press the **[0]** and **[Enter]** keys to abort the process.

In the event that you press the **[1]** key by mistake, you can exit the menu by pressing the **[Esc]** key if you wish to save the data from deletion.

1.8 Setting the date and time

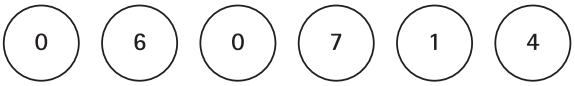
Press the keys **[Mode]** **[1]** **[2]** in succession.

Confirm your selection by pressing **[Enter]**.

The display now shows:

The date and time are entered in the following sequence:

year, month, day,
e.g.: July 14, 2006 = **[0]** **[6]** **[0]** **[7]** **[1]** **[4]**



hours, minutes,
e.g.: 3.07pm = **[1]** **[5]** **[0]** **[7]**.

Confirm your selection by pressing **[Enter]**.

Note
When you confirm the entry by pressing **[Enter]** the seconds are automatically set to zero.

Pressing the **[Esc]** key takes you back to the method-selection mode.

1.9 Time and date display

Press the **[Time]** key.

The display now shows the current time and date.
The unit returns to the previous routine after approx. 15 seconds

or when you press the **[Enter]** key.

1.10 Automatic switch-off

The Spectroquant® Multy switches off automatically 20 minutes after the last time a key was pressed. In the last 30 seconds before it switches off, the unit emits an acoustic signal. During these 30 seconds you can press a key to prevent the unit from switching off automatically. The automatic switch-off function is inactive while the unit is performing operations (running countdown, printing). After the operation in question has ended, the 20-minute waiting time before the automatic switch-off function starts running anew.

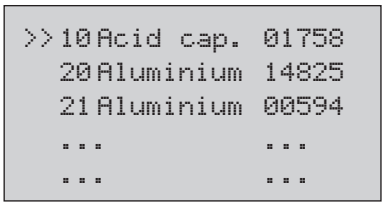
en

2 Operating mode

2.1 Selecting the method

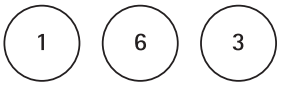
Switch on the Spectroquant® Multy by pressing the **[On/Off]** key.

The display shows the selection list of the stored methods:



There are two ways to select the desired method:

a) by entering the method number directly, e.g.: **[1] [6] [3]** for COD 14541, or



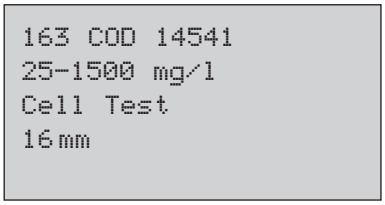
b) by pressing the **[▲]** or **[▼]** arrow keys to select the desired method from the displayed list.

Confirm your selection by pressing **[Enter]**.

Note
Pressing the **[F1]** key switches between the compact and the detailed method-selection list. The method-selection list must be shown on the display for this option.

Example for the detailed method-selection list

Line 1: Method number, method name, item number
Line 2: Measuring range
Line 3: Type of test (cell test or test)
Line 4: Cells used (16 mm/24 mm)



Note
The five-digit item number (e.g. 14541) gives the five digits in the middle of the Merck catalogue/ordering number 1.**XXXXX**.0001, in this case 1.14541.0001. In some cases in which the assignment is self-evident (e.g. monochloramine) or else in which all Spectroquant® tests available for one parameter can be used (e.g. chlorine), this number is not shown.

For an overview of all programmed methods please refer to the included CD, section 5.1, "Overview of preprogrammed methods and analytical procedures".

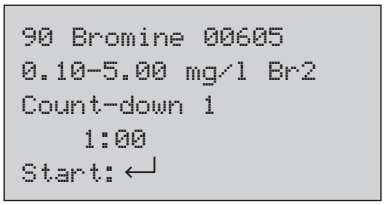
2.2 Measuring with test kits

A detailed description of the procedure for the selected method is given on the provided CD in section 5.1, "Overview of preprogrammed methods and analytical procedures". The procedures may differ slightly from those described in the respective package inserts.

After selecting the method, prepare the blank and sample for measurement.

In the case of analysis specifications in which reaction times must be observed, a timer (countdown) is integrated in the method programme. (In such cases the cells must not be inserted into the measurement compartment.)

After the method has been selected the display shows:
Example: Method 90, Bromine 00605



If you wish to exit the menu at this stage, simply press the **[Enter]** key twice (= abort countdown) and then the **[Esc]** key once.

After the method has been selected, the countdown function is started by pressing the **[Enter]** key. The remaining time is shown continuously. An acoustic signal is emitted in the last 10 seconds before the countdown expires. After the countdown has run out, proceed as described in the analysis procedures.

In some methods there are several reaction times that have to be considered; these are shown and processed in the proper sequence.

Note
The running countdown can be skipped by pressing the **[Enter]** key once. In this case the user must observe the necessary reaction time him-/herself. (Failure to observe the specified reaction time can lead to erroneous results.) Further options to deactivate the countdown procedure: mode No. 13 or Profi mode (mode No. 50).

Enter

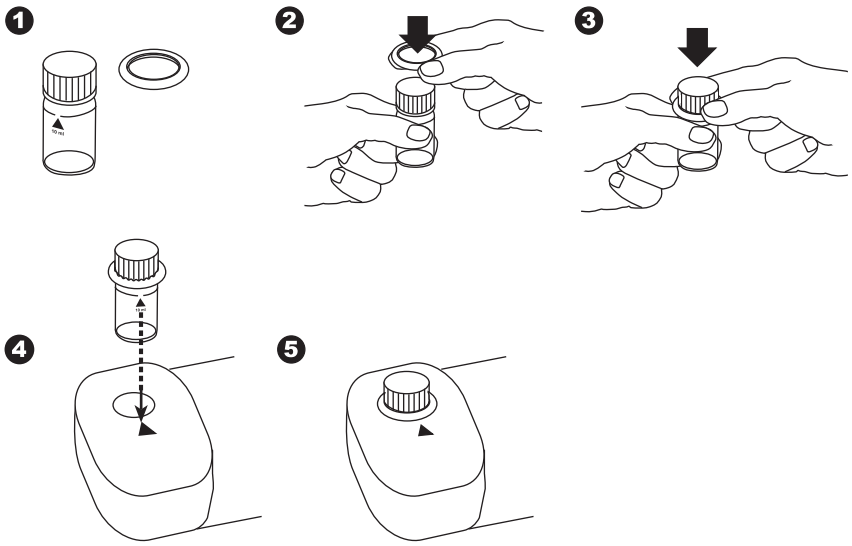
After the countdown has expired the display shows:

```
90 Bromine 00605
0.10-5.00 mg/l Br2

prepare Zero
press ZERO
```

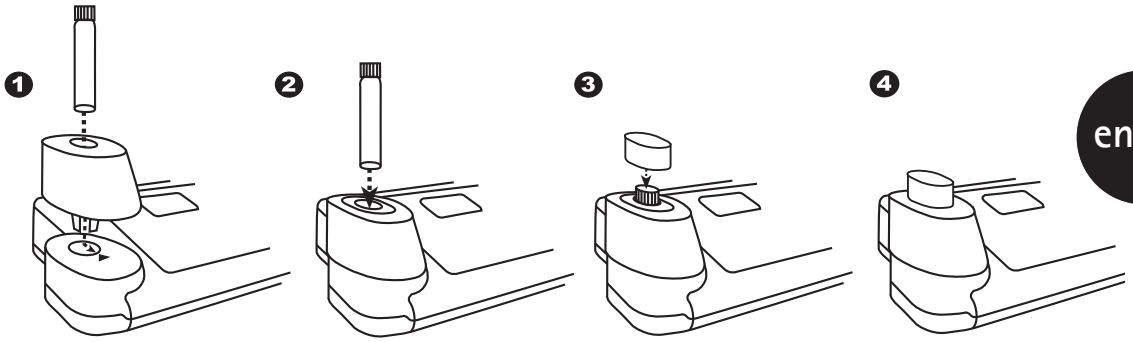
Place the prepared blank in the measurement compartment with the mark on the cell pointing towards the mark on the unit case.

Positioning the cell (ø 24 mm)



Align the triangular mark on the cell with that on the SQ Multy: To afford better protection against sunlight, press the o-ring firmly into place.

Positioning the cell (ø 16 mm)



Attach the 16-mm cell adapter.
Align the line mark above the item number of the cell with the triangular mark on the SQ Multy. Subsequently attach the lid to cover the adapter.

Press the **[Zero]** key.

Zero

The display shows:

```
90 Bromine 00605
0.10-5.00 mg/l Br2
Zero accepted
prepare Test
press TEST
```

Insert the prepared sample into the measurement compartment with the cell mark aligned with the mark on the unit case.

Press the **[Test]** key.

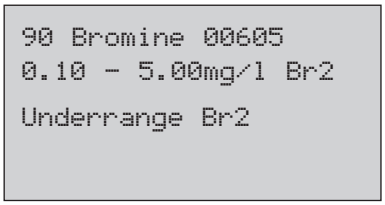
Test

The result is displayed in the following manner:
Example: Method 90 (Bromine 00605)

Line 1: Method number, method name, item number
Line 2: Measuring range
Line 3: Result (expressed as the concentration)

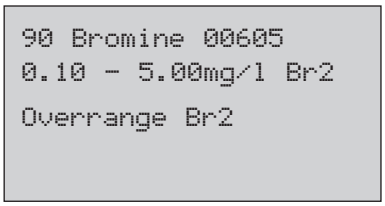
```
90 Bromine 00605
0.10 - 5.00mg/l Br2
2.11mg/l Br2
```

In the event the result lies outside the respective measuring range, the following message appears on the display:



the concentration of the sample lies below the measuring range

or, respectively,



the concentration of the sample lies above the measuring range.

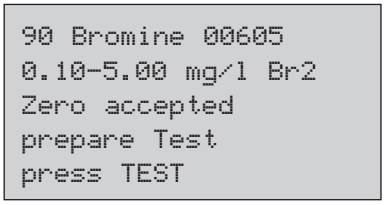
After the result has been displayed

- it can be saved (see section 2.7, "Saving measurement results" and section 2.8, "Retrieving saved measurement results" for further details)
- it can be printed out (see section 5.3)
- a new method can be selected:
  pressing the **[Esc]** key takes the colorimeter back to the method-selection mode;
  you can also enter a new method number directly (confirm by pressing **[Enter]**)

- further measurements can be made using the same or a new zero setting:
  - If you wish to measure other samples using the same method:

    Press the **[Test]** key.

    The display shows:

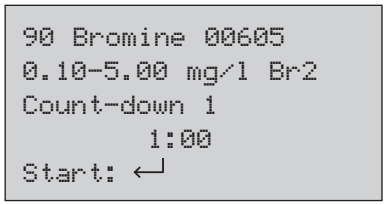


    Confirm by pressing **[Test]**.

- If you wish to measure other samples with a new zero setting:

  Press the **[Zero]** key to reset to zero.

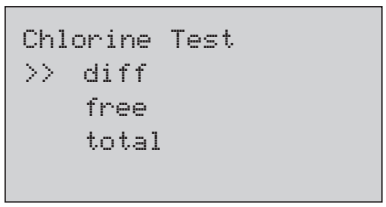
  The display shows:



en

2.3 Differentiation

Some methods permit further differentiation (e.g. chlorine). After selecting the method, e.g. 131 Chlorine Test, you are prompted to state the type of measurement (e.g. differentiated, free, or total).



Use the **[▲]** or **[▼]** arrow keys to select the desired measurement type.

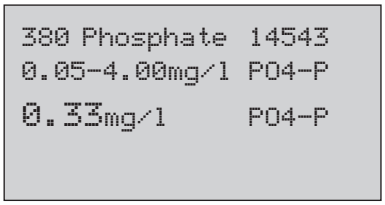
Confirm your selection by pressing **[Enter]**.

2.4 Altering the citation form

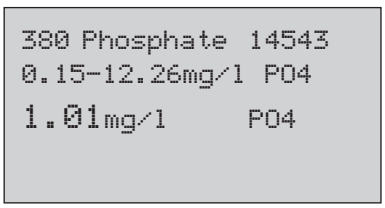
Wherever this is appropriate, it is possible to alter the citation form (see section 5.1, "Overview of preprogrammed methods and analytical procedures" for possible citation-form alternatives).

After the first sample has been measured using a specific method and the result is shown on the display, you can alter the citation form in the following manner:

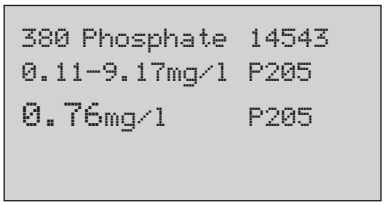
Result shown on display using Method 380 (Phosphate 14543) as an example:



Pressing the [▼] arrow key gives you the option to select a citation form.
The result shown on the display changes to this:



Pressing the [▼] arrow key again shows the next citation form:



Pressing the [▲] arrow key takes you back to the previous citation form.

The citation form last shown on the display remains valid for all consequent measurements until changed again.

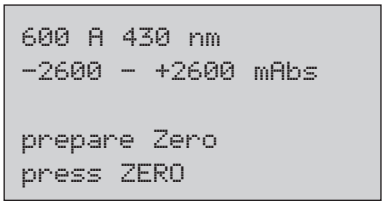
2.5 Measuring absorbances

Besides measuring concentrations using a selected method, the unit is also capable of measuring absorbances. For this you call up the desired wavelength by entering the corresponding method number or by choosing from the method-selection list.

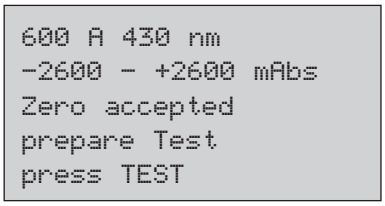
Measuring range: -2600 mAbs to +2600 mAbs

Method No.	Designation
600	A 430 nm
610	A 530 nm
620	A 560 nm
630	A 580 nm
640	A 610 nm
650	A 660 nm

The display shows e.g.:

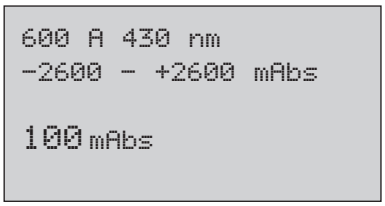


Always zero the colorimeter using a filled cell (e.g. with DI water).
The display shows e.g.:



Then measure the sample.

The display shows e.g.:



100 mAbs = 0.100 A (absorbance units)

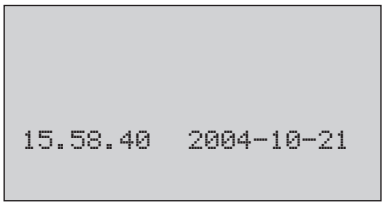
Tip
Reaction times for your own measurements in the absorbance mode can be more easily observed by using the user-countdown function (see the following section 2.6, "User countdown").

2.6 User countdown (timer function)

This function enables the user to employ a self-defined countdown time.

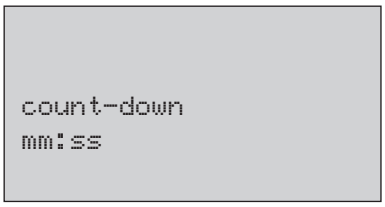
Press the **[Time]** key.

The display shows the current time and date.



Press the **[Time]** key again.

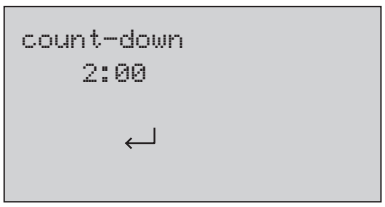
The display shows:



Enter the time in double digits, in the sequence minutes and seconds, e.g.: 2 minutes, 0 seconds = **[0][2][0][0]**.

Confirm your selection by pressing **[Enter]**.

The display shows:



Press the **[Enter]** key to start the countdown.

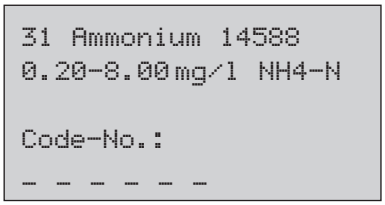
After the countdown has expired, the unit returns to the previous routine.

Note
The user-countdown function is available even when the preset countdown function is deactivated.

2.7 Saving measurement results

Press the **[Store]** key while the result is shown on the display.

The display shows
(Example: Method 31, Ammonium 14558):



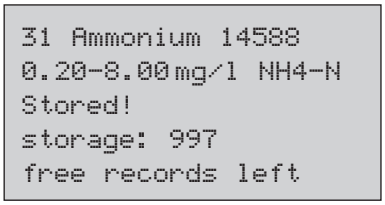
The user is able to enter a six-digit code at this stage.
(The code No. can be used to show e.g. information regarding the user or the sampling site.)

Confirm the code No. by pressing **[Enter]**.

If you do not wish to enter a code No., simply confirm by pressing **[Enter]**. (This results in the automatic assigment of a code No. starting with 0.)

The entire data set is then stored together with the date, time, code No., method, and result.

The display shows:



Note
The number of available memory records is also shown on the display. Subsequently the measurement result is shown again.

When fewer than 30 free memory records are available, the display shows:

It is advisable to delete the data memory as soon as possible when no longer required (see section 2.9, "Deleting saved measurement results"). When all memory records are occupied, it is not possible to save any further results.

2.8 Retrieving saved measurement results

2.8.1 Retrieving all saved measurement results

en

Press the keys **[Mode]** **[3]** **[0]** in succession.

Confirm your selection by pressing **[Enter]**.

The display shows:

```
<storage>
display all data
Start:↵  cancel: ESC
print: F3
print all: F2
```

Confirm by pressing **[Enter]**.
The data sets are then shown in reverse chronological sequence, starting with the most recently saved measurement result.

Pressing the **[▼]** key takes you to the next data set.

Pressing the **[▲]** key takes you back to the previous data set.

Pressing the **[F3]** key prints out the result shown on the display.

Exit by pressing the **[Esc]** key.

If there are no data saved in the memory, the display shows:

```
<storage>
display all data

no data
```

2.8.2 Retrieving saved measurement results from a defined date range

Press the keys **[Mode]** **[3]** **[1]** in succession.

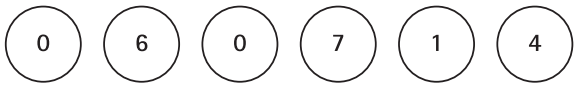
Confirm your selection by pressing **[Enter]**.

The display shows:

```
<storage>
sorted: date
from  yy-mm-dd
      __-__-__
```

Enter the starting date in the sequence year, month, day:

e.g.: July 14, 2006 = **[0]** **[6]** **[0]** **[7]** **[1]** **[4]**.



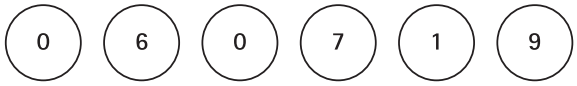
Confirm by pressing **[Enter]**.

The display shows:

```
<storage>
sorted: date
to  yy-mm-dd
    __-__-__
```

Enter the end date in the sequence year, month, day:

e.g.: July 19, 2006 = **[0]** **[6]** **[0]** **[7]** **[1]** **[9]**.



Confirm by pressing **[Enter]**.

The display shows:

```
<storage>
sorted: date
from  2006-07-14
to    2006-07-19
Start: ↵  cancel:ESC
print:F3
print all:F2
```

Pressing the **[Enter]** key shows the saved test results for the defined period of time.

Enter

Pressing the **[F3]** key prints out the result shown on the display.

F3

Pressing the **[F2]** key prints out all selected results.

F2

Exit by pressing the **[Esc]** key.

Esc

Note
To show test results obtained on just one day, enter the same date for both start and end date.

2.8.3 Retrieving saved measurement results from a defined code-No. range

Press the keys **[Mode]** **[3]** **[2]** in succession.

Mode 3 2

Confirm your selection by pressing **[Enter]**.

Enter

The display shows:

```
<storage>
sorted: Code-No.
from _ _ _ _ _ _
```

Enter the start code No. (max. 6 digits), e.g.: **[1]**.

1

Confirm by pressing **[Enter]**.

Enter

The display shows:

```
<storage>
sorted: Code-No.
from  1 _ _ _ _ _
to      _ _ _ _ _ _
```

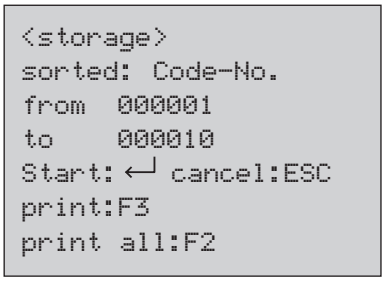
Enter the end code No. (max. 6 digits), e.g.: **[1] [0]**.

1 0

Confirm by pressing **[Enter]**.

Enter

The display shows:



en

Pressing the **[Enter]** key shows all saved test results for the selected code-No. range.

Enter

Pressing the **[F3]** key prints out the result shown on the display.

F3

Pressing the **[F2]** key prints out all selected results.

F2

Exit by pressing the **[Esc]** key.

Esc

Note
To show test results with one and the same code No., enter the same number for both the start and the end code No.
To show all test results without the code No. (code No. = 0), enter a zero **[0]** for both the start and the end code No.

2.8.4 Retrieving saved measurement results from a defined method

Press the keys **[Mode]** **[3]** **[3]** in succession.

Confirm your selection by pressing **[Enter]**.

The display shows e.g.:

```
<storage>
>>10 Acid cap. 01758
  20 Aluminium 14825
  21 Aluminium 00594
  ...
```

Select the desired method from the list or otherwise enter the method number directly, e.g. 21 (aluminium 00594).

Confirm by pressing **[Enter]**.

In the case of differentiated methods make the corresponding new selection and confirm by pressing the **[Enter]** key.

The display shows:

```
<storage>
method
21 Aluminium 00594
Start:↵ cancel:ESC
print:F3
print all:F2
```

Pressing the **[Enter]** key shows all saved test results for the selected method.

Pressing the **[F3]** key prints out the result shown on the display.

Pressing the **[F2]** key prints out all selected results.

Exit by pressing the **[Esc]** key.

2.9 Deleting saved measurement results

Press the keys **[Mode]** **[3]** **[4]** in succession.

Confirm your selection by pressing **[Enter]**.

The display shows:

```
<Delete data>
Delete all Data?

YES:1       NO:0
```

Pressing the **[0]** key saves the data for further use.

Pressing the **[1]** key deletes the data from the memory records.

The display shows:

```
<Delete data>
Delete all Data?

YES:1       NO:0
do not delete  ↵
```

or, respectively,

```
<Delete data>
Delete all Data?

YES:1       NO:0
Delete Data    ↵
```

Confirm by pressing **[Enter]**.

In the event that you press the **[1]** key by mistake, you can exit the menu by pressing the **[Esc]** key if you wish to save the data from deletion.

Note
All saved measurement results are deleted by this operation, irrespective of the method.

en

3 Other functions

3.1 User-specific method list

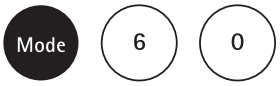
In the unit's delivery configuration the method-selection list displays all available methods. Additionally the user can configure the method-selection list to suit his/her specific requirements.

After an update all new methods are automatically added to the user list.

For software-technical reasons at least one method must be activated in the user-specific method list. The unit automatically activates the first method stored in the sorting list.
For this reason another method must be activated before the automatically activated method can be deactivated.

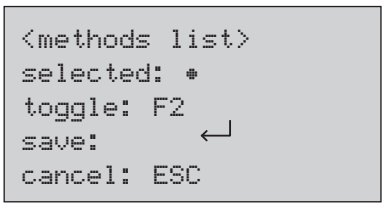
3.1.1 Processing the user-specific method list

Press the keys **[Mode] [6] [0]** in succession.



Confirm your selection by pressing **[Enter]**.

The display shows:



Start by pressing the **[Enter]** key.

The complete method list appears on the display.

```
<methods list>
>>10•Acid cap. 01758
  20•Aluminium 14825
  21•Aluminium 00594
  ...
```

en

Methods showing a dot (•) following the method number appear in the method-selection list, while methods without the dot are not shown.

Press the **[▲]** or **[▼]** keys to position the cursor next to the method to be processed.

Use the **[F2]** key to switch between "activated" and "deactivated". Deactivated methods are then shown without the dot.


```
<methods list>
>>10•Acid cap. 01758
  20 Aluminium 14825
  21•Aluminium 00594
  ...
```

Select the next method and follow the above procedure to adjust the list to match your requirements until all methods show the desired settings.

Confirm your selection for saving by pressing **[Enter]**.

Pressing the **[Esc]** key

and then the **[Enter]** key

enables you to exit this mode at any time without adopting the alterations.

Tip

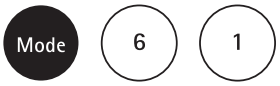
In the event that you wish for only a few methods to be shown in the method-selection list, it is advisable to first execute mode 62 "Mlist all off" (deactivate all methods) and then to process the method-selection list using mode 60 "Method list". All you then need do is select the methods that you would like to include in the method-selection list for later use by marking them with the dot (•).

The names of the user polynomials (1-25) and user concentrations (1-10) all appear in the method list, even when they are not programmed. Unprogrammed methods cannot be activated!

3.1.2 User-specific method list: Activate all methods

This mode function activates all methods and the complete method-selection list appears when the unit is switched on.

Press the keys **[Mode] [6] [1]** in succession.



Confirm your selection by pressing **[Enter]**.

The display shows:

```
<Mlist all on>
switch on all
methods
YES:1      NO:0
```

Pressing the **[1]** key shows all methods in the method-selection list.

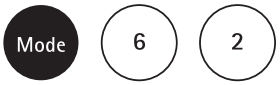
Pressing the **[0]** key saves the current method-selection list for later use.

The unit then returns to the mode menu.

3.1.3 User-specific method list: Deactivate all methods

For software-technical reasons at least one method must be activated in the user-specific method list. The unit automatically activates the first method stored in the sorting list.

Press the keys **[Mode] [6] [2]** in succession.



Confirm your selection by pressing **[Enter]**.

The display shows:

```
<Mlist all off>
switch off all
methods
YES:1      NO:0
```

Pressing the **[1]** key shows just one method in the method list.

Pressing the **[0]** key saves the current method list for later use.

The unit then returns to the mode menu.

3.2 Profi mode

As a rule the methods include the following information:

a) Method
b) Measuring range
c) Date and time
d) Differentiation of measurement results
e) Observance of reaction times (countdown)

When the Profi mode is activated, the colorimeter restricts itself to a minimum of user guidance. Items d and e are omitted.

Press the keys **[Mode] [5] [0]** in succession.

Confirm your selection by pressing **[Enter]**.

The display shows:

```
<Profi-Mode>
actual:
    switched off
ON:1        OFF:0
                ↵
```

Pressing the **[0]** key deactivates the Profi mode.

Pressing the **[1]** key activates the Profi mode.

The display shows:

```
<Profi-Mode>
actual:
    switched off
ON:1        OFF:0
switched on     ↵
```

or

```
<Profi-Mode>
actual:
    switched off
ON:1        OFF:0
switched off    ↵
```

Confirm by pressing **[Enter]**.

Note
It is also possible to save results in the Profi mode. When results are saved here, the display also shows the message: "Profi mode". This selected setting remains activated even when the unit is switched off until a new setting is made.

3.3 Acoustic signals

3.3.1 Activating/deactivating the key beep

Press the keys **[Mode]** **[1]** **[1]** in succession.

Confirm your selection by pressing **[Enter]**.

The display shows:

Pressing the **[0]** key deactivates the key beep function.

Press the **[1]** key activates the key beep function.

Confirm by pressing **[Enter]**.

Note
In connection with methods that include a reaction time, the unit emits an acoustic signal in the last 10 seconds before the countdown expires even when the key beep function is inactive.

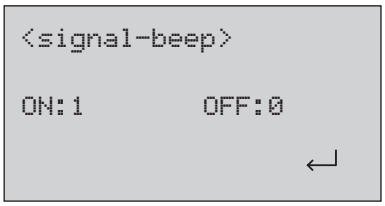
3.3.2 Activating/deactivating the signal beep

It takes the colorimeter approx. 8 seconds to perform a zero calibration and measurements. It emits a brief signal beep at the end of a measurement.

Press the keys **[Mode]** **[1]** **[4]** in succession.

Confirm your selection by pressing **[Enter]**.

The display shows:



Pressing the **[0]** key deactivates the signal beep function.

0

Press the **[1]** key activates the signal beep function.

1

Confirm by pressing **[Enter]**.

Enter

en

Note
In connection with methods that include a reaction time, the unit emits an acoustic signal in the last 10 seconds before the countdown expires even when the signal beep function is inactive.

3.3.3 Activating/deactivating the countdown function (observance of reaction times)

Certain methods require the observance of reaction times. These waiting times are stored as standard settings in the respective methods in the form of a timer (countdown) function. The countdown can be deactivated for all methods involved in the following manner:

Press the keys **[Mode] [1] [3]** in succession.

Mode 1 3

Confirm your selection by pressing **[Enter]**.

Enter

The display shows:

<countdown>
actual:
switched on
ON:1 OFF:0
↵

Pressing the **[0]** key deactivates the countdown function.

0

Pressing the **[1]** key activates the countdown function.

1

Confirm by pressing **[Enter]**.

Enter

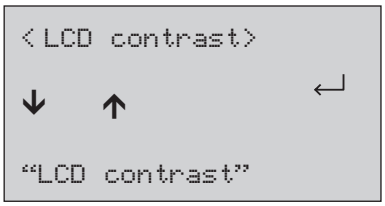
Note
When the countdown function is inactive, the necessary reaction time must be observed by the user him-/herself. Failure to observe the specified reaction time can lead to erroneous results.

3.4 Setting the display contrast

Press the keys **[Mode]** **[8]** **[0]** in succession.

Confirm your selection by pressing **[Enter]**.

The display shows:



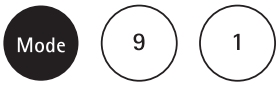
Pressing the **[▲]** key enhances the contrast of the LC display.

Pressing the **[▼]** key reduces the contrast of the LC display.

Confirm by pressing **[Enter]**.

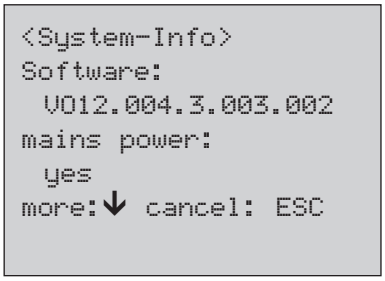
3.5 System info

Press the keys **[Mode]** **[9]** **[1]** in succession.

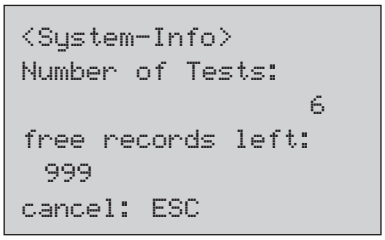


Confirm your selection by pressing **[Enter]**.

This mode provides details on the current software version, the number of measurements that have already been made, and the number of free memory records.



Pressing the **[▼]** key takes you on to further information.



Press the **[Esc]** key to return to the mode menu.

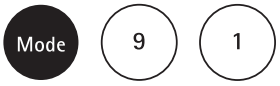
4 Trouble-shooting

4.1 User messages on the display / Error messages

Display message: ADU Err 01: xx (xx = 01, 02, 10, or 20)

Measure: Initialize LED parameters

Please carry out the following steps to set and save the LED brightness parameters:
Test the software version of the unit by pressing the keys **[Mode] [9] [1]**.
The version should be **V012.00x.3.003.zzz**, with zzz = 003 or higher. If you have a lower software version you should perform a software update (see chapter 5.5, **"Software update via Internet"**). To do this download the current version for the Spectroquant® Multy from our website (**www.service-test-kits.com**).



The cell compartment must be clean and dry.

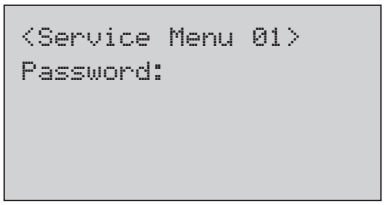
Fill one cell with distilled water and place it in the cell compartment. It is irrelevant whether you use a 16-mm or 24-mm round cell.

Take care that the unit is NOT exposed to direct sunlight or a bright spotlight.

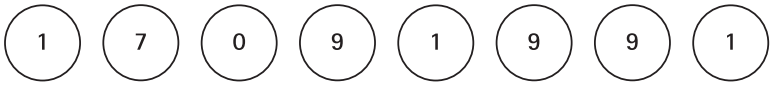
Keep the **[Mode]** key pressed, switch off the unit

and switch it back on while pressing the **[Mode]** key.

The display shows:

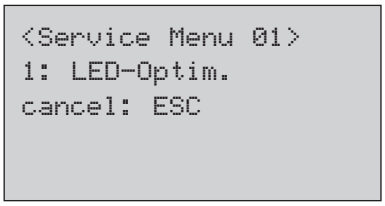


Enter the password: **[1] [7] [0] [9] [1] [9] [9] [1].**



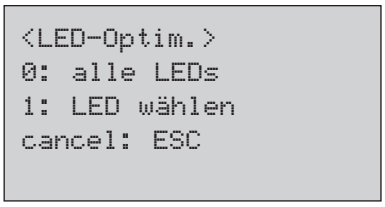
Confirm by pressing **[Enter]**.

The display shows:



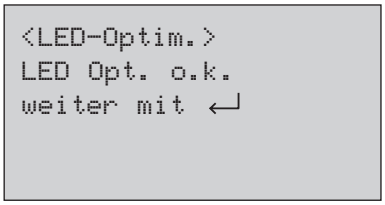
Press the **[1]** key.

The display then shows:



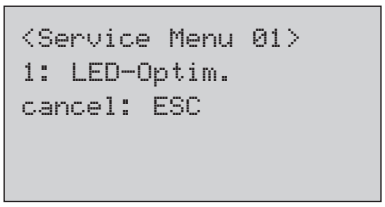
Press the **[0]** key.
The LED parameters are now determined. The unit displays the wavelength in operation, and shortly thereafter "LED-Opt. o.k." if the determined parameter is correct.

When all the LEDs have been processed the display shows:



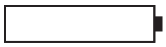
Confirm by pressing **[Enter]**.

The display then shows:



Press the **[Esc]** key.

The unit continues to run normally. Now switch off by pressing the **[On/Off]** key.
Thereafter the unit can be used as usual.

Display message	Possible causes	Measures
Battery capacity		
	Full capacity	
	Warning signal every 3 minutes	The battery capacity will be out soon. Recharge battery pack; operate the unit with mains adapter
	Warning signal every 12 seconds	
	Warning signal, the colorimeter switches itself off	
E40 User cal. here not possible	If the test result appears with Overrange/Underrange, a user calibration is not possible Check sources of error, e.g.: user error (correct procedure, observance of the reaction time, ...)	Use a test with a standard of lower/higher concentration
Jus Overrange E4, Jus Underrange E4	When the user makes calibrations, the setting of the specified value is possible only within defined limits. These were exceeded or, respectively, not reached.	Check error sources, e.g.: user error (correct procedure, observance of reaction time,...) standard (sample weight, dilution, age, pH,...) Repeat adjustment
Overrange	Measuring range exceeded	Where possible dilute sample or select another measuring range
	Turbidities in the sample	Heed possible interferences
	Light entering measurement compartment	Seal ring attached to cell lid? Repeat measurement with seal ring attached
Overrange E1	During the user calibration the upper measuring-range limit was exceeded while setting to the specified value	Carry out test with a standard of lower concentration
Underrange	Result below measuring range	State result with lower than x mg/l x = Lower limit of measuring range; if necessary use a different analytical method
Underrange E1	During the user calibration the lower measuring-range limit was not met while setting to the specified value.	Carry out test with a standard of a higher concentration
Zero not accepted	Too much, too little incident light	Zero cell in place? Insert zero cell, repeat measurement Clean measurement compartment Repeat zero calibration
Printer Timeout	Printer inactive, no connection	Connect printer, check contacts, switch on printer
Storage-system error Use Mode 34	Power supply for storage system interrupted or not available.	Insert or replace the lithium powerpack. Then execute mode 34 to delete the data
ADU Err 02: xx (xx = 01, 02, 10, or 20)	Light entering measurement compartment	Seal ring attached to cell lid? Repeat measurement with seal ring attached

Display message	Possible causes	Measures
Err 51	LED used is too bright	Perform a software update Initialize LED parameters see chapter 4.1
Err 53	Light path in measurement compartment is completely blocked Optics unit is mechanically defe Electronic defect on mainboard	Clean measurement compartment Initialize LED parameters see chapter 4.1
... ??? ...	It is not possible to calculate a value (e.g.: bound chlorine).	**Correctly measured?** If not, repeat
Example 1 130 Chlorine CT 0.05-5.00 mg/l Cl2 0,60 mg/l free Cl ??? comb. Cl 0,59 mg/l total Cl		Example: 1 While the values displayed differ in terms of magnitude, in consideration of the tolerances they are identical. In this case there is no bound chlorine present in the sample.
Example 2 130 Chlorine CT 0.05-5.00 mg/l Cl2 Underrange free Cl ??? comb. Cl 0,59 mg/l total Cl		Example: 2 The result for free chlorine lies outside the measuring range, which is why the value for free chlorine cannot be calculated. Since no detectable free chlorine is present, the proportion of bound chlorine can be assumed to be the total chlorine content.
Example 3 130 Chlorine CT 0.05-5.00 mg/l Cl2 0,60 mg/l free Cl ??? comb. Cl Overrange total Cl		Example: 3 The result for total chlorine lies outside the measuring range, which is why the unit is not able to calculate the value for bound chlorine. In this case the sample must be diluted to obtain the total chlorine content.

4.2 Other potential sources of error

Problem	Possible cause	Measure
The colorimeter runs off mains power, but not with the otherwise fully functionable battery pack.	Fuse (type A, delayed action, 20 mm) is defective	Replace fuse

4.3 Avoiding errors in photometric measurements

1. The cells and lid must be cleaned thoroughly after each analysis run to prevent errors due to cross-contamination. Even the smallest residues of reagents will lead to erroneous results.

2. The outer walls of the cells must be clean and dry before the analysis is carried out. Fingerprints or water droplets on the light-path surfaces of the cells will lead to erroneous results.

3. The cells for the zero calibration and the test itself must always be inserted into the measurement compartment in such a way that the white triangle or, respectively, the line of the graduation is correctly aligned with the corresponding mark on the case (see page 16 or 17).

4. The zero calibration and the test itself must both be made with the cell lid in place. The cell lid of the 24-mm cell must be fitted with a seal ring. The 16-mm cell must be covered with the lid for the adapter.

5. The formation of air bubbles on the inner walls of the cell will lead to erroneous results. In this case attach the cell lid to the cell and swirl the cell to eliminate any air bubbles before carrying out the test.

6. Care must be taken to prevent any water from entering the measurement compartment. Any entry of water into the case of the colorimeter may result in the destruction of electronic components and in damage due to corrosion.

7. Any contamination of the optical components in the measurement compartment will lead to erroneous results. The light-path surfaces of the measurement compartment must be checked at regular intervals and cleaned wherever necessary. Use moist wipes and cotton-wool buds for these cleaning operations.

8. Major differences in temperature between the colorimeter and the local environment can lead to erroneous results, e.g. due to condensation on the optical components and on the cell.

9. When operating the colorimeter make sure that it is protected from direct sunlight.

5 CD-ROM

5.1 Overview of preprogrammed methods and analytical procedures

Meth. No.	Parameter	Cat. No.	Measuring range		Blank	Type of test	Type of cell
10	Acid cap. 01758	1.01758.0001	0.40 - 8.00 mmol/l	OH	RB	Cell test	16 mm
20	Aluminium 14825	1.14825.0001*	20 - 700 µg/l	Al	RB	Cell test	16 mm
21	Aluminium 00594	1.00594.0001	0.05 - 0.50 mg/l	Al	RB	Test	24 mm
30	Ammonium 14739	1.14739.0001	10 - 2000 µg/l	NH_4-N	RB	Cell test	16 mm
31	Ammonium 14558	1.14558.0001	0.20 - 8.00 mg/l	NH_4-N	RB	Cell test	16 mm
32	Ammonium 14559	1.14559.0001	4.0 - 80.0 mg/l	NH_4-N	RB	Cell test	16 mm
33	Ammonium 14752	1.14752.0001*	0.02 - 1.30 mg/l	NH_4-N	RB	Test	24 mm
34	Ammonium 00683	1.00683.0001	1.0 - 50.0 mg/l	NH_4-N	RB	Test	16 mm
40	AOX 00675	1.00675.0001	0.05 - 2.50 mg/l	AOX	RB	Cell test	16 mm
50	Arsenic 01747	1.01747.0001	5 - 100 µg/l	As	RB	Test	16 mm
70	BOD 00687	1.00687.0001	0.5 - 3000 mg/l	BOD	H_2O	Cell test	16 mm
80	Boron 00826	1.00826.0001	0.05 - 2.00 mg/l	B	RB	Cell test	16 mm
90	Bromine 00605	1.00605.0001	0.10 - 5.00 mg/l	Br_2	H_2O	Test	24 mm
100	Cadmium 14834	1.14834.0001	25 - 1000 µg/l	Cd	RB	Cell test	16 mm
101	Cadmium 01745	1.01745.0001	5 - 500 µg/l	Cd	RB	Test	24 mm
110	Calcium 00858	1.00858.0001	10 - 250 mg/l	Ca	RB	Cell test	16 mm
111	Calcium 14815	1.14815.0001	5 - 160 mg/l	Ca	RB	Test	16 mm
120	Chloride 14730	1.14730.0001	5 - 125 mg/l	Cl	RB	Cell test	16 mm
121	Chloride 14897	1.14897.0001	10 - 250 mg/l	Cl	RB	Test	16 mm
122	Chloride 01804	1.01804.0001	0.5 - 15.0 mg/l	Cl	RB	Cell Test	16 mm
123	Chloride 01807	1.01807.0001	0.50 - 5.00 mg/l	Cl	RB	Test	24 mm
130	Chlorine Cell Test	1.00595.0001 (free) 1.00597.0001 (free + total)	0.05 - 5.00 mg/l	Cl_2	H_2O	Cell test	16 mm
131	Chlorine Test	1.00598.0002 (free) 1.00598.0001 (free) 1.00602.0001 (total) 1.00602.0002 (total) 1.00599.0001 (free + total)	0.02 - 3.00 mg/l	Cl_2	H_2O	Test	24 mm

* in contrast to the instructions given in the package insert the sample volume as well as the reagent volume must be doubled

RB = own reagent blank value

Meth. No.	Parameter	Cat. No.	Measuring range		Blank	Type of test	Type of cell
132	Chlorine LR, CT	1.00086.0001 + 1.00087.0001 (free)					
		1.00086.0001 + 1.00087.0001 + 1.00088.0001 (total)					
			0.05 - 5.00 mg/l	Cl_2	H_2O	Cell test	16 mm
133	Chlorine LR, test	1.00086.0001 + 1.00087.0001 (free)					
		1.00086.0001 + 1.00087.0001 + 1.00088.0001 (total)					
			0.02 - 3.00 mg/l	Cl_2	H_2O	Test	24 mm
140	Chlorine dioxide	1.00608.0001	0.10 - 5.00 mg/l	ClO_2	H_2O	Test	24 mm
150	Chromate 14552	1.14552.0001	0.05 - 2.00 mg/l	Cr	H_2O	Cell test	16 mm
151	Chromate 14758	1.14758.0001*	10 - 1400 µg/l	Cr	H_2O	Test	24 mm
168	COD 01796	1.01796.0001	5.0 - 80.0 mg/l	COD	RB	Cell test	16 mm
160	COD 14540	1.14540.0001	10 - 150 mg/l	COD	RB	Cell test	16 mm
161	COD 14895	1.14895.0001	15 - 300 mg/l	COD	RB	Cell test	16 mm
162	COD 14690	1.14690.0001	50 - 500 mg/l	COD	RB	Cell test	16 mm
163	COD 14541	1.14541.0001	25 - 1500 mg/l	COD	RB	Cell test	16 mm
164	COD 14691	1.14691.0001	300 - 3500 mg/l	COD	RB	Cell test	16 mm
165	COD 14555	1.14555.0001	0.50 -10.00 g/l	COD	RB	Cell test	16 mm
169	COD 01797	1.01797.0001	5.00 - 90.00 g/l	COD	RB	Cell test	16 mm
166	COD 09772	1.09772.0001	10 - 150 mg/l	COD	RB	Cell test	16 mm
167	COD 09773	1.09773.0001	100 - 1500 mg/l	COD	RB	Cell test	16 mm
570	COD 17058	1.17058.0001	5.0 - 60.0 mg/l	COD	RB	Cell test	16 mm
571	COD 17059	1.17059.0001	50 - 3000 mg/l	COD	RB	Cell test	16 mm
170	Color	-	0 - 1000 mg/l	Pt/Co (Hazen)	H_2O	Method	24 mm
180	Copper 14553	1.14553.0001	0.05 - 8.00 mg/l	Cu	H_2O	Cell test	16 mm
181	Copper 14767	1.14767.0001	0.10 - 6.00 mg/l	Cu	H_2O	Test	16 mm
190	Cyanide 14561	1.14561.0001	10 - 350 µg/l	CN	H_2O	Cell test	16 mm
191	Cyanide 09701	1.09701.0001*	5 - 200 µg/l	CN	H_2O	Test	24 mm
200	Cyan. acid19250	119250.0001	2 - 160 mg/l	Cys	SB	Test	24 mm
201	Cyan. acid19253	119253.0001	2 - 160 mg/l	CyA	SB	Test	24 mm
220	Fluoride 14557	1.14557.0001	0.10 - 1.50 mg/l	F	RB	Cell test	16 mm
222	Fluoride 00809	1.00809.0001	0.10 - 1.80 mg/l	F	RB	Cell test	16 mm
221	Fluoride 14598	1.14598.0001	0.10 - 2.00 mg/l	F	RB	Test	16 mm
223	Fluoride 00822	1.00822.0001	0.08 - 2.00 mg/l	F	RB	Test	24 mm
230	Hydrazine 09711	1.09711.0001*	10 - 1200 µg/l	N_2H_4	RB	Test	24 mm
560	HydroPerox 18789	1.18789.0001	0.02 - 5.50 mg/l	H_2O_2	RB	Test	16 mm
240	Iodine 00606	1.00606.0001	0.10 - 5.00 mg/l	I_2	H_2O	Test	24 mm
250	Iron 14549	1.14549.0001	0.05 - 4.00 mg/l	Fe	H_2O	Cell test	16 mm
251	Iron 14761	1.14761.0001*	0.01 - 2.00 mg/l	Fe	H_2O	Test	24 mm
		1.14761.0002*					
252	Iron 00796	1.00796.0001	0.10 - 5.00 mg/l	Fe	H_2O	Test	16 mm
260	Lead 14833	1.14833.0001	0.10 - 5.00 mg/l	Pb	RB	Cell test	16 mm
261	Lead 09717	1.09717.0001	0.05 - 5.00 mg/l	Pb	RB	Test	24 mm
270	Magnesium 00815	1.00815.0001	5.0 - 75.0 mg/l	Mg	RB	Cell test	16 mm
280	Manganese 00816	1.00816.0001	0.10 -5.00 mg/l	Mn	H_2O	Cell test	16 mm
281	Manganese 01739	1.01739.0001	0.05 - 1.80 mg/l	Mn	RB	Test	24 mm
282	Manganese 14770	1.14770.0001*	0.05 - 6.00 mg/l	Mn	H_2O	Test	24 mm
283	Manganese 01846	1.01846.0001	0.05 - 1.80 mg/l	Mn	RB	Test	24 mm
290	Molybdenum 00860	1.00860.0001	0.02 - 1.00 mg/l	Mo	H_2O	Cell test	16 mm
291	Molybdenum 19252	119252.0001	0.5 - 45.0 mg/l	Mo	H_2O	Test	24 mm
300	Monochloramine	1.01632.0001	0.10 - 5.00 mg/l	Cl_2	H_2O	Test	24 mm
310	Nickel 14554	1.14554.0001	0.10 - 6.00 mg/l	Ni	RB	Cell test	16 mm
311	Nickel 14785	1.14785.0001*	0.05 - 5.00 mg/l	Ni	RB	Test	24 mm
320	Nitrate 14542	1.14542.0001	0.5 - 15.0 mg/l	NO_3-N	RB	Cell test	16 mm
321	Nitrate 14773	1.14773.0001	0.5 - 15.0 mg/l	NO_3-N	RB	Test	16 mm
322	Nitrate 14556	1.14556.0001	0.10 - 3.00 mg/l	NO_3-N	H_2O	Cell test	16 mm
323	Nitrate 01842	1.01842.0001	0.3 - 30.0 mg/l	NO_3-N	RB	Test	24 mm
330	Nitrite 14547	1.14547.0001	10 - 700 µg/l	NO_2-N	H_2O	Cell test	16 mm

* in contrast to the instructions given in the package insert the sample volume as well as the reagent volume must be doubled

RB = own reagent blank value SB = sample blank value

Meth. No.	Parameter	Cat. No.	Measuring range		Blank	Type of test	Type of cell
331	Nitrite 14776	1.14776.0001* 1.14776.0002*	5 - 400 µg/l	NO_2-N	H_2O	Test	24 mm
332	Nitrite 00609	1.00609.0001	1.0 - 90.0 mg/l	NO_2-N	H_2O	Cell test	16 mm
340	Nitrogen 14537	1.14537.0001	0.5 - 15.0 mg/l	N	RB	Cell test	16 mm
550	Oxygen 14694	1.14694.0001	0.5 - 12.0 mg/l	O_2	H_2O	Cell test	16 mm
555	Oxyg. scavengers	119251.0001	20 - 500 µg/l	DEHA	RB	Test	24 mm
350	Ozone 00607	1.00607.0001 1.00607.0002	0.02 - 2.00 mg/l	O_3	H_2O	Test	24 mm
360	pH 01744	1.01744.0001	6.4 - 8.8		H_2O	Cell test	16 mm
370	Phenol 14551	1.14551.0001	0.10 - 2.50 mg/l	C_6H_5OH	RB	Cell test	16 mm
371	Phenol 00856	1.00856.0001	0.10 - 5.00 mg/l	C_6H_5OH	RB	Test	24 mm
387	Phosphate 00474	1.00474.0001	0.05 - 4.00 mg/l	PO_4-P	H_2O	Cell test	16 mm
380	Phosphate 14543	1.14543.0001	0.05 - 4.00 mg/l	PO_4-P	H_2O	Cell test	16 mm
388	Phosphate 00475	1.00475.0001	0.5 - 20.0 mg/l	PO_4-P	H_2O	Cell test	16 mm
381	Phosphate 14729	1.14729.0001	0.5 - 20.0 mg/l	PO_4-P	H_2O	Cell test	16 mm
382	Phosphate 00616	1.00616.0001	3.0 - 100.0 mg/l	PO_4-P	H_2O	Cell test	16 mm
389	Phosphate 00673	1.00673.0001	3.0 - 100.0 mg/l	PO_4-P	H_2O	Cell test	16 mm
383	Phosphate 14848	1.14848.0001*	0.01 - 2.50 mg/l	PO_4-P	H_2O	Test	24 mm
384	Phosphate 00798	1.00798.0001	1.0 - 60.0 mg/l	PO_4-P	H_2O	Test	16 mm
385	Phosphate 14842	1.14842.0001	0.5 - 30.0 mg/l	PO_4-P	RB	Test	16 mm
386	Phosphate 14546	1.14546.0001	0.5 - 25.0 mg/l	PO_4-P	RB	Cell test	16 mm
400	Potassium 14562	1.14562.0001	5.0 - 50.0 mg/l	K	H_2O	Cell test	16 mm
401	Potassium 00615	1.00615.0001	30 - 300 mg/l	K	H_2O	Cell test	16 mm
410	Residual hardness 14683	1.14683.0001	0.50 - 5.00 mg/l	Ca	RB	Cell test	16 mm
420	Silicate 14794	1.14794.0001*	0.11 - 8.56 mg/l	SiO_2	H_2O	Test	24 mm
421	Silicate 00857	1.00857.0001	11 - 1070 mg/l	SiO_2	H_2O	Test	16 mm
422	Silicate 01813	1.01813.0001	0.004 - 0.500 mg/l	SiO_2	RB	Test	24 mm
430	Sodium 00885	1.00885.0001	10 - 300 mg/l	Na	RB	Cell test	16 mm
440	Sulfate 14548	1.14548.0001	5 - 250 mg/l	SO_4	H_2O	Cell test	16 mm
441	Sulfate 00617	1.00617.0001	50 - 500 mg/l	SO_4	H_2O	Cell test	16 mm
442	Sulfate 14564	1.14564.0001	100 - 1000 mg/l	SO_4	H_2O	Cell test	16 mm
443	Sulfate 01812	1.01812.0001	1.0 - 25.0 mg/l	SO_4	RB	Test	24 mm
450	Sulfide 14779	1.14779.0001	0.10 - 1.50 mg/l	S	H_2O	Test	16 mm
460	Sulfite 14394	1.14394.0001	1.0 - 20.0 mg/l	SO_3	RB	Cell test	16 mm
461	Sulfite 01746	1.01746.0001	1.0 - 60.0 mg/l	SO_3	RB	Test	16 mm
470	Surfact-a 14697	1.14697.0001	0.05 - 2.00 mg/l	MBAS	RB	Cell test	16 mm
471	Surfact-c 01764	1.01764.0001	0.05 - 1.50 mg/l		RB	Cell test	16 mm
472	Surfact-n 01787	1.01787.0001	0.10 - 7.50 mg/l		RB	Cell test	16 mm
480	Susp. solids	-	50 - 750 mg/l		H_2O	Method	24 mm
490	Tin 14622	1.14622.0001	0.10 - 2.50 mg/l	Sn	H_2O	Cell test	16 mm
500	TOC 14878	1.14878.0001	5.0 - 80.0 mg/l	TOC	RB	Cell test	16 mm
501	TOC 14879	1.14879.0001	50 - 800 mg/l	TOC	RB	Cell test	16 mm
510	Total hardness 00961	1.00961.0001	5 - 215 mg/l	Ca	RB	Cell test	16 mm
520	Turbidity	-	1 - 100 FAU		H_2O	Method	24 mm
530	Volatile org. acids	1.01763.0001	50 - 3000 mg/l		RB	Cell test	16 mm
531	Volatile org. acids	1.01749.0001	50 - 3000 mg/l		RB	Cell test	16 mm
		1.01809.0001	50 - 3000 mg/l		RB	Test	16 mm
540	Zinc 00861	1.00861.0001	25 - 1000 µg/l	Zn	RB	Cell test	16 mm
541	Zinc 14566	1.14566.0001	0.20 - 5.00 mg/l	Zn	RB	Cell test	16 mm
600	A 430 nm					Absorbance	
610	A 530 nm					Absorbance	
620	A 560 nm					Absorbance	
630	A 580 nm					Absorbance	
640	A 610 nm					Absorbance	
650	A 660 nm					Absorbance	

* in contrast to the instructions given in the package insert the sample volume as well as the reagent volume must be doubled

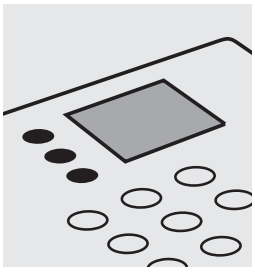
RB = own reagent blank value

Acid Capacity to pH 4.3 (Total Alkalinity)

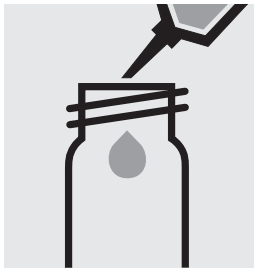
101758

Cell Test

Measuring range:	0.40 –	8.00	mmol/l OH	16-mm cell
	20 –	400	mg/l $CaCO_3$	16-mm cell



Select method ◯ 1 0.

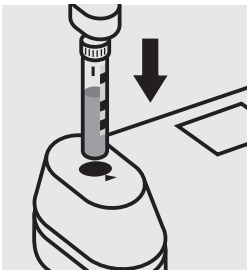


Pipette 4.0 ml each of **AC-1** into two round cells.

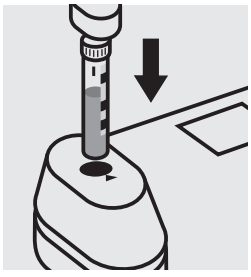
Add to one cell 1.0 ml of the sample with pipette, close with the screw cap, and mix.

Add to the second cell 1.0 ml of distilled water with pipette, close with the screw cap, and mix. (Blank cell)

Add to each cell 0.50 ml of **AC-2** with pipette, close with the screw cap, and mix.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a sodium hydroxide solution 1.0 mol/l, Cat.No. 109141, can be used after diluting accordingly (see section “Standard solutions”).

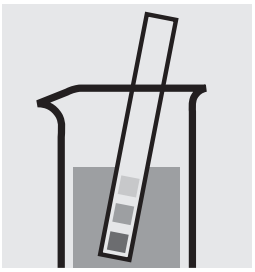
Aluminium

114825

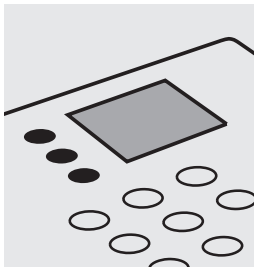
Test

Measuring range: 20 – 700 µg/l Al 24-mm cell

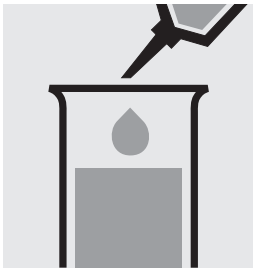
Attention: In contrast to the instructions given in the package insert the sample volume as well as the reagent volume must be doubled.



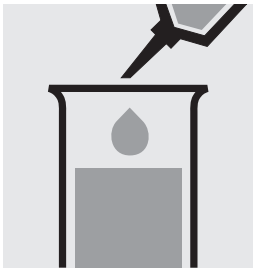
Check the pH of the sample, specified range: pH 3 – 10.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



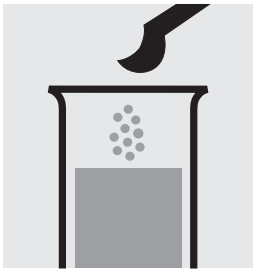
Select method 20.



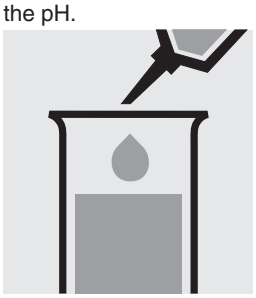
Pipette 10 ml of the sample into a test tube.



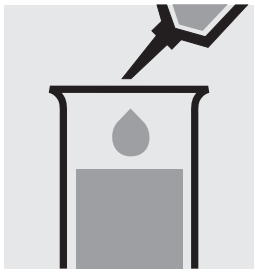
Pipette 10 ml of distilled water into a second test tube.
(Blank)



Add to each test tube 2 level blue microspoons of **Al-1** and dissolve the solid substance.

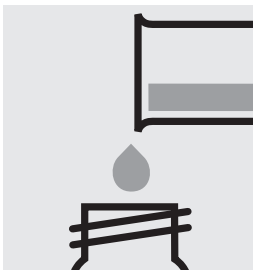


Add to each test tube 2.4 ml of **Al-2** with pipette and mix.

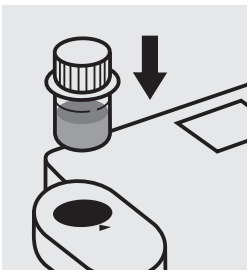


Add to each test tube 0.5 ml of **Al-3** with pipette and mix.

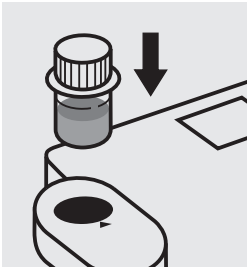
Reaction time:
2 minutes
Press Enter to start the countdown.



Transfer each solution into a separate 24-mm cell, close with the screw caps.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Quality assurance:

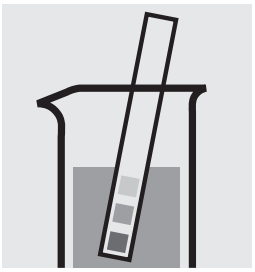
To check the measurement system (test reagents, measurement device, and handling) ready-for-use aluminium standard solution CertiPUR®, Cat.No. 119770, concentration 1000 mg/l Al can be used after diluting accordingly.

Aluminium

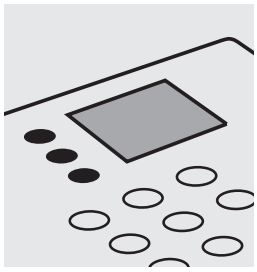
100594

Cell Test

Measuring range: 0.05 – 0.50 mg/l Al 16-mm cell

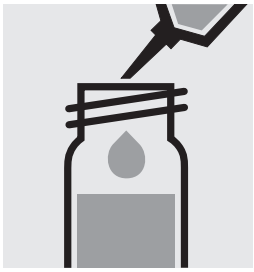


Check the pH of the sample, specified range: pH 3 – 10.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



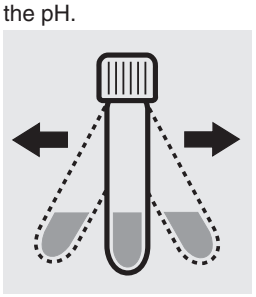
Select method 2 1.

Pipette 6.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



Pipette 6.0 ml of distilled water into a second reaction cell, close with the screw cap, and mix. (Blank cell)

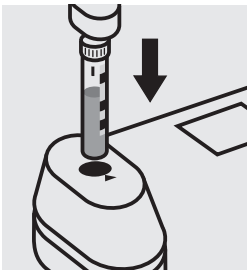
Add to each cell 1 level blue microspoon of **Al-1K**, close with the screw cap.



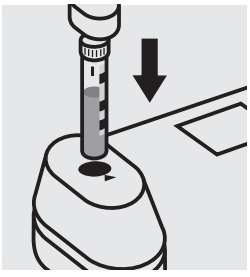
Shake both cells vigorously to dissolve the solid substance.

Add to each test tube 0.25 ml of **Al-2K** with pipette, close with the screw cap, and mix.

Reaction time:
5 minutes
Press Enter to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Quality assurance:

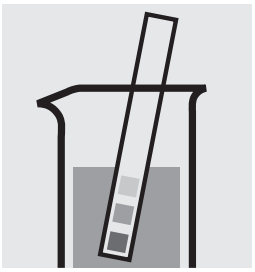
To check the measurement system (test reagents, measurement device, and handling) ready-for-use aluminium standard solution CertiPUR®, Cat.No. 119770, concentration 1000 mg/l Al can be used after diluting accordingly.

Ammonium

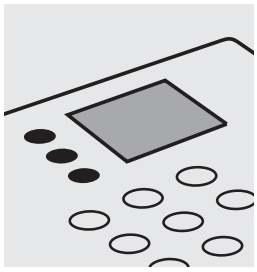
114739

Cell Test

Measuring range:	10 – 2000 µg/l NH_4-N	16-mm cell
	13 – 2576 µg/l NH_4	16-mm cell



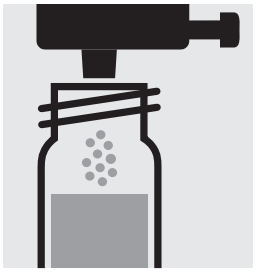
Check the pH of the sample, specified range: pH 4 – 13.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



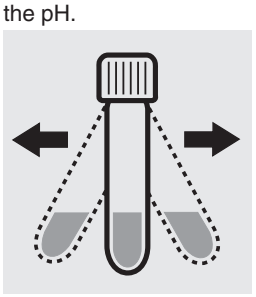
Select method 30.

Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.

Pipette 5.0 ml of distilled water into a second reaction cell, close with the screw cap, and mix. (Blank cell)

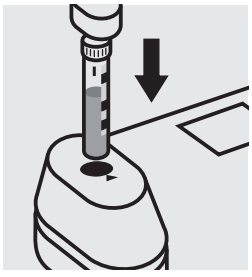


Add to each cell 1 dose of **NH_4-1K** using the blue dose-metering cap, close with the screw cap.

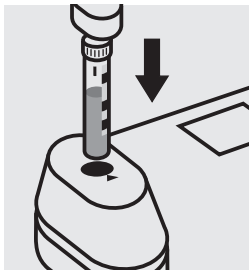


Shake both cells vigorously to dissolve the solid substance.

Reaction time:
15 minutes
Press Enter to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Important:

Very high ammonium concentrations in the sample produce turquoise-coloured solutions (measurement solution should be yellow-green to green) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 50, Cat.No. 114695, or the Standard solution for photometric applications, CRM, Cat.No. 125022 and 125023.
The measurement results are expressed in µg/l NH_4-N.

Ready-for-use ammonium standard solution CertiPUR®, Cat.No. 119812, concentration 1000 mg/l NH_4^+, can also be used after diluting accordingly.

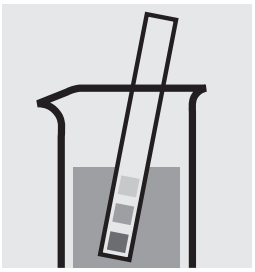
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 50) is highly recommended.

Ammonium

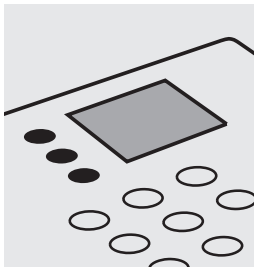
114558

Cell Test

Measuring range:	0.20 – 8.00 mg/l NH_4-N	16-mm-cell
	0.26 – 10.30 mg/l NH_4	16-mm-cell



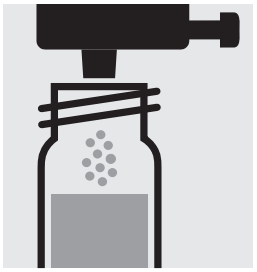
Check the pH of the sample, specified range: pH 4 – 13.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



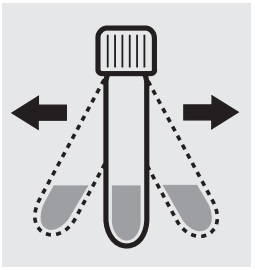
Select method (3)(1).

Pipette 1.0 ml of the sample into a reaction cell, close with the screw cap, and mix.

Pipette 1.0 ml of distilled water into a second reaction cell, close with the screw cap, and mix. (Blank cell)

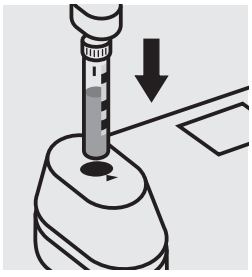


Add to each cell 1 dose of **NH_4-1K** using the blue dose-metering cap, close with the screw cap.

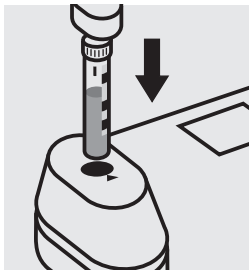


Shake both cells vigorously to dissolve the solid substance.

Reaction time:
15 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Important:

Very high ammonium concentrations in the sample produce turquoise-coloured solutions (measurement solution should be yellow-green to green) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10, Cat.No. 114676, or the Standard solution for photometric applications, CRM, Cat. No. 125022, 125023, 125024, and 125025.

Ready-for-use ammonium standard solution CertiPUR®, Cat.No. 119812, concentration 1000 mg/l NH_4^+, can also be used after diluting accordingly.

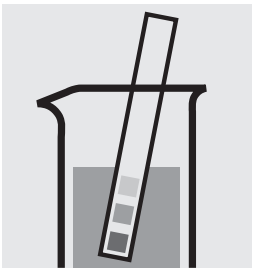
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 10) is highly recommended.

Ammonium

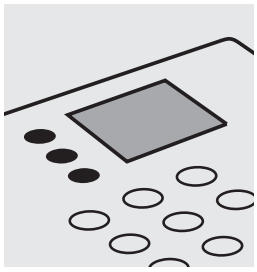
114559

Cell Test

Measuring range:	4.0 – 80.0 mg/l NH_4-N	16-mm-cell
	5.2 – 103.0 mg/l NH_4	16-mm-cell



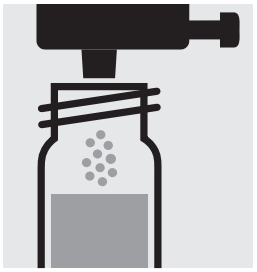
Check the pH of the sample, specified range: pH 4 – 13.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



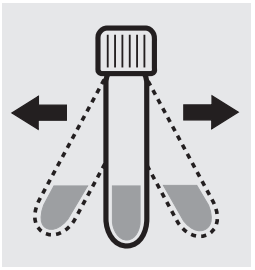
Select method ▢ 3 2.

Pipette 0.10 ml of the sample into a reaction cell, close with the screw cap, and mix.

Pipette 0.10 ml of distilled water into a second reaction cell, close with the screw cap, and mix.
(Blank cell)

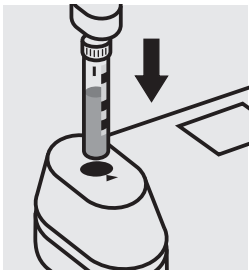


Add to each cell 1 dose of **NH_4-1K** using the blue dose-metering cap, close with the screw cap.

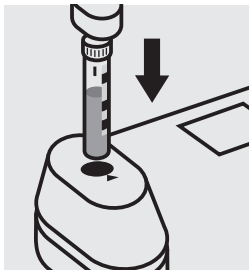


Shake both cells vigorously to dissolve the solid substance.

Reaction time:
15 minutes
Press Enter to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Important:

Very high ammonium concentrations in the sample produce turquoise-coloured solutions (measurement solution should be yellow-green to green) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 70, Cat.No. 114689, or the Standard solution for photometric applications, CRM, Cat. No. 125025, 125026, and 125027.

Ready-for-use ammonium standard solution CertiPUR®, Cat.No. 119812, concentration 1000 mg/l NH_4^+, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 70) is highly recommended.

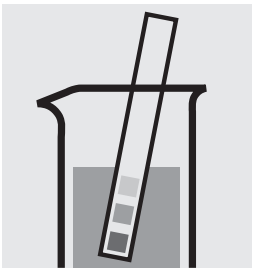
Ammonium

114752

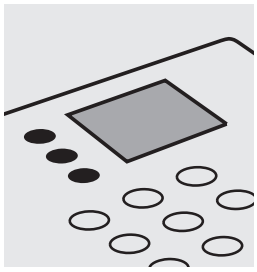
Test

Measuring range:	0.02 – 1.30 mg/l NH_4-N	24-mm cell
	0.03 – 1.67 mg/l NH_4	24-mm cell

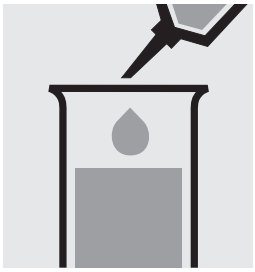
Attention: In contrast to the instructions given in the package insert the sample volume as well as the reagent volume must be doubled.



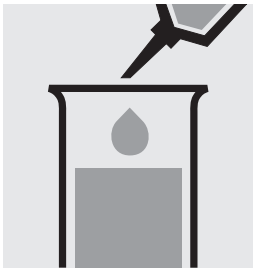
Check the pH of the sample, specified range: pH 4 – 13.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



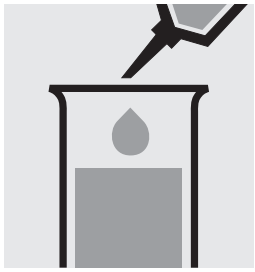
Select method (3)(3).



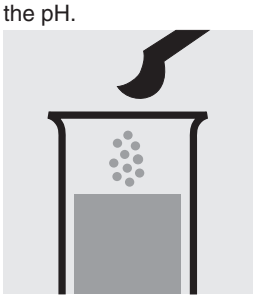
Pipette 10 ml of the sample into a test tube.



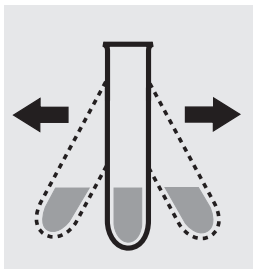
Pipette 10 ml of distilled water into a second test tube.
(Blank)



Add to each test tube 1.2 ml of **NH_4-1** with pipette and mix.

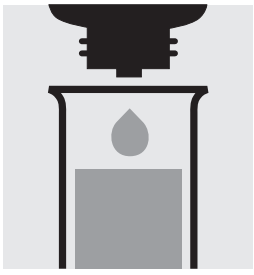


Add to each test tube 2 level blue microspoons of **NH_4-2**.



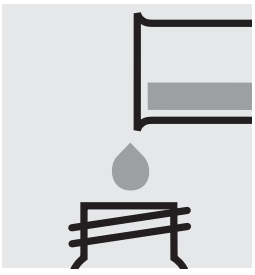
Shake both test tubes vigorously to dissolve the solid substance.

Reaction time:
5 minutes
Press (Enter) to start the countdown.

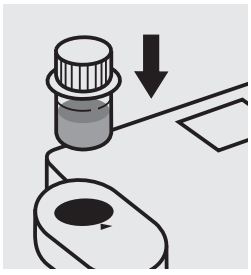


Add to each test tube 8 drops of **NH_4-3** and mix.

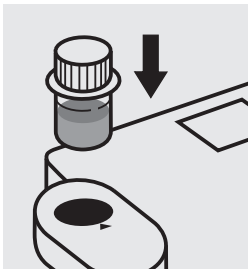
Reaction time:
5 minutes
Press (Enter) to start the countdown.



Transfer each solution into a separate 24-mm cell, close with the screw caps.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Important:

Very high ammonium concentrations in the sample produce turquoise-coloured solutions (measurement solution should be yellow-green to green) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 50, Cat.No. 114695, or the Standard solution for photometric applications, CRM, Cat.No. 125022 and 125023.
Use 10 ml R-1 instead of the sample.

Ready-for-use ammonium standard solution CertiPUR®, Cat.No. 119812, concentration 1000 mg/l NH_4^+, can also be used after diluting accordingly.

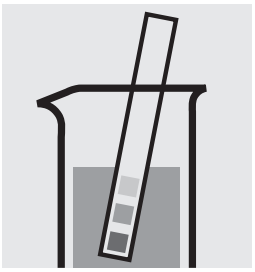
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 50) is highly recommended.
Use 10 ml sample + 0.1 ml R-2.

Ammonium

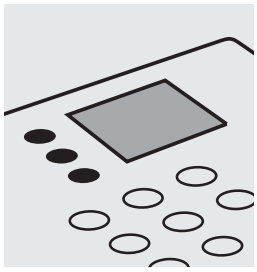
100683

Test

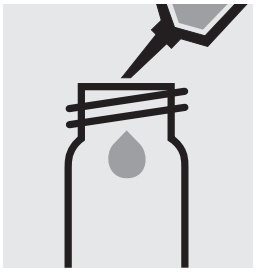
Measuring range:	1.0 – 50.0 mg/l NH_4-N	16-mm cell
	1.3 – 64.4 mg/l NH_4	16-mm cell



Check the pH of the sample, specified range: pH 4 – 13.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method 3 4.

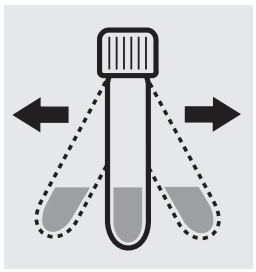


Pipette 5.0 ml each of **NH_4-1** into two 16-mm cells.

Add to one cell 0.20 ml of the sample with pipette, close with the screw cap, and mix.

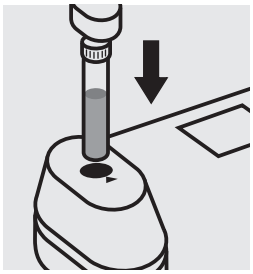
Add to the second cell 0.20 ml of distilled water with pipette, close with the screw cap, and mix. (Blank cell)

Add to each cell 1 level blue microspoon of **NH_4-2**, close with the screw cap.

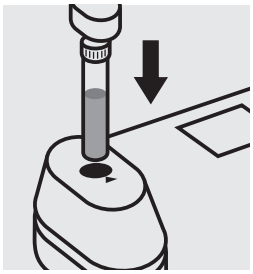


Shake both cells vigorously to dissolve the solid substance.

Reaction time:
15 minutes
Press Enter to start the countdown.



Insert the blank cell into the cell compartment.
Press Zero.



Insert the cell containing the sample into the cell compartment. Press Test.

Important:

Very high ammonium concentrations in the sample produce turquoise-coloured solutions (measurement solution should be yellow-green to green) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 70, Cat.No. 114689, or the Standard solution for photometric applications, CRM, Cat. No. 125025 and 125026.

Ready-for-use ammonium standard solution CertiPUR®, Cat.No. 119812, concentration 1000 mg/l NH_4^+, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 70) is highly recommended.

AOX

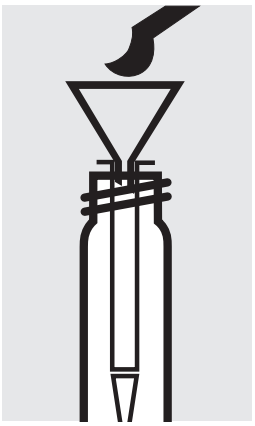
Adsorbable Organic Halogens (x)

100675

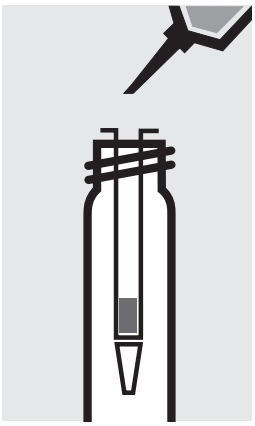
Cell Test

Measuring range: 0.05 – 2.50 mg/l AOX 16-mm cell

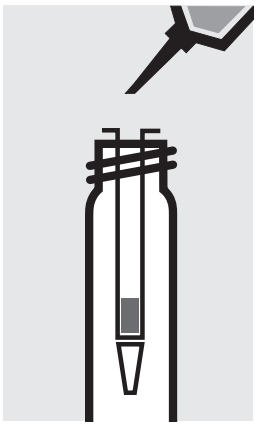
Preparation of the adsorption column:



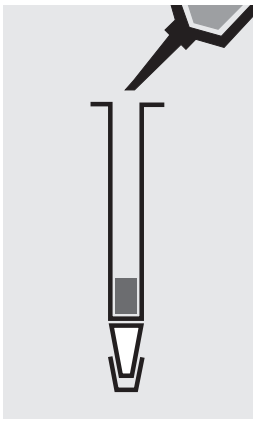
Place the column in an empty cell. Fill 1 level blue microspoon of **AOX-1** into the column using the glass funnel.



Run 3 separate 1-ml portions of **AOX-2** through the column. Discard the wash solution.

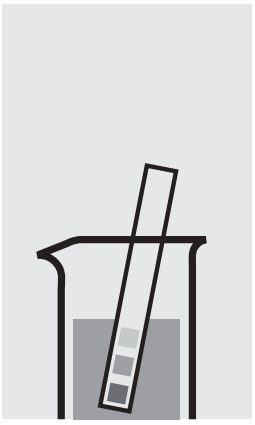


Run 3 separate 1-ml portions of **AOX-3** through the column. Discard the wash solution.

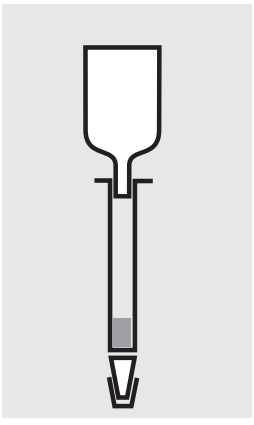


Close the bottom end of the column with the stopper. Apply to the column 1 ml of **AOX-3**. Close the top end of the column with the stopper and swirl to eliminate air bubbles. Remove the stopper on the top end and fill the column to the brim with **AOX-3**.

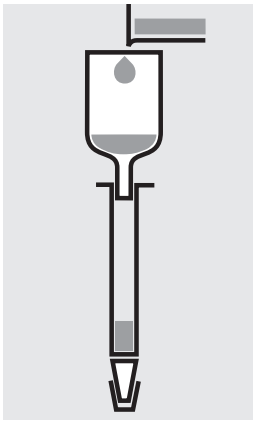
Sample enrichment:



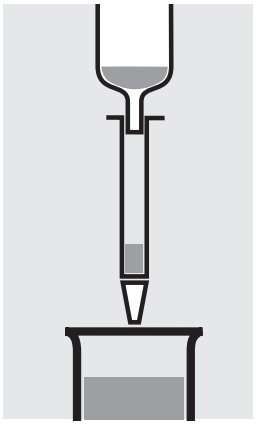
Check the pH of the sample, specified range: pH 6 – 7.
If required, add dilute sodium hydroxide solution or nitric acid drop by drop to adjust the pH.



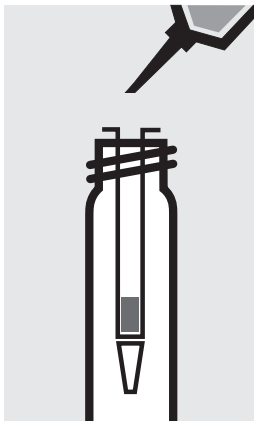
Attach the glass reservoir to the prepared column (closed at the bottom end).



Fill 100 ml of the sample and 6 drops of **AOX-4** into the reservoir.



Remove the stopper from the column outlet and run the sample through completely.



Detach the column from the reservoir. Apply 3 separate 1-ml portions of **AOX-3**. Discard the wash solution.

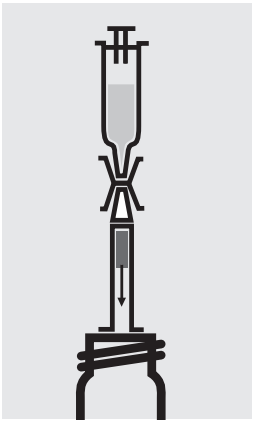
AOX

Adsorbable Organic Halogens (x)

100675

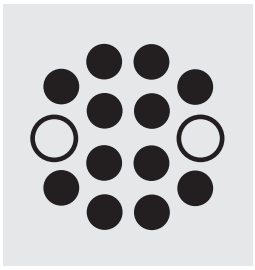
Cell Test

Digestion:

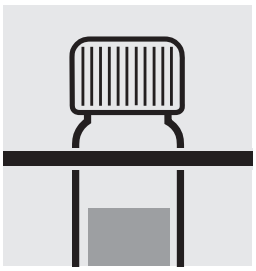


Fill the 10-ml syringe with 10 ml of reagent **AOX-5** and attach the syringe with the column outlet using the connector. Place the top end of the column on an empty cell and rinse the charcoal filling of the column into an empty 16-mm cell.

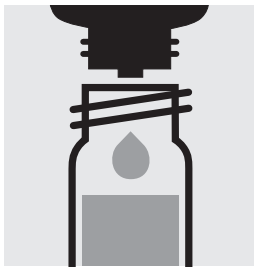
Add 2 level green microspoons of **AOX-6**, close with the screw cap, and mix.



Heat the cell at 120 °C in the thermoreactor for 30 minutes.

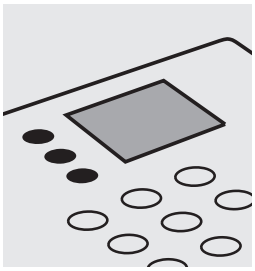


Remove the cell from the thermoreactor and place in a test-tube rack to cool to room temperature.



Add 5 drops of **AOX-4**, close the cell, and mix; clear supernatant: **pretreated sample**.

Determination:



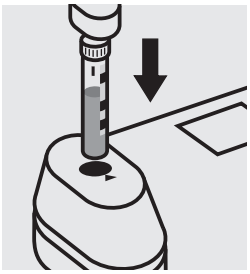
Select method (4)(0).

Pipette 0.20 ml each of **AOX-1K** into two reaction cells, close with the screw cap, and mix.

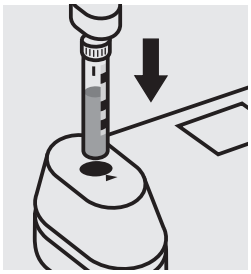
Add to one cell 7.0 ml of **pretreated sample** (without charcoal) with glass pipette, close with the screw cap, and mix.

Add to the second cell 7.0 ml distilled water with pipette, close with the screw cap, and mix. (Blank cell)

Reaction time: 15 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

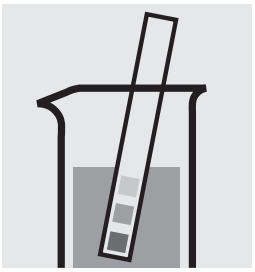
To check the measurement system (test reagents, measurement device, and handling) Spectroquant® AOX Standard, Cat.No. 100680, concentration 0.2 – 2.0 mg/l can be used.

Arsenic

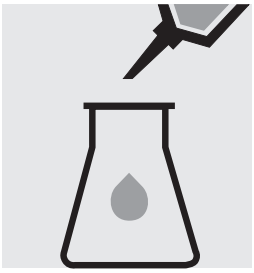
101747

Test

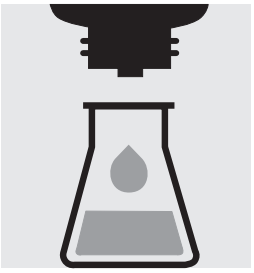
Measuring range: 5 – 100 µg/l As 16-mm cell



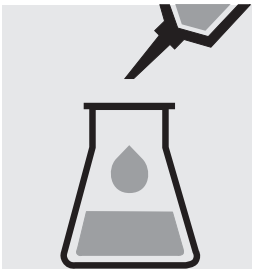
Check the pH of the sample, specified range: pH 0 – 13.



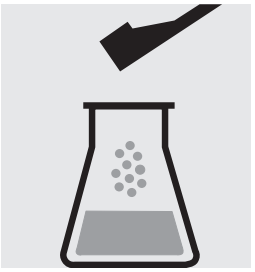
Place 350 ml of the sample into an Erlenmeyer flask with ground joint.



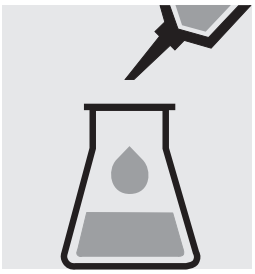
Add 5 drops of **As-1** and mix.



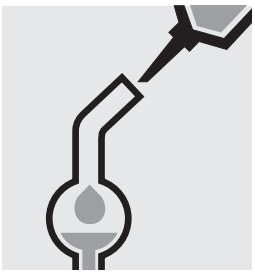
Add 20 ml of **As-2** with pipette and mix.



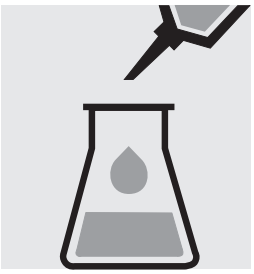
Add 1 level green dosing spoon of **As-3** and dissolve.



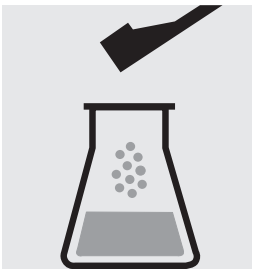
Add 1.0 ml of **As-4** with pipette and mix.



Pipette 5.0 ml of **As-5** into the absorption tube.

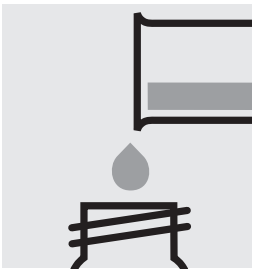


Add 1.0 ml of **As-6** with pipette to the solution in the Erlenmeyer flask and mix.

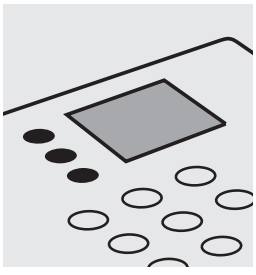


Add 3 level red dosing spoons of **As-7**. **Immediately** attach the absorption tube to the Erlenmeyer flask.

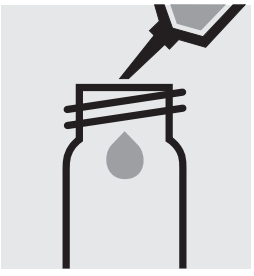
Leave to stand for 2 hours. During this time carefully swirl the flask several times or stir slowly with a magnetic stirrer.



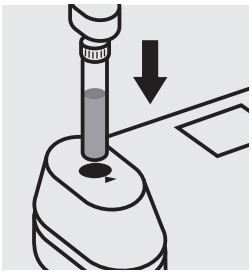
Transfer the solution from the absorption tube into a 16-mm cell, close with the screw cap.



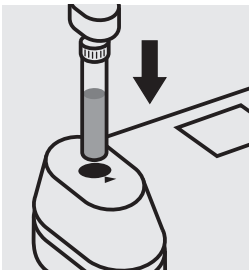
Select method (5)(0).



Fill approx. 10 ml of distilled water into a 16-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)



Insert the blank cell into the cell compartment. Press (Zero).



Insert the cell containing the sample into the cell compartment. Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-for-use arsenic standard solution CertiPUR®, Cat.No. 119773, concentration 1000 mg/l As can be used after diluting accordingly.

BOD

Biochemical Oxygen Demand

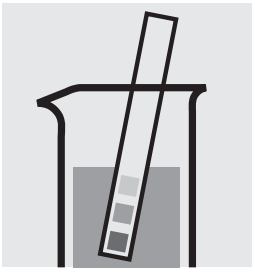
100687

Cell Test

Measuring range: 0.5 – 3000[1)] mg/l O_2 16-mm cell

[1)] after corresponding dilution (details see package insert)

Preparation and incubation:



Check the pH of the sample, specified range: pH 6 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.

Fill 2 oxygen reaction bottles each with **pretreated sample** and 2 glass beads to overflowing. Close bubble-free with the slanted ground-glass stoppers.

Fill 2 oxygen reaction bottles each with **inoculated nutrient-salt solution** and 2 glass beads to overflowing. Close bubble-free with the slanted ground-glass stoppers.

Measurement of inital oxygen concentration

= Result 1
(measurement sample)
= Result 1
(blank)

Use one bottle of **pretreated sample** and one of **inoculated nutrient-salt solution** for the measurement of the initial oxygen concentration.

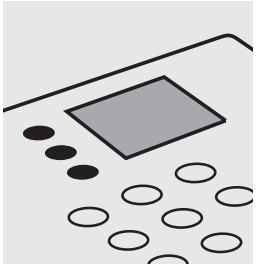
Incubate one bottle of **pretreated sample** and one of **inoculated nutrient-salt solution** closed in a thermostatic incubation cabinet at 20 ± 1°C for 5 days.

Determination:

Measurement of final oxygen concentration

= Result 2
(measurement sample)
= Result 2
(blank)

After incubation, use one bottle of **pretreated sample** and one of **inoculated nutrient-salt solution** for the measurement of the final oxygen concentration.



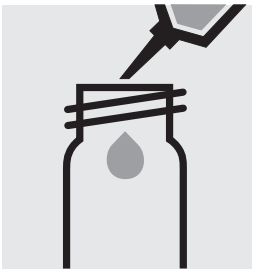
Select method 70.

Add to each oxygen reaction bottle 5 drops of **BOD-1K** and then 10 drops of **BOD-2K**, close bubble-free, and mix for approx. 10 seconds.

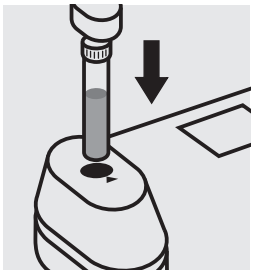
Reaction time:
1 minute

Add to each oxygen reaction bottle 10 drops of **BOD-3K**, reclose, and mix.

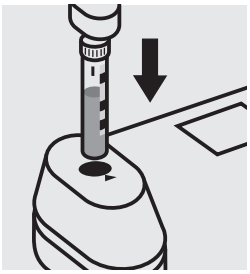
Transfer each solution into a separate 16-mm cell, close with the screw caps.



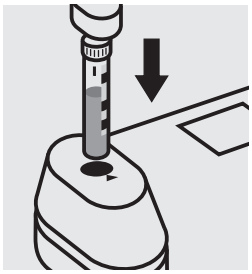
Fill approx. 10 ml of distilled water into a 16-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)



Insert the blank cell into the cell compartment. Press Zero.



Insert the blank cell (nutrient-salt solution) into the cell compartment. Align the mark on the cell with that on the photometer.
Press Test.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press Test.

Calculation:

BOD of measurement sample:
Result 1 – Result 2 (measurement sample) = A in mg/l

BOD of blank:
Result 1 – Result 2 (blank) = B in mg/l

BOD of original sample in mg/l = A • dilution factor – B

Quality assurance:

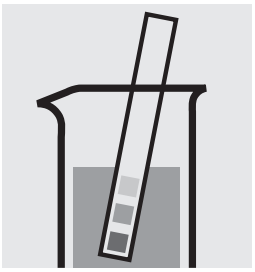
To check the measurement system (test reagents, measurement device, and handling) Spectroquant BOD Standard (analogous to EN 1899), Cat.No. 100718, can be used.

Boron

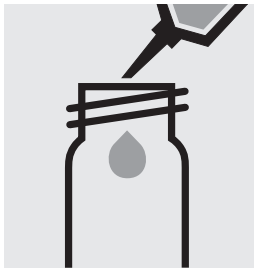
100826

Cell Test

Measuring range: 0.05 – 2.00 mg/l B 16-mm cell



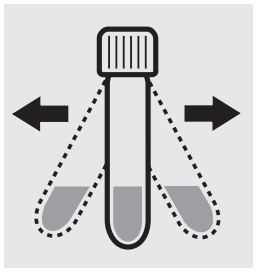
Check the pH of the sample, specified range: pH 2 – 12.
If required, add dilute sodium hydroxide solution or nitric acid drop by drop to adjust the pH.



Pipette 1.0 ml each of **B-1K** into two reaction cells, close with the screw cap, and mix.

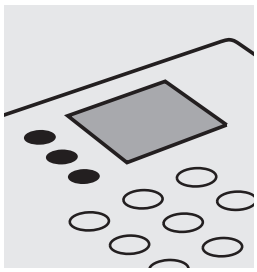
Add to one cell 4.0 ml of the sample with pipette, close with the screw cap.

Add to the second cell 4.0 ml of distilled water with pipette, close with the screw cap.
(Blank cell)

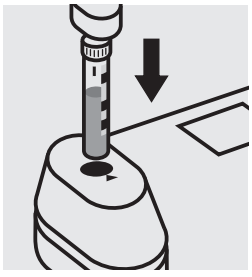


Shake both cells vigorously to dissolve the solid substance.

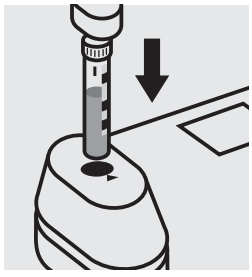
Reaction time:
60 minutes



Select method ▢ 8 0.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Quality assurance:

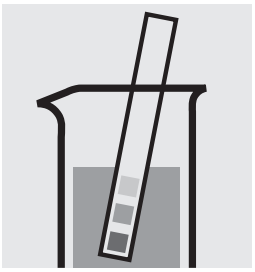
To check the measurement system (test reagents, measurement device, and handling) ready-for-use boron standard solution CertiPUR®, Cat.No. 119500, concentration 1000 mg/l B can also be used after diluting accordingly.

Bromine

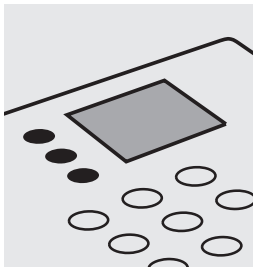
100605

Test

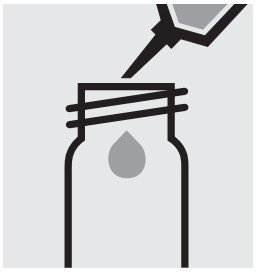
Measuring range: 0.10 – 5.00 mg/l Br_2 24-mm cell



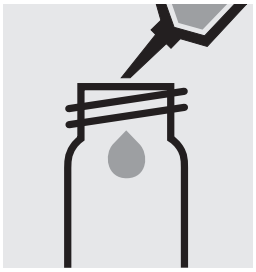
Check the pH of the sample, specified range: pH 4 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method 90.

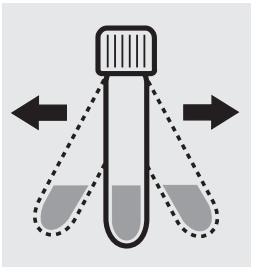


Fill approx. 10 ml of distilled water into a 24-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)



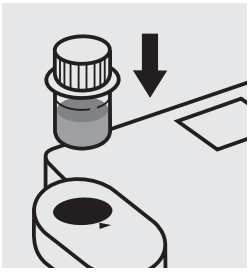
Pipette 10 ml of the sample into a 24-mm cell.

Add 1 level blue microspoon of **Br_2-1**, close with the screw cap.

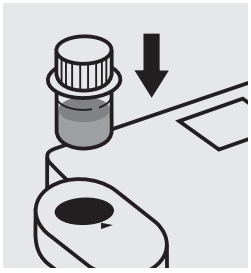


Shake the cell vigorously to dissolve the solid substance.

Reaction time:
1 minute
Press Enter to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Important:

Very high bromine concentrations in the sample produce yellow-coloured solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

Quality assurance:

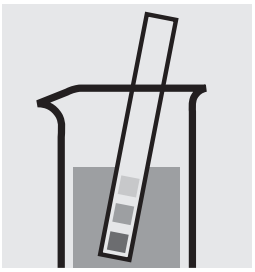
To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section “Standard solutions”).

Cadmium

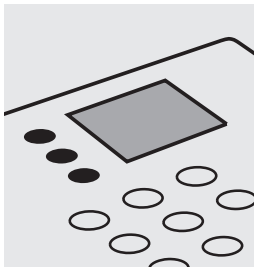
114834

Cell Test

Measuring range: 25 – 1000 µg/l Cd 16-mm cell

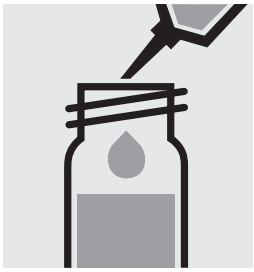


Check the pH of the sample, specified range: pH 3 – 11.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.

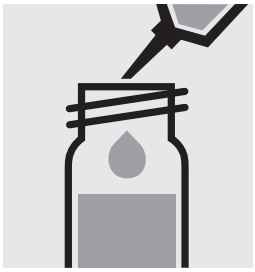


Select method (1)(0)(0).

Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.

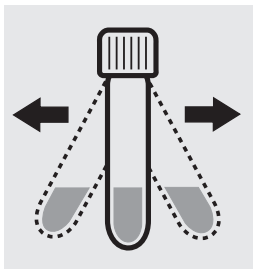


Pipette 5.0 ml of distilled water into a second reaction cell, close with the screw cap, and mix. (Blank cell)



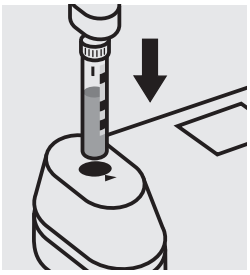
Add 0.20 ml each of **Cd-1K** with pipette, close with the screw cap, and mix.

Add to each cell 1 level green microspoon of **Cd-2K**, close with the screw cap.

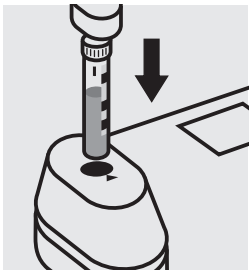


Shake both cells vigorously to dissolve the solid substance.

Reaction time:
2 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Important:

For the determination of **total cadmium** a pretreatment with Crack Set 10C, Cat.No. 114688 or Crack Set 10, Cat.No. 114687, and thermoreactor is necessary.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 30, Cat.No. 114677.
The measurement results are expressed in µg/l Cd.

Ready-for-use cadmium standard solution CertiPUR®, Cat.No. 119777, concentration 1000 mg/l Cd, can also be used after diluting accordingly.

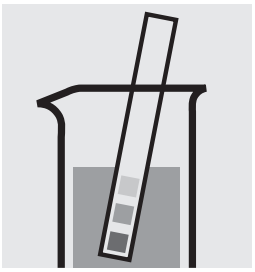
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 30) is highly recommended.

Cadmium

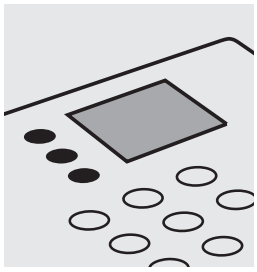
101745

Test

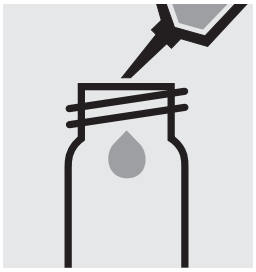
Measuring range: 5 – 500 µg/l Cd 24-mm cell



Check the pH of the sample, specified range: pH 3 – 11.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method 101.



Pipette 1.0 ml each of **Cd-1** into two 24-mm cells.

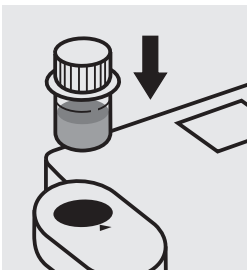
Add to one cell 10 ml of the sample with pipette, close with the screw cap, and mix.

Add to the second cell 10 ml of distilled water with pipette, close with the screw cap, and mix. (Blank cell)

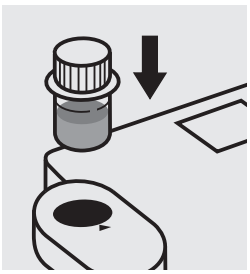
Add to each cell 0.20 ml of **Cd-2** with pipette, close with the screw cap, and mix.

Add to each cell 1 level green microspoon of **Cd-3**, close with the screw cap, and dissolve the solid substance.

Reaction time:
2 minutes
Press Enter to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Important:

For the determination of **total cadmium** a pretreatment with Crack Set 10C, Cat.No. 114688 or Crack Set 10, Cat.No. 114687, and thermoreactor is necessary.

Quality assurance:

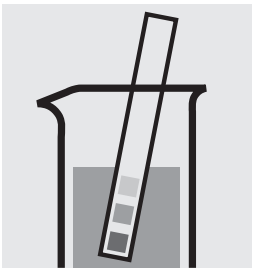
To check the measurement system (test reagents, measurement device, and handling) ready-for-use cadmium standard solution CertiPUR®, Cat.No. 119777, concentration 1000 mg/l Cd, can be used after diluting accordingly.

Calcium

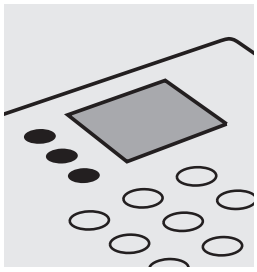
100858

Cell Test

Measuring range:	10 – 250 mg/l Ca	16-mm cell
	14 – 350 mg/l CaO	16-mm cell
	25 – 625 mg/l $CaCO_3$	16-mm cell



Check the pH of the sample, specified range: pH 3 – 9.
If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



Select method (1)(1)(0).

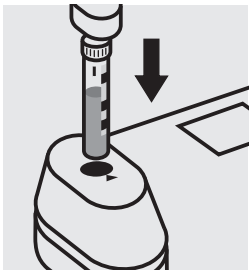
Pipette 1.0 ml of the sample into a reaction cell, close with the screw cap, and mix.

Pipette 1.0 ml of distilled water into a second reaction cell, close with the screw cap, and mix. (Blank cell)

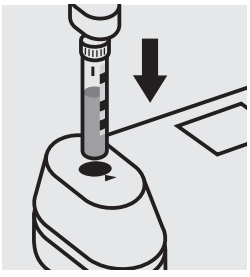
Add to each cell 1.0 ml of **Ca-1K** with pipette, close with the screw cap, and mix.

Reaction time:
exactly 3 minutes
Press (Enter) to start the countdown.

Add to each cell 0.50 ml of **Ca-2K** with pipette, close with the screw cap, and mix.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

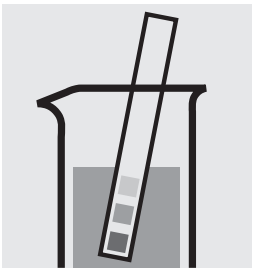
To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section “Standard solutions”).

Calcium

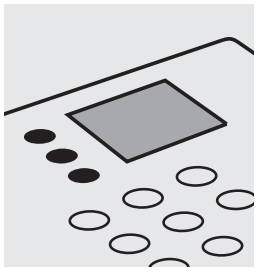
114815

Test

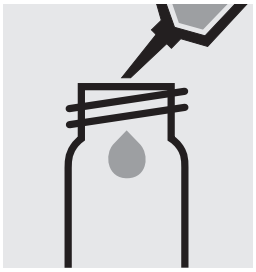
Measuring range:	5 – 160 mg/l Ca	16-mm cell
	7 – 224 mg/l CaO	16-mm cell
	13 – 400 mg/l $CaCO_3$	16-mm cell



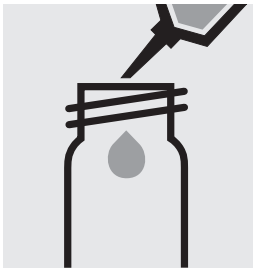
Check the pH of the sample, specified range: pH 4 – 10.
If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



Select method (1)(1)(1).



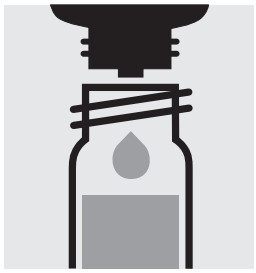
Pipette 0.10 ml of the sample into a 16-mm cell.



Pipette 0.10 ml of distilled water into a second 16-mm cell. (Blank cell)

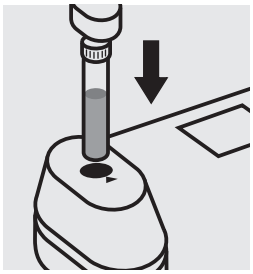
Add to each cell 5.0 ml of **Ca-1** with pipette, close with the screw cap, and mix.

Add to each cell 4 drops of **Ca-2**, close with the screw cap, and mix.

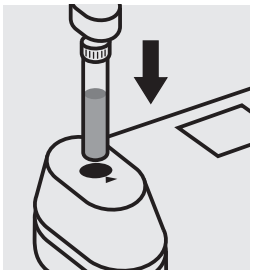


Add to each cell 4 drops of **Ca-3**, close with the screw cap, and mix.

Reaction time:
8 minutes, **measure immediately**.
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Press (Test).

Quality assurance:

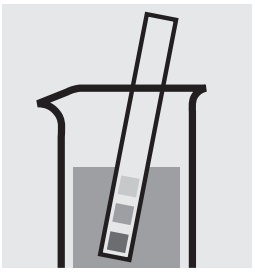
To check the measurement system (test reagents, measurement device, and handling) ready-for-use calcium standard solution CertiPUR®, Cat.No. 119778, concentration 1000 mg/l Ca, can be used after diluting accordingly.

Chloride

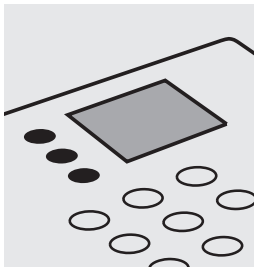
114730

Cell Test

Measuring range: 5 – 125 mg/l Cl 16-mm cell



Check the pH of the sample, specified range: pH 1 – 12.
If required, add dilute ammonia solution or nitric acid drop by drop to adjust the pH.

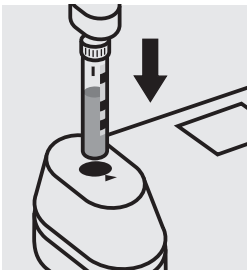


Select method (1)(2)(0).

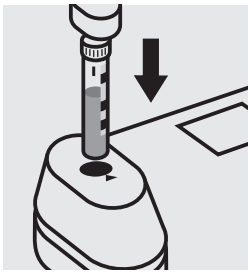
Pipette 0.50 ml each of **CI-1K** into two reaction cells, close with the screw cap, and mix.

Add to one cell 1.0 ml of the sample with pipette, close with the screw cap, and mix.

Add to the second cell 1.0 ml of distilled water, close with the screw cap, and mix.
(Blank cell)



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10 and 20, Cat.No. 114676 and 114675.

Ready-for-use chloride standard solution CertiPUR®, Cat.No. 119897, concentration 1000 mg/l Cl^-, can also be used after diluting accordingly.

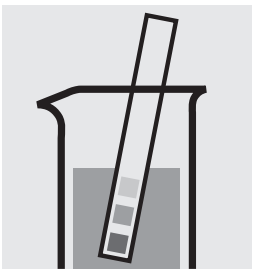
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck) is highly recommended.

Chloride

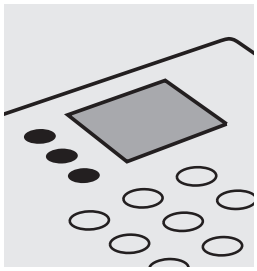
114897

Test

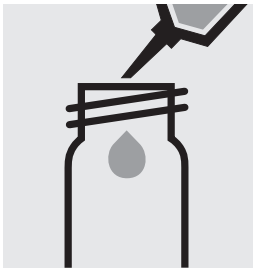
Measuring range: 10 – 250 mg/l Cl 16-mm cell



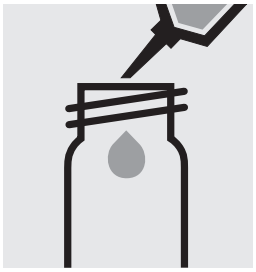
Check the pH of the sample, specified range: pH 1 – 12.
If required, add dilute ammonia solution or nitric acid drop by drop to adjust the pH.



Select method (1)(2)(1).



Pipette 1.0 ml of the sample into a 16-mm cell.

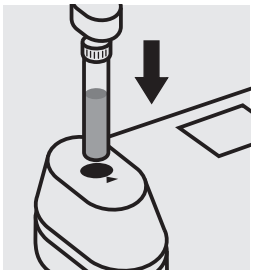


Pipette 1.0 ml of distilled water into a second 16-mm cell. (Blank cell)

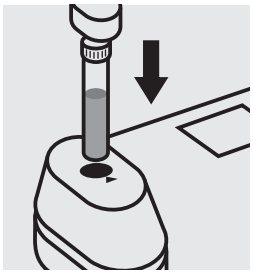
Add to each cell 2.5 ml of **Cl-1** with pipette, close with the screw cap, and mix.

Add to each cell 0.50 ml of **Cl-2** with pipette, close with the screw cap, and mix.

Reaction time:
1 minute
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Press (Zero).



Insert the cell containing the sample into the cell compartment. Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 60, Cat.No. 114696.

Ready-for-use chloride standard solution CertiPUR®, Cat.No. 119897, concentration 1000 mg/l Cl^-, can also be used after diluting accordingly.

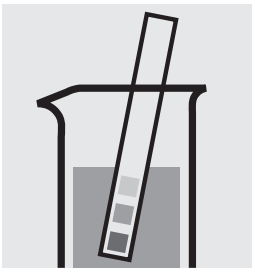
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 60) is highly recommended.

Chloride

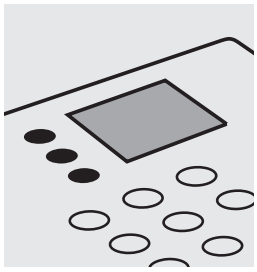
101804

Cell Test

Measuring range: 0.5 – 15.0 mg/l Cl 16-mm cell

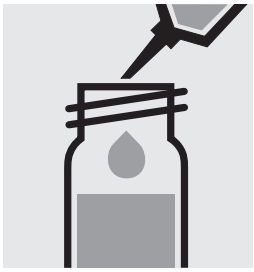


Check the pH of the sample, specified range: pH 3 – 11.
If required, add dilute ammonia solution or nitric acid drop by drop to adjust the pH.

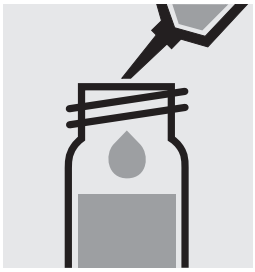


Select method (1)(2)(2).

Pipette 10 ml of the sample into a reaction cell, close with the screw cap, and mix.

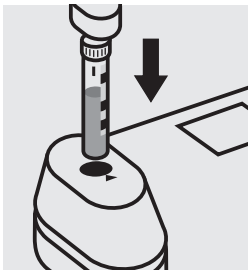


Pipette 10 ml of distilled water into a second reaction cell, close with the screw cap, and mix. (Blank cell)

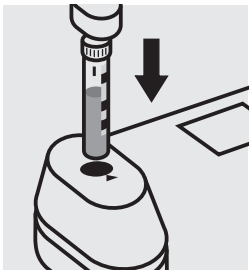


Add 0.25 ml each of **Cl-1K** with pipette, close with the screw cap, and mix.

Reaction time:
10 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

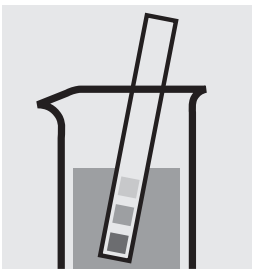
To check the measurement system (test reagents, measurement device, and handling) ready-for-use chloride standard solution CertiPUR®, Cat.No. 119897, concentration 1000 mg/l Cl^-, can be used after diluting accordingly.

Chloride

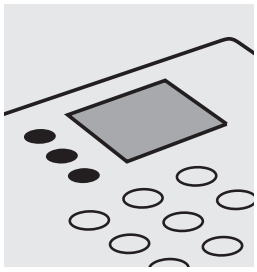
101807

Test

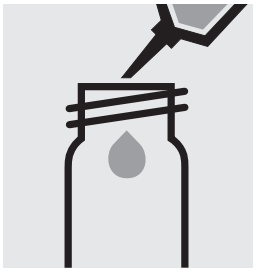
Measuring range: 0.50 – 5.00 mg/l Cl 24-mm cell



Check the pH of the sample, specified range: pH 3 – 11.
If required, add dilute ammonia solution or nitric acid drop by drop to adjust the pH.



Select method (1)(2)(3).



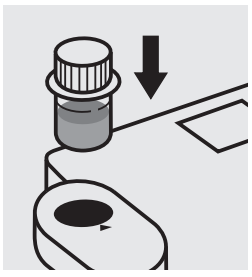
Pipette 0.20 ml each of **Cl-1** into two 24-mm cells.

Add 10 ml of the sample with pipette, close with the screw cap, and mix.

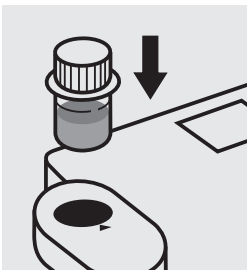
Add to the second cell 10 ml of distilled water (Water for process analysis, Cat.No. 101051, is recommended) with pipette, close with the screw cap, and mix. (Blank cell)

Add to each cell 0.20 ml of **Cl-2** with pipette, close with the screw cap, and mix.

Reaction time:
10 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-for-use chloride standard solution CertiPUR®, Cat.No. 119897, concentration 1000 mg/l Cl^-, can be used after diluting accordingly.

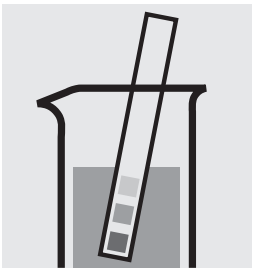
Chlorine

Determination of free chlorine

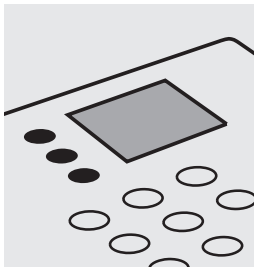
100595

Cell Test

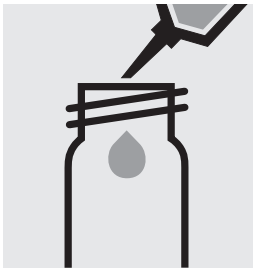
Measuring range: 0.05 – 5.00 mg/l Cl_2 16-mm cell



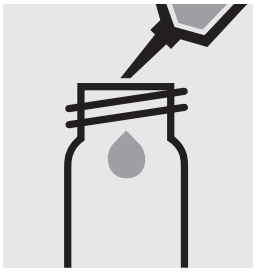
Check the pH of the sample, specified range: pH 4 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method (1)(3)(0), select subitem >>free.

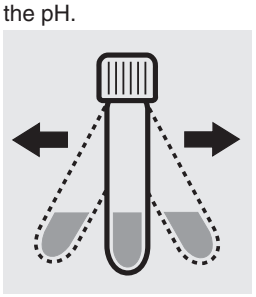


Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



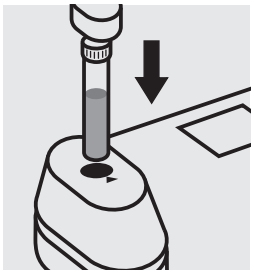
Pipette 5.0 ml of the sample into a round cell.

Add 1 level blue microspoon of **Cl_2-1**, close with the screw cap.

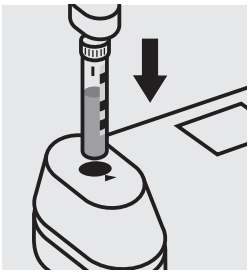


Shake the cell vigorously to dissolve the solid substance.

Reaction time:
1 minute
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Important:

Very high chlorine concentrations in the sample produce yellow-coloured solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section “Standard solutions”).

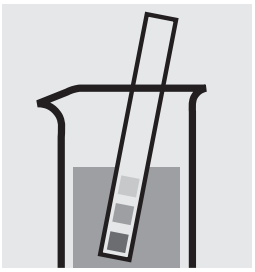
Chlorine

Determination of free chlorine

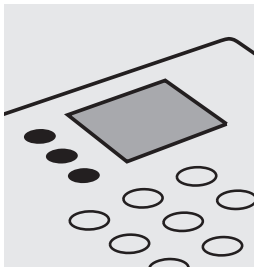
100597

Cell Test

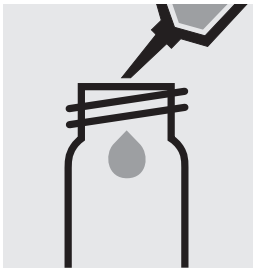
Measuring range: 0.05 – 5.00 mg/l Cl_2 16-mm cell



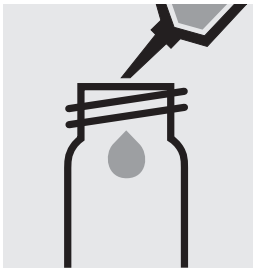
Check the pH of the sample, specified range: pH 4 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method (1)(3)(0), select subitem >>free.

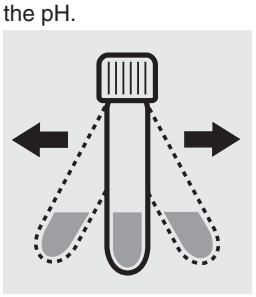


Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



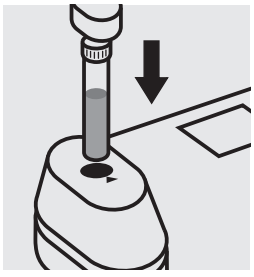
Pipette 5.0 ml of the sample into a round cell.

Add 1 level blue microspoon of **Cl_2-1**, close with the screw cap.

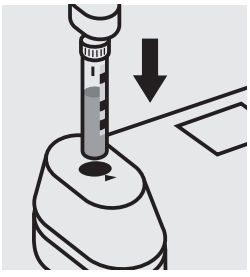


Shake the cell vigorously to dissolve the solid substance.

Reaction time:
1 minute
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Important:

Very high chlorine concentrations in the sample produce yellow-coloured solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section “Standard solutions”).

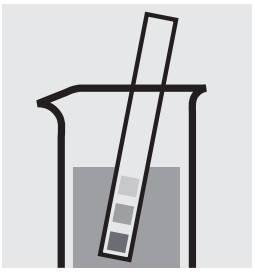
Chlorine

Determination of total chlorine

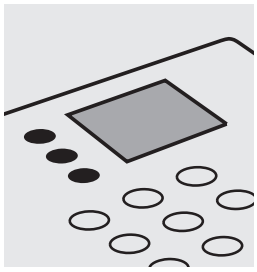
100597

Cell Test

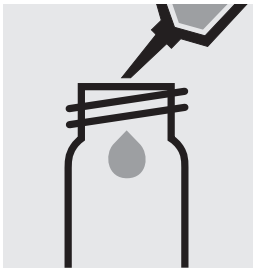
Measuring range: 0.05 – 5.00 mg/l Cl_2 16-mm cell



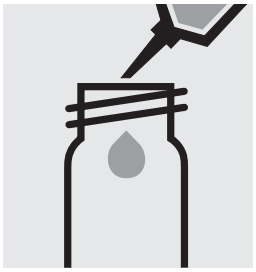
Check the pH of the sample, specified range: pH 4 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method (1)(3)(0), select subitem >>total.

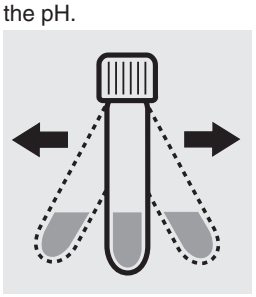


Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)

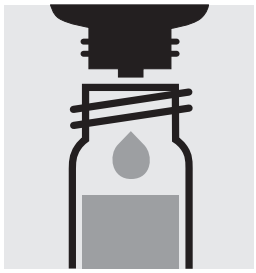


Pipette 5.0 ml of the sample into a round cell.

Add 1 level blue microspoon of **Cl_2-1**, close with the screw cap.

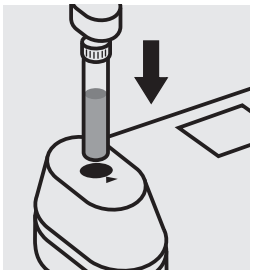


Shake the cell vigorously to dissolve the solid substance.

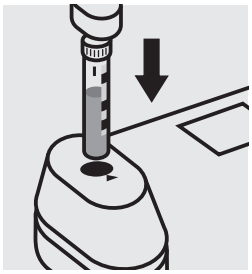


Add 2 drops of **Cl_2-2**, close with the screw cap, and mix.

Reaction time:
1 minute
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Important:

Very high chlorine concentrations in the sample produce yellow-coloured solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).
After each determination of total chlorine rinse the cell with sulfuric acid 25 % and subsequently several times with distilled water.

Quality assurance:

To check the measurement system (test reagents,measurement device, and handling) a freshly prepared standard from Chloramine T GR, Cat.No. 102426, can be used (see section “Standard solutions”).

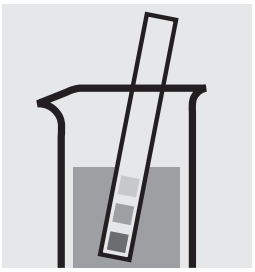
Chlorine

Determination of free chlorine, total chlorine, and combined chlorine

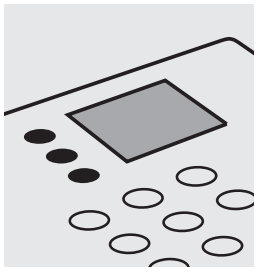
100597

Cell Test

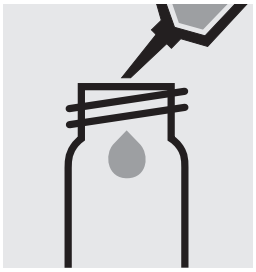
Measuring range: 0.05 – 5.00 mg/l Cl_2 16-mm cell



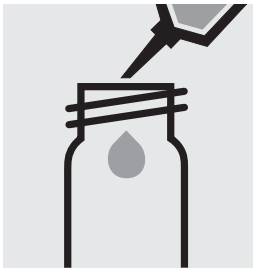
Check the pH of the sample, specified range: pH 4 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method (1)(3)(0), select subitem >>diff.

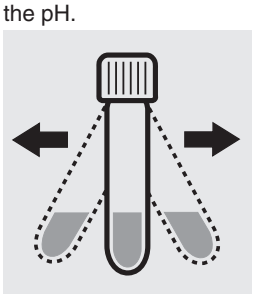


Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



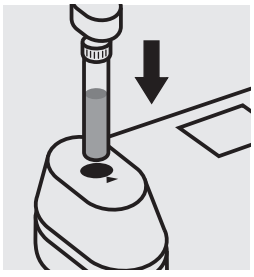
Pipette 5.0 ml of the sample into a round cell.

Add 1 level blue micro-spoon of **Cl_2-1**, close with the screw cap.

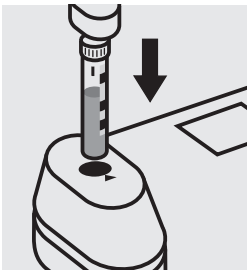


Shake the cell vigorously to dissolve the solid substance.

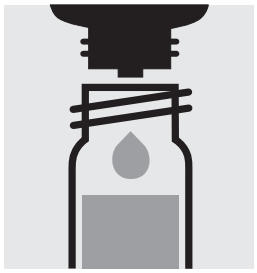
Reaction time:
1 minute
Press (Enter) to start the countdown.



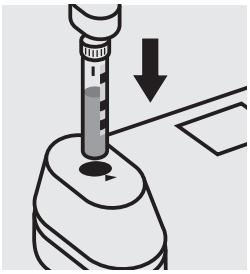
Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test). **(= T1)**



Remove sample cell from the photometer, open, add 2 drops of **Cl_2-2**, close with the screw cap, and mix.



Insert anew the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).
(= T2)

Important:

Very high chlorine concentrations in the sample produce yellow-coloured solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).
After each determination of total chlorine rinse the cell with sulfuric acid 25 % and subsequently several times with distilled water.
For on-the-spot determinations where there are no suitable facilities for rinsing, the cell contents can be transferred to a new 16-mm cell before the addition of reagent Cl_2-2. Use this second cell **only** for the determination of **total chlorine**!

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section “Standard solutions”).

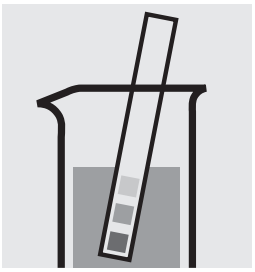
Chlorine

Determination of free chlorine

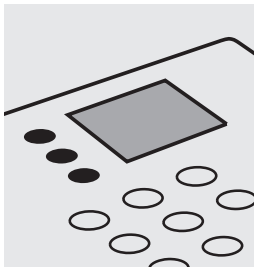
100598

Test

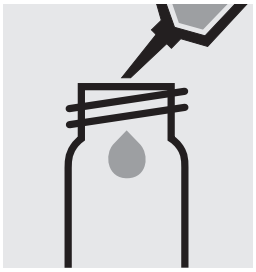
Measuring range: 0.02 – 3.00 mg/l Cl_2 24-mm cell



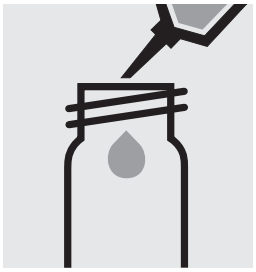
Check the pH of the sample, specified range: pH 4 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method (1)(3)(1), select subitem >>free.

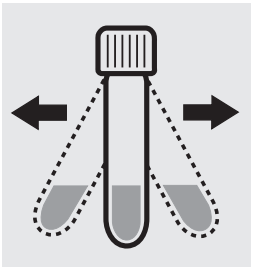


Fill approx. 10 ml of distilled water into a 24-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)



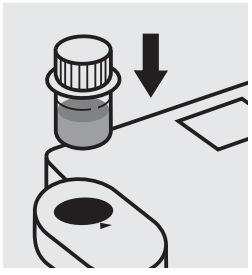
Pipette 10 ml of the sample into a 24-mm cell.

Add 1 level blue microspoon of **Cl_2-1**, close with the screw cap.

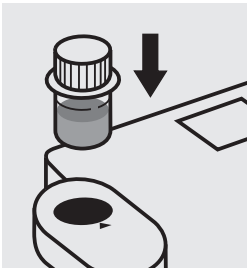


Shake the cell vigorously to dissolve the solid substance.

Reaction time:
1 minute
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Important:

Very high chlorine concentrations in the sample produce yellow-coloured solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section “Standard solutions”).

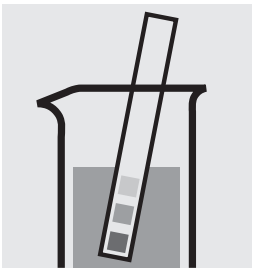
Chlorine

Determinatin of total chlorine

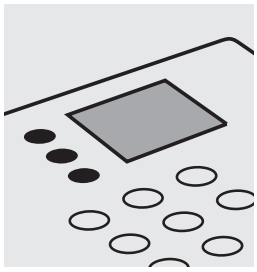
100602

Test

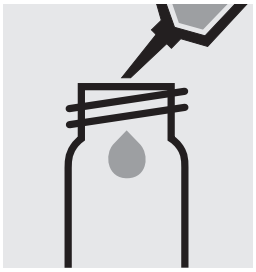
Measuring range: 0.02 – 3.00 mg/l Cl_2 24-mm cell



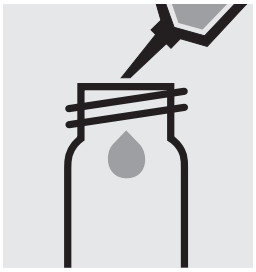
Check the pH of the sample, specified range: pH 4 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method (1)(3)(1), select subitem >>total.

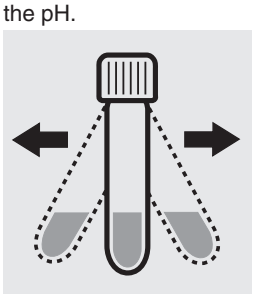


Fill approx. 10 ml of distilled water into a 24-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)

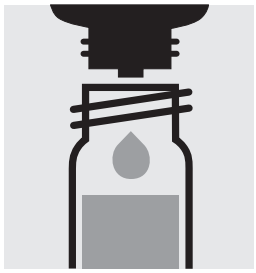


Pipette 10 ml of the sample into a 24-mm cell.

Add 1 level blue microspoon of **Cl_2-1**, close with the screw cap.

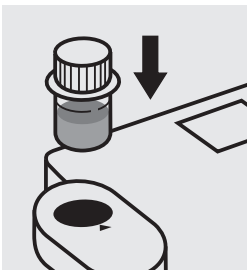


Shake the cell vigorously to dissolve the solid substance.

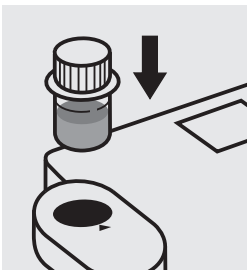


Add 2 drops of **Cl_2-2**, close with the screw cap, and mix.

Reaction time:
1 minute
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Important:

Very high chlorine concentrations in the sample produce yellow-coloured solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).
After each determination of total chlorine rinse the cell with sulfuric acid 25 % and subsequently several times with distilled water.

Quality assurance:

To check the measurement system (test reagents,measurement device, and handling) a freshly prepared standard from Chloramine T GR, Cat.No. 102426, can be used (see section “Standard solutions”).

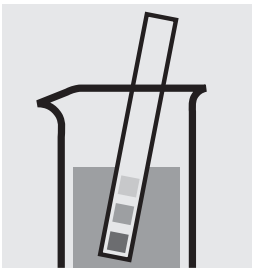
Chlorine

Detemination of free chlorine

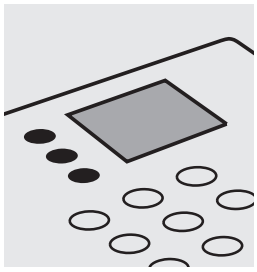
100599

Test

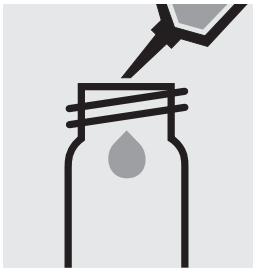
Measuring range: 0.02 – 3.00 mg/l Cl_2 24-mm cell



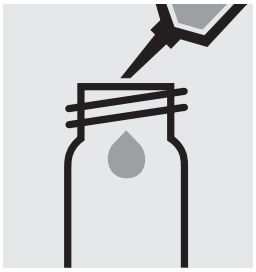
Check the pH of the sample, specified range: pH 4 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method (1)(3)(1), select subitem >>free.

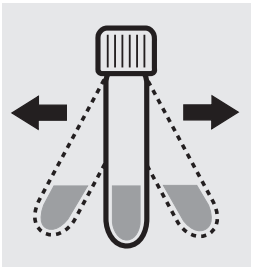


Fill approx. 10 ml of distilled water into a 24-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)



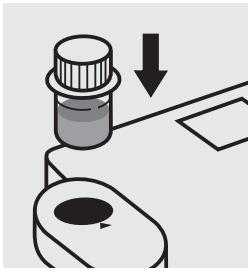
Pipette 10 ml of the sample into a 24-mm cell.

Add 1 level blue microspoon of **Cl_2-1**, close with the screw cap.

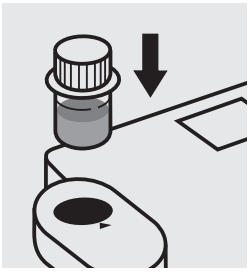


Shake the cell vigorously to dissolve the solid substance.

Reaction time:
1 minute
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Important:

Very high chlorine concentrations in the sample produce yellow-coloured solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section “Standard solutions”).

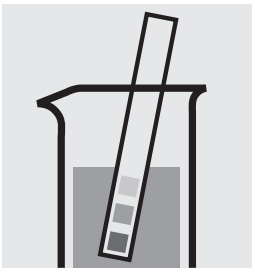
Chlorine

Determination of total chlorine

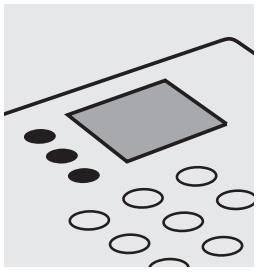
100599

Test

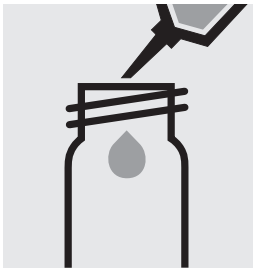
Measuring range: 0.02 – 3.00 mg/l Cl_2 24-mm cell



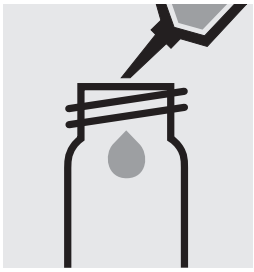
Check the pH of the sample, specified range: pH 4 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method (1)(3)(1), select subitem >>total.

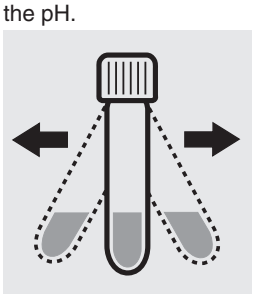


Fill approx. 10 ml of distilled water into a 24-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)

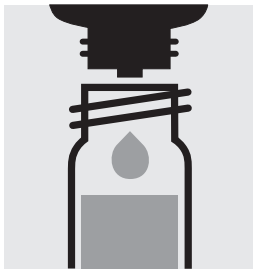


Pipette 10 ml of the sample into a 24-mm cell.

Add 1 level blue microspoon of **Cl_2-1**, close with the screw cap.

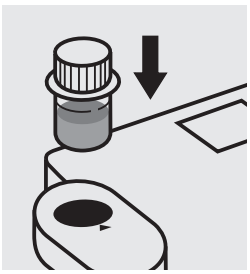


Shake the cell vigorously to dissolve the solid substance.

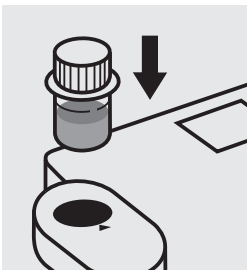


Add 2 drops of **Cl_2-2**, close with the screw cap, and mix.

Reaction time:
1 minute
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Important:

Very high chlorine concentrations in the sample produce yellow-coloured solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).
After each determination of total chlorine rinse the cell with sulfuric acid 25 % and subsequently several times with distilled water.

Quality assurance:

To check the measurement system (test reagents,measurement device, and handling) a freshly prepared standard from Chloramine T GR, Cat.No. 102426, can be used (see section “Standard solutions”).

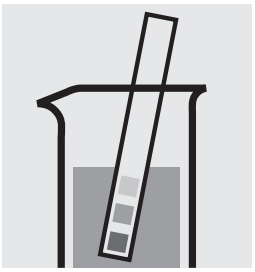
Chlorine

Determination of free chlorine, total chlorine, and combined chlorine

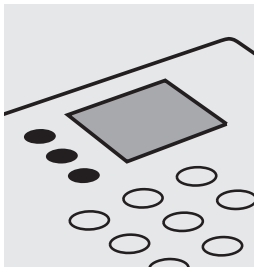
100599

Test

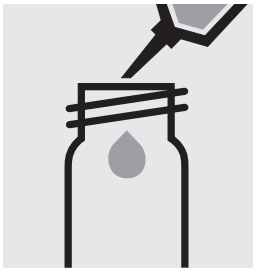
Measuring range: 0.02 – 3.00 mg/l Cl_2 24-mm cell



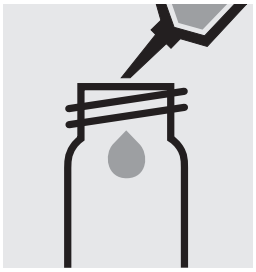
Check the pH of the sample, specified range: pH 4 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method (1)(3)(1), select subitem >>diff.

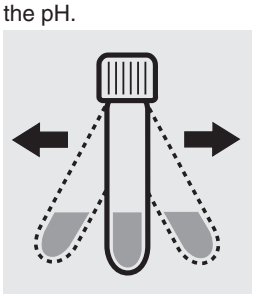


Fill approx. 10 ml of distilled water into a 24-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)



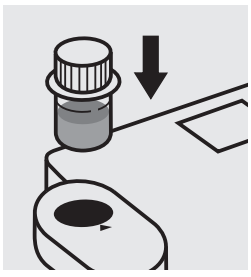
Pipette 10 ml of the sample into a 24-mm cell.

Add 1 level blue microspoon of **Cl_2-1**, close with the screw cap.

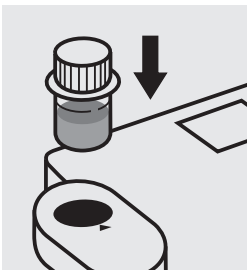


Shake the cell vigorously to dissolve the solid substance.

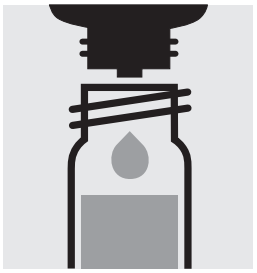
Reaction time:
1 minute
Press (Enter) to start the countdown.



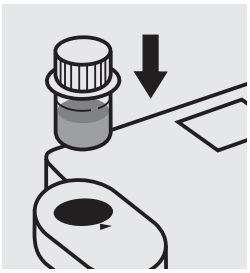
Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test). **(= T1)**



Remove the sample cell from the photometer, open, add 2 drops of **Cl_2-2**, close with the screw cap, and mix.



Insert anew the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test). **(= T2)**

Important:

Very high chlorine concentrations in the sample produce yellow-coloured solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).
After each determination of total chlorine rinse the cell with sulfuric acid 25 % and subsequently several times with distilled water.
For on-the-spot determinations where there are no suitable facilities for rinsing, the cell contents can be transferred to a new 24-mm cell before the addition of reagent Cl_2-2. Use this second cell **only** for the determination of **total chlorine**!

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section “Standard solutions”).

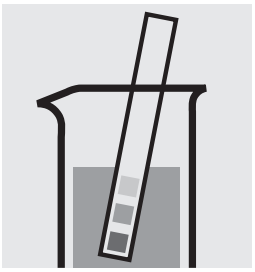
Chlorine (with liquid reagents)

Detemination of free chlorine

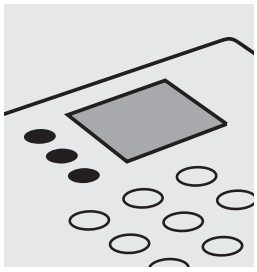
100086/100087

Cell Test

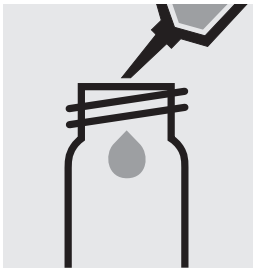
Measuring range: 0.05– 5.00 mg/l Cl_2 16-mm cell



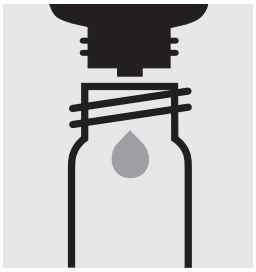
Check the pH of the sample, specified range: pH 4 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



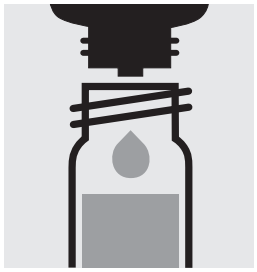
Select method (1)(3)(2), select subitem >>free.



Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



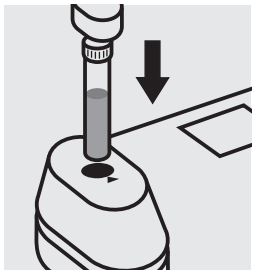
Place 6 drops of **Cl_2-1** into a round cell.



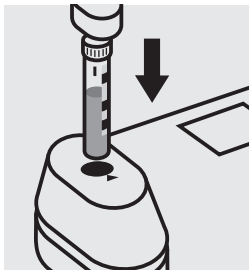
Add 3 drops of **Cl_2-2**, close with the screw cap, and mix.

Add 10 ml of the sample with pipette, close with the screw cap, and mix.

Reaction time:
1 minute
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Important:

Very high chlorine concentrations in the sample produce yellow-coloured solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section “Standard solutions”).

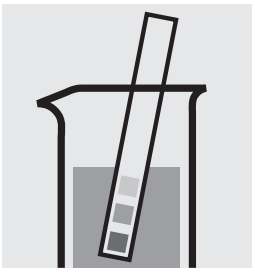
Chlorine (with liquid reagents)

Detemination of free chlorine

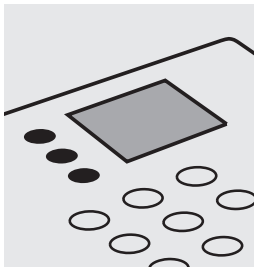
100086/100087

Test

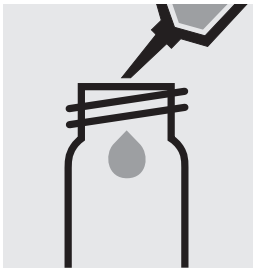
Measuring range: 0.02– 3.00 mg/l Cl_2 24-mm cell



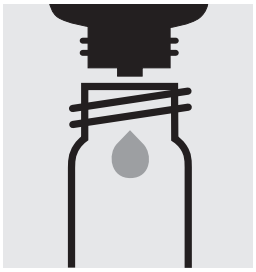
Check the pH of the sample, specified range: pH 4 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



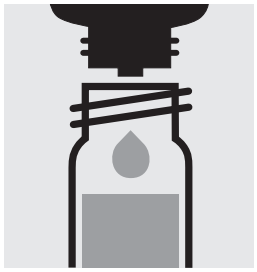
Select method (1)(3)(3), select subitem >>free.



Fill approx. 10 ml of distilled water into an empty 24-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



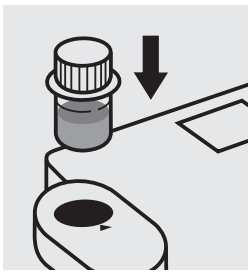
Place 6 drops of **Cl_2-1** into a 24-mm cell.



Add 3 drops of **Cl_2-2**, close with the screw cap, and mix.

Add 10 ml of the sample with pipette, close with the screw cap, and mix.

Reaction time:
1 minute
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).

Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Important:

Very high chlorine concentrations in the sample produce yellow-coloured solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section “Standard solutions”).

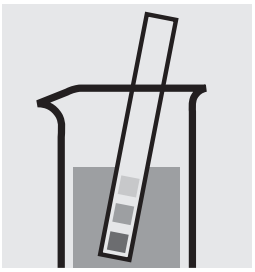
Chlorine (with liquid reagents)

Detemination of total chlorine

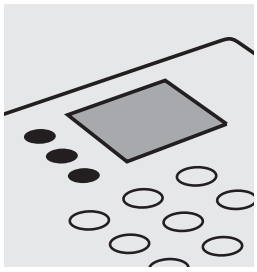
100086/100087/ 100088

Cell Test

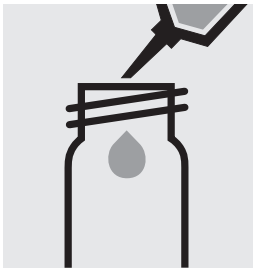
Measuring range: 0.05– 5.00 mg/l Cl_2 16-mm cell



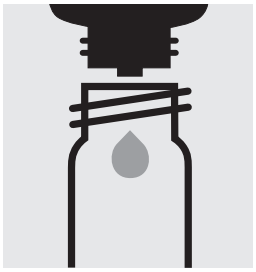
Check the pH of the sample, specified range: pH 4 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



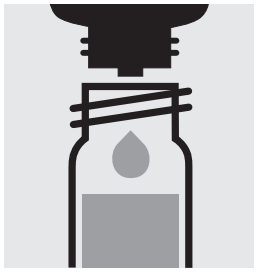
Select method (1)(3)(2), select subitem >>total.



Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)

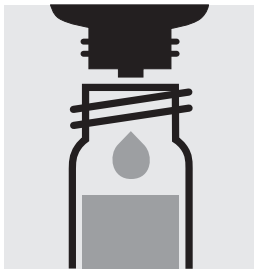


Place 6 drops of **Cl_2-1** into a round cell.



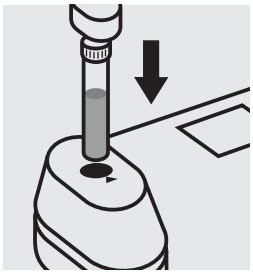
Add 3 drops of **Cl_2-2**, close with the screw cap, and mix.

Add 10 ml of the sample with pipette, close with the screw cap, and mix.

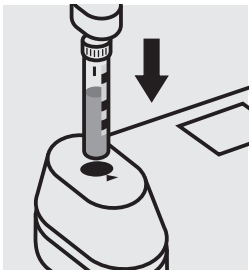


Add 2 drops of **Cl_2-3**, close with the screw cap, and mix.

Reaction time:
1 minute
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Important:

Very high chlorine concentrations in the sample produce yellow-coloured solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).
After each determination of total chlorine rinse the cell with sulfuric acid 25 % and subsequently several times with distilled water.

Quality assurance:

To check the measurement system (test reagents,measurement device, and handling) a freshly prepared standard from Chloramine T GR, Cat.No. 102426, can be used (see section “Standard solutions”).

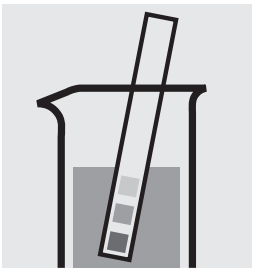
Chlorine (with liquid reagents)

Detemination of total chlorine

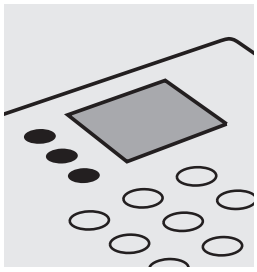
100086/100087/ 100088

Test

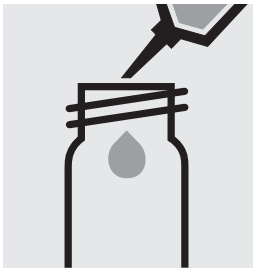
Measuring range: 0.02– 3.00 mg/l Cl_2 24-mm cell



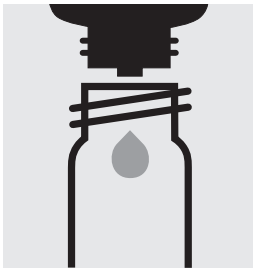
Check the pH of the sample, specified range: pH 4 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



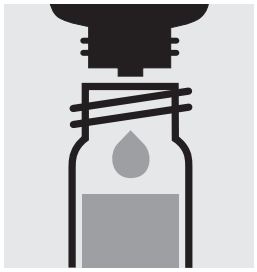
Select method (1)(3)(3), select subitem >>total.



Fill approx. 10 ml of distilled water into an empty 24-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)

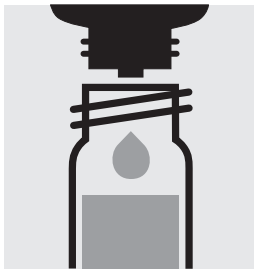


Place 6 drops of **Cl_2-1** into a 24-mm cell.



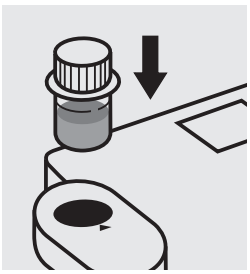
Add 3 drops of **Cl_2-2**, close with the screw cap, and mix.

Add 10 ml of the sample with pipette, close with the screw cap, and mix.

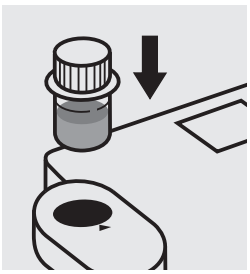


Add 2 drops of **Cl_2-3**, close with the screw cap, and mix.

Reaction time:
1 minute
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Important:

Very high chlorine concentrations in the sample produce yellow-coloured solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).
After each determination of total chlorine rinse the cell with sulfuric acid 25 % and subsequently several times with distilled water.

Quality assurance:

To check the measurement system (test reagents,measurement device, and handling) a freshly prepared standard from Chloramine T GR, Cat.No. 102426, can be used (see section “Standard solutions”).

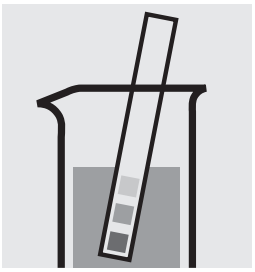
Chlorine (with liquid reagents)

Determination of free chlorine, total chlorine, and combined chlorine

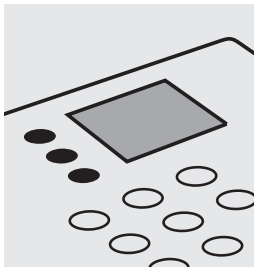
100086/100087/ 100088

Cell Test

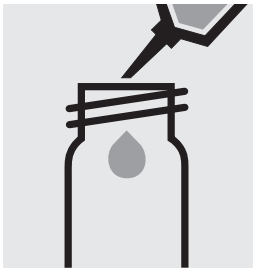
Measuring range: 0.05– 5.00 mg/l Cl_2 16-mm cell



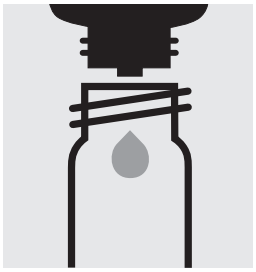
Check the pH of the sample, specified range: pH 4 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



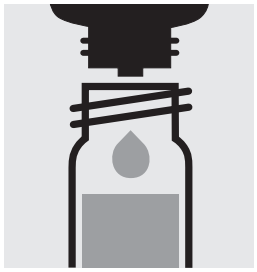
Select method (1)(3)(2), select subitem >>dif.



Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



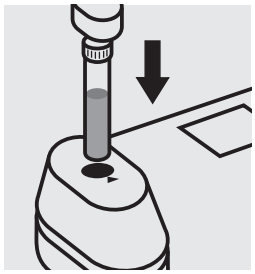
Place 6 drops of **Cl_2-1** into a round cell.



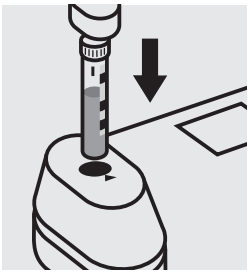
Add 3 drops of **Cl_2-2**, close with the screw cap, and mix.

Add 10 ml of the sample with pipette, close with the screw cap, and mix.

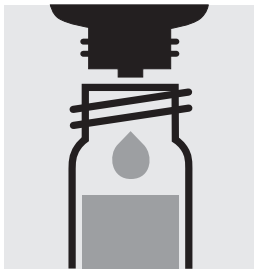
Reaction time:
1 minute
Press (Enter) to start the countdown.



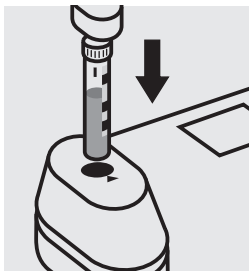
Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test). **(= T1)**



Remove the sample cell from the photometer, open, add 2 drops of **Cl_2-3**, close with the screw cap, and mix.



Insert anew the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).
(= T2)

Important:

Very high chlorine concentrations in the sample produce yellow-coloured solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).
After each determination of total chlorine rinse the cell with sulfuric acid 25 % and subsequently several times with distilled water.
For on-the-spot determinations where there are no suitable facilities for rinsing, the cell contents can be transferred to a new 16-mm cell before the addition of reagent Cl_2-3. Use this second cell **only** for the determination of **total chlorine**!

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section “Standard solutions”).

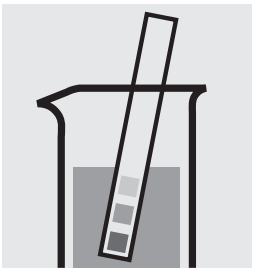
Chlorine (with liquid reagents)

Determination of free chlorine, total chlorine, and combined chlorine

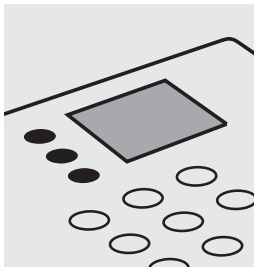
100086/100087/ 100088

Test

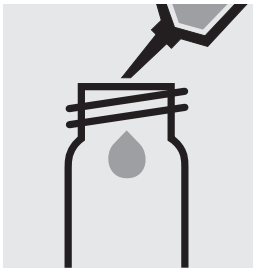
Measuring range: 0.02– 3.00 mg/l Cl_2 24-mm cell



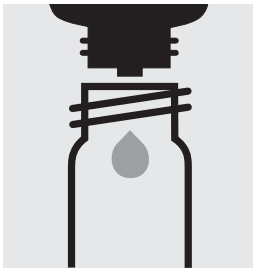
Check the pH of the sample, specified range: pH 4 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



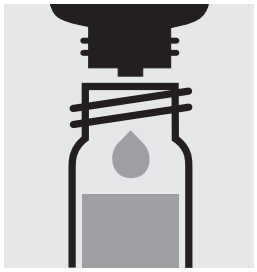
Select method (1)(3)(3), select subitem >>diff.



Fill approx. 10 ml of distilled water into an empty 24-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



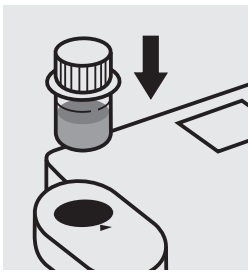
Place 6 drops of **Cl_2-1** into a 24-mm cell.



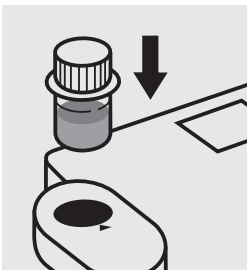
Add 3 drops of **Cl_2-2**, close with the screw cap, and mix.

Add 10 ml of the sample with pipette, close with the screw cap, and mix.

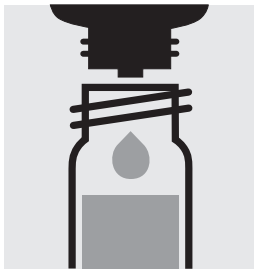
Reaction time:
1 minute
Press (Enter) to start the countdown.



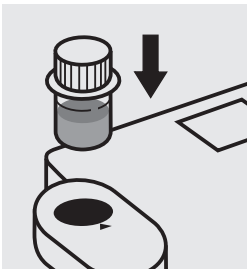
Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test). **(= T1)**



Remove the sample cell from the photometer, open, add 2 drops of **Cl_2-3**, close with the screw cap, and mix.



Insert anew the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test). **(= T2)**

Important:

Very high chlorine concentrations in the sample produce yellow-coloured solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).
After each determination of total chlorine rinse the cell with sulfuric acid 25 % and subsequently several times with distilled water.
For on-the-spot determinations where there are no suitable facilities for rinsing, the cell contents can be transferred to a new 24-mm cell before the addition of reagent Cl_2-3. Use this second cell **only** for the determination of **total chlorine**!

Quality assurance:

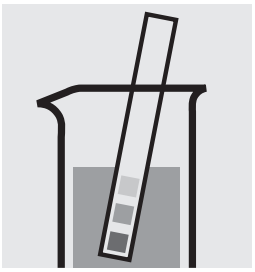
To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section “Standard solutions”).

Chlorine Dioxide

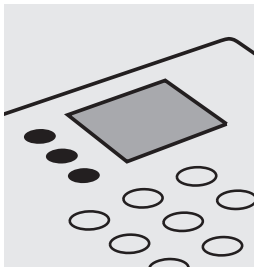
100608

Test

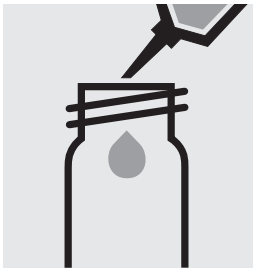
Measuring range: 0.10 – 5.00 mg/l ClO_2 24-mm cell



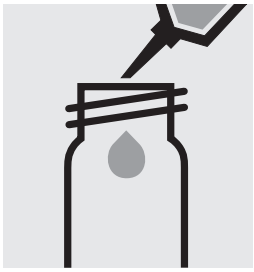
Check the pH of the sample, specified range: pH 4 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



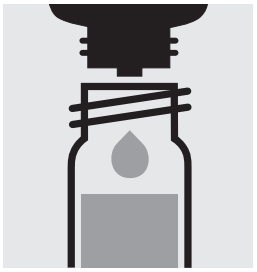
Select method 1 4 0.



Fill approx. 10 ml of distilled water into a 24-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)



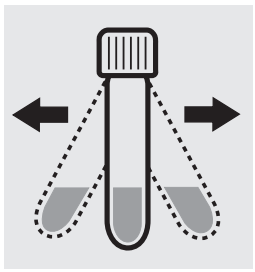
Pipette 10 ml of the sample into a 24-mm cell.



Add 2 drops of **ClO_2-1**, close with the screw cap, and mix.

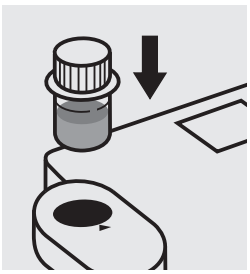
Reaction time:
2 minutes
Press Enter to start the countdown.

Add 1 level blue microspoon of **ClO_2-2**, close with the screw cap.

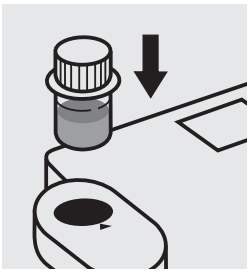


Shake the cell vigorously to dissolve the solid substance.

Reaction time:
1 minute
Press Enter to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Important:

Very high chlorine dioxide concentrations in the sample produce yellow-coloured solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section “Standard solutions”).

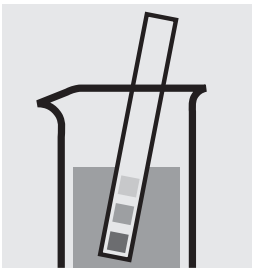
Chromate

114552

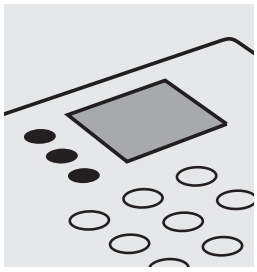
Determination of chromium(VI)

Cell Test

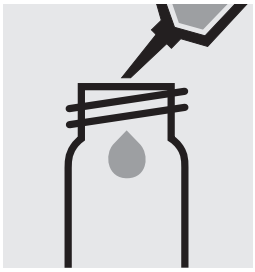
Measuring range:	0.05 – 2.00 mg/l Cr	16-mm cell
	0.11 – 4.46 mg/l CrO_4	16-mm cell



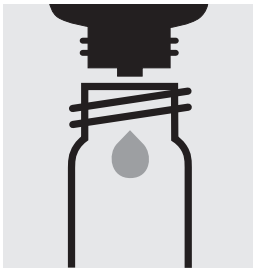
Check the pH of the sample, specified range: pH 1 – 9.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



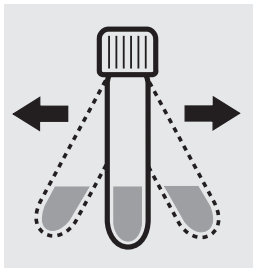
Select method (1)(5)(0).



Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



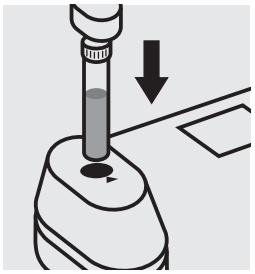
Add 6 drops of **Cr-3K** into a reaction cell, close with the screw cap.



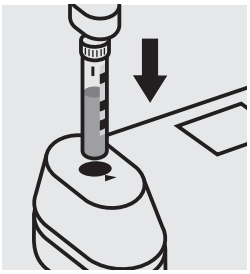
Shake the cell vigorously to dissolve the solid substance and leave to stand for **1 minute**.

Add 5.0 ml of the sample with pipette, close with the screw cap, and mix.

Reaction time:
1 minute
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-for-use chromate standard solution CertiPUR®, Cat.No. 119780, concentration 1000 mg/l CrO_4^{2-}, can be used after diluting accordingly.

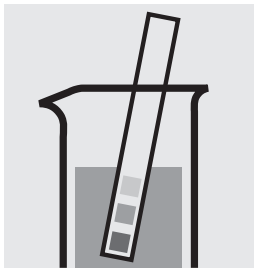
Chromate

Determination of total chromium
= sum of chromium(VI) and chromium(III)

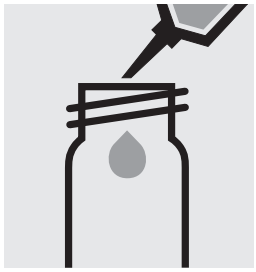
114552

Cell Test

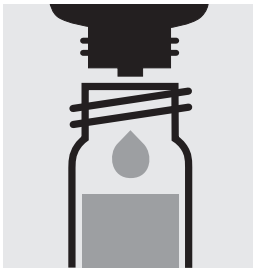
Measuring range:	0.05 – 2.00 mg/l Cr	16-mm cell
	0.11 – 4.46 mg/l CrO_4	16-mm cell



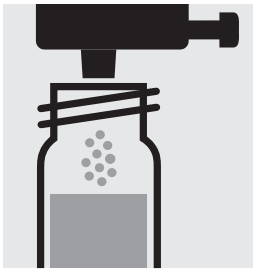
Check the pH of the sample, specified range: pH 1 – 9.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



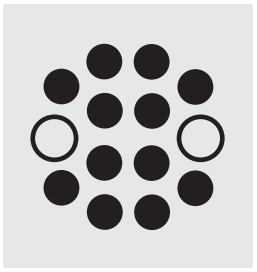
Pipette 10 ml of the sample into an empty 16-mm cell.



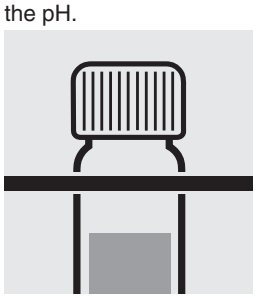
Add 1 drop of **Cr-1K**, close with the screw cap, and mix.



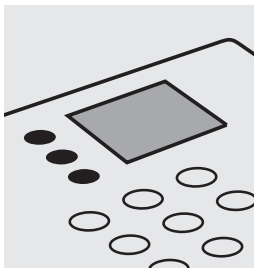
Add 1 dose of **Cr-2K** using the blue dose-metering cap, close the reaction cell with the screw cap.



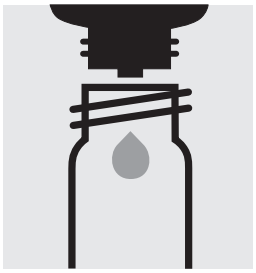
Heat the cell in the thermoreactor at 120 °C (100 °C) for 1 hour.



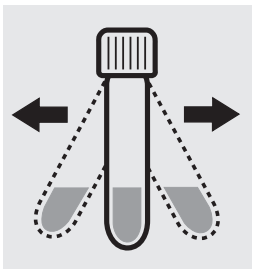
Remove the cell from the thermoreactor and place in a test-tube rack to cool to room temperature: **pretreated sample**.



Select method (1)(5)(0).



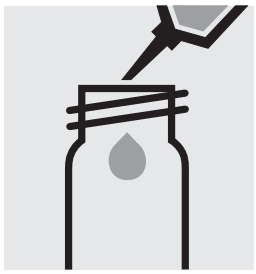
Add 6 drops of **Cr-3K** into a reaction cell, close with the screw cap.



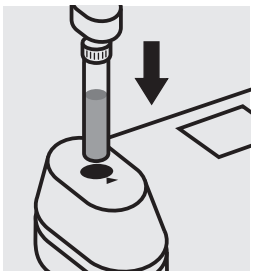
Shake the cell vigorously to dissolve the solid substance and leave to stand for **1 minute**.

Add 5.0 ml of the **pretreated sample** with pipette, close with the screw cap, and mix.

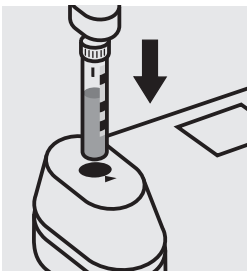
Reaction time:
1 minute
Press (Enter) to start the countdown.



Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-for-use chromate standard solution CertiPUR®, Cat.No. 119780, concentration 1000 mg/l CrO_4^{2-}, can be used after diluting accordingly.

Chromate

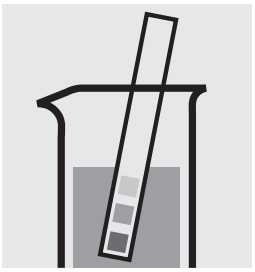
Determination of chromium(VI)

114758

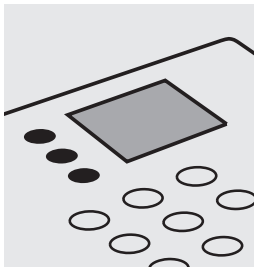
Test

Measuring range:	10 – 1400 µg/l Cr	24-mm cell
	22 – 3123 µg/l CrO_4	24-mm cell

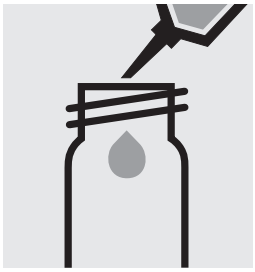
Attention: In contrast to the instructions given in the package insert the sample volume as well as the reagent volume must be doubled.



Check the pH of the sample, specified range: pH 1 – 9.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.

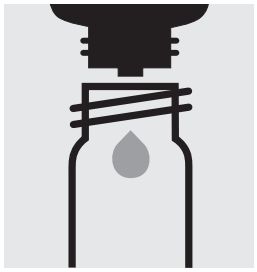


Select method (1)(5)(1).

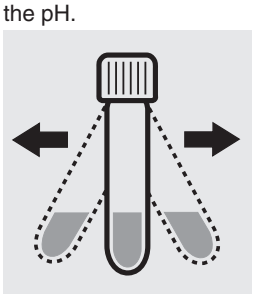


Fill approx. 10 ml of distilled water into a 24-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)

Place 2 level grey microspoons of **Cr-1** into a dry 24-mm cell.



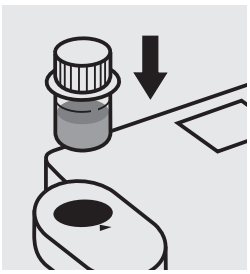
Add 12 drops of **Cr-2**, close with the screw cap.



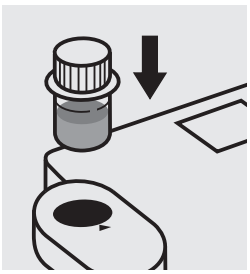
Shake the cell vigorously to dissolve the solid substance.

Add 10 ml of the sample with pipette, close with the screw cap, and mix.

Reaction time:
1 minute
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Important:

For the determination of **total chromium = sum of chromium(VI) and chromium(III)** a pretreatment with Crack Set 10C, Cat.No. 114688, or Crack Set 10, Cat.No. 114687 and thermoreactor is necessary.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-for-use chromate standard solution CertiPUR®, Cat.No. 119780, concentration 1000 mg/l CrO_4^{2-}, can be used after diluting accordingly.

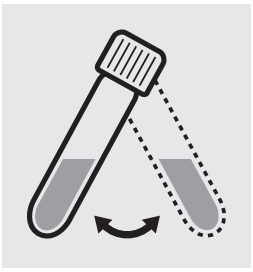
COD

Chemical Oxygen Demand

101796

Cell Test

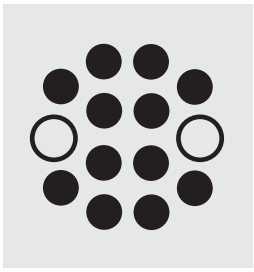
Measuring range: 5.0–80.0 mg/l COD or O_2 16-mm cell



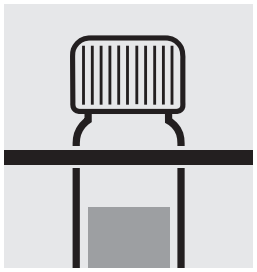
Suspend the bottom sediment in two cells by swirling.

Carefully pipette 2.0 ml of the sample into a reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes very hot!**

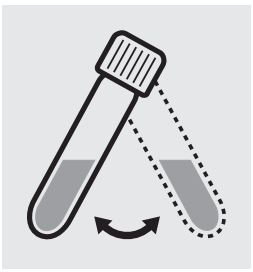
Carefully pipette 2.0 ml of distilled water (Water for process analysis, Cat.No. 101051, is recommended) into a second reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes very hot!** (Blank cell)



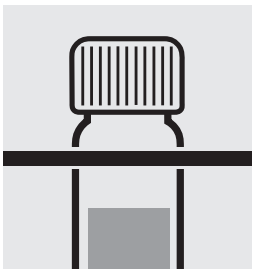
Heat both cells in the thermoreactor at 148 °C for 2 hours.



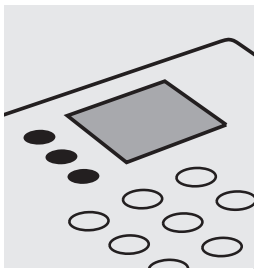
Remove both cells from the thermoreactor and place in a test-tube rack to cool.



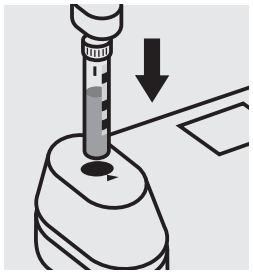
Swirl both cells after 10 minutes.



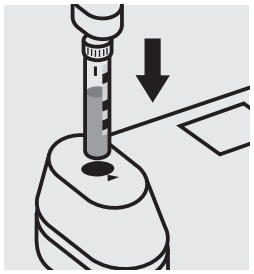
Replace both cells in the rack for complete cooling to room temperature. (**Very important!**)



Select method 1 6 8.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 50, Cat.No. 114695, or the Standard solution for photometric applications, CRM, Cat.No. 125028.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 50) is highly recommended.

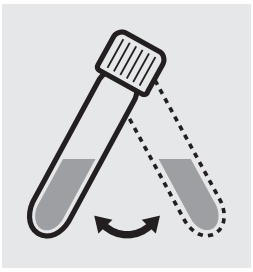
COD

Chemical Oxygen Demand

114540

Cell Test

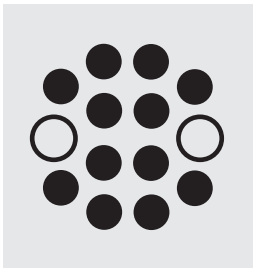
Measuring range: 10 – 150 mg/l COD or O_2 16-mm cell



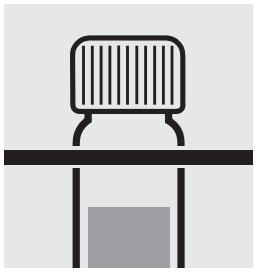
Suspend the bottom sediment in two cells by swirling.

Carefully pipette 3.0 ml of the sample into a reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes very hot!**

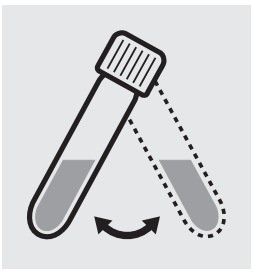
Carefully pipette 3.0 ml of distilled water (Water for process analysis, Cat.No. 101051, is recommended) into a second reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes very hot!** (Blank cell)



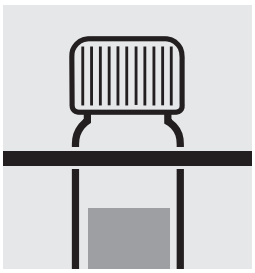
Heat both cells in the thermoreactor at 148 °C for 2 hours.



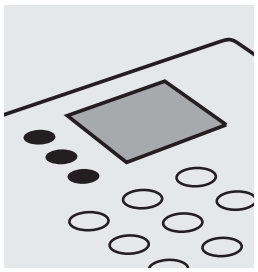
Remove both cells from the thermoreactor and place in a test-tube rack to cool.



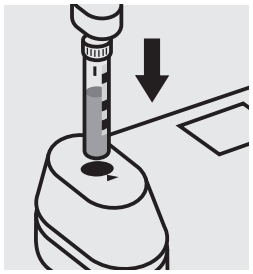
Swirl both cells after 10 minutes.



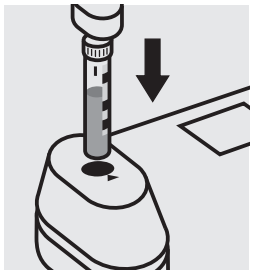
Replace both cells in the rack for complete cooling to room temperature. (**Very important!**)



Select method 1 6 0.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10, Cat.No. 114676, or the Standard solution for photometric applications, CRM, Cat.No. 125029.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 10) is highly recommended.

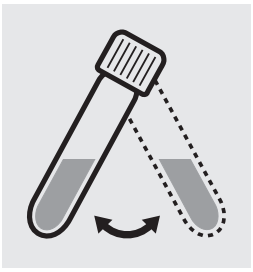
COD

Chemical Oxygen Demand

114895

Cell Test

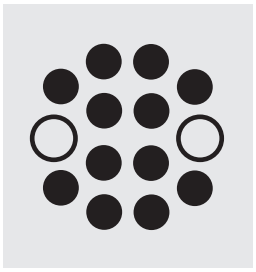
Measuring range: 15–300 mg/l COD or O_2 16-mm cell



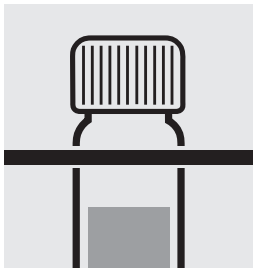
Suspend the bottom sediment in two cells by swirling.

Carefully pipette 2.0 ml of the sample into a reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes very hot!**

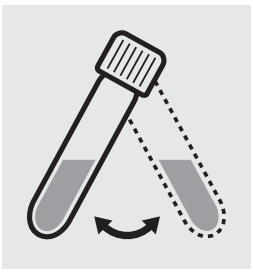
Carefully pipette 2.0 ml of distilled water (Water for process analysis, Cat.No. 101051, is recommended) into a second reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes very hot!** (Blank cell)



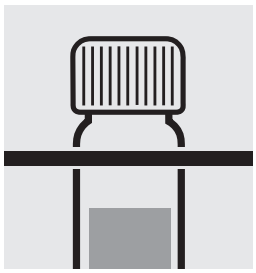
Heat both cells in the thermoreactor at 148 °C for 2 hours.



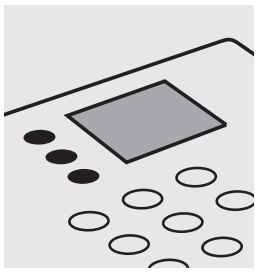
Remove both cells from the thermoreactor and place in a test-tube rack to cool.



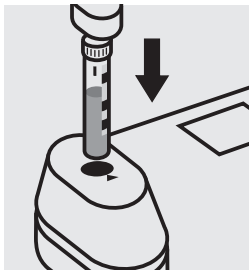
Swirl both cells after 10 minutes.



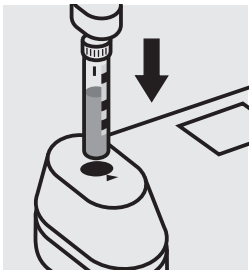
Replace both cells in the rack for complete cooling to room temperature. (**Very important!**)



Select method 1 6 1.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 60, Cat.No. 114696, or the Standard solution for photometric applications, CRM, Cat.No. 125029 and 125030.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 60) is highly recommended.

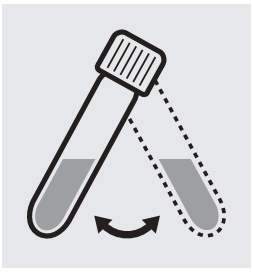
COD

Chemical Oxygen Demand

114690

Cell Test

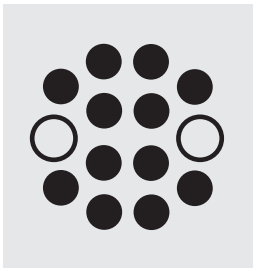
Measuring range: 50 – 500 mg/l COD or O_2 16-mm cell



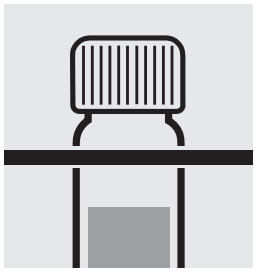
Suspend the bottom sediment in two cells by swirling.

Carefully pipette 2.0 ml of the sample into a reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes very hot!**

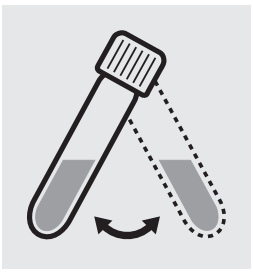
Carefully pipette 2.0 ml of distilled water (Water for process analysis, Cat.No. 101051, is recommended) into a second reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes very hot!** (Blank cell)



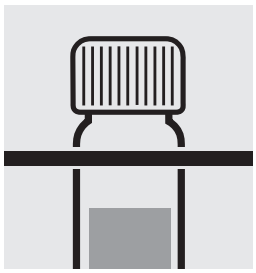
Heat both cells in the thermoreactor at 148 °C for 2 hours.



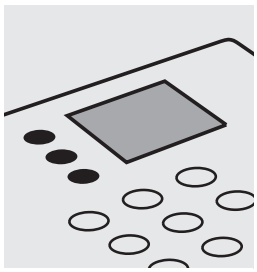
Remove both cells from the thermoreactor and place in a test-tube rack to cool.



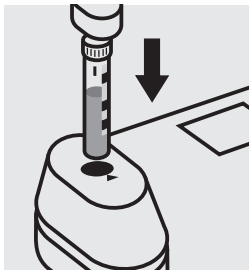
Swirl both cells after 10 minutes.



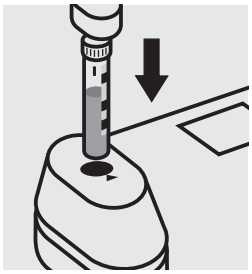
Replace both cells in the rack for complete cooling to room temperature. (**Very important!**)



Select method (1)(6)(2).



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 60, Cat.No. 114696, or the Standard solution for photometric applications, CRM, Cat.No. 125029, 125030, and 125031.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 60) is highly recommended.

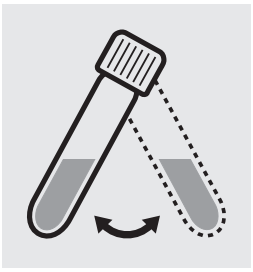
COD

Chemical Oxygen Demand

114541

Cell Test

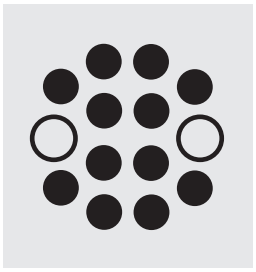
Measuring range: 25–1500 mg/l COD or O_2 16-mm cell



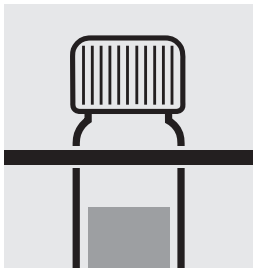
Suspend the bottom sediment in two cells by swirling.

Carefully pipette 3.0 ml of the sample into a reaction cell, close tightly with the screw cap, and mix vigorously.
Caution, the cell becomes very hot!

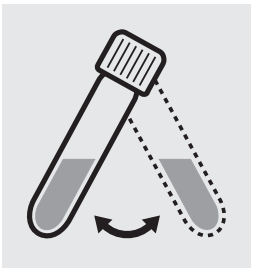
Carefully pipette 3.0 ml of distilled water into a second reaction cell, close tightly with the screw cap, and mix vigorously.
Caution, the cell becomes very hot!
(Blank cell)



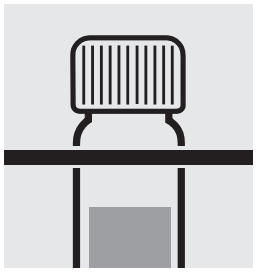
Heat both cells in the thermoreactor at 148 °C for 2 hours.



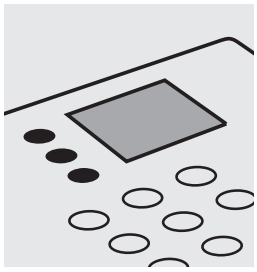
Remove both cells from the thermoreactor and place in a test-tube rack to cool.



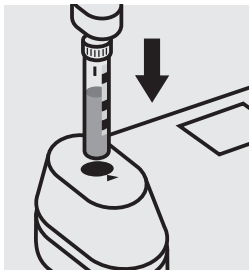
Swirl both cells after 10 minutes.



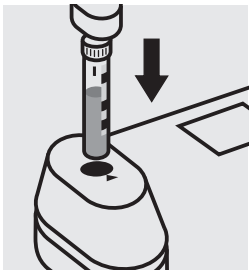
Replace both cells in the rack for complete cooling to room temperature. (**Very important!**)



Select method 1 6 3.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 20, Cat.No. 114675, or the Standard solution for photometric applications, CRM, Cat.No. 125029, 125030, 125031, and 125032.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 20) is highly recommended.

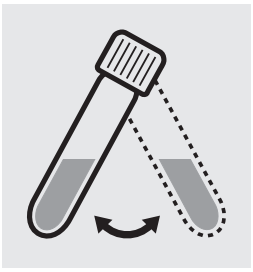
COD

Chemical Oxygen Demand

114691

Cell Test

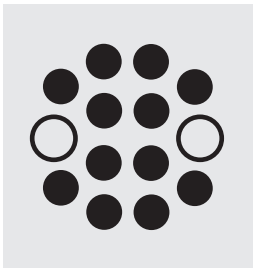
Measuring range: 300 – 3500 mg/l COD or O_2 16-mm cell



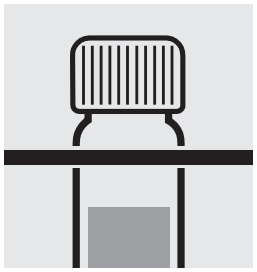
Suspend the bottom sediment in two cells by swirling.

Carefully pipette 2.0 ml of the sample into a reaction cell, close tightly with the screw cap, and mix vigorously.
Caution, the cell becomes very hot!

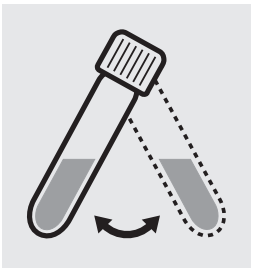
Carefully pipette 2.0 ml of distilled water into a second reaction cell, close tightly with the screw cap, and mix vigorously.
Caution, the cell becomes very hot!
(Blank cell)



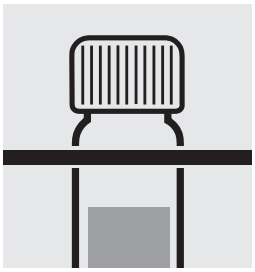
Heat both cells in the thermoreactor at 148 °C for 2 hours.



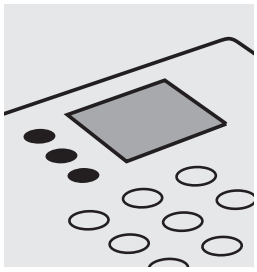
Remove both cells from the thermoreactor and place in a test-tube rack to cool.



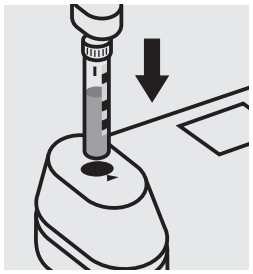
Swirl both cells after 10 minutes.



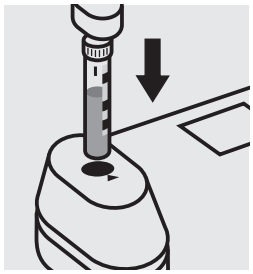
Replace both cells in the rack for complete cooling to room temperature. (**Very important!**)



Select method 1 6 4.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Quality assurance:

To check the measurement system (test reagents,measurement device, and handling) we recommended to use Spectroquant® CombiCheck 80, Cat.No. 114738, or the Standard solution for photometric applications, CRM, Cat.No. 125031, 125032, and 125033.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 80) is highly recommended.

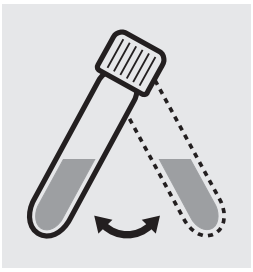
COD

Chemical Oxygen Demand

114555

Cell Test

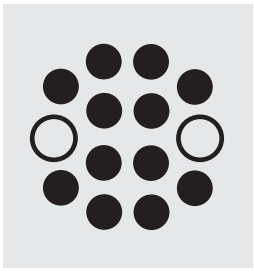
Measuring range: 0.50–10.00 g/l COD or O_2 16-mm cell



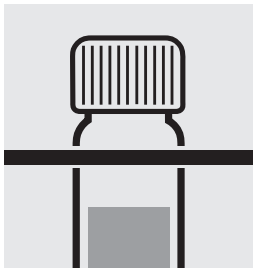
Suspend the bottom sediment in two cells by swirling.

Carefully pipette 1.0 ml of the sample into a reaction cell, close tightly with the screw cap, and mix vigorously.
Caution, the cell becomes very hot!

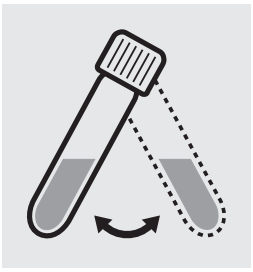
Carefully pipette 1.0 ml of distilled water into a second reaction cell, close tightly with the screw cap, and mix vigorously.
Caution, the cell becomes very hot!
(Blank cell)



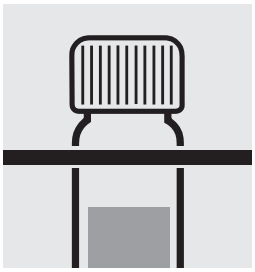
Heat both cells in the thermoreactor at 148 °C for 2 hours.



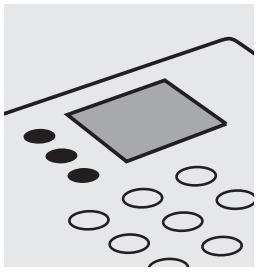
Remove both cells from the thermoreactor and place in a test-tube rack to cool.



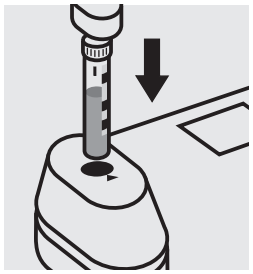
Swirl both cells after 10 minutes.



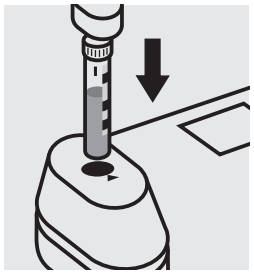
Replace both cells in the rack for complete cooling to room temperature. (**Very important!**)



Select method (1)(6)(5).



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 70, Cat.No. 114689, or the Standard solution for photometric applications, CRM, Cat.No. 125032, 125033, and 125034.
The measurement results are expressed in g/l COD.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 70) is highly recommended.

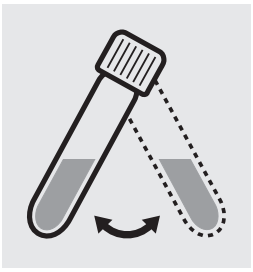
COD

Chemical Oxygen Demand

101797

Cell Test

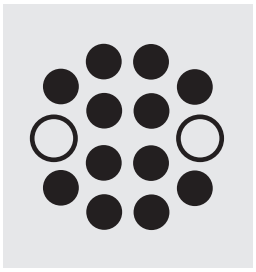
Measuring range: 5.00–90.00 g/l COD or O_2 16-mm cell



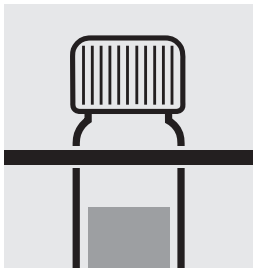
Suspend the bottom sediment in two cells by swirling.

Carefully pipette 0.10 ml of the sample into a reaction cell, close tightly with the screw cap, and mix vigorously.
Caution, the cell becomes very hot!

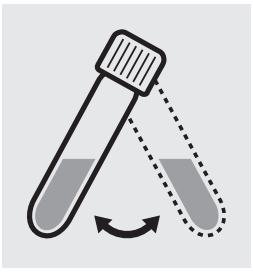
Carefully pipette 0.10 ml of distilled water into a second reaction cell, close tightly with the screw cap, and mix vigorously.
Caution, the cell becomes very hot!
(Blank cell)



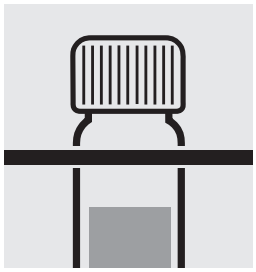
Heat both cells in the thermoreactor at 148 °C for 2 hours.



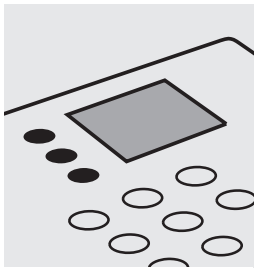
Remove both cells from the thermoreactor and place in a test-tube rack to cool.



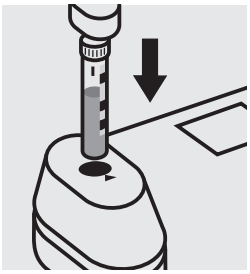
Swirl both cells after 10 minutes.



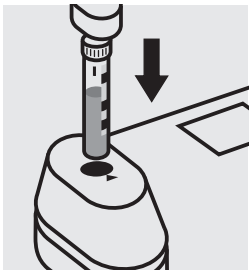
Replace both cells in the rack for complete cooling to room temperature. (**Very important!**)



Select method (1)(6)(9).



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use the Standard solution for photometric applications, CRM, Cat.No. 125034 and 125035.
The measurement results are expressed in g/l COD.

COD (Hg-free)

Chemical Oxygen Demand

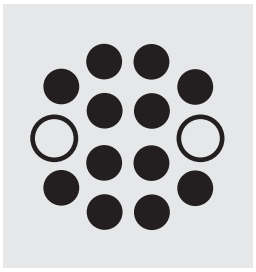
109772

Cell Test

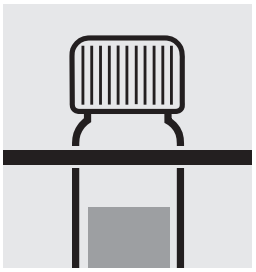
Measuring range: 10–150 mg/l COD or O_2 16-mm cell

Carefully pipette 2.0 ml of the sample into a reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes very hot!**

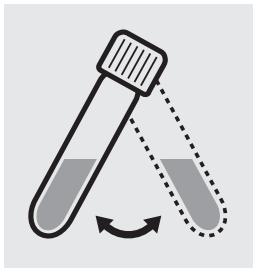
Carefully pipette 2.0 ml of distilled water (Water for process analysis, Cat.No. 101051, is recommended) into a second reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes very hot!** (Blank cell)



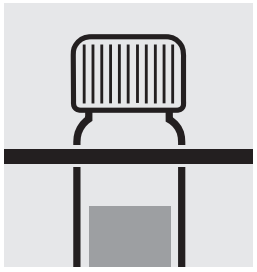
Heat both cells in the thermoreactor at 148 °C for 2 hours.



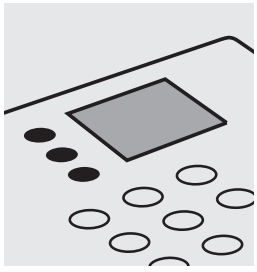
Remove both cells from the thermoreactor and place in a test-tube rack to cool.



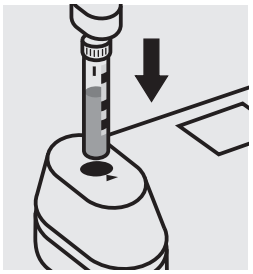
Swirl both cells after 10 minutes.



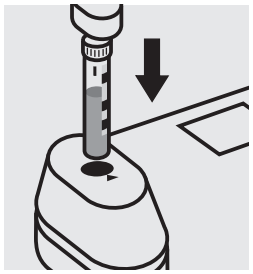
Replace both cells in the rack for complete cooling to room temperature. (**Very important!**)



Select method (1)(6)(6).



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use the Standard solution for photometric applications, CRM, Cat.No. 125028 and 125029.

COD (Hg-free)

Chemical Oxygen Demand

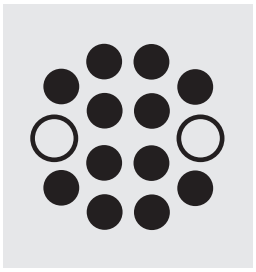
109773

Cell Test

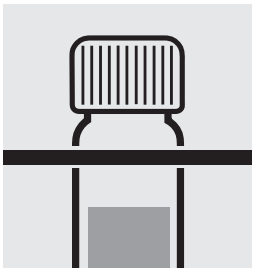
Measuring range: 100–1500 mg/l COD or O_2 16-mm cell

Carefully pipette 2.0 ml of the sample into a reaction cell, close tightly with the screw cap, and mix vigorously.
Caution, the cell becomes very hot!

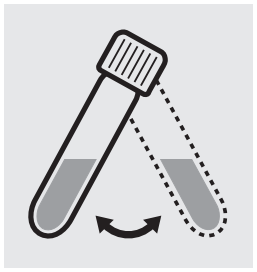
Carefully pipette 2.0 ml of distilled water into a second reaction cell, close tightly with the screw cap, and mix vigorously.
Caution, the cell becomes very hot!
(Blank cell)



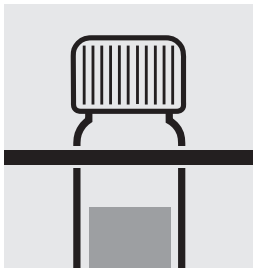
Heat both cells in the thermoreactor at 148 °C for 2 hours.



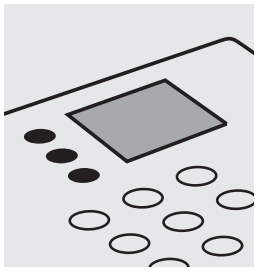
Remove both cells from the thermoreactor and place in a test-tube rack to cool.



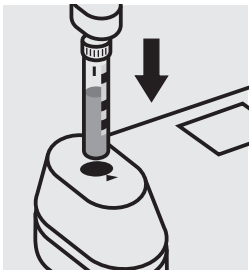
Swirl both cells after 10 minutes.



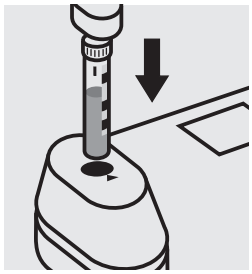
Replace both cells in the rack for complete cooling to room temperature. (**Very important!**)



Select method 1 6 6.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use the Standard solution for photometric applications, CRM, Cat.No. 125029, 125030, 125031, and 125032.

COD

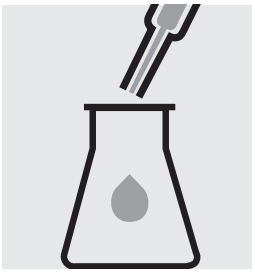
Chemical Oxygen Demand
for seawater / high chloride contents

117058

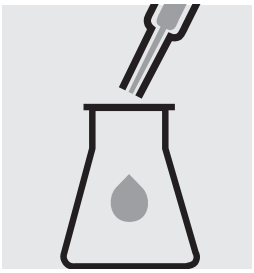
Cell Test

Measuring range: 5.0–60.0 mg/l COD or O_2 16-mm cell

Chloride depletion:

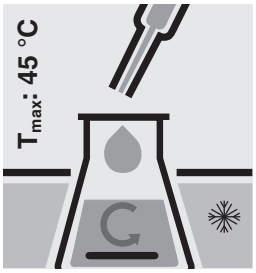


Pipette with glass pipette 20 ml of the sample into a 300-ml Erlenmeyer flask with NS 29/32.



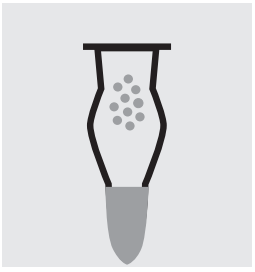
Pipette with glass pipette 20 ml of distilled water (Water for process analysis, Cat.No. 101051, is recommended) into a second 300-ml Erlenmeyer flask with NS 29/32.

Add to each a magnetic stirring rod, and cool in the ice bath.

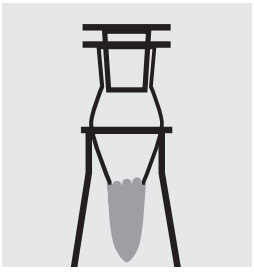


Add **slowly** to each Erlenmeyer flask 25 ml of **Sulfuric acid for the determination of COD** (Cat. No. 117048) with glass pipette **under cooling and stirring**.

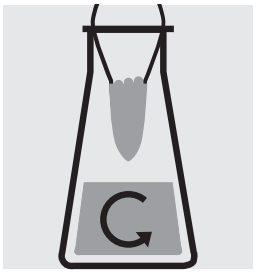
Cool both Erlenmeyer flasks to room temperature in the ice bath.



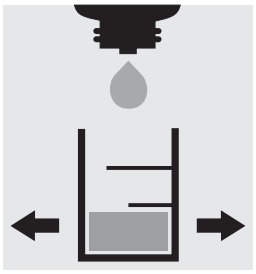
Fill 6 - 7 g each of **Sodalime with indicator** (Cat. No. 106733) into two absorption tubes (Cat. No. 115955).



Close the absorption tubes with the glass stoppers, and attach to the top of the Erlenmeyer flasks.



Stir at 250 rpm for 2 h at room temperature: depleted sample / depleted blank



Check the chloride content of the depleted sample using Aquamerck® Chloride Test, Cat. No. 111132, according to the application (see the website):
Specified value
<2000 mg/l Cl^-.

Chloride determination (acc. to application - brief version):

Fill 5.0 ml of sodium hydroxide solution 2 mol/l, Cat. No. 109136, into the test vessel of the Aquamerck® Chloride Tests. Carefully allow to run from the pipette 0.5 ml of depleted sample down the inside of the tilted test vessel into the sodium hydroxide solution and mix (**Wear eye protection! The test vessel becomes hot!**).
Add 2 drops of reagent Cl-1 and swirl. The sample directly turns yellow in color. (Reagent Cl-2 is not required.)
Holding the reagent bottle vertically, slowly add reagent Cl-3 dropwise to the sample while swirling until its color changes from yellow to blue-violet. Shortly before the color changes, wait a few seconds after adding each drop.

Result in mg/l chloride = number of drops x 250

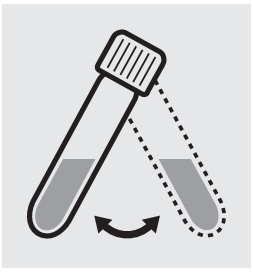
COD

Chemical Oxygen Demand
for seawater / high chloride contents

117058

Cell Test

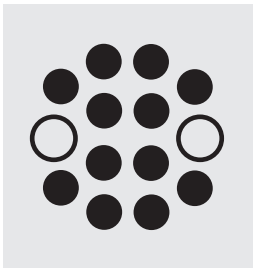
Determination:



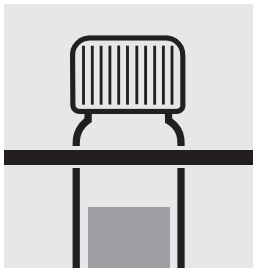
Suspend the bottom sediment in two cells by swirling.

Carefully pipette 5.0 ml of the **depleted sample** into a reaction cell, close tightly with the screw cap, and mix vigorously.
Caution, the cell becomes hot!

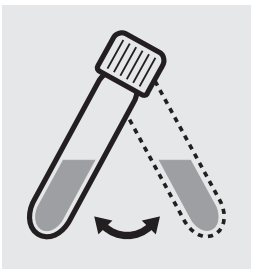
Carefully pipette 5.0 ml of the **depleted blank** into a second reaction cell, close tightly with the screw cap, and mix vigorously.
Caution, the cell becomes hot!
(Blank cell)



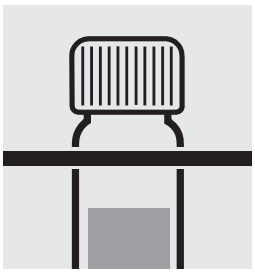
Heat both cells in the thermoreactor at 148 °C for 2 hours.



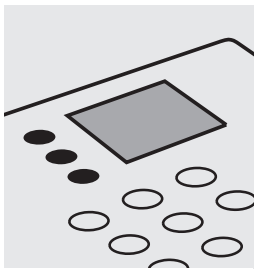
Remove both cells from the thermoreactor and place in a test-tube rack to cool.



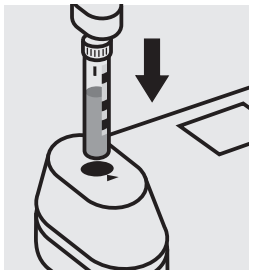
Swirl both cells after 10 minutes.



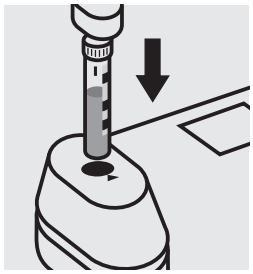
Replace both cells in the rack for complete cooling to room temperature. (**Very important!**)



Select method (5)(7)(0).



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a COD/chloride standard solution must be prepared from Potassium hydrogen phthalate, Cat.No. 102400 and Sodium chloride, Cat.No. 106404 (see section “Standard solutions”).

COD

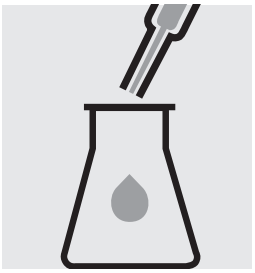
Chemical Oxygen Demand
for seawater / high chloride contents

117059

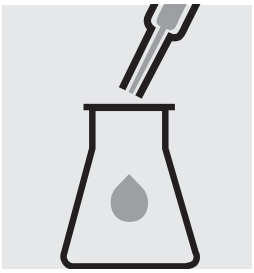
Cell Test

Measuring range: 50–3000 mg/l COD or O_2 16-mm cell

Chloride depletion:

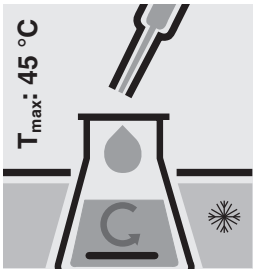


Pipette with glass pipette 20 ml of the sample into a 300-ml Erlenmeyer flask with NS 29/32.



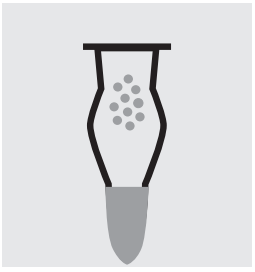
Pipette with glass pipette 20 ml of distilled water (Water for process analysis, Cat.No. 101051, is recommended) into a second 300-ml Erlenmeyer flask with NS 29/32.

Add to each a magnetic stirring rod, and cool in the ice bath.

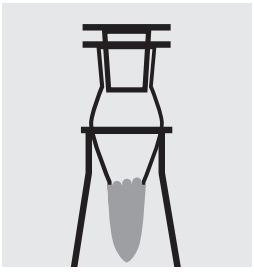


Add **slowly** to each Erlenmeyer flask 25 ml of **Sulfuric acid for the determination of COD** (Cat. No. 117048) with glass pipette **under cooling and stirring**.

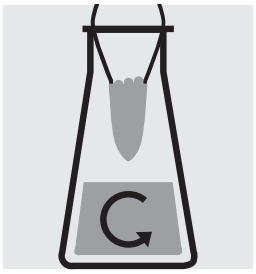
Cool both Erlenmeyer flasks to room temperature in the ice bath.



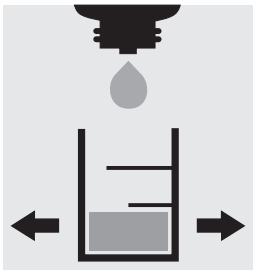
Fill 6 - 7 g each of **Sodalime with indicator** (Cat. No. 106733) into two absorption tubes (Cat. No. 115955).



Close the absorption tubes with the glass stoppers, and attach to the top of the Erlenmeyer flasks.



Stir at 250 rpm for 2 h at room temperature: depleted sample / depleted blank



Check the chloride content of the depleted sample using the Aquamerck® Chloride Test, Cat. No. 111132, as per the application instructions (see the website):
specified value <250 mg/l Cl^-.

Chloride determination (acc. the application instructions - abridged version):

Fill 5.0 ml of sodium hydroxide solution 2 mol/l, Cat. No. 109136, into the test vessel of the Aquamerck® Chloride Tests. Carefully allow to run from the pipette 0.5 ml of depleted sample down the inside of the tilted test vessel onto the sodium hydroxide solution and mix (**Wear eye protection! The cell becomes hot!**).
Add 2 drops of reagent Cl-1 and swirl. The sample directly turns yellow in color. (Reagenz Cl-2 wird nicht benötigt.)
Holding the reagent bottle vertically, slowly add reagent Cl-3 dropwise to the sample while swirling until its color changes from yellow to blue-violet. Shortly before the color changes, wait a few seconds after adding each drop.

Result in mg/l chloride = number of drops x 250

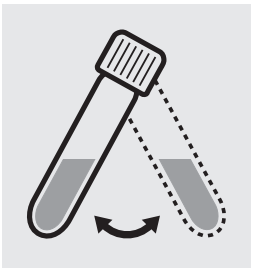
COD

Chemical Oxygen Demand
for seawater / high chloride contents

117059

Cell Test

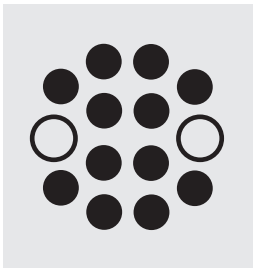
Determination:



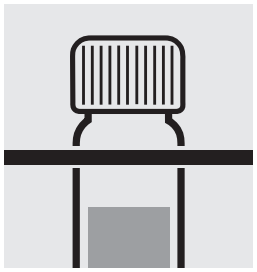
Suspend the bottom sediment in two cells by swirling.

Carefully pipette 3.0 ml of the **depleted sample** into a reaction cell, close tightly with the screw cap, and mix vigorously.
Caution, the cell becomes hot!

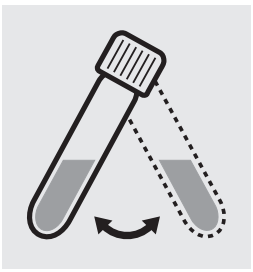
Carefully pipette 3.0 ml of the **depleted blank** into a second reaction cell, close tightly with the screw cap, and mix vigorously.
Caution, the cell becomes hot!
(Blank cell)



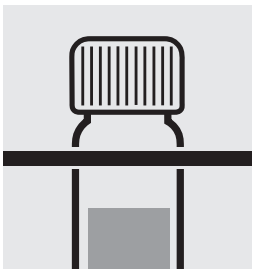
Heat both cells in the thermoreactor at 148 °C for 2 hours.



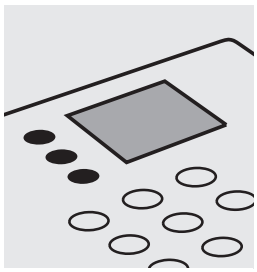
Remove both cells from the thermoreactor and place in a test-tube rack to cool.



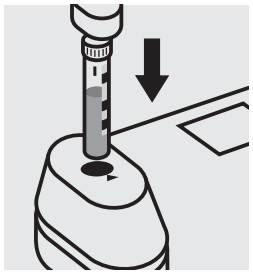
Swirl both cells after 10 minutes.



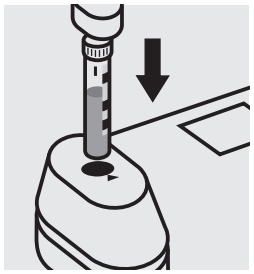
Replace both cells in the rack for complete cooling to room temperature. (**Very important!**)



Select method 5 7 1.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

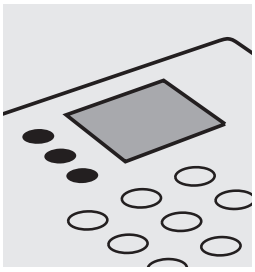
Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a COD/chloride standard solution must be prepared from Potassium hydrogen phthalate, Cat.No. 102400 and Sodium chloride, Cat.No. 106404 (see section “Standard solutions”).

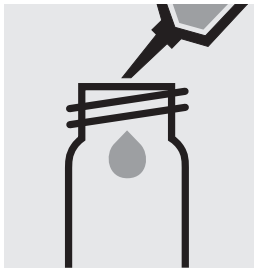
Color
(Platinum-Cobalt Standard Method)

analogous to **APHA 2120B, DIN EN ISO 6271-2, Water Research Vol. 30, No. 11, 2771-2775, 1996**

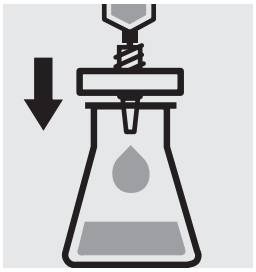
Measuring range: 0 – 1000 mg/l Pt/Co (Hazen)	430 nm	24-mm cell



Select method (1)(7)(0).

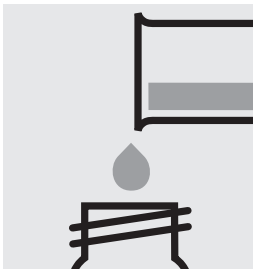


Fill approx. 10 ml of distilled water into a 24-mm cell, close with the screw cap. (Blank cell)

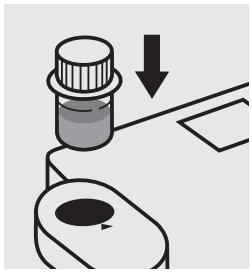


Filter sample solution through a membrane filter with 0.45 µm pore size.

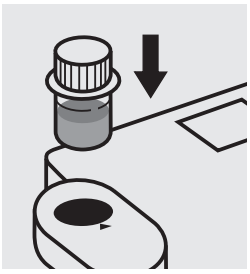
Notes:
Filtered sample = true colour.
Unfiltered sample = apparent colour.



Transfer the solution into a 24-mm cell, close with the screw cap.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

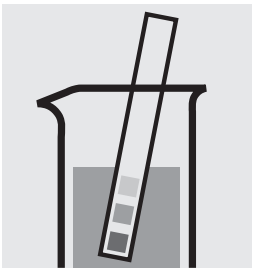
To check the measurement system (measurement device, handling) ready-for-use Platinum Cobalt Color Reference Solution (Hazen 500) CertiPUR®, Cat.No. 100246, concentration 500 mg/l Pt, can be used.

Copper

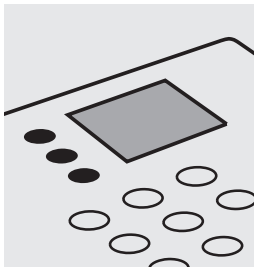
114553

Cell Test

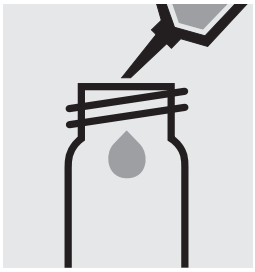
Measuring range: 0.05 – 8.00 mg/l Cu 16-mm cell



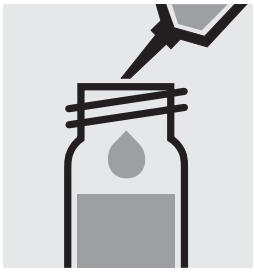
Check the pH of the sample, specified range: pH 4 – 10.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



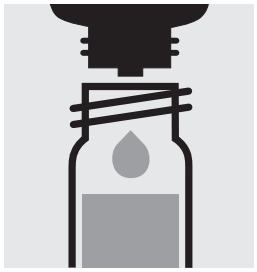
Select method (1)(8)(0).



Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)

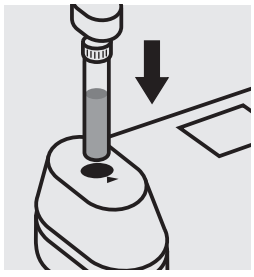


Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.

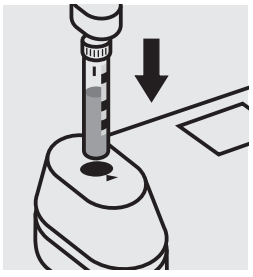


Add 5 drops of **Cu-1K**, close with the screw cap, and mix.

Reaction time:
5 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Important:

Very high copper concentrations in the sample produce turquoise-coloured solutions (measurement solution should be blue) and false-low readings are yielded.
In such cases the sample must be diluted (plausibility check).

For the determination of **total copper** a pretreatment with Crack Set 10C, Cat.No. 114688, or Crack Set 10, Cat.No. 114687 and thermoreactor is necessary.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 30, Cat.No. 114677.

Ready-for-use copper standard solution CertiPUR®, Cat.No. 119786, concentration 1000 mg/l Cu, can also be used after diluting accordingly.

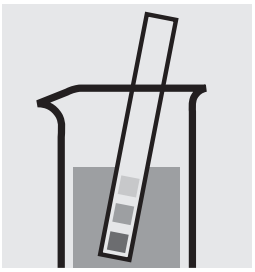
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 30) is highly recommended.

Copper

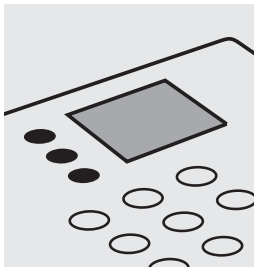
114767

Test

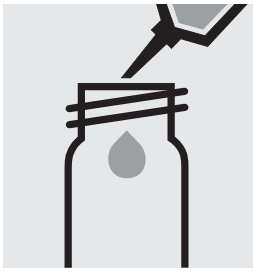
Measuring range: 0.10 – 6.00 mg/l Cu 16-mm cell



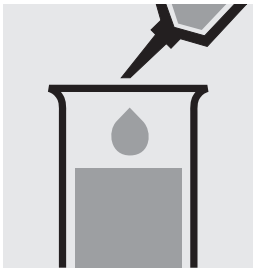
Check the pH of the sample, specified range: pH 4 – 10.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



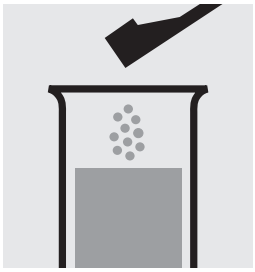
Select method (1)(8)(1).



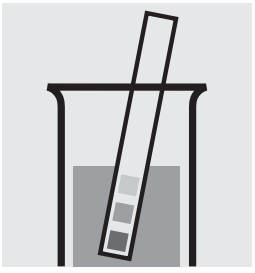
Fill approx. 10 ml of distilled water into a 16-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)



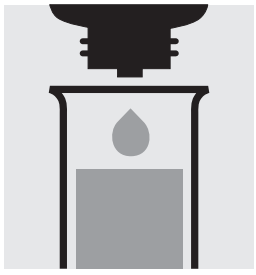
Pipette 5.0 ml of the sample into a test tube.



Add 1 green dosing spoon of **Cu-1** and dissolve the solid substance.

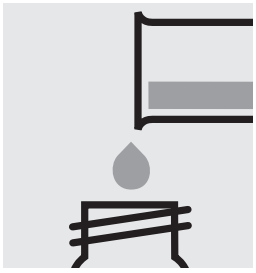


Check the pH of the sample, specified range: pH 7.0 – 9.5.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.

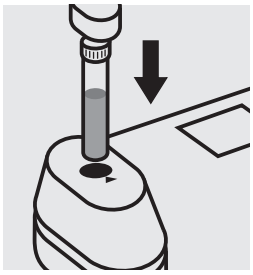


Add 5 drops of **Cu-2** and mix.

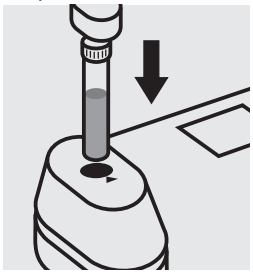
Reaction time: 5 minutes
Press (Enter) to start the countdown.



Transfer the solution into a 16-mm cell, close with the screw cap.



Insert the blank cell into the cell compartment. Press (Zero).



Insert the cell containing the sample into the cell compartment. Press (Test).

Important:

Very high copper concentrations in the sample produce turquoise-coloured solutions (measurement solution should be blue) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

For the determination of **total copper** a pretreatment with Crack Set 10C, Cat.No. 114688, or Crack Set 10, Cat.No. 114687 and thermoreactor is necessary.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 30, Cat.No. 114677.

Ready-for-use copper standard solution CertiPUR®, Cat.No. 119786, concentration 1000 mg/l Cu, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 30) is highly recommended.

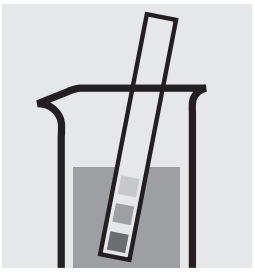
Cyanide

Determination of free cyanide

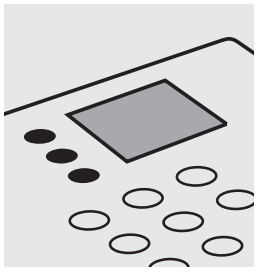
114561

Cell Test

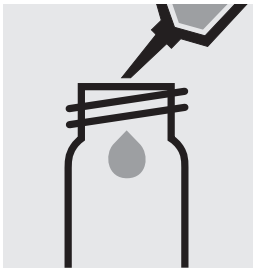
Measuring range: 10 – 350 µg/l CN 16-mm cell



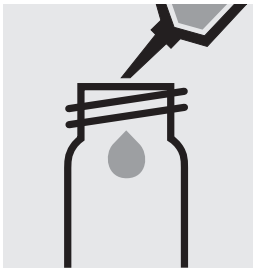
Check the pH of the sample, specified range: pH 4.5 – 8.0.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method (1)(9)(0).

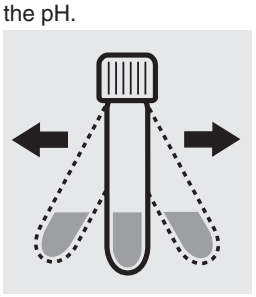


Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



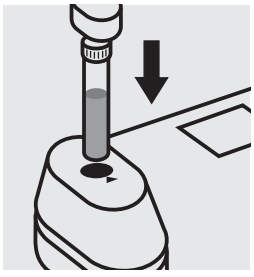
Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and dissolve the solid substance.

Add 1 level blue microspoon of **CN-3K**, close with the screw cap.

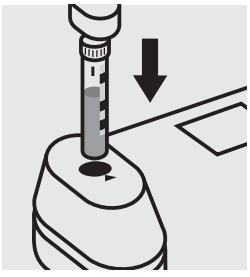


Shake the cell vigorously to dissolve the solid substance.

Reaction time:
10 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-for-use cyanide standard solution, Cat.No. 119533, concentration 1000 mg/l CN^-, can be used after diluting accordingly.

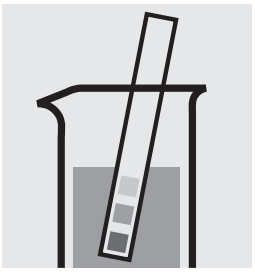
Cyanide

Determination of readily liberated cyanide

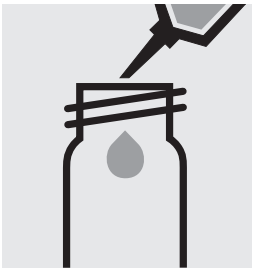
114561

Cell Test

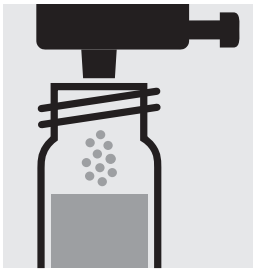
Measuring range: 10 – 350 µg/l CN 16-mm cell



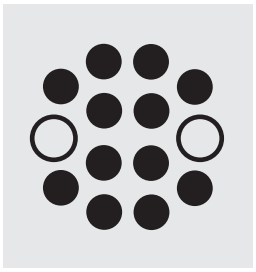
Check the pH of the sample, specified range: pH 4.5 – 8.0.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



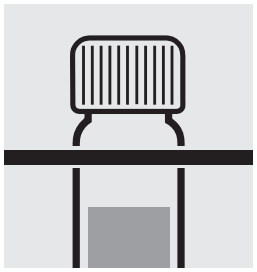
Pipette 10 ml of the sample into an empty 16-mm cell.



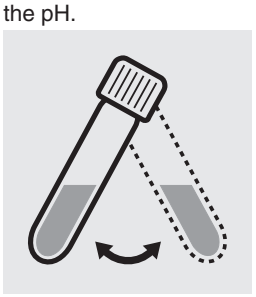
Add 1 dose of **CN-1K** using the green dose-metering cap, close with the screw cap.



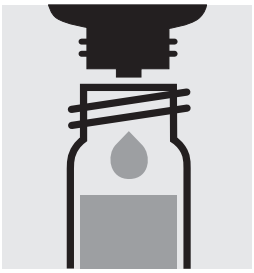
Heat the cell in the thermoreactor at 120 °C (100 °C) for 30 minutes.



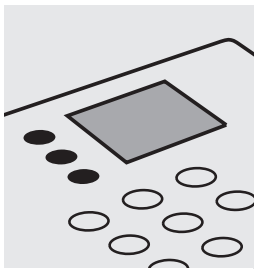
Remove the cell from the thermoreactor and place in a test-tube rack to cool to room temperature.



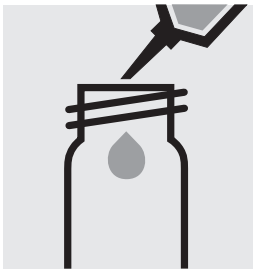
Swirl the cell before opening.



Add 3 drops of **CN-2K**, close with the screw cap, and mix: **pretreated sample**.

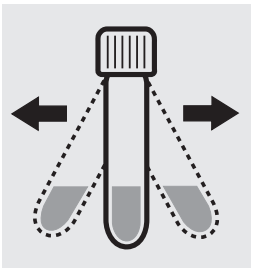


Select method 1 9 0.



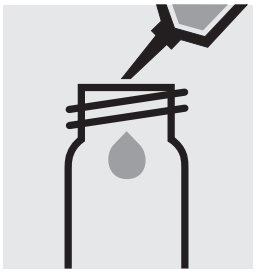
Pipette 5.0 ml of the **pretreated sample** into a reaction cell, close with the screw cap, and dissolve the solid substance.

Add 1 level blue micro-spoon of **CN-3K**, close with the screw cap.

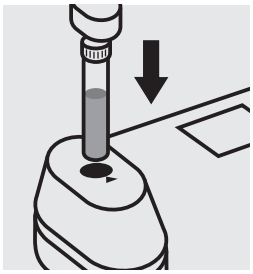


Shake the cell vigorously to dissolve the solid substance.

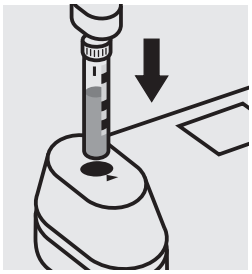
Reaction time:
10 minutes
Press Enter to start the countdown.



Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



Insert the blank cell into the cell compartment.
Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press Test.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-for-use cyanide standard solution, Cat.No. 119533, concentration 1000 mg/l CN^-, can be used after diluting accordingly.

Cyanide

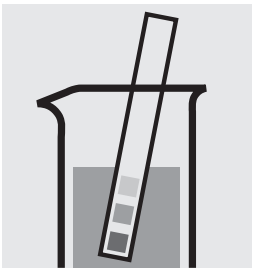
Determination of free cyanide

109701

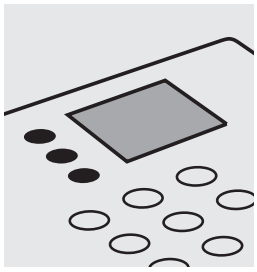
Test

Measuring range: 5 – 200 µg/l CN 24-mm cell

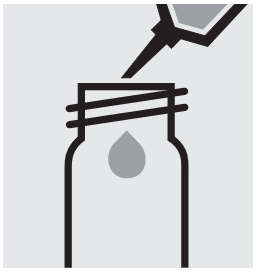
Attention: In contrast to the instructions given in the package insert the sample volume as well as the reagent volume must be doubled.



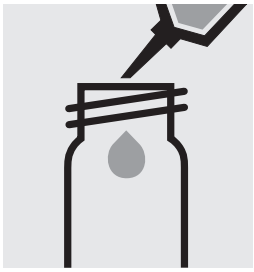
Check the pH of the sample, specified range: pH 4.5 – 8.0.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method 1 9 1.

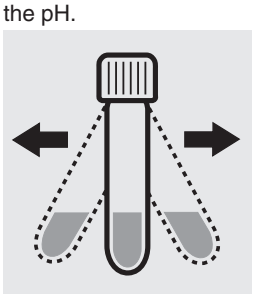


Fill approx. 10 ml of distilled water into a 24-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)



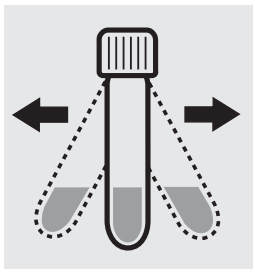
Pipette 10 ml of the sample into a 24-mm cell.

Add 2 level green microspoons of **CN-3**, close with the screw cap.



Shake the cell vigorously to dissolve the solid substance.

Add 2 level blue microspoons of **CN-4**, close with the screw cap.



Shake the cell vigorously to dissolve the solid substance.

Reaction time:
10 minutes
Press Enter to start the countdown.

Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.

Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Quality assurance:

To check the measurement system (test reagents,measurement device, and handling) ready-for-use cyanide standard solution, Cat.No. 119533, concentration 1000 mg/l CN^-, can be used after diluting accordingly.

Cyanide

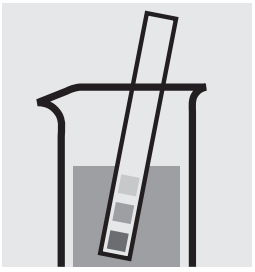
Determination of readily liberated cyanide

109701

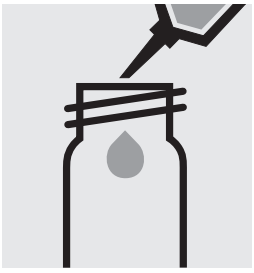
Test

Measuring range: 5 – 200 µg/l CN 24-mm cell

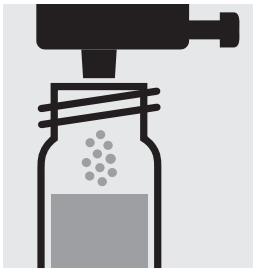
Attention: In contrast to the instructions given in the package insert the sample volume as well as the reagent volume must be doubled.



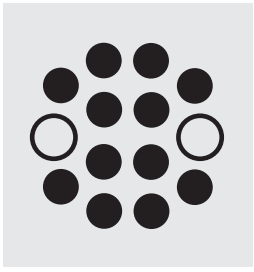
Check the pH of the sample, specified range: pH 4.5 – 8.0.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



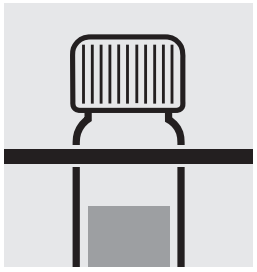
Pipette 10 ml of the sample into a 16-mm cell.



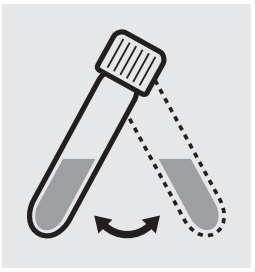
Add 1 dose of **CN-1** using the green dose-metering cap, close with the screw cap.



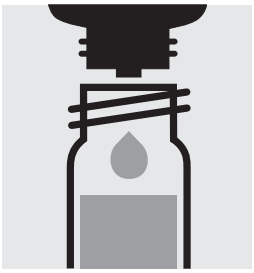
Heat the cell in the thermoreactor at 120 °C (100 °C) for 30 minutes.



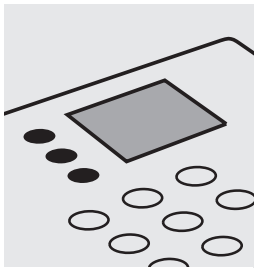
Remove the cell from the thermoreactor and place in a test-tube rack to cool to room temperature.



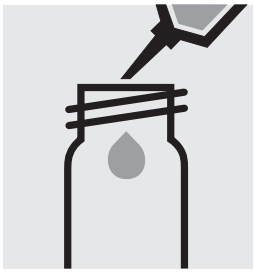
Swirl the cell before opening.



Add 3 drops of **CN-2K**, close with the screw cap, and mix: **pretreated sample**.

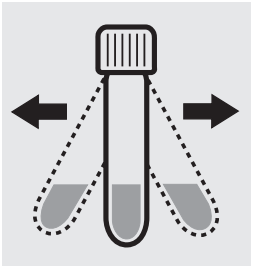


Select method 1 9 1.



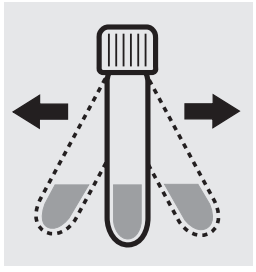
Transfer the **pretreated sample** into a 24-mm cell.

Add 2 level green micro-spoons of **CN-3**, close with the screw cap.



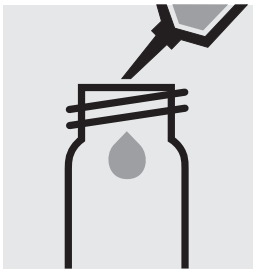
Shake the cell vigorously to dissolve the solid substance.

Add 2 level blue micro-spoons of **CN-4**, close with the screw cap.

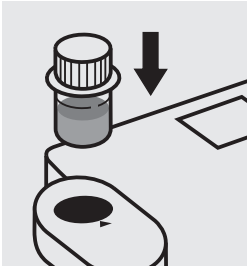


Shake the cell vigorously to dissolve the solid substance.

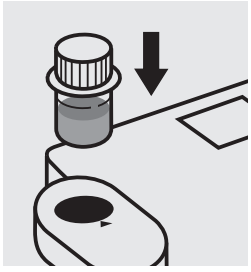
Reaction time:
10 minutes
Press Enter to start the countdown.



Fill approx. 10 ml of distilled water into a 24-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Quality assurance:

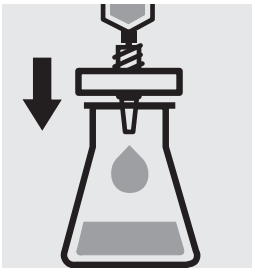
To check the measurement system (test reagents,measurement device, and handling) ready-for-use cyanide standard solution, Cat.No. 119533, concentration 1000 mg/l CN^-, can be used after diluting accordingly.

Cyanuric Acid

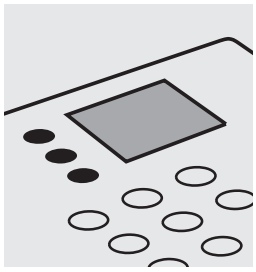
119250

Test

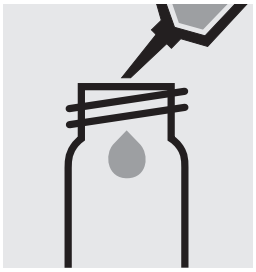
Measuring range: 2 – 160 mg/l cyanuric acid 24-mm cell



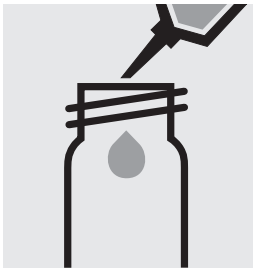
Filter turbid samples.



Select method (2)(0)(0).



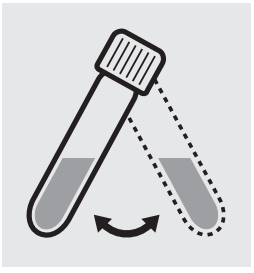
Pipette **5.0 ml of distilled water** (Water for process analysis, Cat.No. 101051, is recommended) **+ 5.0 ml of the sample** into a 24-mm cell (**do not add any reagents!**), close with the screw cap, and mix.
(Blank cell)



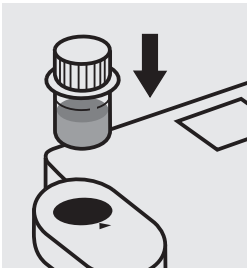
Pipette 5.0 ml of the sample into a 24-mm cell.

Add **5.0 ml of distilled water** (Water for process analysis, Cat.No. 101051, is recommended) with pipette, close with the screw cap, and mix.

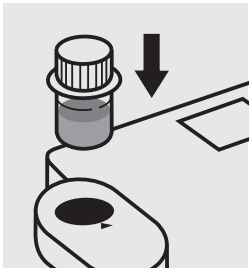
Add 1 tablet **Cyanuric Acid**, crush with stirring rod, and close with the screw cap.



Swirl the cell to dissolve the solid substance.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

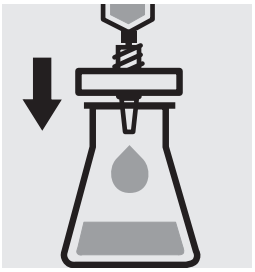
To check the measurement system (test reagents, measurement device, and handling) a cyanuric acid standard solution must be prepared from Cyanuric acid, Cat.No. 820358 (see section “Standard solutions”).

Cyanuric Acid

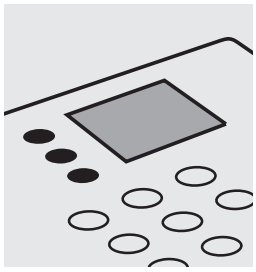
119253

Test

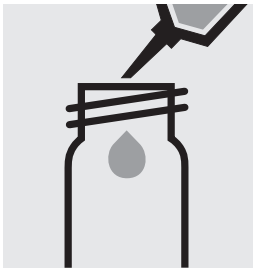
Measuring range: 2 – 160 mg/l cyanuric acid 24-mm cell



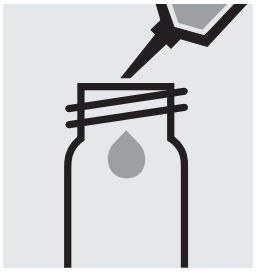
Filter turbid samples.



Select method (2)(0)(1).



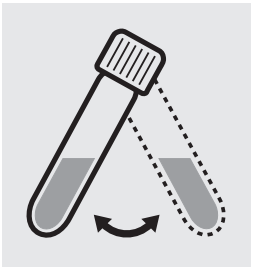
Pipette **5.0 ml of distilled water** (Water for process analysis, Cat.No. 101051, is recommended) **+ 5.0 ml of the sample** into a 24-mm cell (**do not add any reagents!**), close with the screw cap, and mix.
(Blank cell)



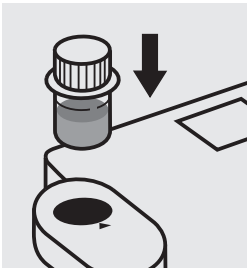
Pipette 5.0 ml of the sample into a 24-mm cell.

Add **5.0 ml of distilled water** (Water for process analysis, Cat.No. 101051, is recommended) with pipette, close with the screw cap, and mix.

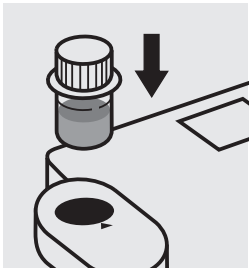
Add 1 **reagent tablet**, crush with stirring rod, and close with the screw cap.



Swirl the cell to dissolve the solid substance.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

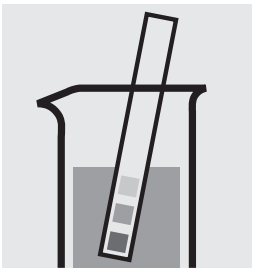
To check the measurement system (test reagents, measurement device, and handling) a cyanuric acid standard solution must be prepared from Cyanuric acid, Cat.No. 820358 (see section “Standard solutions”).

Fluoride

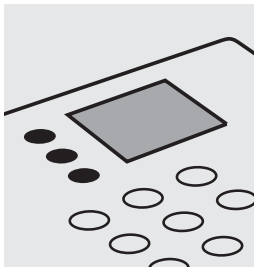
114557

Cell Test

Measuring range: 0.10 – 1.50 mg/l F 16-mm cell

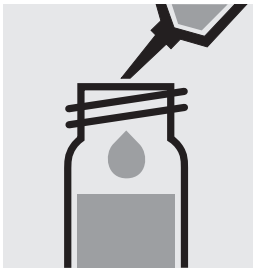


Check the pH of the sample, specified range: pH 3 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.

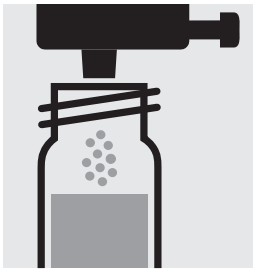


Select method (2)(2)(0).

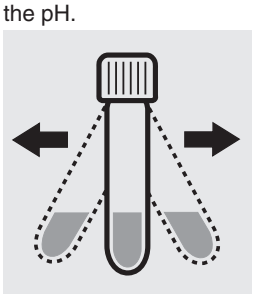
Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



Pipette 5.0 ml of distilled water into a second reaction cell, close with the screw cap, and mix. (Blank cell)

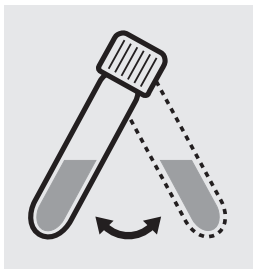


Add to each cell1 dose of **F-1K** using the blue dose-metering cap, close with the screw cap.

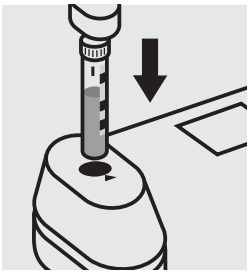


Shake both cells vigorously to dissolve the solid substance.

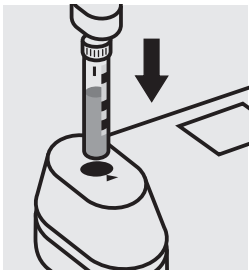
Reaction time:
5 minutes
Press (Enter) to start the countdown.



Swirl both cells before measurement.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Important:

Very high fluoride concentrations in the sample produce brown-coloured solutions (measurement solution should be violet) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

Quality assurance:

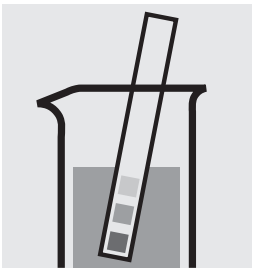
To check the measurement system (test reagents, measurement device, and handling) ready-for-use fluoride standard solution CertiPUR®, Cat.No. 119814, concentration 1000 mg/l F^-, can be used after diluting accordingly.

Fluoride

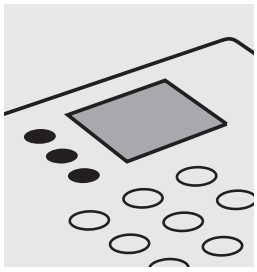
100809

Cell Test

Measuring range: 0.10 – 1.80 mg/l F 16-mm cell

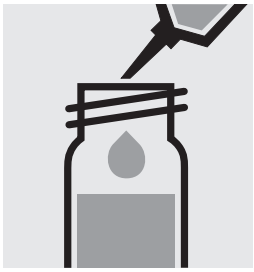


Check the pH of the sample, specified range: pH 3 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



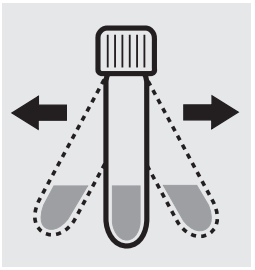
Select method (2)(2)(2).

Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



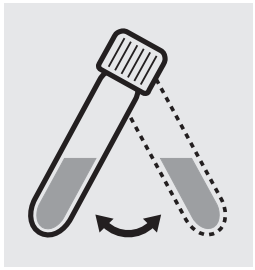
Pipette 5.0 ml of distilled water into a second reaction cell, close with the screw cap, and mix. (Blank cell)

Add to each cell 1 level blue microspoon of **F-1K**, close with the screw cap.

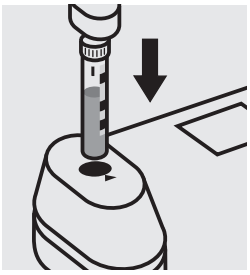


Shake both cells vigorously to dissolve the solid substance.

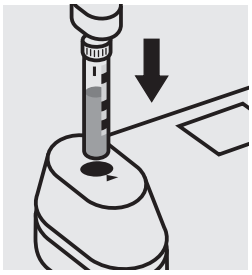
Reaction time:
15 minutes
Press (Enter) to start the countdown.



Swirl both cells before measurement.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Important:

Very high fluoride concentrations in the sample produce brown-coloured solutions (measurement solution should be violet) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

Quality assurance:

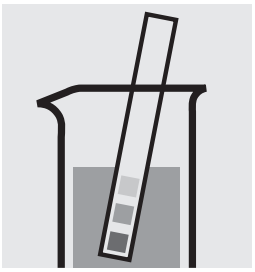
To check the measurement system (test reagents, measurement device, and handling) ready-for-use fluoride standard solution CertiPUR®, Cat.No. 119814, concentration 1000 mg/l F^-, can be used after diluting accordingly.

Fluoride

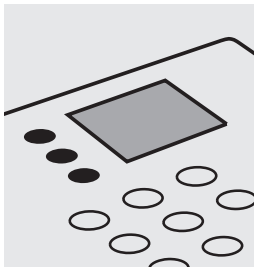
114598

Test

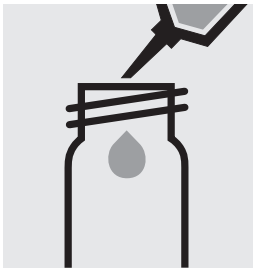
Measuring range: 0.10 – 2.00 mg/l F 16-mm cell



Check the pH of the sample, specified range: pH 3 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method (2)(2)(1).

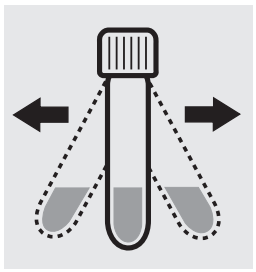


Pipette 2.0 ml each of **F-1** into two 16-mm cells.

Add to one cell 5.0 ml of the sample with pipette, close with the screw cap, and mix.

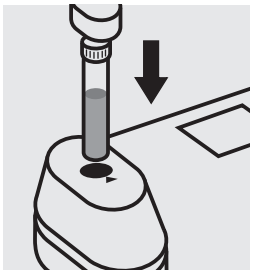
Add to the second cell 5.0 ml of distilled water with pipette, close with the screw cap, and mix. (Blank cell)

Add to each cell 1 level blue microspoon of **F-2**, close with the screw cap.

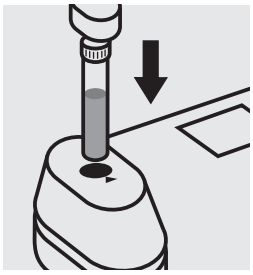


Shake both cells vigorously to dissolve the solid substance.

Reaction time:
5 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Press (Test).

Important:

Very high fluoride concentrations in the sample produce brown-coloured solutions (measurement solution should be violet) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

Quality assurance:

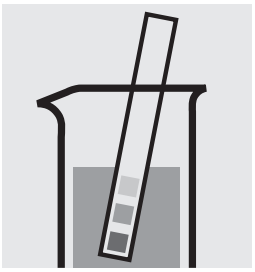
To check the measurement system (test reagents, measurement device, and handling) ready-for-use fluoride standard solution CertiPUR®, Cat.No. 119814, concentration 1000 mg/l F^-, can be used after diluting accordingly.

Fluoride

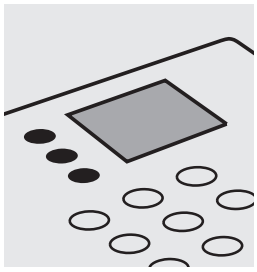
100822

Test

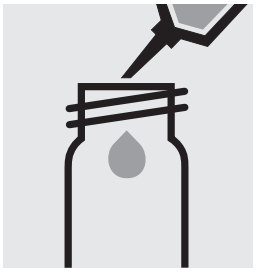
Measuring range: 0.08 – 2.00 mg/l F 24-mm cell



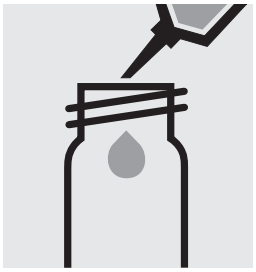
Check the pH of the sample, specified range: pH 1 – 10.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method 2 2 3.



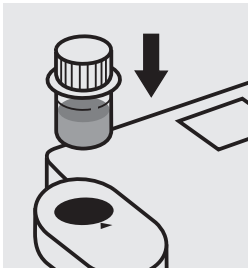
Pipette 10 ml of the sample into a 24-mm cell.



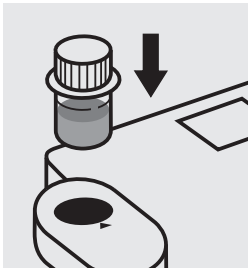
Pipette 10 ml of distilled water into a second 24-mm cell.
(Blank cell)

Add to each cell 2.0 ml of **F-1** with pipette, close with the screw cap, and mix.

Reaction time:
1 minute
Press Enter to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-for-use fluoride standard solution CertiPUR®, Cat.No. 119814, concentration 1000 mg/l F^-, can be used after diluting accordingly.

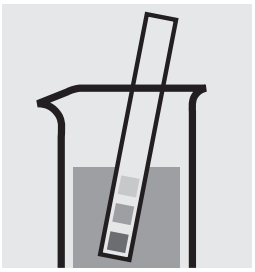
Hydrazine

109711

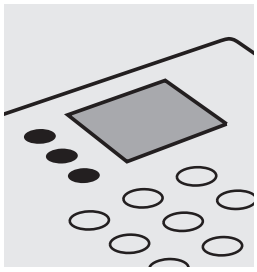
Test

Measuring range: 10– 1200 µg/l N_2H_4 24-mm cell

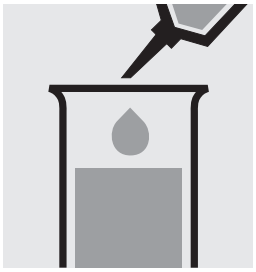
Attention: In contrast to the instructions given in the package insert the sample volume as well as the reagent volume must be doubled.



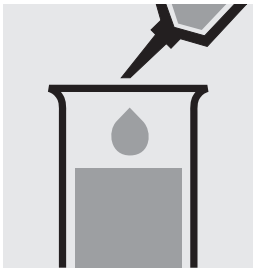
Check the pH of the sample, specified range: pH 2 – 10.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



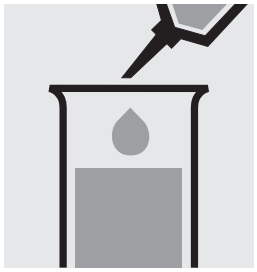
Select method (2)(3)(0).



Pipette 10 ml of the sample into a test tube.

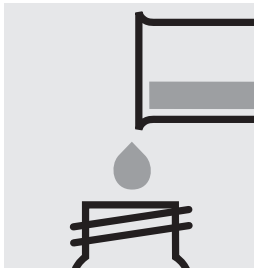


Pipette 10 ml of distilled water into a second test tube.
(Blank)

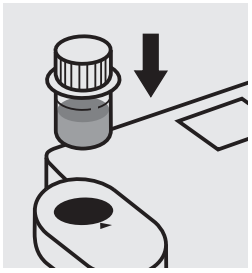


Add to each test tube 4.0 ml of **Hy-1** with pipette and mix.

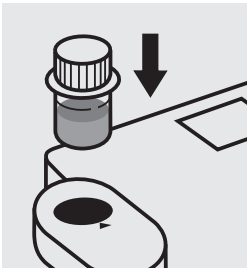
Reaction time:
5 minutes
Press (Enter) to start the countdown.



Transfer each solution into a separate 24-mm cell, close with the screw caps.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

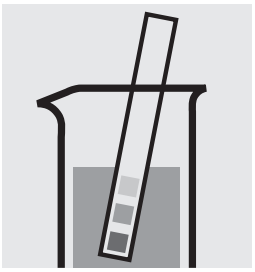
To check the measurement system (test reagents, measurement device, and handling) a hydrazine standard solution must be prepared from Hydrazinium sulfate GR, Cat. No. 104603 (see section “Standard solutions”).

Hydrogenperoxide

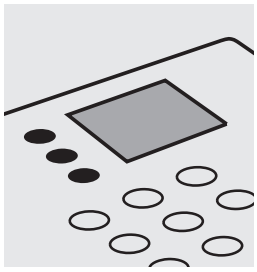
118789

Test

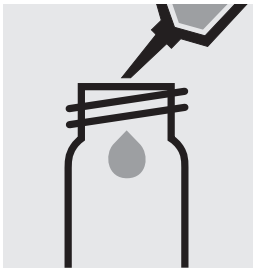
Measuring range: 0.02 – 5.50 mg/l H_2O_2 16-mm cell



Check the pH of the sample, specified range: pH 4 – 10.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.

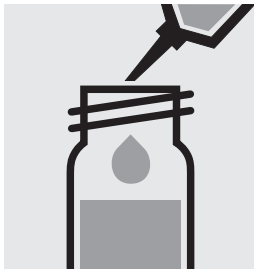


Select method 5 6 0.



Pipette 0.50 ml each of **H_2O_2-1** into two 16-mm cells.

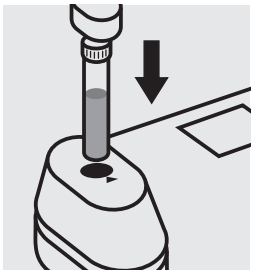
Add to one cell 8.0 ml of the sample with pipette, close with the screw cap, and mix.



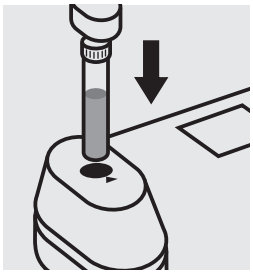
Add to the second cell 8.0 ml of distilled water with pipette, close with the screw cap, and mix. (Blank cell)

Add to each cell 0.50 ml of **H_2O_2-2** with pipette, close with the screw cap, and mix.

Reaction time:
10 minutes
Press Enter to start the countdown.



Insert the blank cell into the cell compartment.
Press Zero.



Insert the cell containing the sample into the cell compartment. Press Test.

Quality assurance:

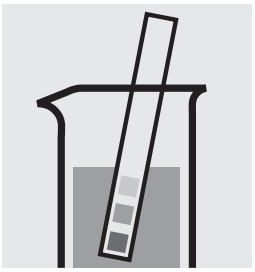
To check the measurement system (test reagents, measurement device, and handling) a hydrogenperoxide standard solution must be prepared from Perhydrol® 30 % H_2O_2 GR, Cat.No. 107209 (see section “Standard solutions”).

Iodine

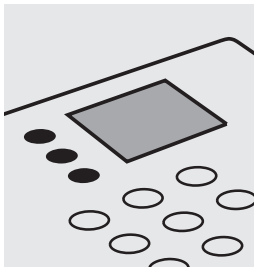
100606

Test

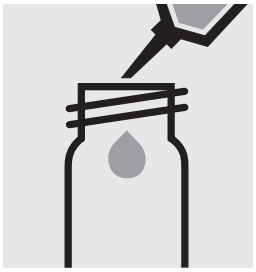
Measuring range: 0.10 – 5.00 mg/l I_2 24-mm cell



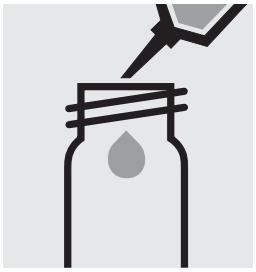
Check the pH of the sample, specified range: pH 4 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method 2 4 0.

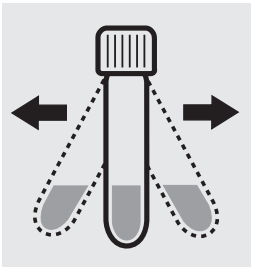


Fill approx. 10 ml of distilled water into a 24-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)



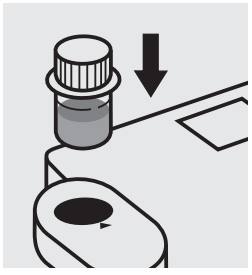
Pipette 10 ml of the sample into a 24-mm cell.

Add 1 level blue microspoon of **I_2-2**, close with the screw cap.

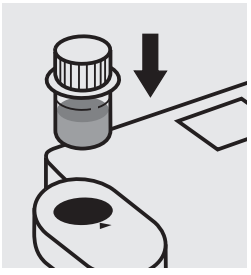


Shake the cell vigorously to dissolve the solid substance.

Reaction time:
1 minute
Press Enter to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Important:

Very high iodine concentrations in the sample produce yellow-coloured solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

Quality assurance:

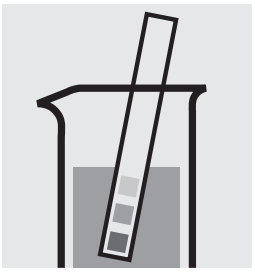
To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section “Standard solutions”).

Iron

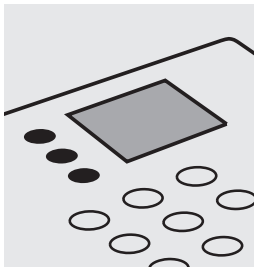
114549

Cell Test

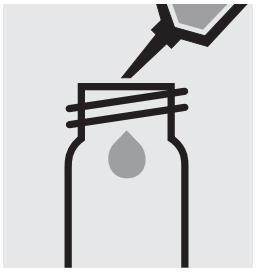
Measuring range: 0.05 – 4.00 mg/l Fe 16-mm cell



Check the pH of the sample, specified range: pH 1 – 10.
If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



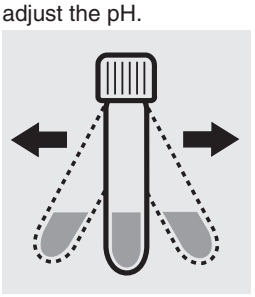
Select method (2)(5)(0).



Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)

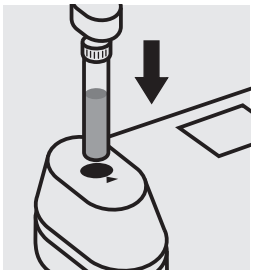
Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.

Add 1 level blue microspoon of **Fe-1K**, close with the screw cap.

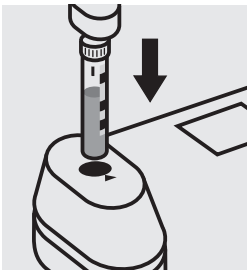


Shake the cell vigorously to dissolve the solid substance.

Reaction time:
3 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Important:

For the determination of **total iron** a pretreatment with Crack Set 10C, Cat.No. 114688, or Crack Set 10, Cat.No. 114687 and thermoreactor is necessary.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 30, Cat.No. 114677.

Ready-for-use iron standard solution CertiPUR®, Cat.No. 119781, concentration 1000 mg/l Fe, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 30) is highly recommended.

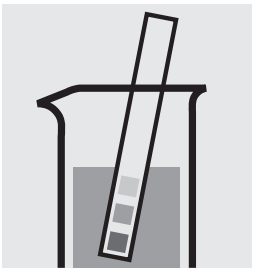
Iron

114761

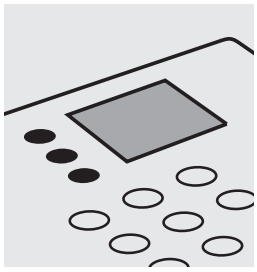
Test

Measuring range: 0.01–2.00 mg/l Fe 24-mm cell

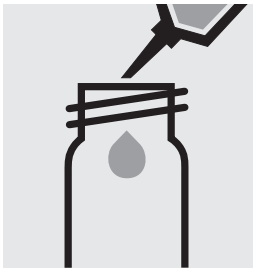
Attention: In contrast to the instructions given in the package insert the sample volume as well as the reagent volume must be doubled.



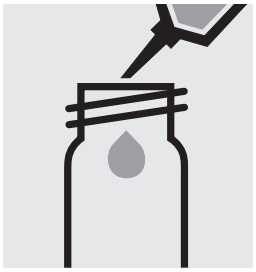
Check the pH of the sample, specified range: pH 1 – 10.
If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



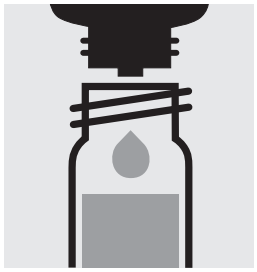
Select method (2)(5)(1).



Fill approx. 10 ml of distilled water into a 24-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)

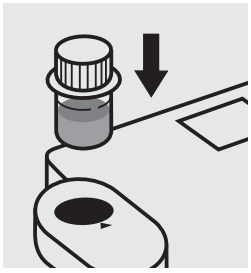


Pipette 10 ml of the sample into a 24-mm cell.

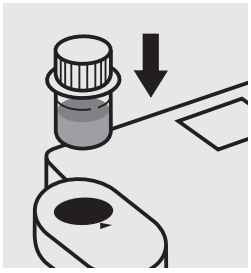


Add 6 drops of **Fe-1**, close with the screw cap, and mix.

Reaction time:
3 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Important:

For the determination of **total iron** a pretreatment with Crack Set 10C, Cat.No. 114688, or Crack Set 10, Cat.No. 114687 and thermoreactor is necessary.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-for-use iron standard solution, Cat.No. 119781, concentration 1000 mg/l Fe, can be used after diluting accordingly.

Iron

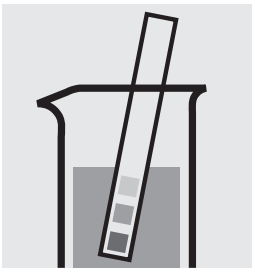
Determination of iron(II) and iron(III)

100796

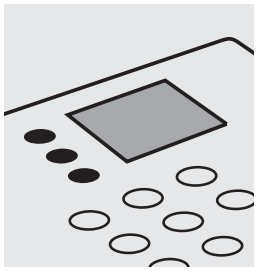
Test

Measuring range: 0.10–5.00 mg/l Fe 16-mm cell

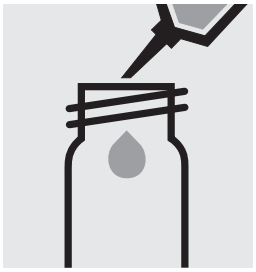
Determination of iron(II)



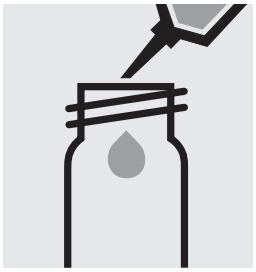
Check the pH of the sample, specified range: pH 2 – 8.
If required, add dilute sodium hydroxide solution or nitric acid drop by drop to adjust the pH.



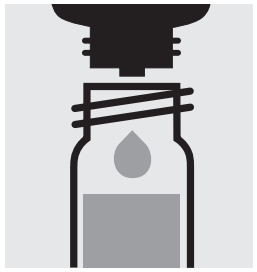
Select method (2)(5)(2).



Fill approx. 10 ml of distilled water into a 16-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)



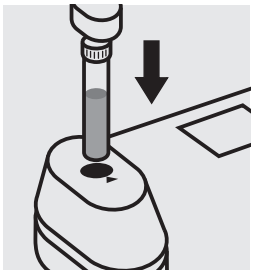
Pipette 8.0 ml of the sample into a 16-mm cell.



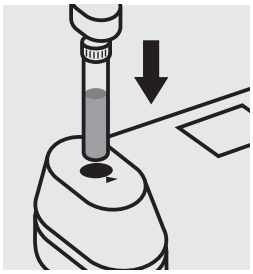
Add 1 drop of **Fe-1**, close with the screw cap, and mix.

Add 0.50 ml of **Fe-2** with pipette, close with the screw cap, and mix.

Reaction time: 5 minutes
Press (Enter) to start the countdown.



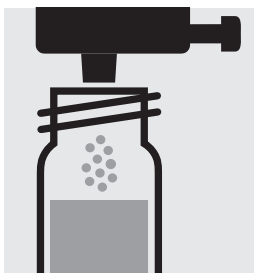
Insert the blank cell into the cell compartment. Press (Zero).



Insert the cell containing the sample into the cell compartment. Press (Test).

Determination of iron(II) + (III)

Same preparation as discribed above. After adding of **Fe-2** continue with **Fe-3**.



Add 1 dose of **Fe-3** using the blue dose-metering cap, close with the screw cap, and dissolve the solid substance.

Reaction time: 10 minutes, then measure.

Calculation of iron(III)

Result B (Fe II+III)
– Result A (Fe II)
= mg/l Fe(III)

Important:

For the determination of **total iron** a pretreatment with Crack Set 10C, Cat.No. 114688, or Crack Set 10, Cat.No. 114687 and thermoreactor is necessary.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 30, Cat.No. 114677.

Ready-for-use iron standard solution CertiPUR®, Cat.No. 119781, concentration 1000 mg/l Fe(III), can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 30) is highly recommended.

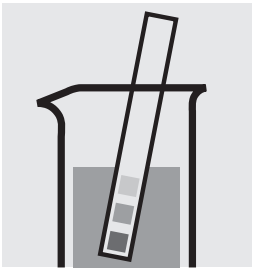
Lead

114833

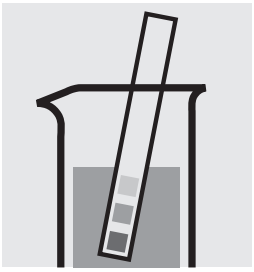
Cell Test

Measuring range: 0.10 – 5.00 mg/l Pb 16-mm cell

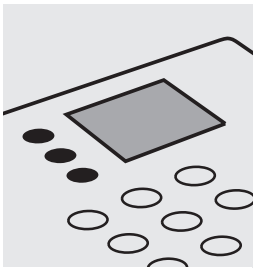
Samples of total hardness 0 – 10 °d



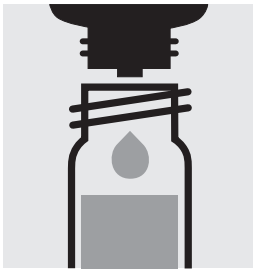
Check the total hardness of the sample



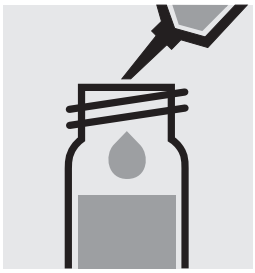
Check the pH of the sample, specified range: pH 3 – 6.
If required, add dilute ammonia solution or nitric acid drop by drop to adjust the pH.



Select method (2)(6)(0).

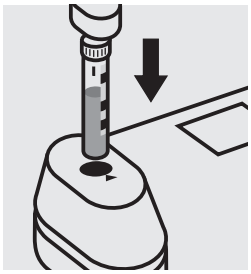


Add 5 drops each of **Pb-1K** into two reaction cells, close with the screw cap, and mix.

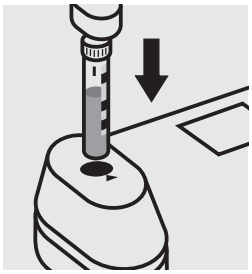


Add to one cell 5.0 ml of the sample with pipette, close with the screw cap, and mix.

Add to the second cell 5.0 ml of distilled water with pipette, close with the screw cap, and mix. (Blank cell)



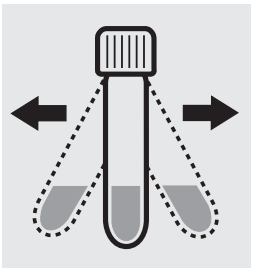
Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



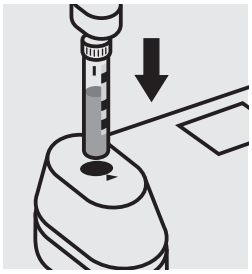
Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).
= Result A

Samples of total hardness > 10 °d

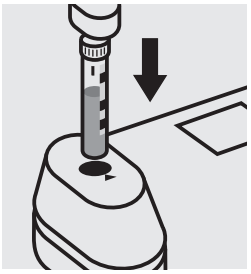
Add 1 level grey microspoon each of **Pb-2K** to the already measured cells, close with the screw cap.



Shake both cells vigorously to dissolve the solid substance.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).
= Result B

Result A
– Result B
= mg/l Pb

Important:

For the determination of **total lead** a pretreatment with Crack Set 10C, Cat.No. 114688, or Crack Set 10, Cat.No. 114687, and thermoreactor is necessary.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 40, Cat.No. 114692.

Ready-for-use lead standard solution CertiPUR®, Cat.No. 119776, concentration 1000 mg/l Pb, can also be used after diluting accordingly.

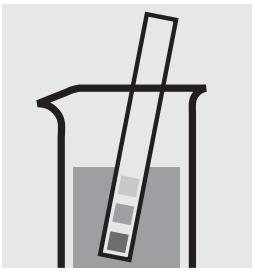
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 40) is highly recommended.

Lead

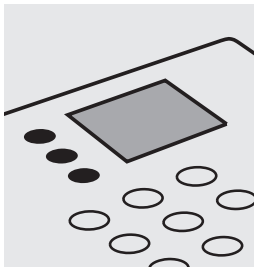
109717

Test

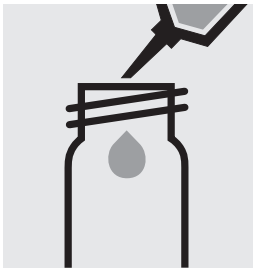
Measuring range: 0.05 – 5.00 mg/l Pb 24-mm cell



Check the pH of the sample, specified range: pH 3 – 6.
If required, add dilute ammonia solution or nitric acid drop by drop to adjust the pH.



Select method (2)(6)(1).

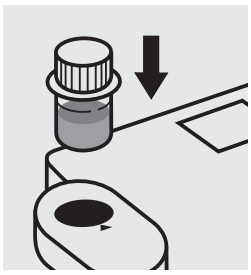


Pipette 0.50 ml each of **Pb-1** into two 24-mm cells.

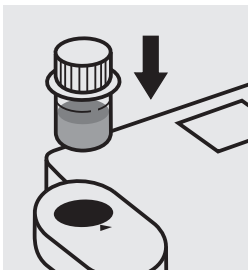
Add to each cell 0.50 ml **Pb-2** with pipette, close with the screw cap, and mix.

Add to one cell 8.0 ml of the sample with pipette, close with the screw cap, and mix.

Add to the second cell 8,0 ml of distilled water with pipette, close with the screw cap, and mix. (Blank cell)



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Important:

For the determination of **total lead** a pretreatment with Crack Set 10C, Cat.No. 114688, or Crack Set 10, Cat.No. 114687, and thermoreactor is necessary.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 40, Cat.No. 114692.

Ready-for-use lead standard solution CertiPUR®, Cat.No. 119776, concentration 1000 mg/l Pb, can also be used after diluting accordingly.

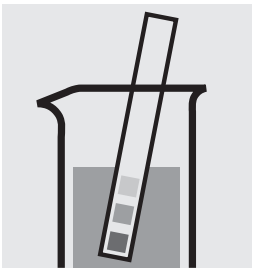
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 40) is highly recommended.

Magnesium

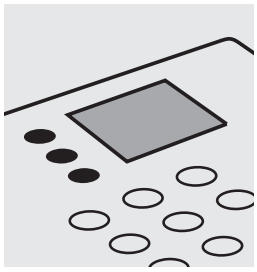
100815

Cell Test

Measuring range: 5.0 – 75.0 mg/l Mg 16-mm cell



Check the pH of the sample, specified range: pH 3 – 9.
If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



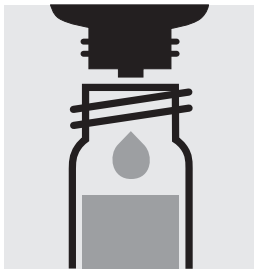
Select method (2)(7)(0).

Pipette 1.0 ml of the sample into a reaction cell, close with the screw cap, and mix.

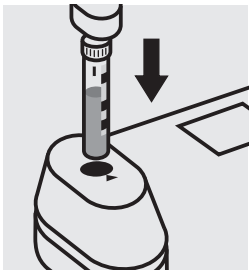
Pipette 1.0 ml of distilled water into a second reaction cell, close with the screw cap, and mix. (Blank cell)

Add to each cell 1.0 ml of **Mg-1K** with pipette, close with the screw cap, and mix.

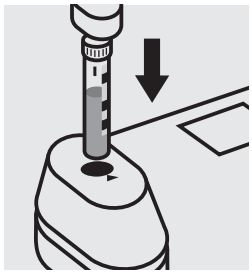
Reaction time:
exactly 3 minutes
Press (Enter) to start the countdown.



Add to each cell 3 drops of **Mg-2K**, close with the screw cap, and mix.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

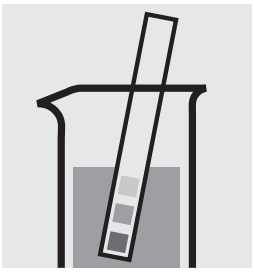
To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section “Standard solutions”).

Manganese

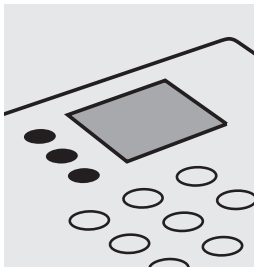
100816

Cell Test

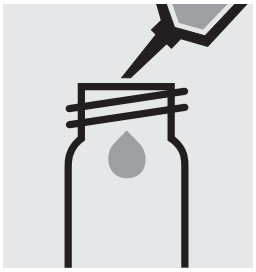
Measuring range: 0.10 – 5.00 mg/l Mn 16-mm cell



Check the pH of the sample, specified range: pH 2 – 7.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.

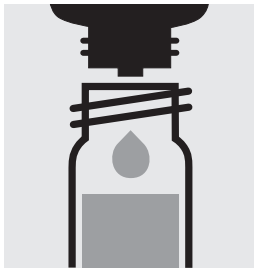


Select method (2)(8)(0).



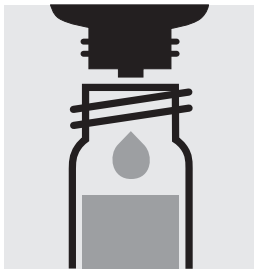
Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)

Pipette 7.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



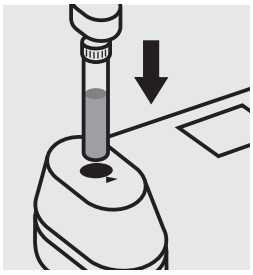
Add 2 drops of **Mn-1K**, close with the screw cap, and mix.

Reaction time:
2 minutes
Press (Enter) to start the countdown.

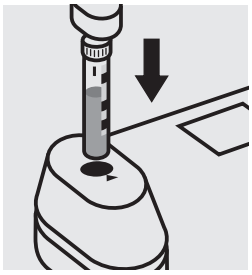


Add 3 drops of **Mn-2K**, close with the screw cap, and mix.

Reaction time:
5 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 30, Cat.No. 114677.

Ready-for-use manganese standard solution CertiPUR®, Cat.No. 119789, concentration 1000 mg/l Mn, can also be used after diluting accordingly.

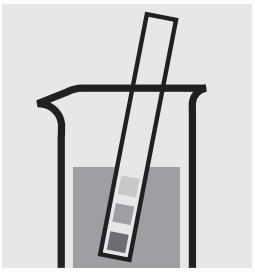
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 30) is highly recommended.

Manganese

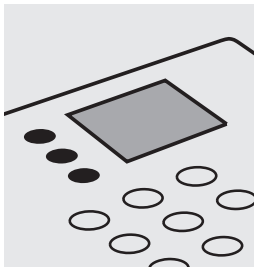
101739

Test

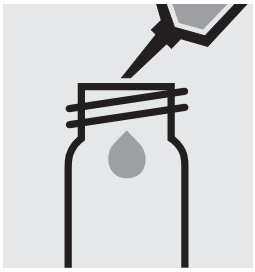
Measuring range: 0.05– 1.80 mg/l Mn 24-mm cell



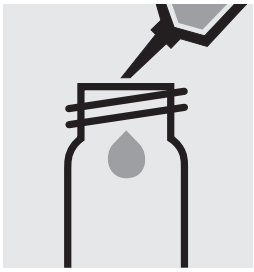
Check the pH of the sample, specified range: pH 3 – 10.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method (2)(8)(1).

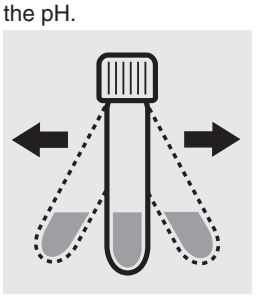


Pipette 8.0 ml of the sample into a 24-mm cell.



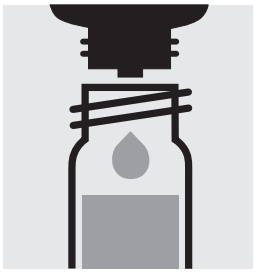
Pipette 8.0 ml of distilled water into a second 24-mm cell.
(Blank cell)

Add to each cell 1 level grey microspoon of **Mn-1**, close with the screw cap.



Shake both cells vigorously to dissolve the solid substance.

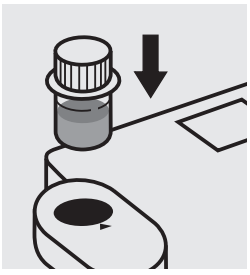
Add to each cell 2.0 ml of **Mn-2** with pipette, close with the screw cap, and mix.



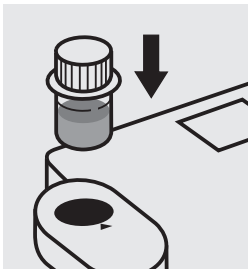
Add to each cell 3 drops of **Mn-3**, close with the screw cap, and mix.

Add **swiftly** to each cell 0.25 ml of **Mn-4** with pipette, close with the screw cap, and mix **immediately**.

Reaction time:
10 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-for-use manganese standard solution CertiPUR®, Cat.No. 119789, concentration 1000 mg/l Mn, can be used after diluting accordingly.

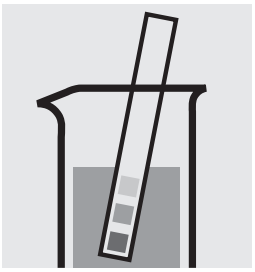
Manganese

114770

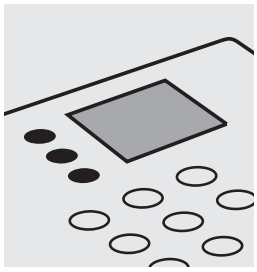
Test

Measuring range: 0.05 – 6.00 mg/l Mn 24-mm cell

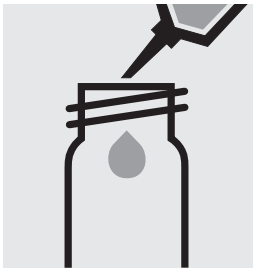
Attention: In contrast to the instructions given in the package insert the sample volume as well as the reagent volume must be doubled.



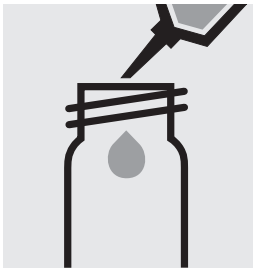
Check the pH of the sample, specified range: pH 2 – 7.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



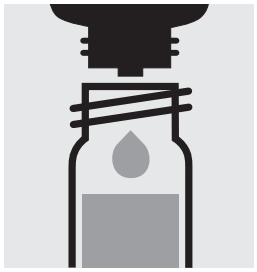
Select method (2)(8)(2).



Fill approx. 10 ml of distilled water into a 24-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)



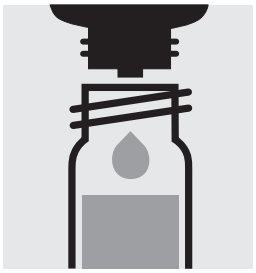
Pipette 10 ml of the sample into a 24-mm cell.



Add 8 drops of **Mn-1**, close with the screw cap, and mix.
Check the pH, specified pH: approx. 11.5.

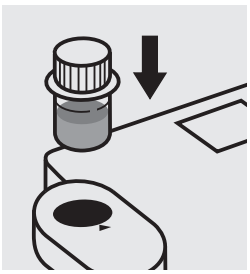
Add 4 drops of **Mn-2**, close with the screw cap, and mix.
Check the pH, specified pH: approx. 11.5.

Reaction time: 2 minutes
Press (Enter) to start the countdown.

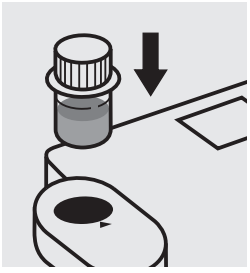


Add 4 drops of **Mn-3**, close with the screw cap, and mix.

Reaction time: 2 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 30, Cat.No. 114677.
Use 10 ml R-1 instead of the sample.

Ready-for-use manganese standard solution CertiPUR®, Cat.No. 119789, concentration 1000 mg/l Mn, can also be used after diluting accordingly.

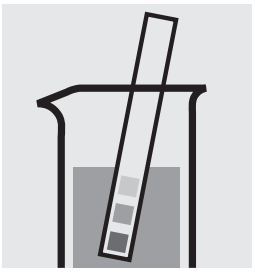
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 30) is highly recommended.
Use 10 ml sample + 0.1 ml R-2.

Manganese

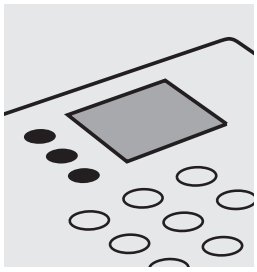
101846

Test

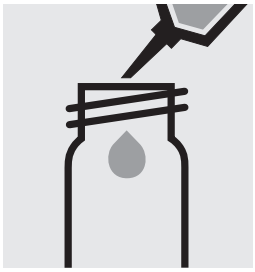
Measuring range: 0.05– 1.80 mg/l Mn 24-mm cell



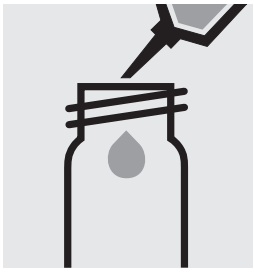
Check the pH of the sample, specified range: pH 3 – 10.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method (2)(8)(3).

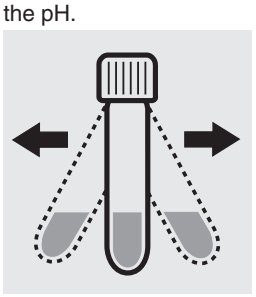


Pipette 8.0 ml of the sample into a 24-mm cell.



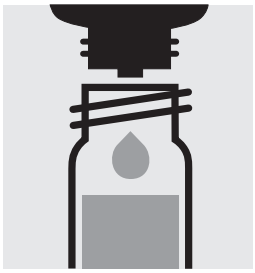
Pipette 8.0 ml of distilled water into a second 24-mm cell.
(Blank cell)

Add to each cell 1 level grey microspoon of **Mn-1**, close with the screw cap.



Shake both cells vigorously to dissolve the solid substance.

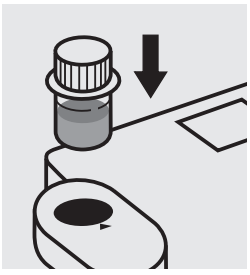
Add to each cell 2.0 ml of **Mn-2** with pipette, close with the screw cap, and mix.



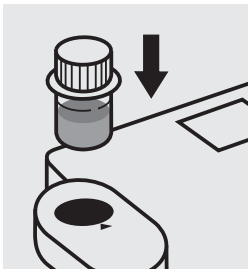
Add **carefully** to each cell 3 drops of **Mn-3**, close with the screw cap, and mix.

Add to each cell 0.25 ml of **Mn-4** with pipette, close with the screw cap, and mix **carefully** (**Foams! Wear eye protection!**).

Reaction time:
10 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

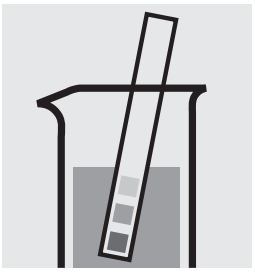
To check the measurement system (test reagents, measurement device, and handling) ready-for-use manganese standard solution CertiPUR®, Cat.No. 119789, concentration 1000 mg/l Mn, can be used after diluting accordingly.

Molybdenum

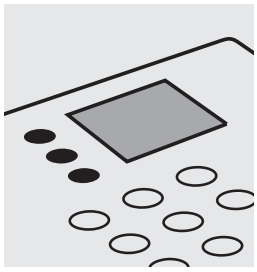
100860

Cell Test

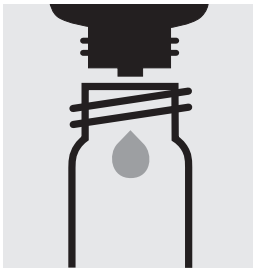
Measuring range:	0.02 – 1.00 mg/l Mo	16-mm cell
	0.03 – 1.67 mg/l MoO_4	16-mm cell
	0.04 – 2.15 mg/l Na_2MoO_4	16-mm cell



Check the pH of the sample, specified range: pH 1 – 10.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



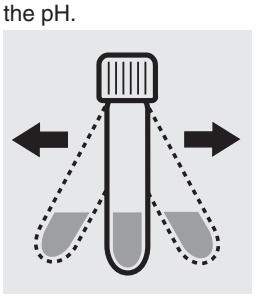
Select method (2)(9)(0).



Add 2 drops each of **Mo-1K** to two reaction cells and mix.

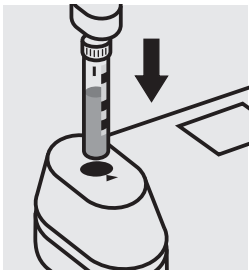
Add to one cell 10 ml of the sample with pipette, close with the screw cap.

Add to the second cell 10 ml of distilled water with pipette, close with the screw cap.
(Blank cell)

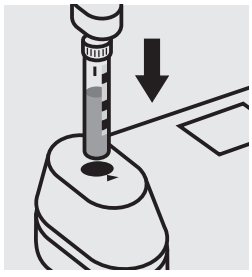


Shake both cells vigorously to dissolve the solid substance.

Reaction time:
2 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

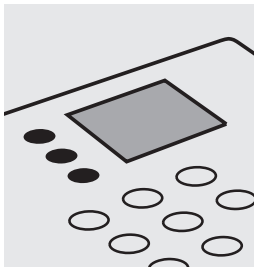
To check the measurement system (test reagents, measurement device, and handling) a ready-for-use molybdenum standard solution CertiPUR®, Cat.No. 170227, concentration 1000 mg/l Mo, can be used after diluting accordingly.

Molybdenum

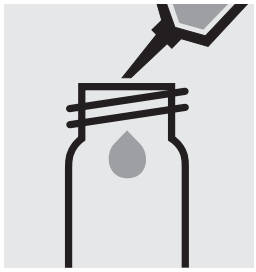
119252

Test

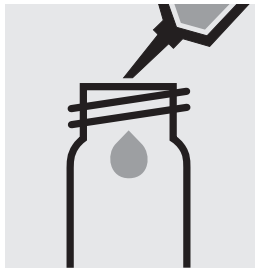
Measuring range:	0.5 – 45.0 mg/l Mo	24-mm cell
	0.8 – 75.0 mg/l MoO_4	24-mm cell
	1.1 – 96.6 mg/l Na_2MoO_4	24-mm cell



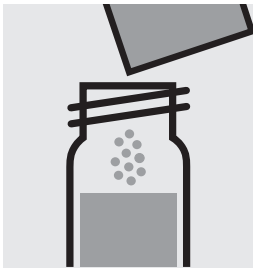
Select method (2)(9)(1).



Fill approx. 10 ml of distilled water into a 24-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)



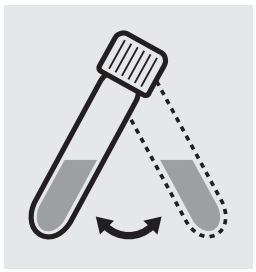
Pipette 10 ml of the sample into a 24-mm cell.



Add 1 powder pack of **Molybdenum HR1**, close with the screw cap, and dissolve the solid substance.

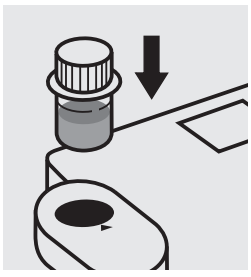
Add 1 powder pack of **Molybdenum HR2**, close with the screw cap, and dissolve the solid substance.

Add 1 powder pack of **Molybdenum HR3** and close with the screw cap.

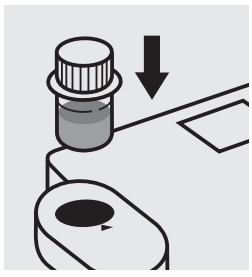


Swirl the cell to dissolve the solid substance.

Reaction time: 5 minutes, **measure immediately**. Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

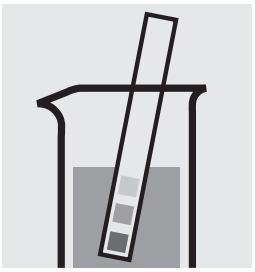
To check the measurement system (test reagents, measurement device, and handling) a ready-for-use molybdenum standard solution CertiPUR®, Cat.No. 170227, concentration 1000 mg/l Mo, can be used after diluting accordingly.

Monochloramine

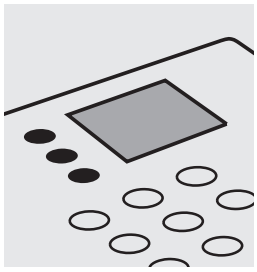
101632

Test

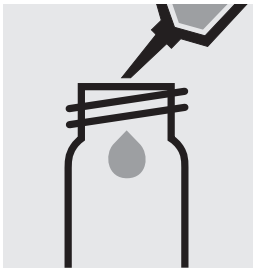
Measuring range:	0.10–5.00 mg/l Cl_2	24-mm cell
	0.07–3.63 mg/l NH_2Cl	24-mm cell
	0.02–0.99 mg/l NH_2Cl-N	24-mm cell



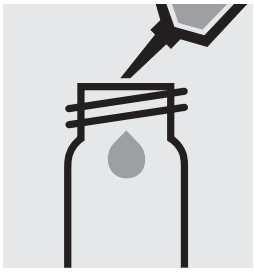
Check the pH of the sample, specified range: pH 4 – 13.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



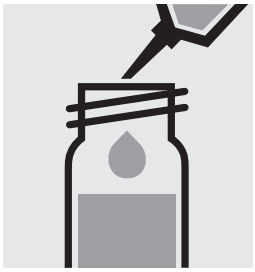
Select method (3)(0)(0).



Fill approx. 10 ml of distilled water into a 24-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)

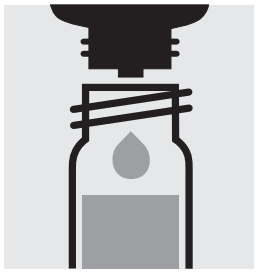


Pipette 10 ml of the sample into a 24-mm cell.



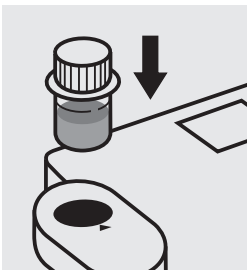
Add 0.60 ml of **MCA-1** with pipette, close with the screw cap, and mix.

Reaction time:
5 minutes
Press (Enter) to start the countdown.

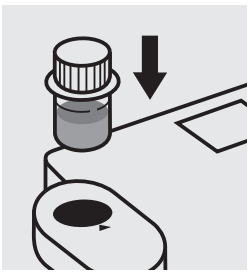


Add 4 drops of **MCA-2**, close with the screw cap, and mix.

Reaction time:
10 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Important:

Very high monochloramine concentrations in the sample produce turquoise-coloured solutions (measurement solution should be yellow-green to green) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

Quality assurance:

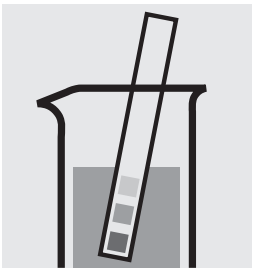
To check the measurement system (test reagents, measurement device, and handling) a standard solution must be prepared (see section “Standard solutions”).

Nickel

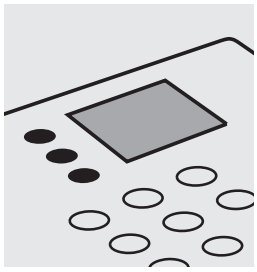
114554

Cell Test

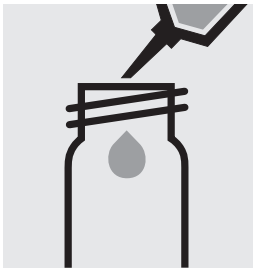
Measuring range: 0.10 – 6.00 mg/l Ni 16-mm cell



Check the pH of the sample, specified range: pH 3 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method (3)(1)(0).

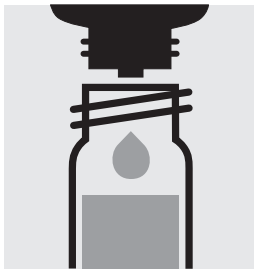


Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)

Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.

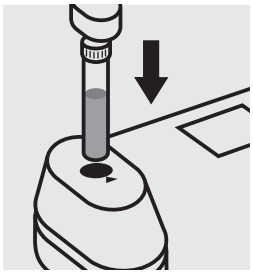
Reaction time:
1 minute
Press (Enter) to start the countdown.

Add 2 drops of **Ni-1K**, close with the screw cap, and mix. Check the pH of the solution, specified range: pH 10 – 12

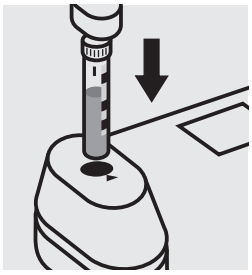


Add 2 drops of **Ni-2K**, close with the screw cap, and mix.

Reaction time:
2 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Important:

For the determination of **total nickel** a pretreatment with Crack Set 10C, Cat.No. 114688, or Crack Set 10, Cat.No. 114687 and thermoreactor is necessary.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 40, Cat.No. 114692.

A nickel standard solution Titrisol®, Cat.No. 109989, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 40) is highly recommended.

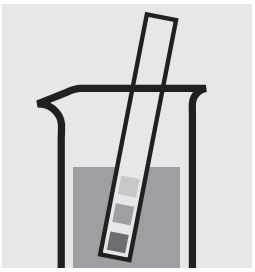
Nickel

114785

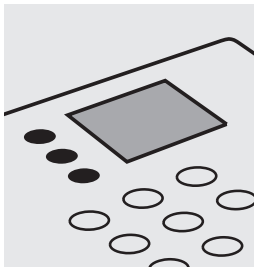
Test

Measuring range: 0.05 – 5.00 mg/l Ni 24-mm cell

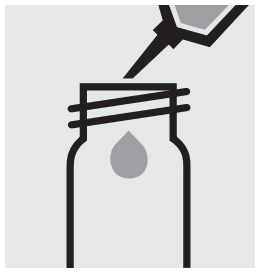
Attention: In contrast to the instructions given in the package insert the sample volume as well as the reagent volume must be doubled.



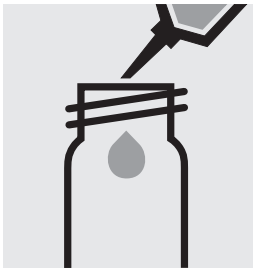
Check the pH of the sample, specified range: pH 3 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



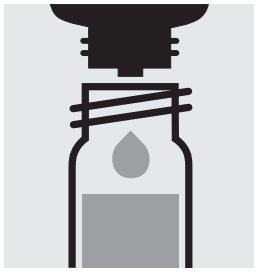
Select method (3)(1)(1).



Pipette 10 ml of the sample into a 24-mm cell.

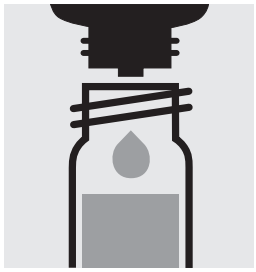


Pipette 10 ml of distilled water into a second 24-mm cell.
(Blank cell)



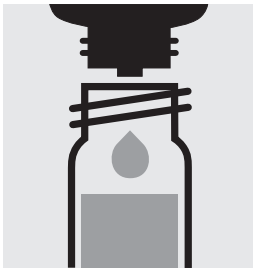
Add to each cell 2 drops of **Ni-1**, close with the screw cap, and mix. If the colour disappears, continue adding drop by drop until a slight yellow colouration persists.

Reaction time:
1 minute
Press (Enter) to start the countdown.

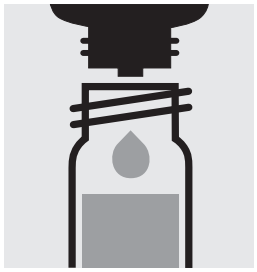


Add to each cell 4 drops of **Ni-2**, close with the screw cap, and mix.

Check the pH, specified range: pH 10 – 12

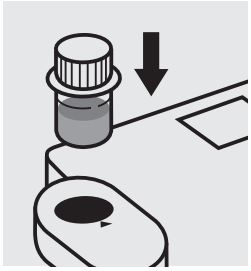


If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.

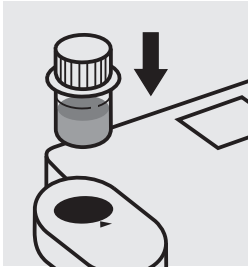


Add to each cell 4 drops of **Ni-3**, close with the screw cap, and mix.

Reaction time:
2 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Important:

For the determination of **total nickel** a pretreatment with Crack Set 10C, Cat.No. 114688, or Crack Set 10, Cat.No. 114687 and thermoreactor is necessary.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 40, Cat.No. 114692.
Use 10 ml R-1 instead of the sample.

A nickel standard solution Titrisol®, Cat.No. 109989, can also be used after diluting accordingly.

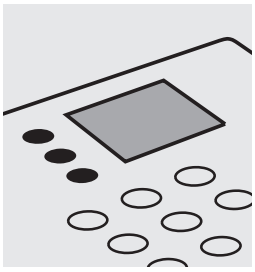
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 40) is highly recommended.
Use 10 ml sample + 0.2 ml R-2.

Nitrate

114542

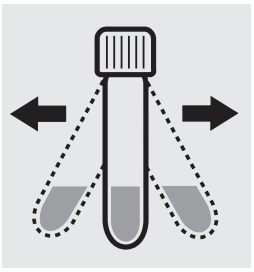
Cell Test

Measuring range:	0.5 – 15.0 mg/l NO_3-N	16-mm cell
	2.2 – 66.4 mg/l NO_3	16-mm cell

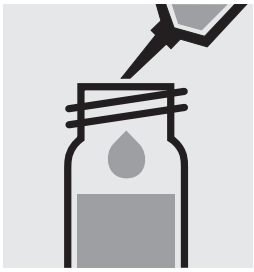


Select method (3)(2)(0).

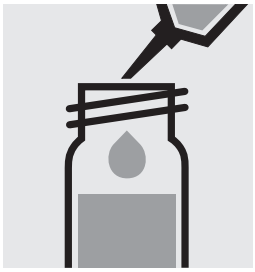
Add 1 level yellow microspoon each of **NO_3-1K** into two reaction cells, close with the screw cap.



Shake both cells **vigorously for 1 minute** to dissolve the solid substance.

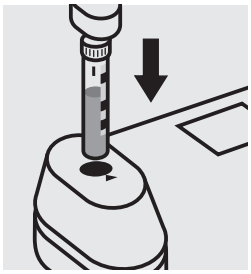


Add to one cell very slowly 1.5 ml of the sample with pipette, close with the screw cap, and mix **briefly**.
Caution, cell becomes very hot!

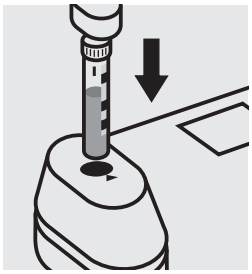


Add to the second cell very slowly 1.5 ml of distilled water with pipette, close with the screw cap, and mix **briefly**.
Caution, cell becomes very hot!
(Blank cell)

Reaction time:
10 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 20, Cat.No. 114675, or the Standard solution for photometric applications, CRM, Cat. No. 125037.

Ready-for-use nitrate standard solution CertiPUR®, Cat.No. 119811, concentration 1000 mg/l NO_3^-, can also be used after diluting accordingly.

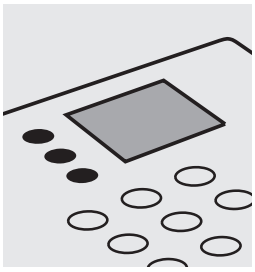
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 20) is highly recommended.

Nitrate

114773

Test

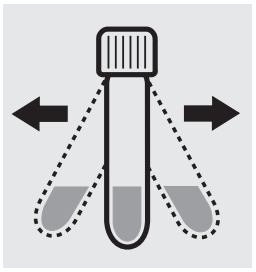
Measuring range:	0.5 – 15.0 mg/l NO_3-N	16-mm cell
	2.2 – 66.4 mg/l NO_3	16-mm cell



Select method (3)(2)(1).

Place 1 level blue microspoon each of **NO_3-1** into two dry 16-mm cells.

Add to each cell 5.0 ml of **NO_3-2** with pipette, close with the screw cap

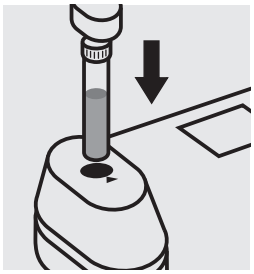


Shake both cells **vigorously for 1 minute** to dissolve the solid substance.

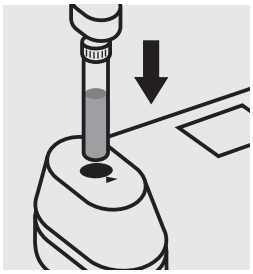
Add to one cell very slowly 1.5 ml of the sample with pipette, close with the screw cap, and mix **briefly**. **Caution, cell becomes very hot!**

Add to the second cell very slowly 1.5 ml of distilled water with pipette, close with the screw cap, and mix **briefly**.
Caution, cell becomes very hot!
(Blank cell)

Reaction time:
10 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Press (Zero).



Insert the cell containing the sample into the cell compartment. Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10 and 20, Cat.No. 114676 and 114675, or the Standard solution for photometric applications, CRM, Cat.No. 125036 and 125037.

Ready-for-use nitrate standard solution CertiPUR®, Cat.No. 119811, concentration 1000 mg/l NO_3^-, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck) is highly recommended.

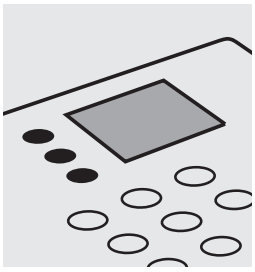
Nitrate

in seawater

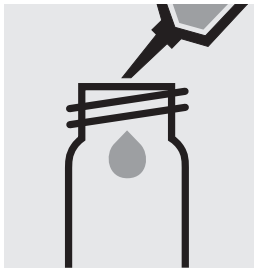
114556

Cell Test

Measuring range:	0.10 – 3.00	mg/l NO_3-N	16-mm cell
	0.4 – 13.3	mg/l NO_3	16-mm cell



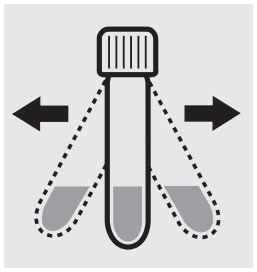
Select method (3)(2)(2).



Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)

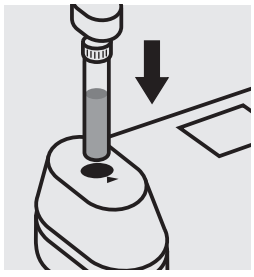
Pipette 2.0 ml of the sample into a reaction cell, **do not mix**.

Add 1 level blue micro-spoon of **NO_3-1K**, **immediately** close the cell tightly with the screw cap. **Caution, foams strongly (eye protection, protective gloves)!**

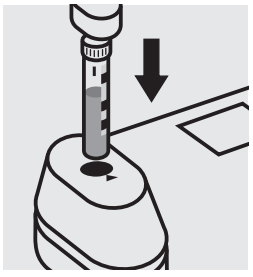


Shake the cell **vigorously for 5 seconds** to dissolve the solid substance.

Reaction time:
30 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10, Cat.No. 114676, or the Standard solution for photometric applications, CRM, Cat. No. 125036 and 125037.

Ready-for-use nitrate standard solution CertiPUR®, Cat.No. 119811, concentration 1000 mg/l NO_3^-, can also be used after diluting accordingly.

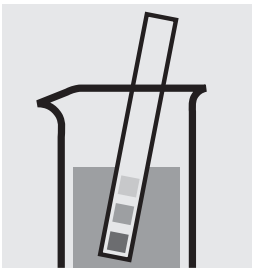
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 10) is highly recommended.

Nitrate

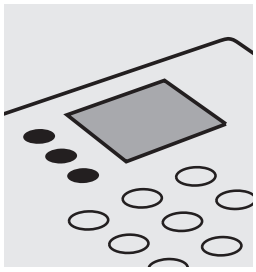
101842

Test

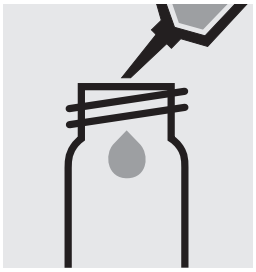
Measuring range:	0.3– 30.0 mg/l NO_3-N	24-mm cell
	1.3– 132.8 mg/l NO_3	24-mm cell



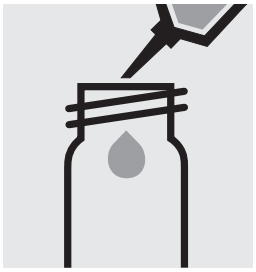
Check the pH of the sample, specified range: pH 3 – 9.
If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



Select method (3)(2)(3).

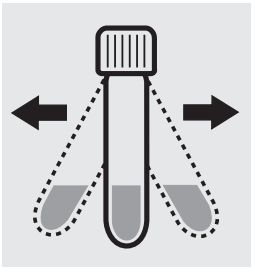


Pipette 10 ml of the sample into a 24-mm cell.



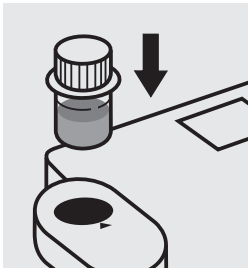
Pipette 10 ml of distilled water into a second 24-mm cell.
(Blank cell)

Add to each cell 1 level blue microspoon of **NO_3-1**, **immediately** close tightly with the screw cap.

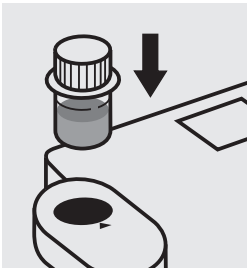


Shake both cells **vigorously for 1 minute** to dissolve the solid substance.

Reaction time:
5 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

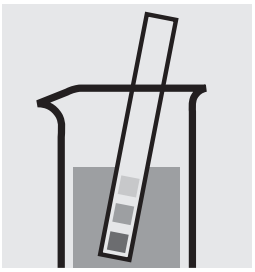
To check the measurement system (test reagents, measurement device, and handling) a ready-for-use nitrate standard solution CertiPUR®, Cat.No. 119811, concentration 1000 mg/l NO_3^-, can be used after diluting accordingly.

Nitrite

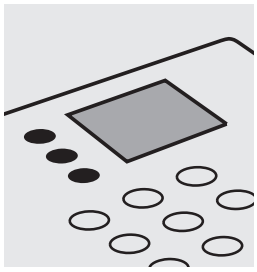
114547

Cell Test

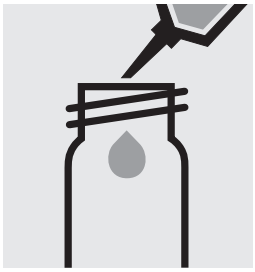
Measuring range:	10 – 700 µg/l NO_2-N	16-mm cell
	33 – 2299 µg/l NO_2	16-mm cell



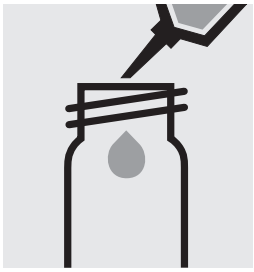
Check the pH of the sample, specified range: pH 2 – 10.
If required, add dilute sulfuric acid drop by drop to adjust the pH.



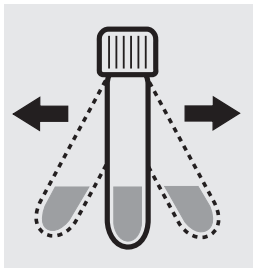
Select method 330.



Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)

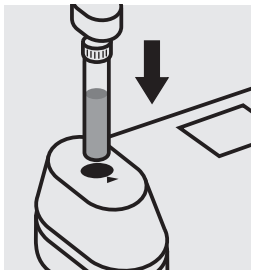


Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap.

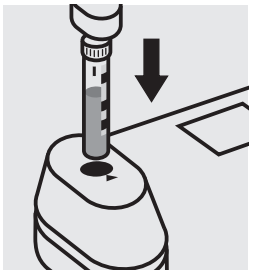


Shake the cell vigorously to dissolve the solid substance.

Reaction time:
10 minutes
Press Enter to start the countdown.



Insert the blank cell into the cell compartment.
Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press Test.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-for-use nitrite standard solution CertiPUR®, Cat.No. 119899, concentration 1000 mg/l NO_2^-, can be used after diluting accordingly as well as the Standard solution for photometric applications, CRM, Cat.No. 125041.

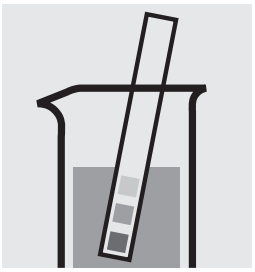
Nitrite

114776

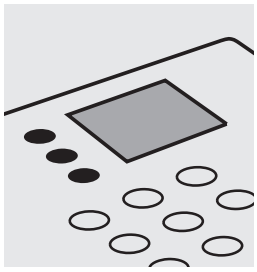
Test

Measuring range:	5 – 400 µg/l NO_2-N	24-mm cell
	16 – 1313 µg/l NO_2	24-mm cell

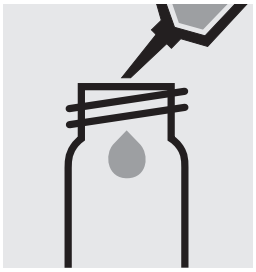
Attention: In contrast to the instructions given in the package insert the sample volume as well as the reagent volume must be doubled.



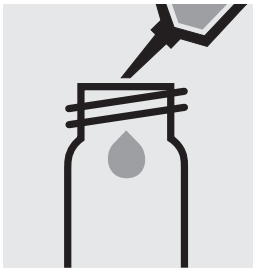
Check the pH of the sample, specified range: pH 2 – 10.
If required, add dilute sulfuric acid drop by drop to adjust the pH.



Select method (3)(3)(1).

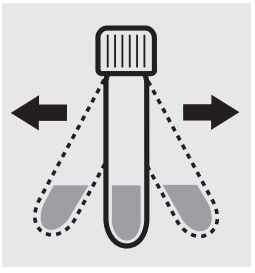


Fill approx. 10 ml of distilled water into a 24-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)



Pipette 10 ml of the sample into a 24-mm cell.

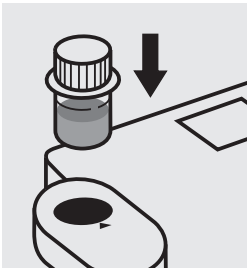
Add 2 level blue micro-spoons of **NO_2-1**, close with the screw cap.



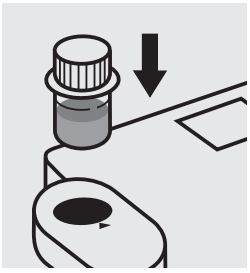
Shake the cell vigorously to dissolve the solid substance.

Check the pH, specified range: pH 2.0 – 2.5.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.

Reaction time:
10 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

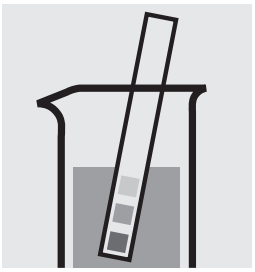
To check the measurement system (test reagents, measurement device, and handling) ready-for-use nitrite standard solution CertiPUR®, Cat.No. 119899, concentration 1000 mg/l NO_2^-, can be used after diluting accordingly as well as the Standard solution for photometric applications, CRM, Cat.No. 125041.

Nitrite

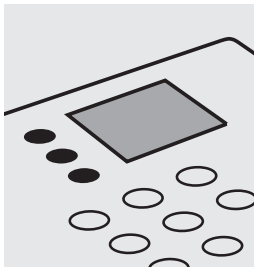
100609

Cell Test

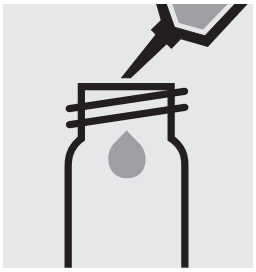
Measuring range:	1.0 – 90.0 mg/l NO_2-N	16-mm cell
	3.3 – 295.2 mg/l NO_2	16-mm cell



Check the pH of the sample, specified range: pH 1 – 12.
If required, add dilute sulfuric acid drop by drop to adjust the pH.

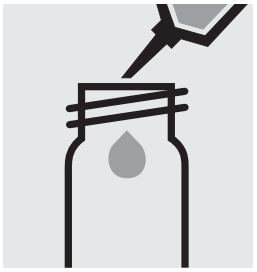


Select method (3)(3)(2).

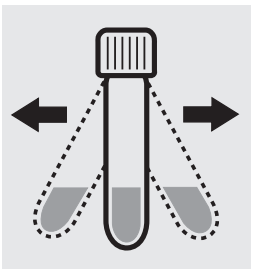


Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)

Add 2 level blue micro-spoons of **NO_2-1K** into a reaction cell.

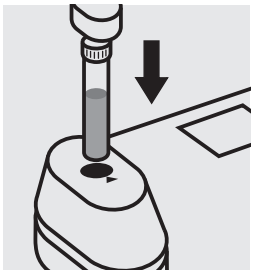


Add 8.0 ml of the sample with pipette and close with the screw cap.

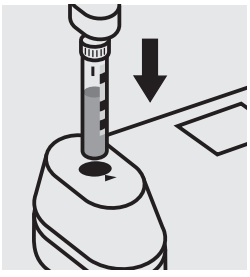


Shake the cell vigorously to dissolve the solid substance.

Reaction time:
20 minutes, **measure immediately**.
Press (Enter) to start the countdown.
Do not shake or swirl the cell before the measurement.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Quality assurance:

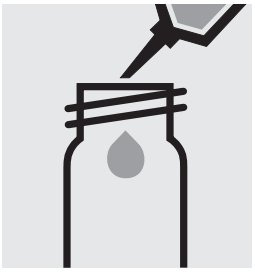
To check the measurement system (test reagents, measurement device, and handling) ready-for-use nitrite standard solution CertiPUR®, Cat.No. 119899, concentration 1000 mg/l NO_2^-, can be used after diluting accordingly as well as the Standard solution for photometric applications, CRM, Cat.No. 125042.

Nitrogen (total)

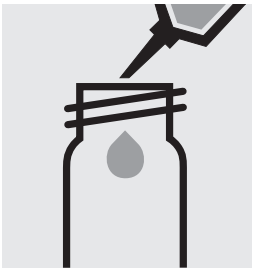
114537

Cell Test

Measuring range: 0.5 – 15.0 mg/l N 16-mm cell

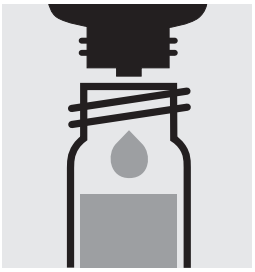


Pipette 10 ml of the sample into an empty 16-mm cell.

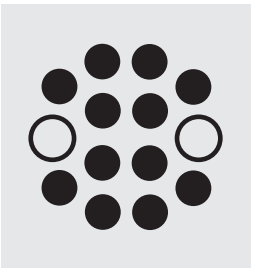


Pipette 10 ml of distilled water into a second empty 16-mm cell. (Blank)

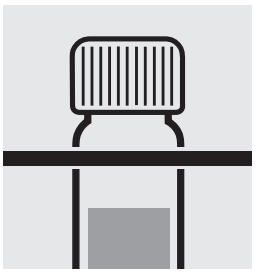
Add to each cell 1 level blue microspoon of **N-1K**.



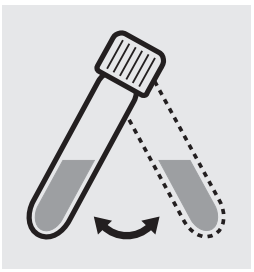
Add to each cell 6 drops of **N-2K**, close with the screw cap, and mix



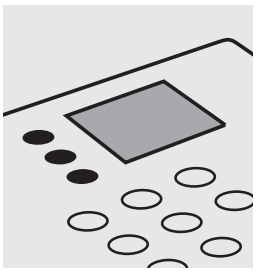
Heat both cells in the thermoreactor at 120 °C (100 °C) for 1 hour.



Remove both cells from the thermoreactor and place in a test-tube rack to cool to room temperature:
pretreated sample / blank.

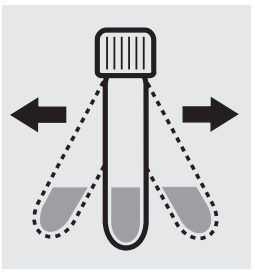


Swirl both cells after 10 minutes.



Select method (3)(4)(0).

Add 1 level yellow microspoon each of **N-3K** into two reaction cells, close with the screw cap.

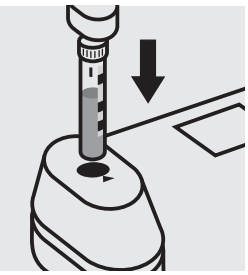


Shake both cells **vigorously for 1 minute** to dissolve the solid substance.

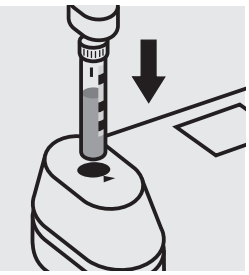
Add to one cell very slowly 1.5 ml of the **pretreated sample** with pipette, close with the screw cap, and mix **briefly**.
Caution, cell becomes very hot!

Add to the second cell very slowly 1.5 ml of the **pretreated blank** with pipette, close with the screw cap, and mix **briefly**.
Caution, cell becomes very hot!
(Blank cell)

Reaction time:
10 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 50, Cat.No. 114695, or the Standard solution for photometric applications, CRM, Cat.No. 125043 and 125044.

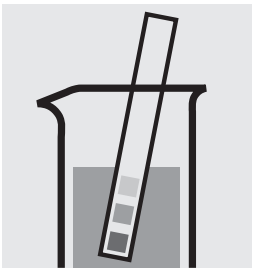
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 50) is highly recommended.

Oxygen

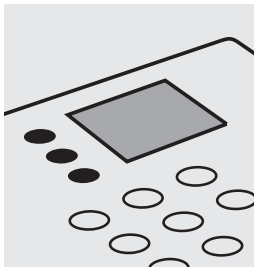
114694

Cell Test

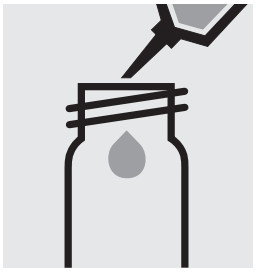
Measuring range: 0.5– 12.0 mg/l O_2 16-mm cell



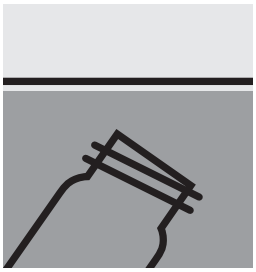
Check the pH of the sample, specified range: pH 6 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method (5)(5)(0).



Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



Fill watersample into a reaction cell to over-flowing and make sure, that no air bubbles are present.

Place the filled cell in a test-tube rack.

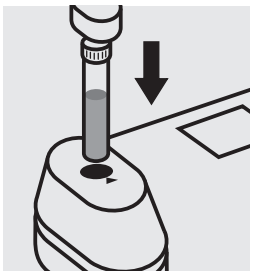
Add with microspoon 1 glass bead.

Add 5 drops of **O_2-1K.**

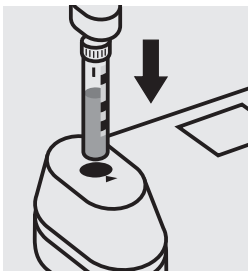
Add 5 drops of **O_2-2K**, close the cell with the screw cap, and shake for 10 seconds.

Reaction time:
1 minute
Press (Enter) to start the countdown.

Add 10 drops of **O_2-3K**, close the cell with the screw cap, mix, and clean from outside.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Quality assurance:

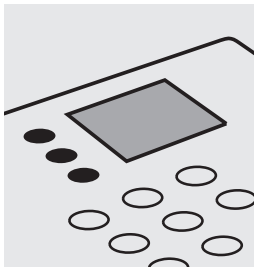
To check the measurement system (test reagents, measurement device, and handling) a oxygen standard solution must be prepared (application see the website).

Oxygen Scavengers

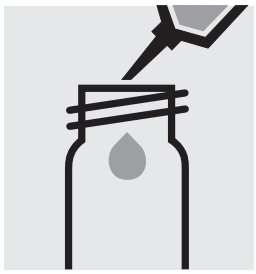
119251

Test

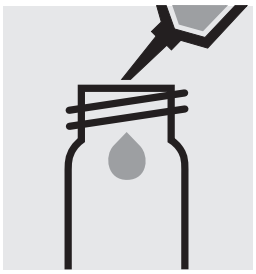
Measuring range:	20 – 500 µg/l DEHA*	24-mm cell
	* N,N-diethylenhydroxylamine	
	27 – 667 µg/l Carbohy*	24-mm cell
	* carbohydrazide	
	53 – 1315 µg/l Hydro*	24-mm cell
	* hydroquinone	
	78 – 1950 µg/l ISA*	24-mm cell
	* isoascorbic acid	
	87 – 2170 µg/l MEKO*	24-mm cell
	* methylethylketoxime	



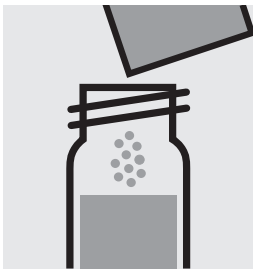
Select method (5)(5)(5).



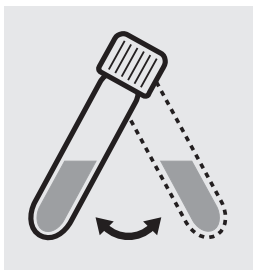
Pipette 10 ml of the sample into a 24-mm cell.



Pipette 10 ml of distilled water into a second 24-mm cell.
(Blank cell)



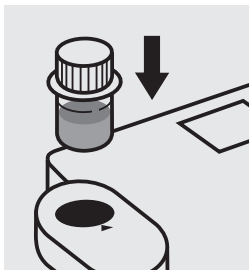
Add to each cell 1 powder pack of **Oxyscav 1** and close with the screw cap.



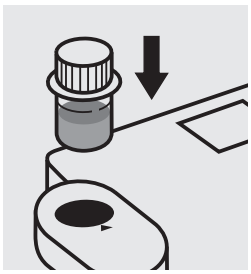
Swirl both cells to dissolve the solid substance.

Add to each cell 0.20 ml of **Oxyscav 2** with pipette, close with the screw cap, and mix.

Reaction time:
10 minutes, **protect from light in the process**, **measure immediately**.
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

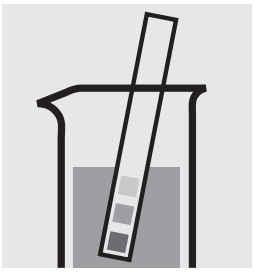
To check the measurement system (test reagents, measurement device, and handling) a oxygen scavengers standard solution must be prepared from N,N-diethylhydroxylamine, Cat.No. 818473 (see section “Standard solutions”).

Ozone

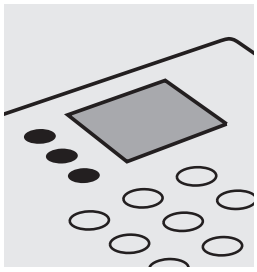
100607

Test

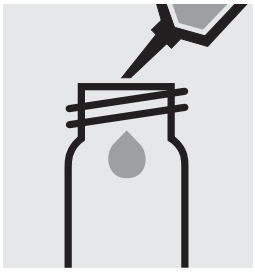
Measuring range: 0.02 – 2.00 mg/l O_3 24-mm cell



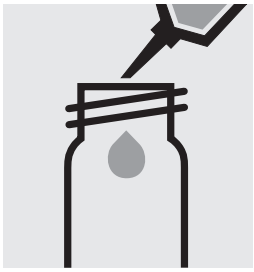
Check the pH of the sample, specified range: pH 4 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



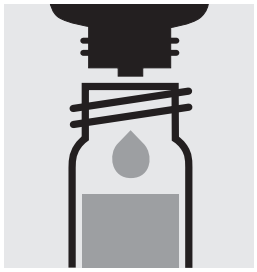
Select method 3 5 0.



Fill approx. 10 ml of distilled water into a 24-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)

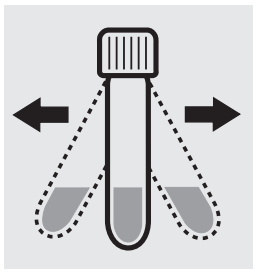


Pipette 10 ml of the sample into a 24-mm cell.



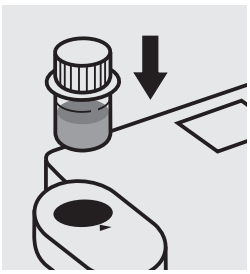
Add 2 drops of **O_3-1**, close with the screw cap, and mix.

Add 1 level blue micro-spoon of **O_3-2**, close with the screw cap.

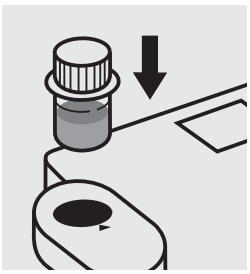


Shake the cell vigorously to dissolve the solid substance.

Reaction time:
1 minute
Press Enter to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Important:

Very high ozone concentrations in the sample produce yellow-coloured solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

Quality assurance:

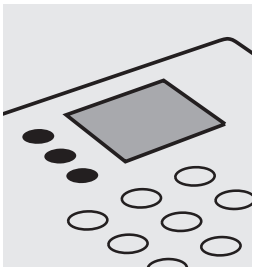
To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section “Standard solutions”).

pH

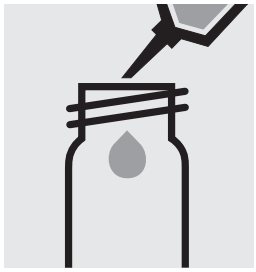
101744

Cell Test

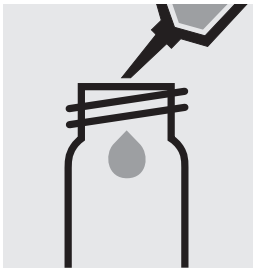
Measuring range: pH 6.4 – 8.8 16-mm cell



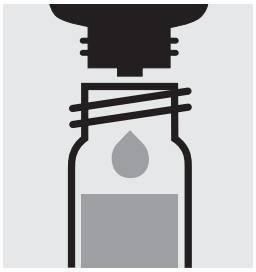
Select method (3)(6)(0).



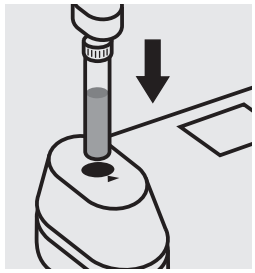
Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



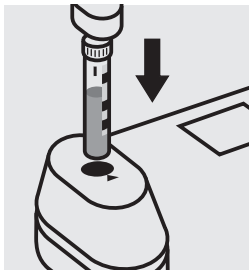
Pipette 10 ml of the sample into a round cell.



Add 4 drops of **pH-1**, close with the screw cap, and mix. **Attention!** The reagent bottle must be held **vertically by all means**!



Insert the blank cell into the cell compartment. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

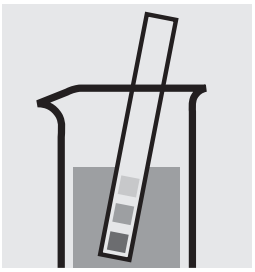
To check the measurement system (test reagents, measurement device, and handling) buffer solution pH 7.00 CertiPUR®, Cat.No. 109407, can be used.

Phenol

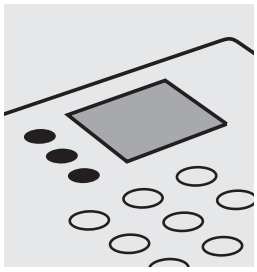
114551

Cell Test

Measuring range: 0.10 – 2.50 mg/l C_6H_5OH 16-mm cell

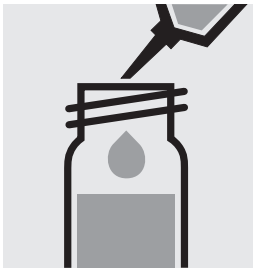


Check the pH of the sample, specified range: pH 2 – 11.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



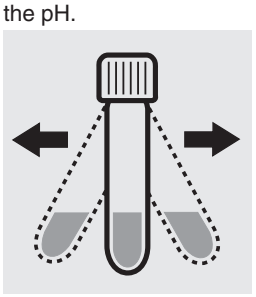
Select method 3 7 0.

Pipette 10 ml of the sample into a reaction cell, close with the screw cap, and mix.



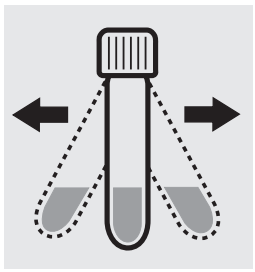
Pipette 10 ml of distilled water into a second reaction cell, close with the screw cap, and mix. (Blank cell)

Add to each cell 1 level grey microspoon of **Ph-1K**, close with the screw cap.



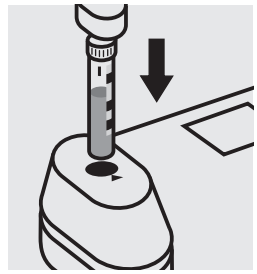
Shake both cells vigorously to dissolve the solid substance.

Add to each cell 1 level green microspoon of **Ph-2K**, close with the screw cap.

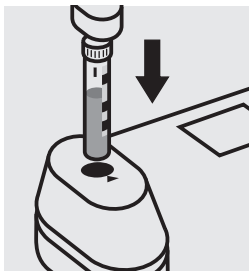


Shake both cells vigorously to dissolve the solid substance.

Reaction time:
1 minute
Press Enter to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Important:

Very high phenol concentrationsin the sample result in a weakening of the colour and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

Quality assurance:

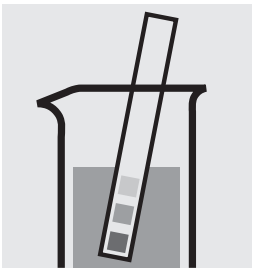
To check the measurement system (test reagents, measurement device, and handling) a phenol standard solution must be prepared from Phenol GR, Cat.No. 100206 (see section “Standard solutions”).

Phenol

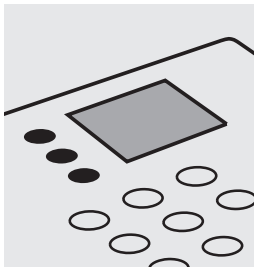
100856

Test

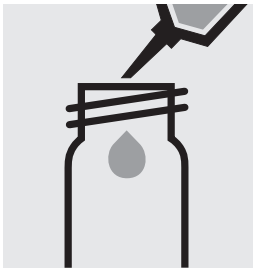
Measuring range: 0,10 – 5,00 mg/l C_6H_5OH 24-mm cell



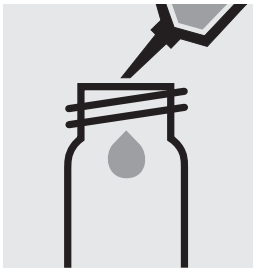
Check the pH of the sample, specified range: pH 2 – 11.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



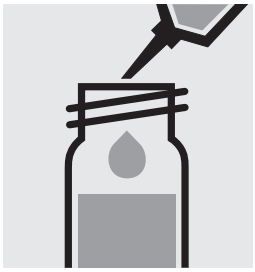
Select method (3)(7)(1).



Pipette 10 ml of the sample into a 24-mm cell.

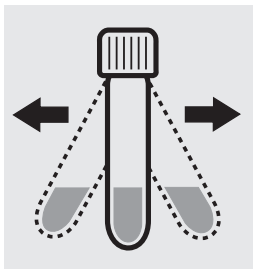


Pipette 10 ml of distilled water into a second 24-mm cell.
(Blank cell)



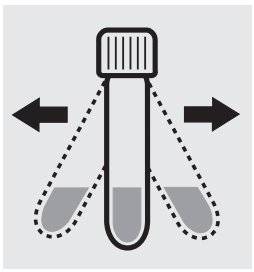
Add to each cell 1.0 ml of **Ph-1** with pipette, close with the screw cap, and mix.

Add to each cell 1 level grey microspoon of **Ph-2**, close with the screw cap, and mix.



Shake both cells vigorously to dissolve the solid substance.

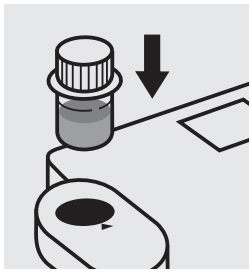
Add to each cell 1 level grey microspoon of **Ph-3**, close with the screw cap, and mix.



Shake both cells vigorously to dissolve the solid substance.

Reaction time:
10 minutes
Press (Enter) to start the countdown.

Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a phenol standard solution must be prepared from Phenol GR, Cat.No. 100206 (see section “Standard solutions”).

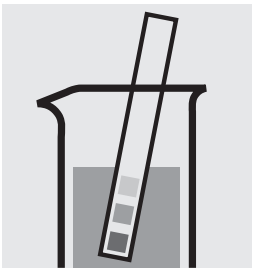
Phosphate

Determination of orthophosphate

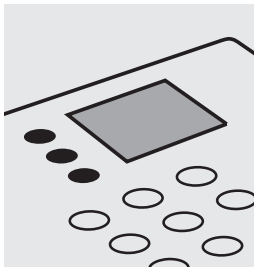
100474

Cell Test

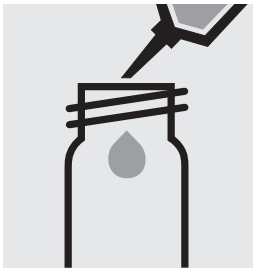
Measuring range:	0.05 – 4.00 mg/l PO_4-P	16-mm cell
	0.15 – 12.26 mg/l PO_4	16-mm cell
	0.11 – 9.17 mg/l P_2O_5	16-mm cell



Check the pH of the sample, specified range: pH 0 – 10.
If required, add dilute sulfuric acid drop by drop to adjust the pH.

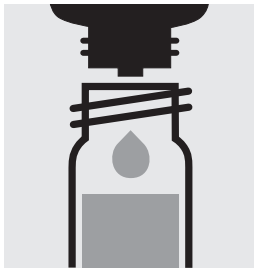


Select method 3 8 7.

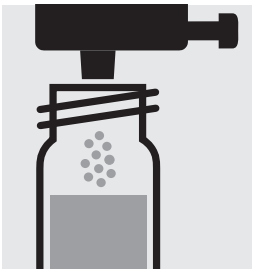


Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)

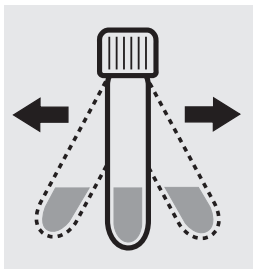
Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



Add 5 drops of **P-1K**, close with the screw cap, and mix.

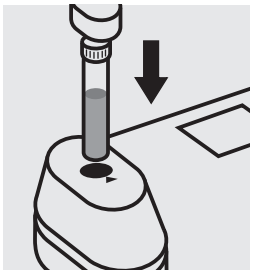


Add 1 dose of **P-2K** using the blue dose-metering cap, close with the screw cap.

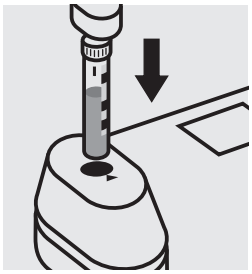


Shake the cell vigorously to dissolve the solid substance.

Reaction time:
5 minutes
Press Enter to start the countdown.



Insert the blank cell into the cell compartment.
Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press Test.

Important:

For the determination of **total phosphorus = sum of orthophosphate, polyphosphate and organophosphate** either Phosphate Cell Test, Cat. No. 114543, 114729, and 100673 or Phosphate Test, Cat. No. 114848 in conjunction with Crack Set 10/10C, Cat. No. 114687 resp. 114688 can be used.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10, Cat.No. 114676.

Ready-for-use phosphate standard solution CertiPUR®, Cat.No. 119898, concentration 1000 mg/l PO_4^{3-}, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 10) is highly recommended.

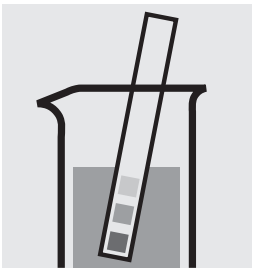
Phosphate

114543

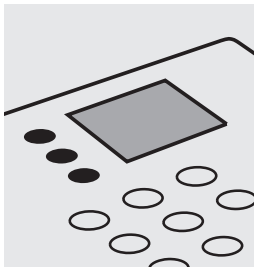
Determination of orthophosphate

Cell Test

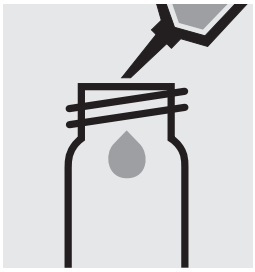
Measuring range:	0.05 – 4.00 mg/l PO_4-P	16-mm cell
	0.15 – 12.26 mg/l PO_4	16-mm cell
	0.11 – 9.17 mg/l P_2O_5	16-mm cell



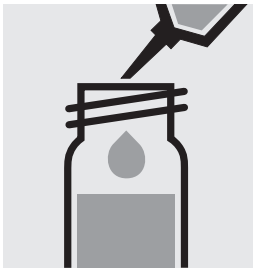
Check the pH of the sample, specified range: pH 0 – 10.
If required, add dilute sulfuric acid drop by drop to adjust the pH.



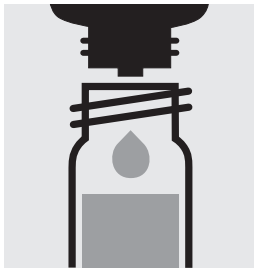
Select method 3 8 0.



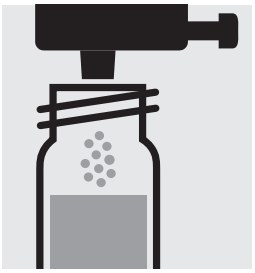
Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



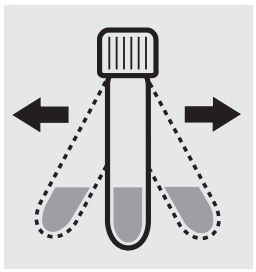
Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



Add 5 drops of **P-2K**, close with the screw cap, and mix.

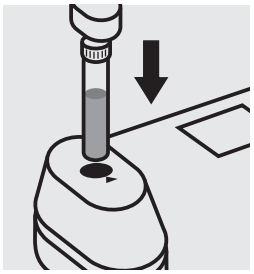


Add 1 dose of **P-3K** using the blue dose-metering cap, close with the screw cap.

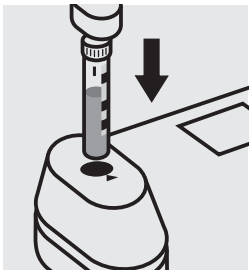


Shake the cell vigorously to dissolve the solid substance.

Reaction time:
5 minutes
Press Enter to start the countdown.



Insert the blank cell into the cell compartment.
Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press Test.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10, Cat.No. 114676.

Ready-for-use phosphate standard solution CertiPUR®, Cat.No. 119898, concentration 1000 mg/l PO_4^{3-}, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 10) is highly recommended.

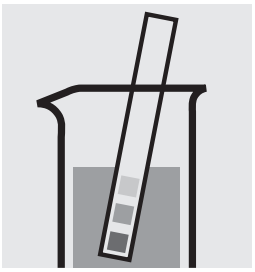
Phosphate

Determination of total phosphorus
= sum of orthophosphate, polyphosphate, and organophosphate

114543

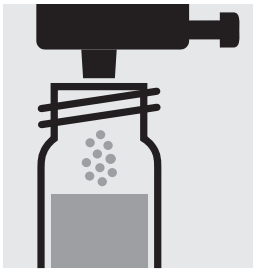
Cell Test

Measuring range:	0.05 – 4.00 mg/l PO_4-P	16-mm cell
	0.15 – 12.26 mg/l PO_4	16-mm cell
	0.11 – 9.17 mg/l P_2O_5	16-mm cell

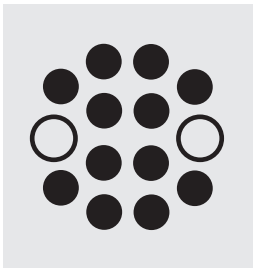


Check the pH of the sample, specified range: pH 0 – 10.
If required, add dilute sulfuric acid drop by drop to adjust the pH.

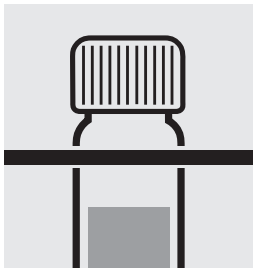
Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



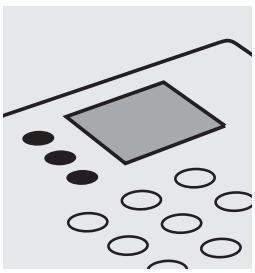
Add 1 dose of **P-1K** using the green dose-metering cap, close with the screw cap.



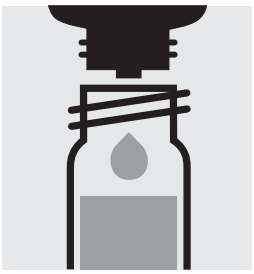
Heat the cell in the thermoreactor at 120 °C (100 °C) for 30 minutes.



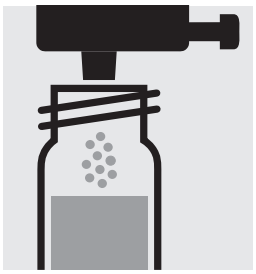
Remove the cell from the thermoreactor and place in a test-tube rack to cool to room temperature.



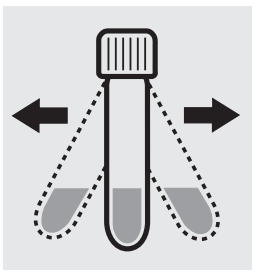
Select method (3)(8)(0).



Add 5 drops of **P-2K**, close with the screw cap, and mix.

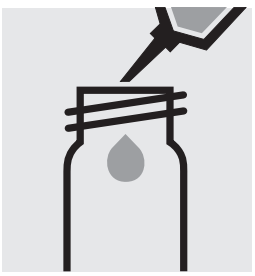


Add 1 dose of **P-3K** using the blue dose-metering cap, close with the screw cap.

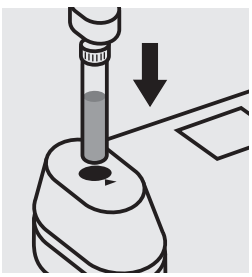


Shake the cell vigorously to dissolve the solid substance.

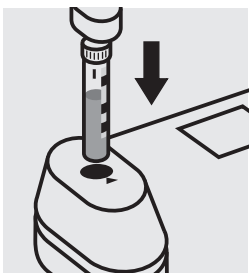
Reaction time:
5 minutes
Press (Enter) to start the countdown.



Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10, Cat.No. 114676, or the Standard solution for photometric applications, CRM, Cat. No. 125046.

Ready-for-use phosphate standard solution CertiPUR®, Cat.No. 119898, concentration 1000 mg/l PO_4^{3-}, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 10) is highly recommended.

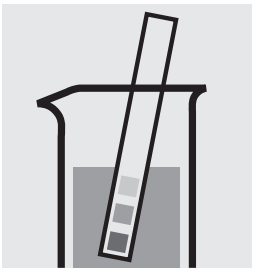
Phosphate

Determination of orthophosphate

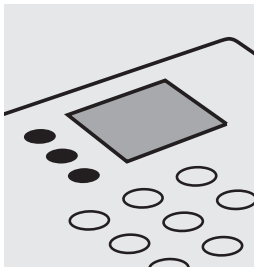
100475

Cell Test

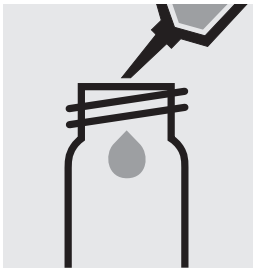
Measuring range:	0.5 – 20.0 mg/l PO_4-P	16-mm cell
	1.5 – 61.3 mg/l PO_4	16-mm cell
	1.1 – 45.8 mg/l P_2O_5	16-mm cell



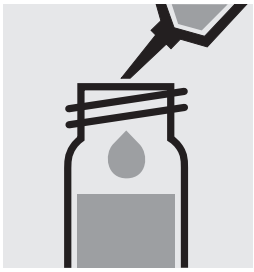
Check the pH of the sample, specified range: pH 0 – 10.
If required, add dilute sulfuric acid drop by drop to adjust the pH.



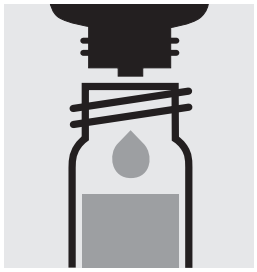
Select method (3)(8)(8).



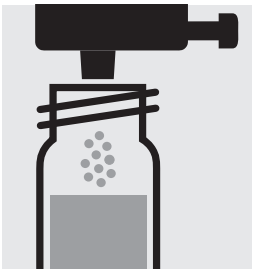
Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



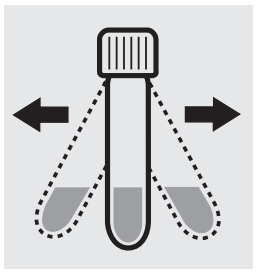
Pipette 1.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



Add 5 drops of **P-1K**, close with the screw cap, and mix.

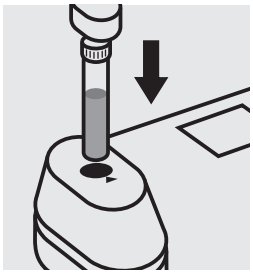


Add 1 dose of **P-2K** using the blue dose-metering cap, close with the screw cap.

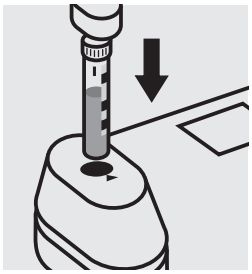


Shake the cell vigorously to dissolve the solid substance.

Reaction time:
5 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Important:

For the determination of **total phosphorus = sum of orthophosphate, polyphosphate and organophosphate** either Phosphate Cell Test, Cat. No. 114543, 114729, and 100673 or Phosphate Test, Cat. No. 114848 in conjunction with Crack Set 10/10C, Cat. No. 114687 resp. 114688 can be used.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 20 and 80, Cat.No. 114675 and 114738.

Ready-for-use phosphate standard solution CertiPUR®, Cat.No. 119898, concentration 1000 mg/l PO_4^{3-}, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck) is highly recommended.

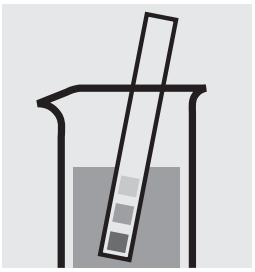
Phosphate

Determination of orthophosphate

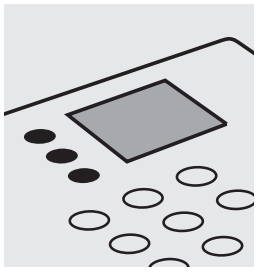
114729

Cell Test

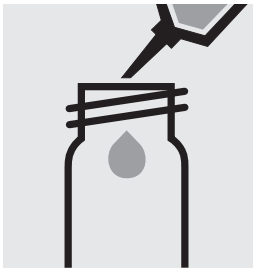
Measuring range:	0.5 – 20.0 mg/l PO_4-P	16-mm cell
	1.5 – 61.3 mg/l PO_4	16-mm cell
	1.1 – 45.8 mg/l P_2O_5	16-mm cell



Check the pH of the sample, specified range: pH 0 – 10.
If required, add dilute sulfuric acid drop by drop to adjust the pH.

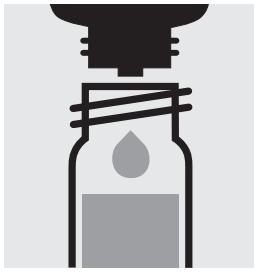


Select method (3)(8)(1).

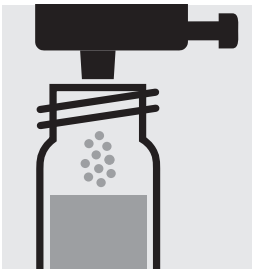


Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)

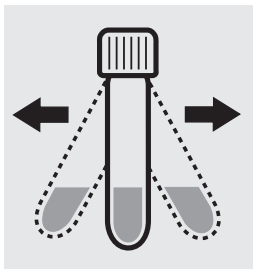
Pipette 1.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



Add 5 drops of **P-2K**, close with the screw cap, and mix.

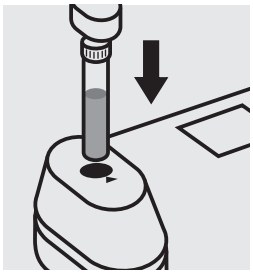


Add 1 dose of **P-3K** using the blue dose-metering cap, close with the screw cap.

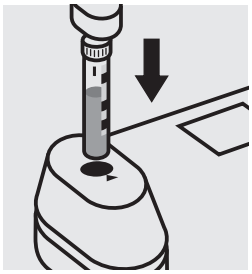


Shake the cell vigorously to dissolve the solid substance.

Reaction time:
5 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 20 and 80, Cat.No. 114675 and 114738.

Ready-for-use phosphate standard solution CertiPUR®, Cat.No. 119898, concentration 1000 mg/l PO_4^{3-}, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck) is highly recommended.

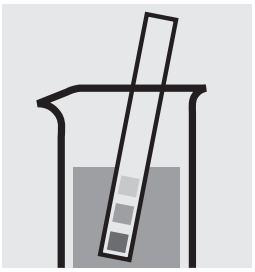
Phosphate

Determination of total phosphorus
= sum of orthophosphate, polyphosphate, and organophosphate

114729

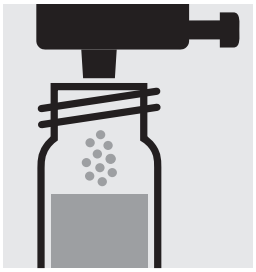
Cell Test

Measuring range:	0.5 – 20.0 mg/l PO_4-P	16-mm cell
	1.5 – 61.3 mg/l PO_4	16-mm cell
	1.1 – 45.8 mg/l P_2O_5	16-mm cell

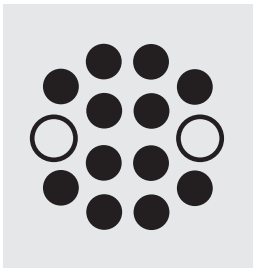


Check the pH of the sample, specified range: pH 0 – 10.
If required, add dilute sulfuric acid drop by drop to adjust the pH.

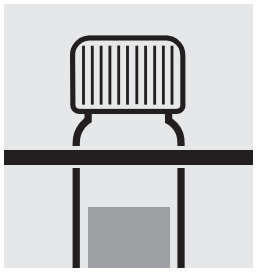
Pipette 1.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



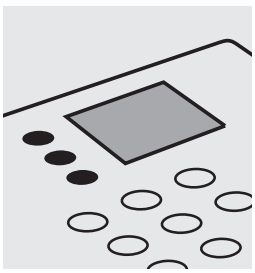
Add 1 dose of **P-1K** using the green dose-metering cap, close with the screw cap.



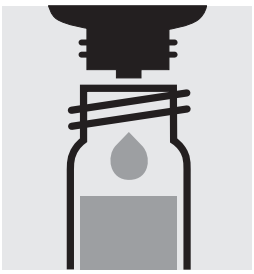
Heat the cell in the thermoreactor at 120 °C (100 °C) for 30 minutes.



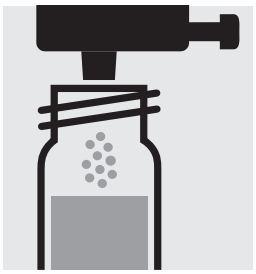
Remove the cell from the thermoreactor and place in a test-tube rack to cool to room temperature.



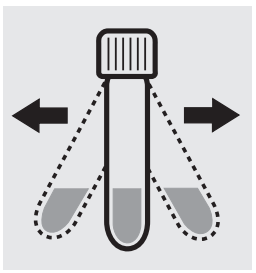
Select method (3)(8)(1).



Add 5 drops of **P-2K**, close with the screw cap, and mix.

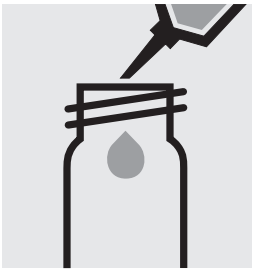


Add 1 dose of **P-3K** using the blue dose-metering cap, close with the screw cap.

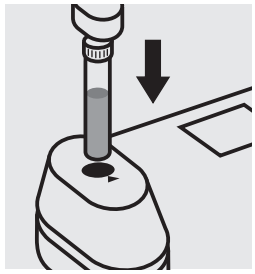


Shake the cell vigorously to dissolve the solid substance.

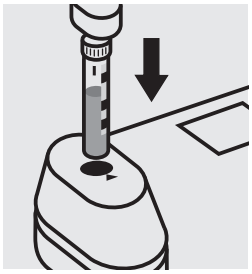
Reaction time:
5 minutes
Press (Enter) to start the countdown.



Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 20 and 80, Cat.No. 114675 and 114738, or as well as the Standard solution for photometric applications, CRM, Cat.No. 125047 and 125048.

Ready-for-use phosphate standard solution CertiPUR®, Cat.No. 119898, concentration 1000 mg/l PO_4^{3-}, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck) is highly recommended.

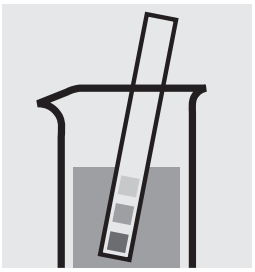
Phosphate

Determination of orthophosphate

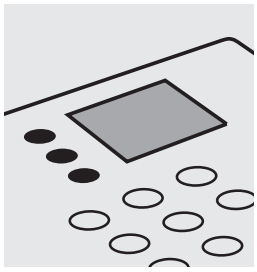
100616

Cell Test

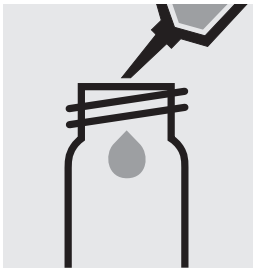
Measuring range:	3.0 – 100.0 mg/l PO_4-P	16-mm cell
	9 – 307 mg/l PO_4	16-mm cell
	7 – 229 mg/l P_2O_5	16-mm cell



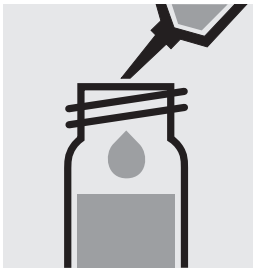
Check the pH of the sample, specified range: pH 0 – 10.
If required, add dilute sulfuric acid drop by drop to adjust the pH.



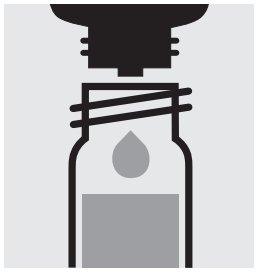
Select method (3)(8)(2).



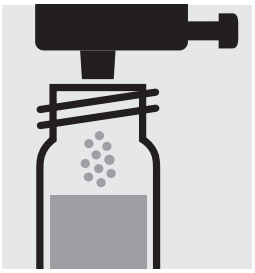
Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



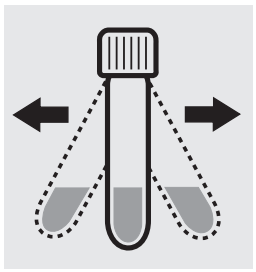
Pipette 0.20 ml of the sample into a reaction cell, close with the screw cap, and mix.



Add 5 drops of **PO_4-1K**, close with the screw cap, and mix.

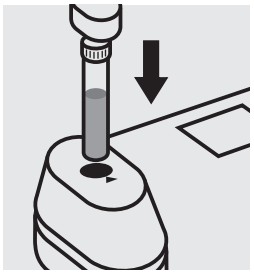


Add 1 dose of **PO_4-2K** using the blue dose-metering cap, close with the screw cap.

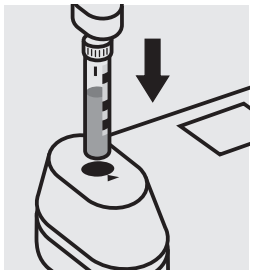


Shake the cell vigorously to dissolve the solid substance.

Reaction time:
5 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Important:

For the determination of **total phosphorus = sum of orthophosphate, polyphosphate and organophosphate** either Phosphate Cell Test, Cat. No. 114543, 114729, and 100673 or Phosphate Test, Cat. No. 114848 in conjunction with Crack Set 10/10C, Cat. No. 114687 resp. 114688 can be used.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-for-use phosphate standard solution CertiPUR®, Cat.No. 119898, concentration 1000 mg/l PO_4^{3-}, can be used after diluting accordingly.

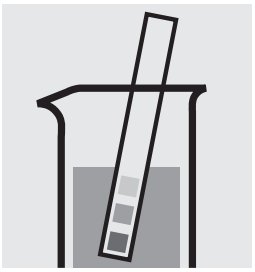
Phosphate

Determination of orthophosphate

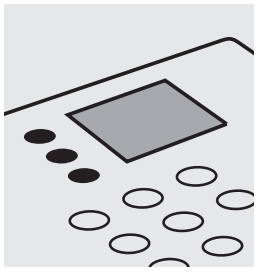
100673

Cell Test

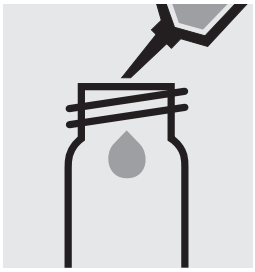
Measuring range:	3.0 – 100.0 mg/l PO_4-P	16-mm cell
	9 – 307 mg/l PO_4	16-mm cell
	7 – 229 mg/l P_2O_5	16-mm cell



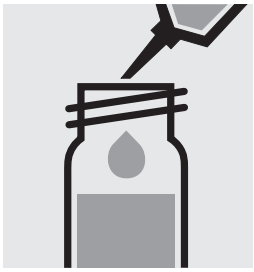
Check the pH of the sample, specified range: pH 0 – 10.
If required, add dilute sulfuric acid drop by drop to adjust the pH.



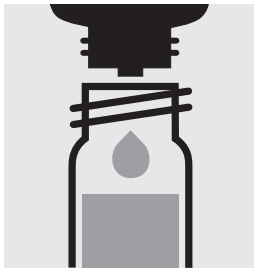
Select method 3 8 9.



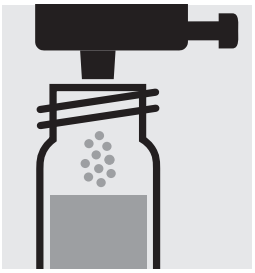
Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



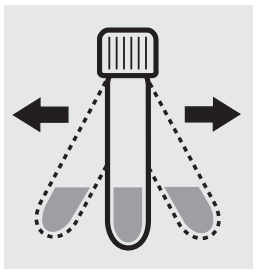
Pipette 0.20 ml of the sample into a reaction cell, close with the screw cap, and mix.



Add 5 drops of **P-2K**, close with the screw cap, and mix.

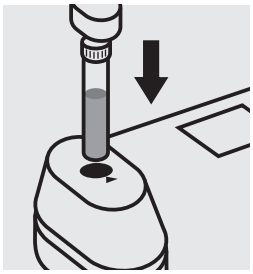


Add 1 dose of **P-3K** using the blue dose-metering cap, close with the screw cap.

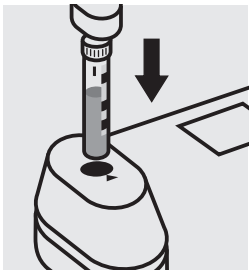


Shake the cell vigorously to dissolve the solid substance.

Reaction time:
5 minutes
Press Enter to start the countdown.



Insert the blank cell into the cell compartment.
Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press Test.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-for-use phosphate standard solution CertiPUR®, Cat.No. 119898, concentration 1000 mg/l PO_4^{3-}, can be used after diluting accordingly.

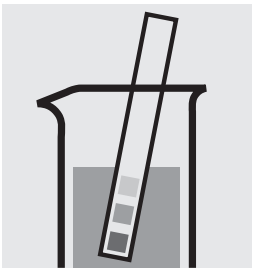
Phosphate

Determination of total phosphorus
= sum of orthophosphate, polyphosphate, and organophosphate

100673

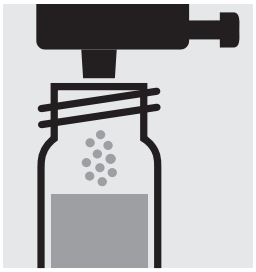
Cell Test

Measuring range:	3.0 – 100.0 mg/l PO_4-P	16-mm cell
	9 – 307 mg/l PO_4	16-mm cell
	7 – 229 mg/l P_2O_5	16-mm cell

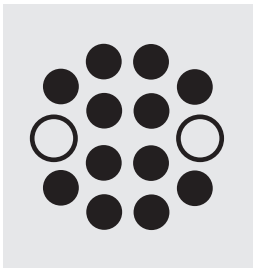


Check the pH of the sample, specified range: pH 0 – 10.
If required, add dilute sulfuric acid drop by drop to adjust the pH.

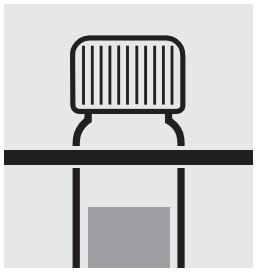
Pipette 0.20 ml of the sample into a reaction cell, close with the screw cap, and mix.



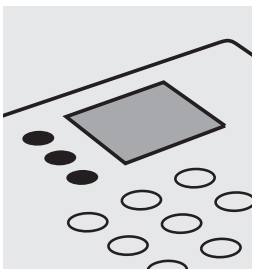
Add 1 dose of **P-1K** using the green dose-metering cap, close with the screw cap.



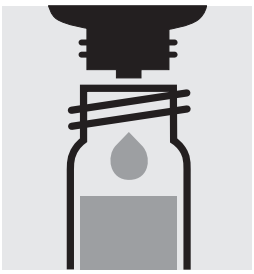
Heat the cell in the thermoreactor at 120 °C (100 °C) for 30 minutes.



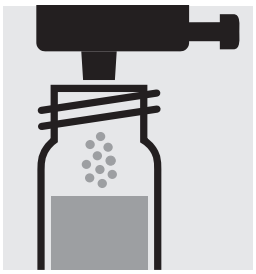
Remove the cell from the thermoreactor and place in a test-tube rack to cool to room temperature.



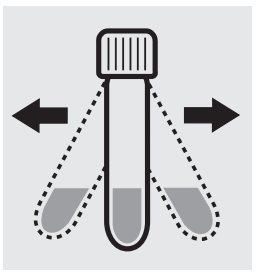
Select method (3)(8)(9).



Add 5 drops of **P-2K**, close with the screw cap, and mix.

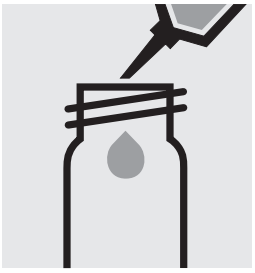


Add 1 dose of **P-3K** using the blue dose-metering cap, close with the screw cap.

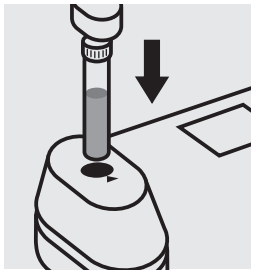


Shake the cell vigorously to dissolve the solid substance.

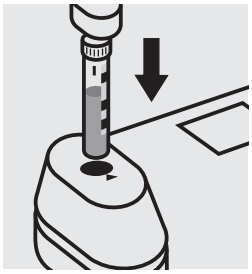
Reaction time:
5 minutes
Press (Enter) to start the countdown.



Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-for-use phosphate standard solution CertiPUR®, Cat.No. 119898, concentration 1000 mg/l PO_4^{3-}, can be used after diluting accordingly as well as the Standard solution for photometric applications, CRM, Cat.No. 125047, 125048, and 125049.

Phosphate

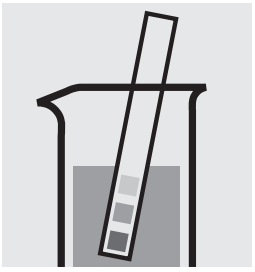
Determination of orthophosphate

114848

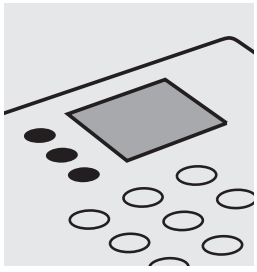
Test

Measuring range:	0.01 – 2.50 mg/l PO_4-P	24-mm cell
	0.03 – 7.66 mg/l PO_4	24-mm cell
	0.02 – 5.73 mg/l P_2O_5	24-mm cell

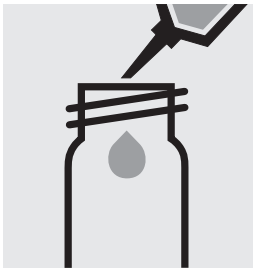
Attention: In contrast to the instructions given in the package insert the sample volume as well as the reagent volume must be doubled.



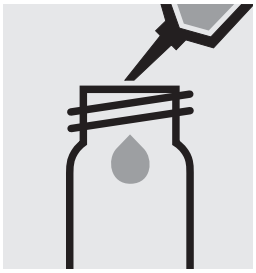
Check the pH of the sample, specified range: pH 0 – 10.
If required, add dilute sulfuric acid drop by drop to adjust the pH.



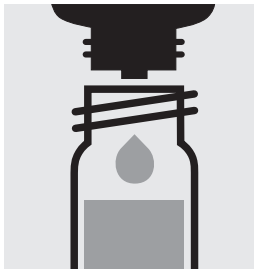
Select method 3 8 3.



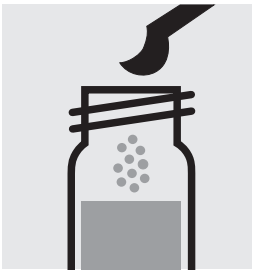
Fill approx. 10 ml of distilled water into a 24-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)



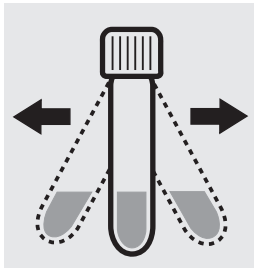
Pipette 10 ml of the sample into a 24-mm cell.



Add 10 drops of **PO_4-1**, close with the screw cap, and mix.

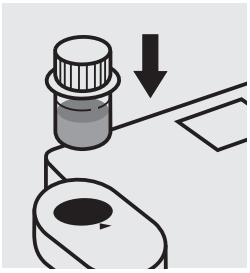


Add 2 level blue micro-spoons of **PO_4-2**, close with the screw cap.

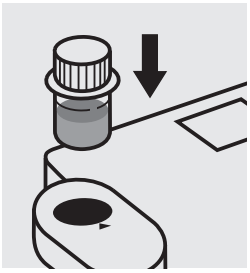


Shake the cell vigorously to dissolve the solid substance.

Reaction time: 5 minutes
Press Enter to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Important:

For the determination of **total phosphorus = sum of orthophosphate, polyphosphate, and organophosphate** a pretreatment with Crack Set 10C, Cat.No. 114688, or Crack Set 10, Cat.No. 114687, and thermoreactor is necessary.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10, Cat.No. 114676. Use 10 ml R-1 instead of the sample.

Ready-for-use phosphate standard solution CertiPUR®, Cat.No. 119898, concentration 1000 mg/l PO_4^{3-}, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 10) is highly recommended. Use 10 ml sample + 0.1 ml R-2.

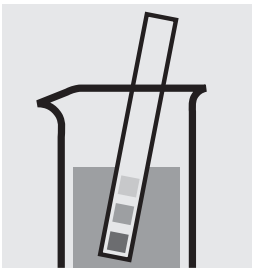
Phosphate

Determination of orthophosphate

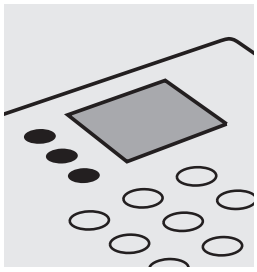
100798

Test

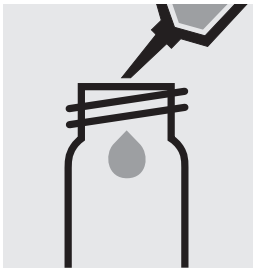
Measuring range:	1.0 – 60.0 mg/l PO_4-P	16-mm cell
	3.1 – 184.0 mg/l PO_4	16-mm cell
	2.3 – 137.5 mg/l P_2O_5	16-mm cell



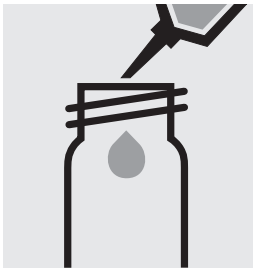
Check the pH of the sample, specified range: pH 0 – 10.
If required, add dilute sulfuric acid drop by drop to adjust the pH.



Select method (3)(8)(4).



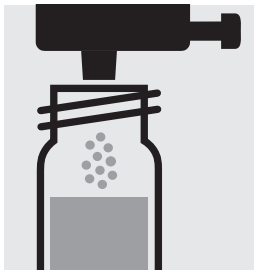
Fill approx. 10 ml of distilled water into a 16-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)



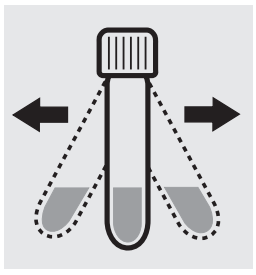
Pipette 8.0 ml of distilled water (Water for process analysis, Cat.No. 01051, is recommended) into a 16-mm cell.

Add 0.50 ml of the sample with pipette, close with the screw cap, and mix.

Add 0.50 ml of **PO_4-1** with pipette, close with the screw cap, and mix.

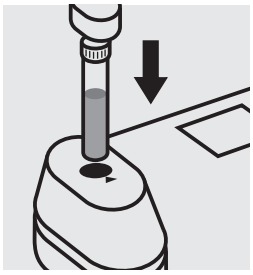


Add 1 dose of **PO_4-2** using the blue dose-metering cap, close with the screw cap.

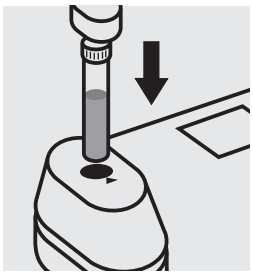


Shake the cell vigorously to dissolve the solid substance.

Reaction time:
5 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Press (Test).

Important:

For the determination of **total phosphorus = sum of orthophosphate, polyphosphate and organophosphate** either Phosphate Cell Test, Cat. No. 114543, 114729, and 100673 or Phosphate Test, Cat. No. 114848 in conjunction with Crack Set 10/10C, Cat. No. 114687 resp. 114688 can be used.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-for-use phosphate standard solution CertiPUR®, Cat.No. 119898, concentration 1000 mg/l PO_4^{3-}, can be used after diluting accordingly.

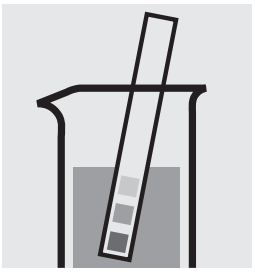
Phosphate

Determination of orthophosphate

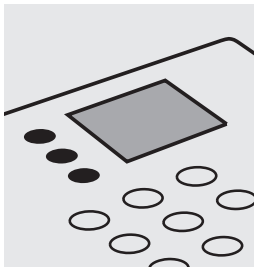
114842

Test

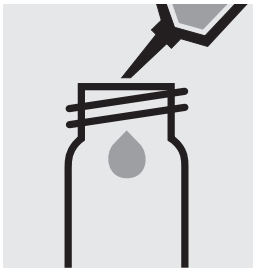
Measuring range:	0.5 – 30.0 mg/l PO_4-P	16-mm cell
	1.5 – 92.0 mg/l PO_4	16-mm cell
	1.1 – 68.7 mg/l P_2O_5	16-mm cell



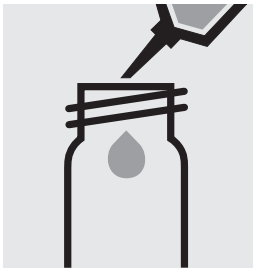
Check the pH of the sample, specified range: pH 0 – 10.
If required, add dilute sulfuric acid drop by drop to adjust the pH.



Select method (3)(8)(5).

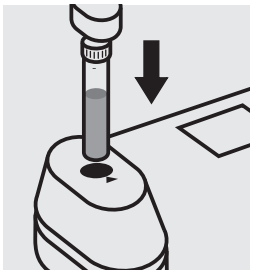


Pipette 5.0 ml of the sample into a 16-mm cell.

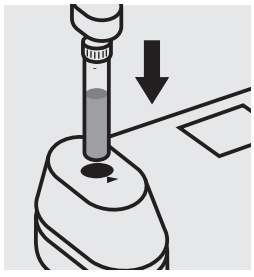


Pipette 5.0 ml of distilled water into a second 16-mm cell.
(Blank cell)

Add to each cell 1.2 ml of **PO_4-1** with pipette, close with the screw cap, and mix.



Insert the blank cell into the cell compartment. Press (Zero).



Insert the cell containing the sample into the cell compartment. Press (Test).

Important:

For the determination of **total phosphorus = sum of orthophosphate, polyphosphate and organophosphate** either Phosphate Cell Test, Cat. No. 114543, 114729, and 100673 or Phosphate Test, Cat. No. 114848 in conjunction with Crack Set 10/10C, Cat. No. 114687 resp. 114688 can be used.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-for-use phosphate standard solution CertiPUR®, Cat.No. 119898, concentration 1000 mg/l PO_4^{3-}, can be used after diluting accordingly.

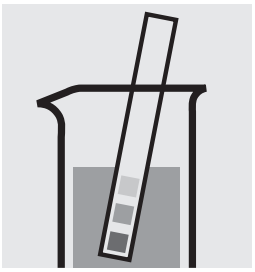
Phosphate

Determination of orthophosphate

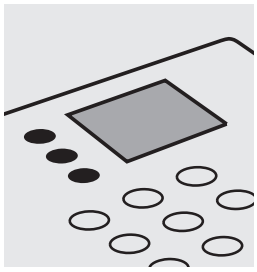
114546

Cell Test

Measuring range:	0.5 – 25.0 mg/l PO_4-P	16-mm cell
	1.5 – 76.7 mg/l PO_4	16-mm cell
	1.1 – 57.3 mg/l P_2O_5	16-mm cell



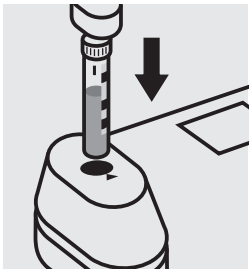
Check the pH of the sample, specified range: pH 0 – 10.
If required, add dilute sulfuric acid drop by drop to adjust the pH.



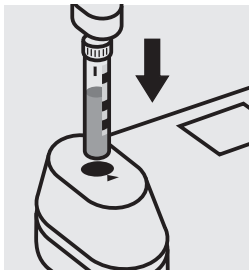
Select method (3)(8)(6).

Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.

Pipette 5.0 ml of distilled water into a second reaction cell, close with the screw cap, and mix. (Blank cell)



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Important:

For the determination of **total phosphorus = sum of orthophosphate, polyphosphate and organophosphate** either Phosphate Cell Test, Cat. No. 114543, 114729, and 100673 or Phosphate Test, Cat. No. 114848 in conjunction with Crack Set 10/10C, Cat. No. 114687 resp. 114688 can be used.

Quality assurance:

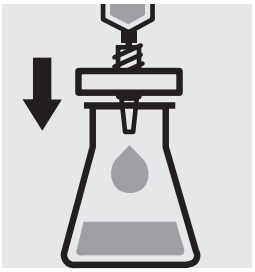
To check the measurement system (test reagents, measurement device, and handling) ready-for-use phosphate standard solution CertiPUR®, Cat.No. 119898, concentration 1000 mg/l PO_4^{3-}, can be used after diluting accordingly.

Potassium

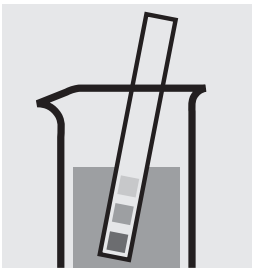
114562

Cell Test

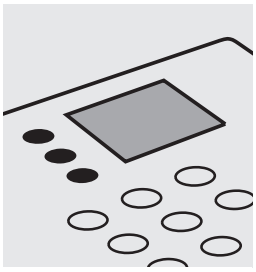
Measuring range: 5.0 – 50.0 mg/l K 16-mm cell



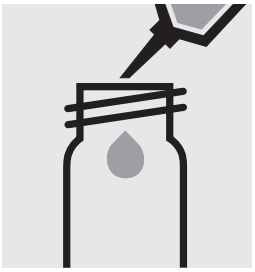
Filter turbid samples.



Check the pH of the sample, specified range: pH 3 – 12.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



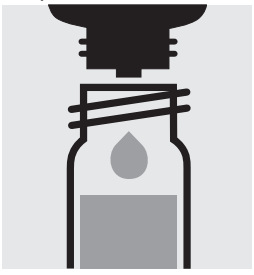
Select method (4)(0)(0).



Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)

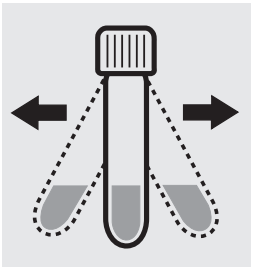
Pipette 2.0 ml of the sample into a reaction cell, close with the screw cap, and mix.

Check the pH, specified range: pH 10.0 – 11.5.



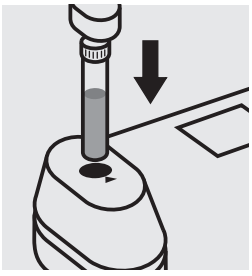
Add 6 drops of **K-1K**, close the cell with the screw cap, and mix.

Add 1 level blue micro-spoon of **K-2K**, close the cell with the screw cap.

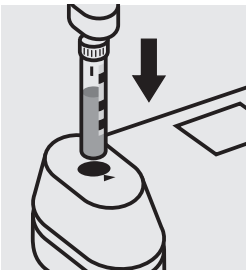


Shake the cell vigorously to dissolve the solid substance.

Reaction time:
5 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Quality assurance:

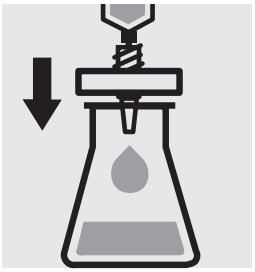
To check the measurement system (test reagents, measurement device, and handling) ready-for-use potassium standard solution CertiPUR®, Cat.No. 170230, concentration 1000 mg/l K, can be used after diluting accordingly.

Potassium

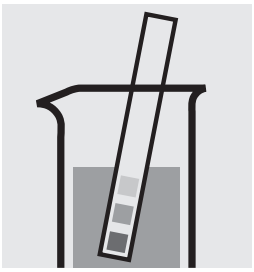
100615

Cell Test

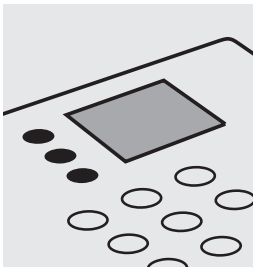
Measuring range: 30 – 300 mg/l K 16-mm cell



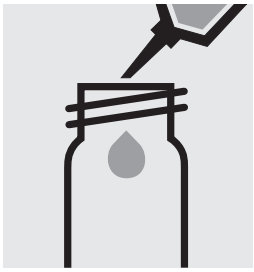
Filter turbid samples.



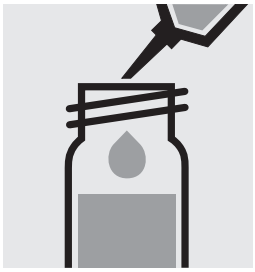
Check the pH of the sample, specified range: pH 3 – 12.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method (4)(0)(1).

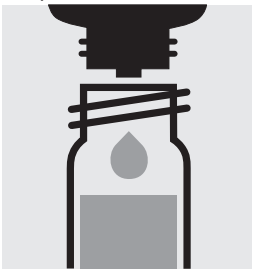


Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



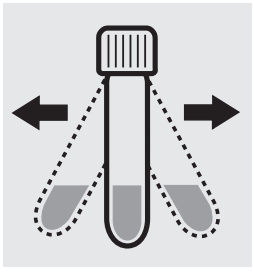
Pipette 0.50 ml of the sample into a reaction cell, close with the screw cap, and mix.

Check the pH, specified range: pH 10.0 – 11.5.



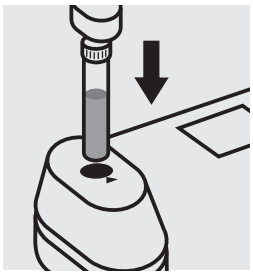
Add 6 drops of **K-1K**, close the cell with the screw cap, and mix.

Add 1 level blue microspoon of **K-2K**, close the cell with the screw cap.

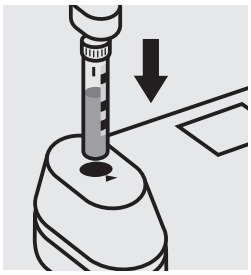


Shake the cell vigorously to dissolve the solid substance.

Reaction time:
5 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Quality assurance:

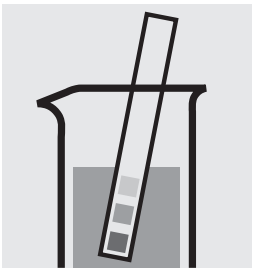
To check the measurement system (test reagents, measurement device, and handling) ready-for-use potassium standard solution CertiPUR®, Cat.No. 170230, concentration 1000 mg/l K, can be used after diluting accordingly.

Residual Hardness

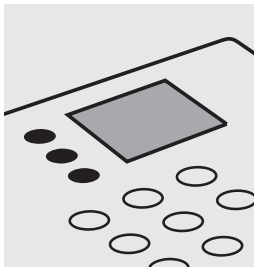
114683

Cell Test

Measuring range:	0.50 – 5.00 mg/l Ca	16-mm cell	**Measuring range:**	0.07 – 0.70 °d	16-mm cell
	0.70 – 7.00 mg/l CaO	16-mm cell		0.12 – 1.25 °f	16-mm cell
	1.2 – 12.5 mg/l $CaCO_3$	16-mm cell		0.09 – 0.87 °e	16-mm cell



Check the pH of the sample, specified range: pH 5 – 8.
If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



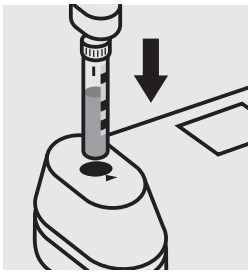
Select method (4)(1)(0).

Pipette 4.0 ml of the sample into a reaction cell, close with the screw cap, and mix.

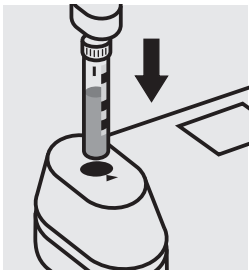
Pipette 4.0 ml of distilled water into a second reaction cell, close with the screw cap, and mix. (Blank cell)

Add to each cell 0.20 ml of **RH-1K** with pipette, close with the screw cap, and mix.

Reaction time:
10 minutes, **measure immediately**.
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-for-use calcium standard solution CertiPUR®, Cat.No. 119778, concentration 1000 mg/l Ca, can be used after diluting accordingly. (Pay attention to pH value!)

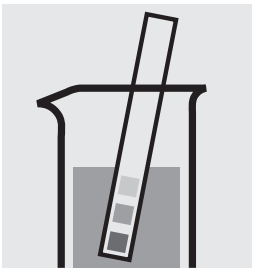
Silicate (Silicic Acid)

114794

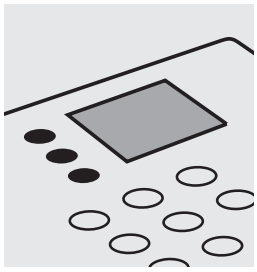
Test

Measuring range:	0.11 – 8.56 mg/l SiO_2	24-mm cell
	0.05 – 4.00 mg/l Si	24-mm cell

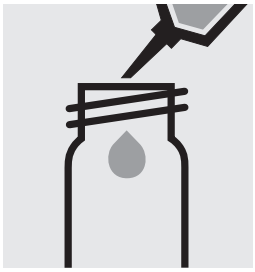
Attention: In contrast to the instructions given in the package insert the sample volume as well as the reagent volume must be doubled.



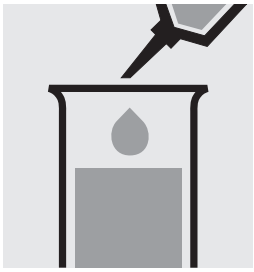
Check the pH of the sample, specified range: pH 2 – 10.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



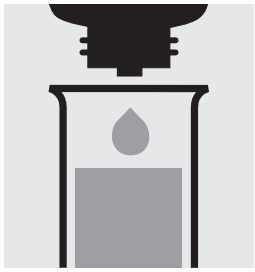
Select method (4)(2)(0).



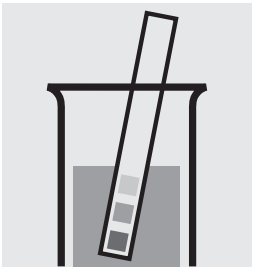
Fill approx. 10 ml of distilled water into a 24-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)



Pipette 10 ml of the sample into a test tube.

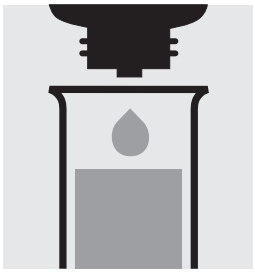


Add 6 drops of **Si-1** and mix.

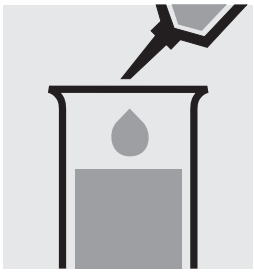


Check the pH, specified range: pH 1.2 – 1.6.

Reaction time:
3 minutes
Press (Enter) to start the countdown.

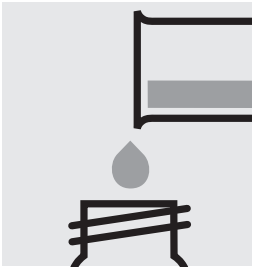


Add 6 drops of **Si-2** and mix.

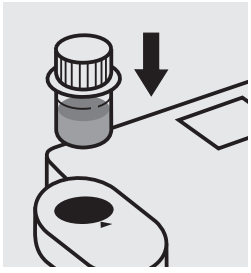


Add 1.0 ml of **Si-3** with pipette and mix.

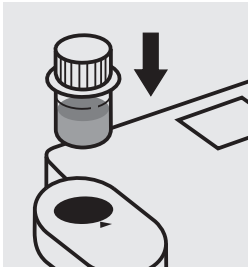
Reaction time:
10 minutes
Press (Enter) to start the countdown.



Transfer the solution into a 24-mm cell, close with the screw cap.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

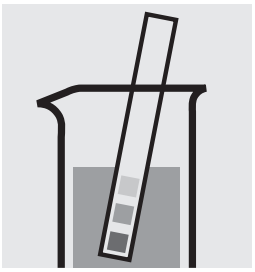
To check the measurement system (test reagents, measurement device, and handling) ready-for-use silicon standard solution CertiPUR®, Cat.No. 170236, concentration 1000 mg/l Si, can be used after diluting accordingly (Attention! Do **not** store standard solutions in glass vessels - see section "Standard solutions").

Silicate (Silicic Acid)

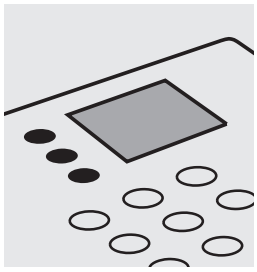
100857

Test

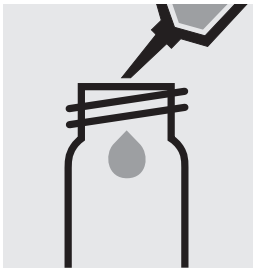
Measuring range:	11 – 1070 mg/l SiO_2	16-mm cell
	5 – 500 mg/l Si	16-mm cell



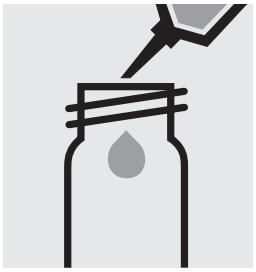
Check the pH of the sample, specified range: pH 2 – 10.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method (4)(2)(1).



Fill approx. 10 ml of distilled water into a 16-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)



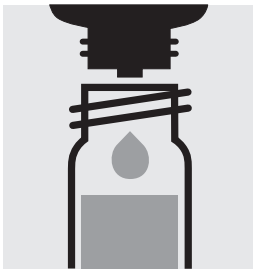
Pipette 5.0 ml of distilled water (Water for process analysis, Cat.No. 101051, is recommended) into a 16-mm cell.

Add 0.50 ml of the sample with pipette, close with the screw cap, and mix.

Add 4 drops of **Si-1**, close with the screw cap, and mix.

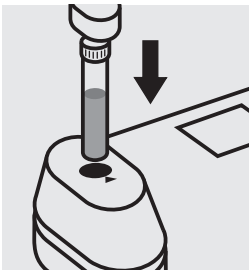
Add 2.0 ml of **Si-2** with pipette, close with the screw cap, and mix.

Reaction time:
2 minutes
Press (Enter) to start the countdown.

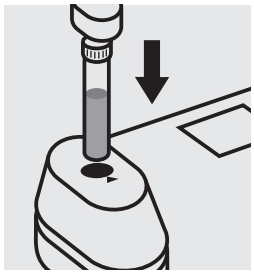


Add 4 drops of **Si-3** , close with the screw cap, and mix.

Reaction time:
2 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Press (Zero).



Insert the cell containing the sample into the cell compartment. Press (Test).

Quality assurance:

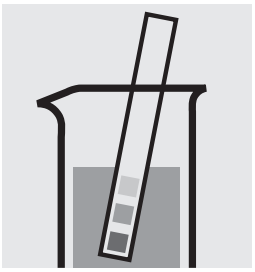
To check the measurement system (test reagents, measurement device, and handling) ready-for-use silicon standard solution CertiPUR®, Cat.No. 170236, concentration 1000 mg/l Si, can be used after diluting accordingly (Attention! Do **not** store standard solutions in glass vessels - see section "Standard solutions").

Silicate (Silicic Acid)

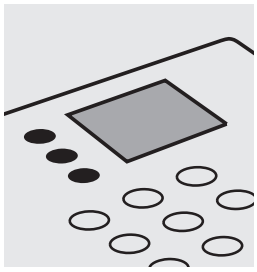
101813

Test

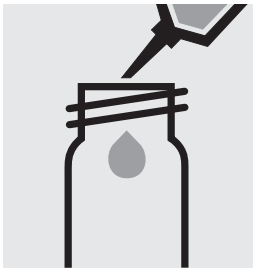
Measuring range:	0.004 – 0.500 mg/l SiO_2	24-mm cell
	0.002 – 0.234 mg/l Si	24-mm cell



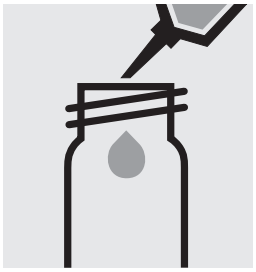
Check the pH of the sample, specified range: pH 2 – 10.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



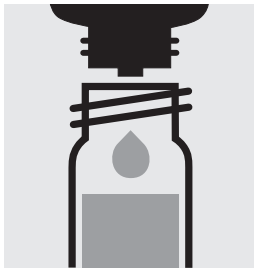
Select method (4)(2)(2).



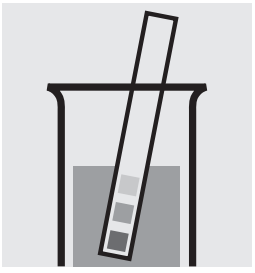
Pipette 10 ml of the sample into a plastic vessel (**Flat-bottomed tubes, Cat.No. 117988**).



Pipette 10 ml of distilled water (Water Ultrapur, Cat.No. 101262, is recommended) into a second plastic vessel (**Flat-bottomed tubes, Cat.No. 117988**).
(Blank)

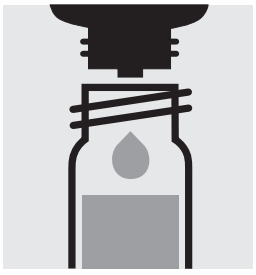


Add to each vessel 3 drops of **Si-1**, close with the screw cap, and mix.



Check the pH, specified range: pH 1.2 – 1.6.

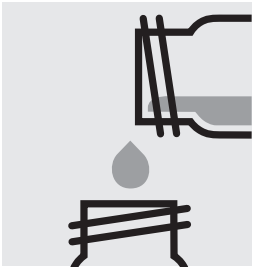
Reaction time:
5 minutes
Press (Enter) to start the countdown.



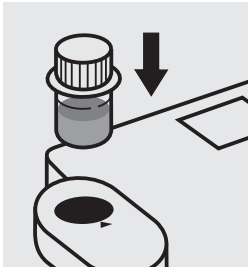
Add to each vessel 3 drops of **Si-2**, close with the screw cap, and mix.

Add to each vessel 0.50 ml of **Si-3** with pipette, close with the screw cap, and mix.

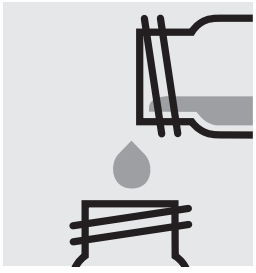
Reaction time:
5 minutes
Press (Enter) to start the countdown.



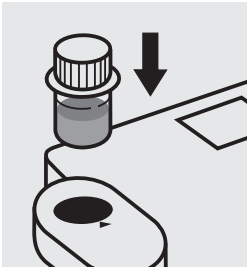
Transfer the blank into a 24-mm cell, close with the screw cap and measure **immediately**.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Transfer the measurement sample into a 24-mm cell, close with the screw cap and measure **immediately**.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Important:

No glass equipment may be used in the course of the measurement (e.g. pipettes etc.)!

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-for-use silicon standard solution CertiPUR®, Cat.No. 170236, concentration 1000 mg/l Si, can be used after diluting accordingly (Attention! Do **not** store standard solutions in glass vessels - see section "Standard solutions").

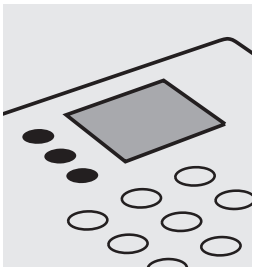
Sodium

in nutrient solutions

100885

Cell Test

Measuring range: 10 – 300 mg/l Na 16-mm cell



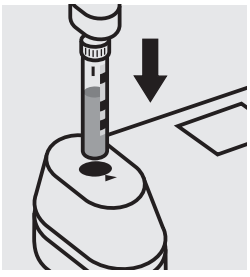
Select method (4)(3)(0).

Pipette 0.50 ml each of **Na-1K** into two reaction cells, close with the screw cap, and mix.

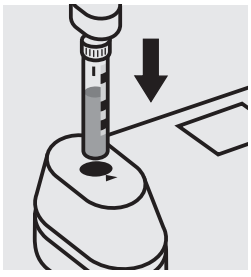
Add to one cell 0.50 ml of the sample with pipette, close with the screw cap, and mix.

Add to the second cell 0.50 ml of distilled water with pipette, close with the screw cap, and mix. (Blank cell)

Reaction time:
1 minute
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

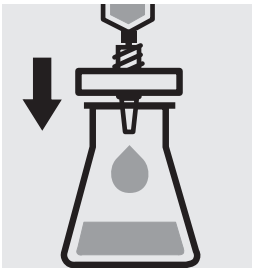
To check the measurement system (test reagents, measurement device, and handling) ready-for-use chloride standard solution CertiPUR®, Cat.No. 119897, concentration 1000 mg/l Cl^- (corresponds to 649 mg/l Na), can be used after diluting accordingly (see section “Standard solutions”).

Sulfate

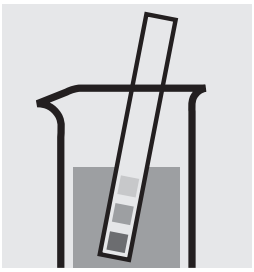
114548

Cell Test

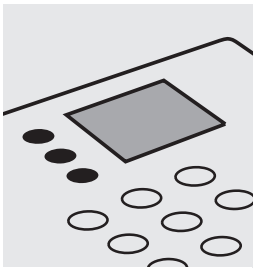
Measuring range: 5 – 250 mg/l SO_4 16-mm cell



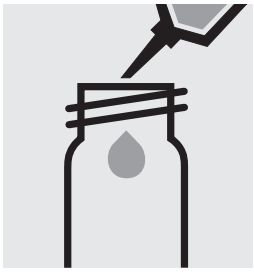
Filter turbid samples.



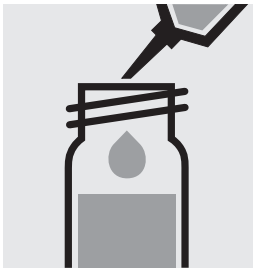
Check the pH of the sample, specified range: pH 2 – 10.
If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



Select method (4)(4)(0).

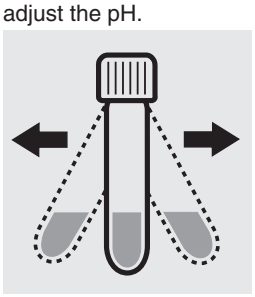


Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



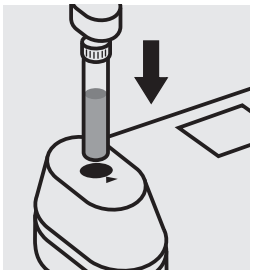
Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.

Add 1 level green microspoon of **SO_4-1K** and close the cell with the screw cap.

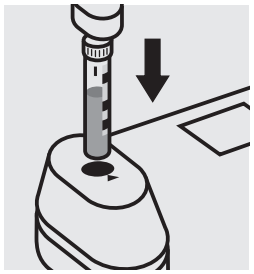


Shake the cell vigorously to dissolve the solid substance**.**

Reaction time:
2 minutes, **measure immediately**.
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10, Cat.No. 114676, or the Standard solution for photometric applications, CRM, Cat. No. 125050 and 125051.

Ready-for-use sulfate standard solution CertiPUR®, Cat.No. 119813, concentration 1000 mg/l SO_4^{2-}, can also be used after diluting accordingly.

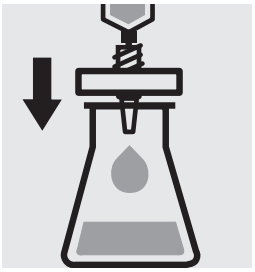
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 10) is highly recommended.

Sulfate

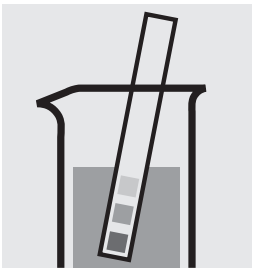
100617

Cell Test

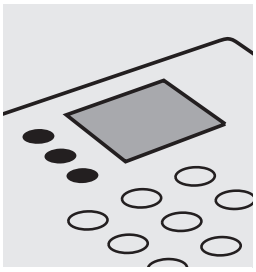
Measuring range: 50–500 mg/l SO_4 16-mm cell



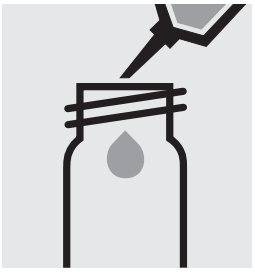
Filter turbid samples.



Check the pH of the sample, specified range: pH 2 – 10.
If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



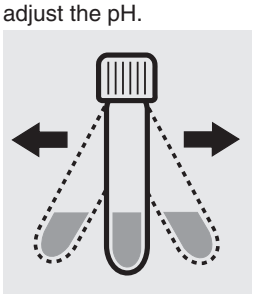
Select method (4)(4)(1).



Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)

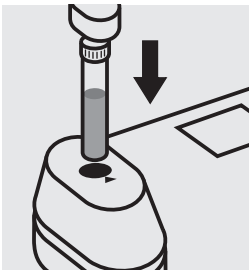
Pipette 2.0 ml of the sample into a reaction cell, close with the screw cap, and mix.

Add 1 level green microspoon of **SO_4-1K** and close the cell with the screw cap.

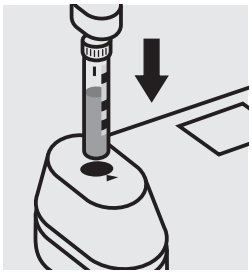


Shake the cell vigorously to dissolve the solid substance**.**

Reaction time:
2 minutes, **measure immediately**.
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10, Cat.No. 114676, or the Standard solution for photometric applications, CRM, Cat. No. 125051 and 125052.

Ready-for-use sulfate standard solution CertiPUR®, Cat.No. 119813, concentration 1000 mg/l SO_4^{2-}, can also be used after diluting accordingly.

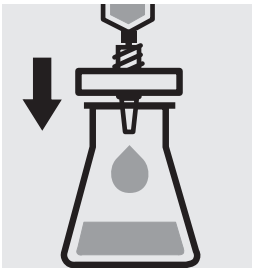
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 10) is highly recommended.

Sulfate

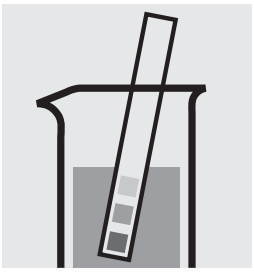
114564

Cell Test

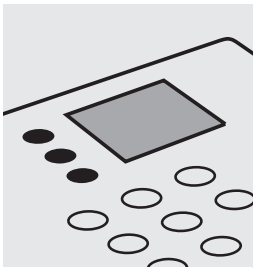
Measuring range: 100 – 1000 mg/l SO_4 16-mm cell



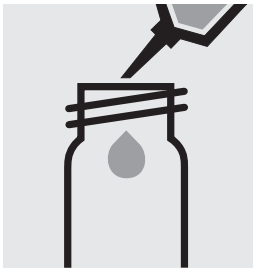
Filter turbid samples.



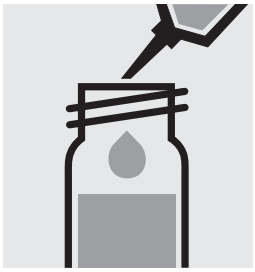
Check the pH of the sample, specified range: pH 2 – 10.
If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



Select method (4)(4)(2).

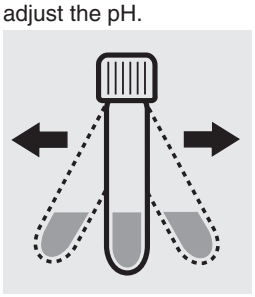


Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)



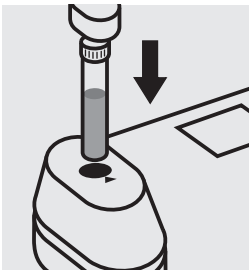
Pipette 1.0 ml of the sample into a reaction cell, close with the screw cap, and mix.

Add 1 level green microspoon of **SO_4-1K** and close the cell with the screw cap.

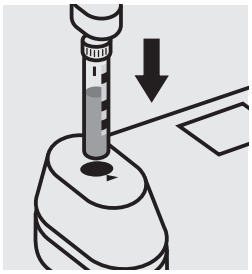


Shake the cell vigorously to dissolve the solid substance**.**

Reaction time:
2 minutes, **measure immediately**.
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 20, Cat.No. 114675, or the Standard solution for photometric applications, CRM, Cat. No. 125051, 125052 and 125053.

Ready-for-use sulfate standard solution CertiPUR®, Cat.No. 119813, concentration 1000 mg/l SO_4^{2-}, can also be used after diluting accordingly.

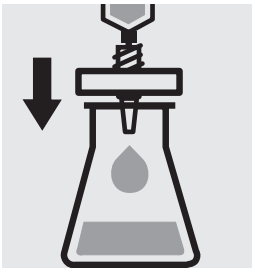
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 20) is highly recommended.

Sulfate

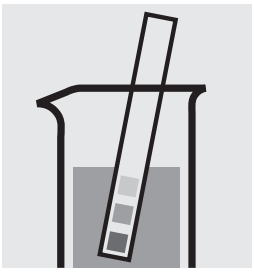
101812

Test

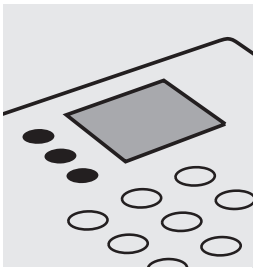
Measuring range: 1.0–25.0 mg/l SO_4 24-mm cell



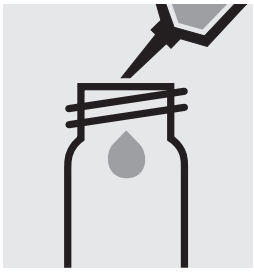
Filter turbid samples.



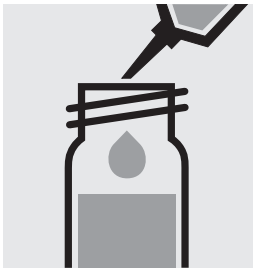
Check the pH of the sample, specified range: pH 2 – 10.
If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



Select method (4)(4)(3).



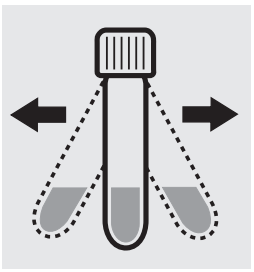
Pipette 0.50 ml each of **SO_4-1** into two 24-mm cells.



Add to one cell 10 ml of the sample with pipette, close with the screw cap, and mix.

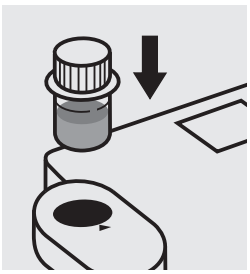
Add to the second cell 10 ml of distilled water with pipette, close with the screw cap, and mix. (Blank cell)

Add to each cell 1 level green microspoon of **SO_4-2**, close the cell with the screw cap.

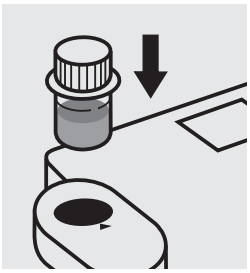


Shake the cell vigorously to dissolve the solid substance**.**

Reaction time:
2 minutes, **measure immediately**.
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

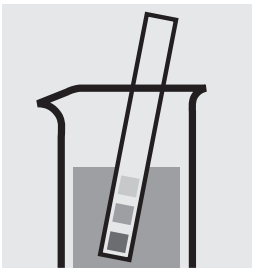
To check the measurement system (test reagents, measurement device, and handling) ready-for-use sulfate standard solution CertiPUR®, Cat.No. 119813, concentration 1000 mg/l SO_4^{2-}, can be used after diluting accordingly.

Sulfide

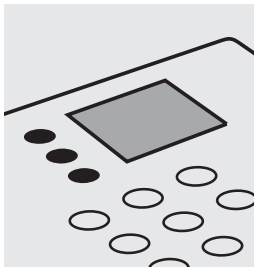
114779

Test

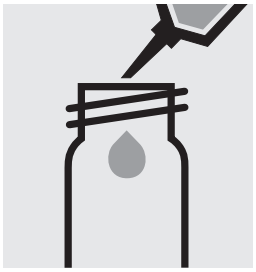
Measuring range: 0.10 – 1.50 mg/l S 16-mm cell



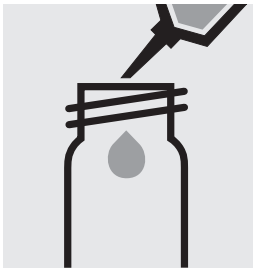
Check the pH of the sample, specified range: pH 2 – 10.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



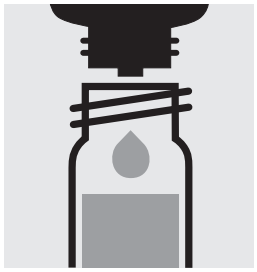
Select method (4)(5)(0).



Fill approx. 10 ml of distilled water into a 16-mm cell (**do not add any reagents!**), close with the screw cap. (Blank cell)

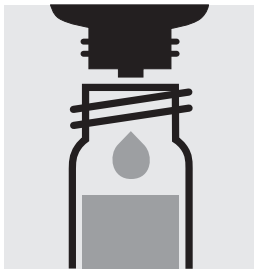


Pipette 5.0 ml of the sample into a 16-mm cell.



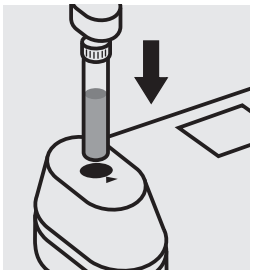
Add 1 drop of **S-1**, close with the screw cap, and mix.

Add 5 drops of **S-2**, close with the screw cap, and mix.

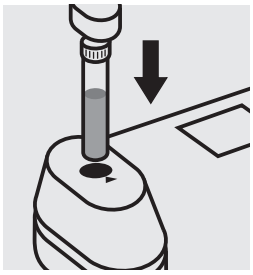


Add 5 drops of **S-3**, close with the screw cap, and mix.

Reaction time:
1 minute
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Press (Zero).



Insert the cell containing the sample into the cell compartment. Press (Test).

Quality assurance:

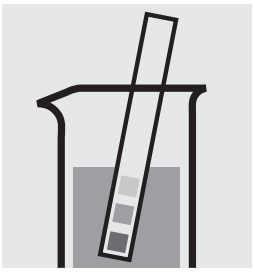
To check the measurement system (test reagents, measurement device, and handling) a sulfide standard solution must be prepared from sodium sulfide GR (see section “Standard solutions”).

Sulfite

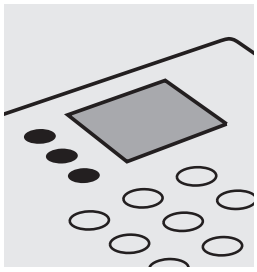
114394

Cell Test

Measuring range: 1.0 – 20.0 mg/l SO_3 16-mm cell

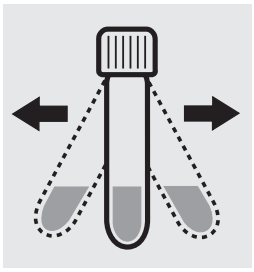


Check the pH of the sample, specified range: pH 4 – 9.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method 4 6 0.

Add 1 level grey microspoon each of **SO_3-1K** into two reaction cells, close with the screw cap.

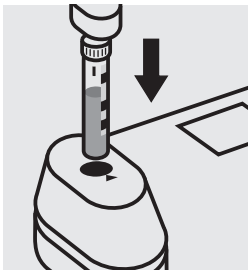


Shake both cells vigorously to dissolve the solid substance.

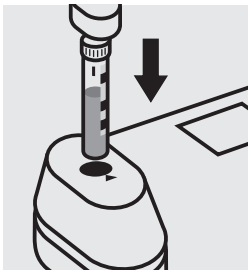
Add to one cell 3.0 ml of the sample with pipette, close with the screw cap, and mix.

Add to the second cell 3.0 ml of distilled water with pipette, close with the screw cap, and mix. (Blank cell)

Reaction time:
2 minutes
Press Enter to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press Zero.



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press Test.

Quality assurance:

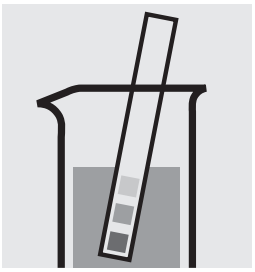
To check the measurement system (test reagents, measurement device, and handling) a sulfite standard solution must be prepared from sodium sulfite GR, Cat.No. 106657 (see section “Standard solutions”).

Sulfite

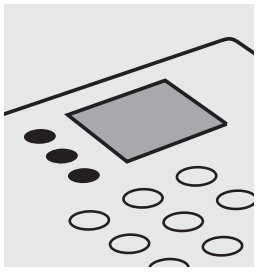
101746

Test

Measuring range: 1.0 – 60.0 mg/l SO_3 16-mm cell



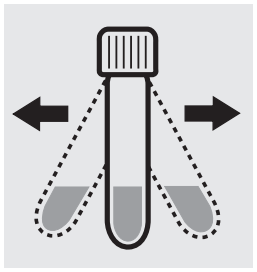
Check the pH of the sample, specified range: pH 4 – 9.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method (4)(6)(1).

Place 1 level grey microspoon each of **SO_3-1** into two dry 16-mm cells.

Add to each cell 3.0 ml of **SO_3-2** with pipette, close with the screw cap.



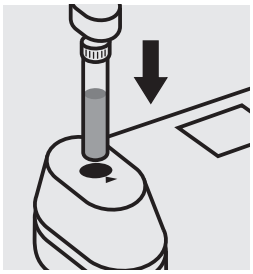
Shake both cells vigorously to dissolve the solid substance.

Add to each cell 5.0 ml of distilled water with pipette, close with the screw cap, and mix.

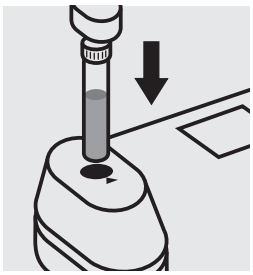
Add to one cell 2.0 ml of the sample with pipette, close with the screw cap, and mix.

Add to the second cell 2.0 ml of distilled water with pipette, close with the screw cap, and mix. (Blank cell)

Reaction time:
2 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a sulfite standard solution must be prepared from sodium sulfite GR, Cat.No. 106657 (see section “Standard solutions”).

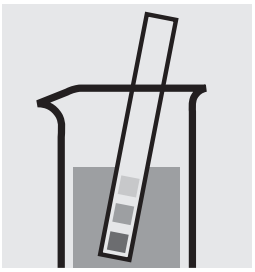
Surfactants (anionic)

114697

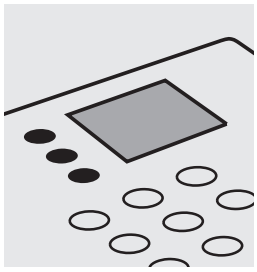
Cell Test

Measuring range: 0.05 – 2.00 mg/l MBAS* 16-mm cell

* **M**ethylene-**b**lue-**a**ctive **s**ubstances

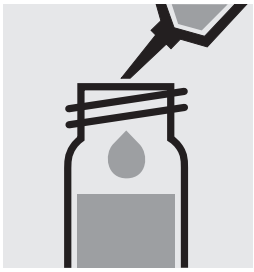


Check the pH of the sample, specified range: pH 5 – 10.
If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.

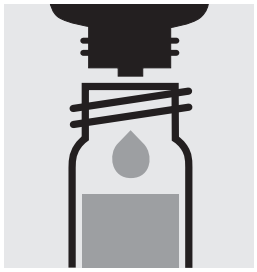


Select method (4)(7)(0).

Pipette 5.0 ml of the sample into a reaction cell, **do not mix**!

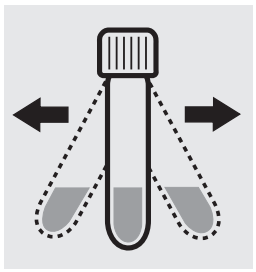


Pipette 5.0 ml of distilled water into a second reaction cell, close with the screw cap, **do not mix**! (Blank cell)



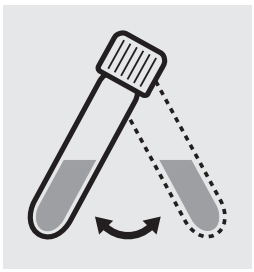
Add to each cell 3 drops of **T-1K**, **do not mix**!

Add to each cell 2 drops of **T-2K**, close with the screw cap.

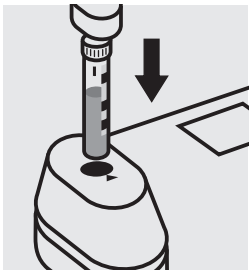


Shake both cells vigorously for 30 seconds.

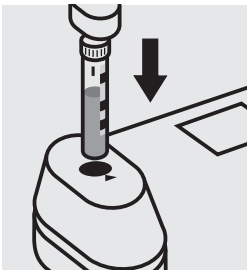
Reaction time:
10 minutes
Press (Enter) to start the countdown.



Swirl both cells before the measurement.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a surfactants standard solution must be prepared from dodecane-1-sulfonic acid sodium salt GR, Cat.No. 112146 (see section “Standard solutions”).

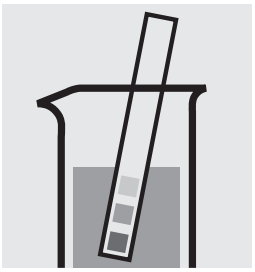
Surfactants (cationic)

101764

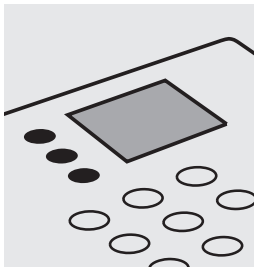
Cell Test

Measuring range: 0.05 – 1.50 mg/l surfactants (cationic) 16-mm cell

(calculated as N-cetyl-N,N,N-trimethylammonium bromide)



Check the pH of the sample, specified range: pH 3 – 8.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.

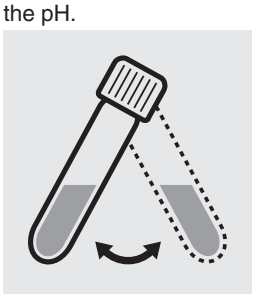


Select method (4)(7)(1).

Pipette 5.0 ml of the sample into a reaction cell, **do not mix**!

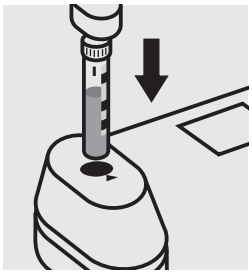
Pipette 5.0 ml of distilled water into a second reaction cell, close with the screw cap, **do not mix**!
(Blank cell)

Add to each cell 0.50 ml **T-1K** with pipette, close with the screw cap.

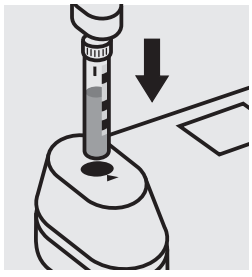


Swirl both cells for 30 seconds.

Reaction time:
5 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

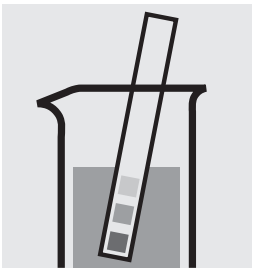
To check the measurement system (test reagents, measurement device, and handling) a surfactants standard solution must be prepared from N-cetyl-N,N,N-trimethylammonium bromide, Cat.No. 102342 (see section “Standard solutions”).

Surfactants (nonionic)

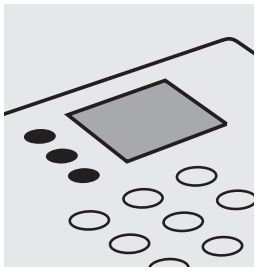
101787

Cell Test

Measuring range: 0.10 – 7.50 mg/l surfactants (nonionic) 16-mm cell
(calculated as Triton® X-100)



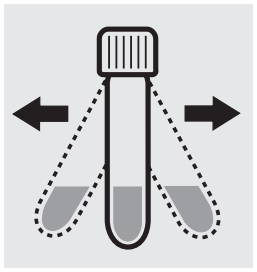
Check the pH of the sample, specified range: pH 3 – 9.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method (4)(7)(1).

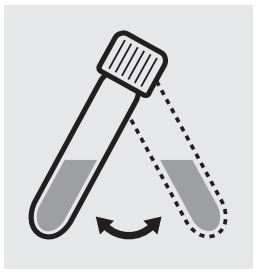
Pipette 4.0 ml of the sample into a reaction cell, close with the screw cap.

Pipette 4.0 ml of distilled water into a second reaction cell, close with the screw cap.
(Blank cell)

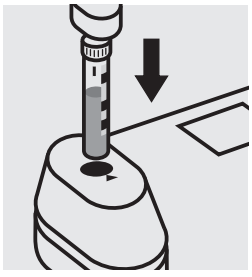


Shake both cells **vigorously for 1 minute**.

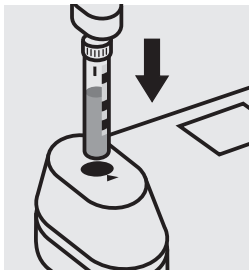
Reaction time:
2 minutes
Press (Enter) to start the countdown.



Swirl both cells before the measurement.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



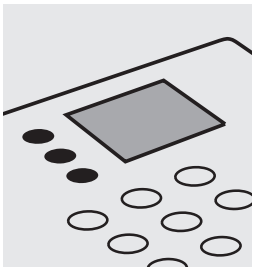
Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

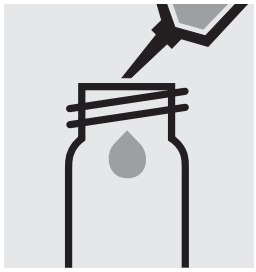
To check the measurement system (test reagents, measurement device, and handling) a surfactants standard solution must be prepared from Triton® X-100, Cat.No. 112298 (see section “Standard solutions”).

Suspended Solids

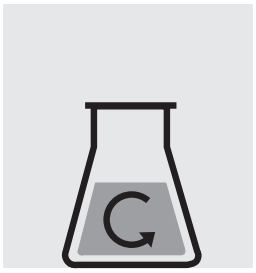
Measuring range: 50 – 750 mg/l of suspended solid 24-mm cell



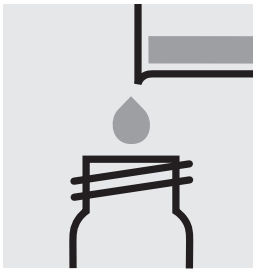
Select method (4)(8)(0).



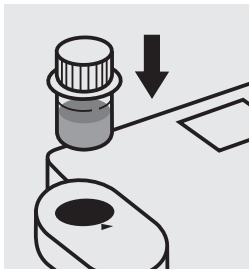
Fill approx. 10 ml of distilled water into a 24-mm cell, close with the screw cap. (Blank cell)



Homogenize 500 ml of sample for 2 minutes in a mixer running at high speed.



Transfer the solution into a 24-mm cell, close with the screw cap.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).

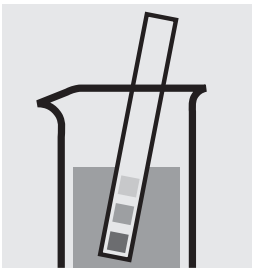
Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Tin

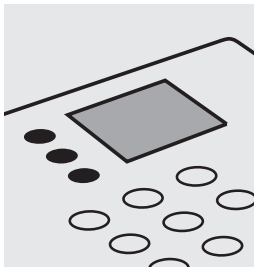
114622

Cell Test

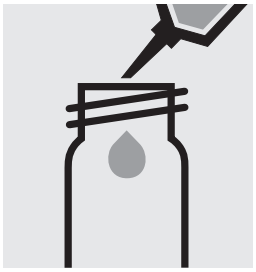
Measuring range: 0.10 – 2.50 mg/l Sn 16-mm cell



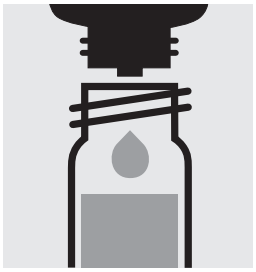
Check the pH of the sample, specified range: pH <3.
If required, add dilute sulfuric acid drop by drop to adjust the pH.



Select method (4)(9)(0).



Fill approx. 10 ml of distilled water into an empty 16-mm cell (**do not add any reagents!**), close with the screw cap.
(Blank cell)

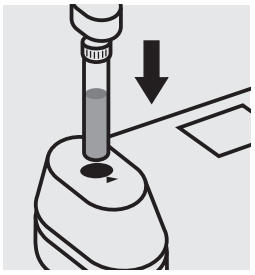


Add 6 drops of **Sn-1K** into a reaction cell, close with the screw cap, and mix.

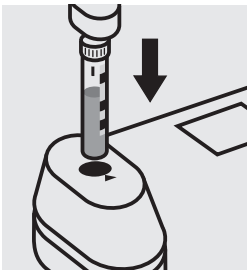
Add 5.0 ml of the sample with pipette, close with the screw cap, and mix.

Check the pH, specified range: pH 1.5 – 3.5.
If required, add dilute sulfuric acid drop by drop to adjust the pH.

Reaction time:
15 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment.
Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.
Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a tin standard solution must be prepared from ready-for-use tin standard solution CertiPUR®, Cat.No. 170242, concentration 1000 mg/l Sn (see section “Standard solutions”).

TOC

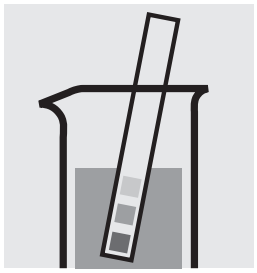
Total Organic Carbon

114878

Cell Test

Measuring range: 5.0 – 80.0 mg/l TOC 16-mm cell

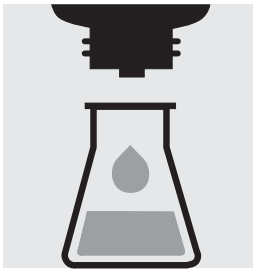
Removal of inorganic bound carbon (TIC):



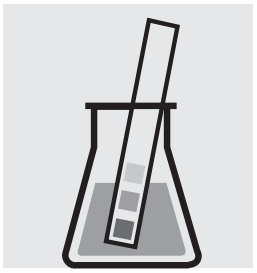
Check the pH of the sample, specified range: pH 2 – 12.
If required, add dilute sulfuric acid drop by drop to adjust the pH.

Place 25 ml of the sample into a suitable glass vessel.

Place 25 ml of distilled water (Water for process analysis, Cat.No. 101051, is recommended) into a second suitable glass vessel. (Blank)

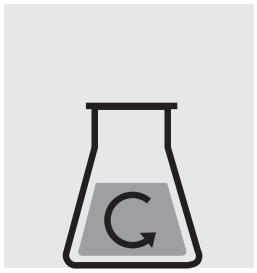


Add to each glass vessel 3 drops of **TOC-1K** and mix.



Check the pH, specified range pH < 2.5.

Preparation of measurement sample:

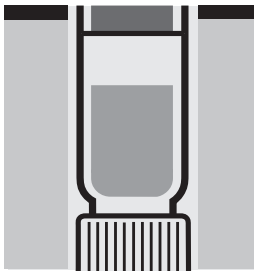


Stir both glass vessels for 10 minutes:
stirred sample / blank

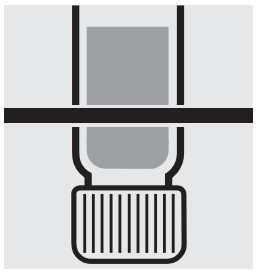
Pipette 3.0 ml of the **stirred sample** into a reaction cell.

Pipette 3.0 ml of the **stirred blank** into a second reaction cell. (Blank cell)

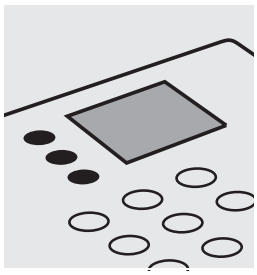
Add to each cell 1 level grey microspoon of **TOC-2K**. **Immediately** close the cells tightly with an **aluminium cap** (Cat.No. 173500).



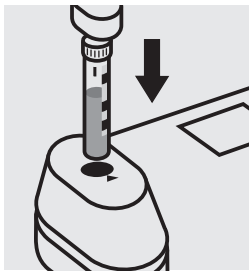
Heat both cells, standing on their heads, at 120 °C in the thermoreactor for 2 hours.



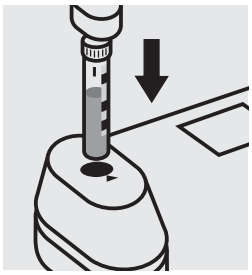
Remove both cells from the thermoreactor and let them, **standing on their heads**, to cool for 1 hour.



Select method (5)(0)(0).



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a TOC standard solution CertiPUR®, Cat.No. 109017, concentration 1000 mg/l TOC, can be used after diluting accordingly.

TOC

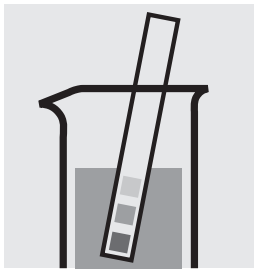
Total Organic Carbon

114879

Cell Test

Measuring range: 50 – 800 mg/l TOC 16-mm cell

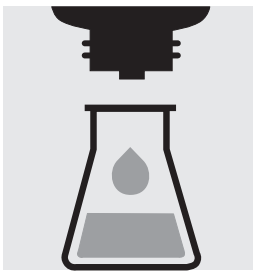
Removal of inorganic bound carbon (TIC):



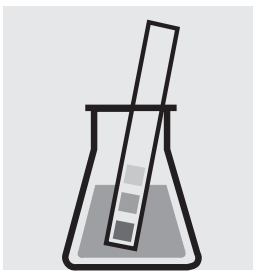
Check the pH of the sample, specified range: pH 2 – 12.
If required, add dilute sulfuric acid drop by drop to adjust the pH.

Place 1.0 ml of the sample and 9.0 ml of distilled water (Water for process analysis, Cat.No. 101051, is recommended) into a suitable glass vessel.

Place 10 ml of distilled water (Water for process analysis, Cat.No. 101051, is recommended) into a second suitable glass vessel. (Blank)

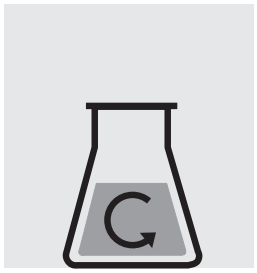


Add to each glass vessel 2 drops of **TOC-1K** and mix.



Check the pH, specified range pH < 2.5.

Preparation of measurement sample:

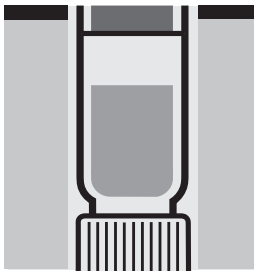


Stir both glass vessels for 10 minutes:
stirred sample / blank

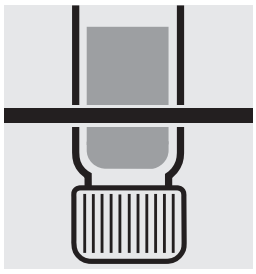
Pipette 3.0 ml of the **stirred sample** into a reaction cell.

Pipette 3.0 ml of the **stirred blank** into a second reaction cell. (Blank cell)

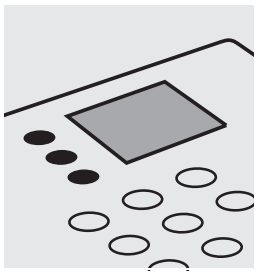
Add to each cell 1 level grey microspoon of **TOC-2K**. **Immediately** close the cells tightly with an **aluminium cap** (Cat.No. 173500).



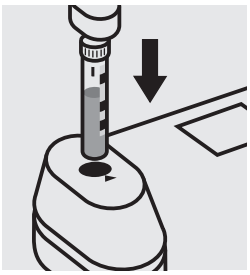
Heat both cells, standing on their heads, at 120 °C in the thermoreactor for 2 hours.



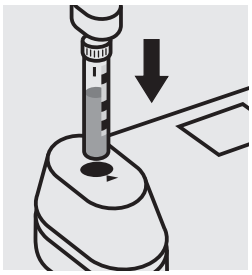
Remove both cells from the thermoreactor and let them, **standing on their heads**, to cool for 1 hour.



Select method (5)(0)(1).



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a TOC standard solution CertiPUR®, Cat.No. 109017, concentration 1000 mg/l TOC, can be used after diluting accordingly.

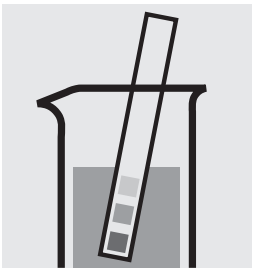
Total Hardness

100961

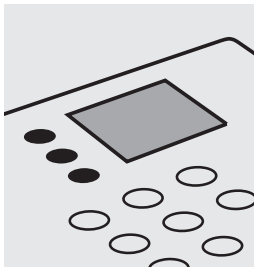
Cell Test

Measuring range:	5 – 215	mg/l Ca	16-mm cell
	7 – 301	mg/l CaO	16-mm cell
	12 – 537	mg/l $CaCO_3$	16-mm cell

Measuring range:	0.7 – 30.1	°d	16-mm cell
	1.2 – 53.7	°f	16-mm cell
	0.9 – 37.6	°e	16-mm cell



Check the pH of the sample, specified range: pH 3 – 9.
If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



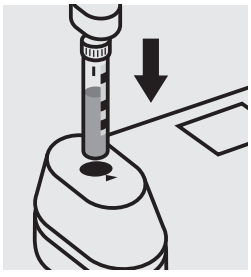
Select method (5)(1)(0).

Pipette 1.0 ml of the sample into a reaction cell, close with the screw cap, and mix.

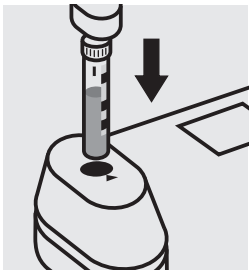
Pipette 1.0 ml of distilled water into a second reaction cell, close with the screw cap, and mix. (Blank cell)

Add to each cell 1.0 ml of **H-1K** with pipette, close with the screw cap, and mix.

Reaction time:
3 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

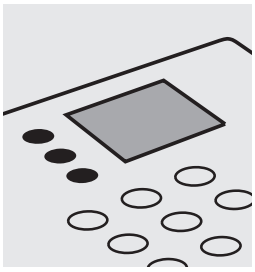
Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section “Standard solutions”).

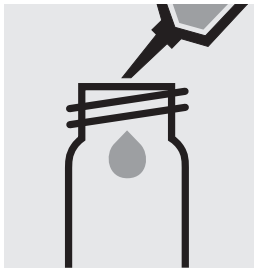
Turbidity

analogous to **EN ISO 7027**

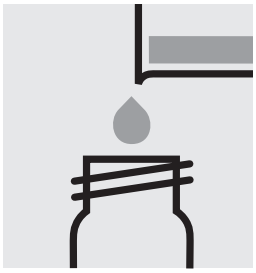
Measuring range: 1 – 100 FAU 24-mm cell



Select method (5)(2)(0).

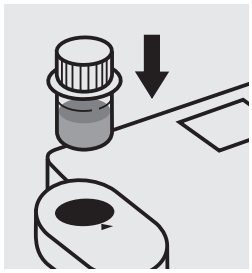


Fill approx. 10 ml of distilled water into a 24-mm cell, close with the screw cap. (Blank cell)



Transfer the sample into a 24-mm cell, close with the screw cap.

Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



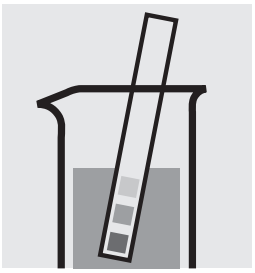
Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Volatile Organic Acids

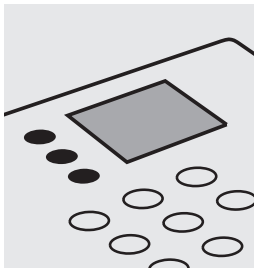
101763

Cell Test

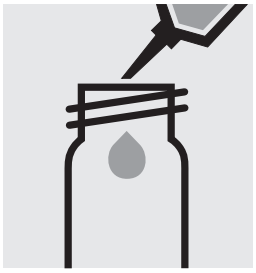
Measuring range: 50 – 3000 mg/l volatile organic acid (calculated as acetic acid) 16-mm cell



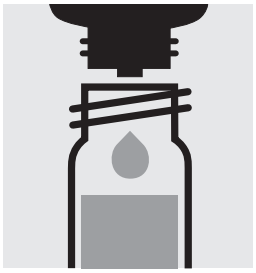
Check the pH of the sample, specified range: pH 2 – 12.



Select method (5)(3)(0).



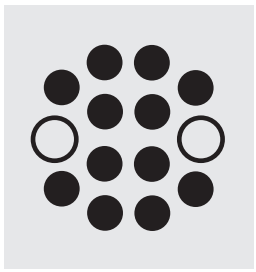
Pipette 0.75 ml each of **OA-1** into two round cells.



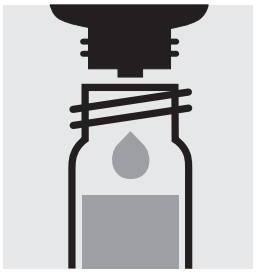
Add to each cell 2 drops of **OA-2**.

Add to one cell 0.50 ml of the sample with pipette, close with the screw cap, and mix.

Add to the second cell 0.50 ml of distilled water with pipette, close with the screw cap, and mix. (Blank cell)



Heat both cells in the thermoreactor at 100 °C for 10 minutes. Then cool to room temperature under running water.



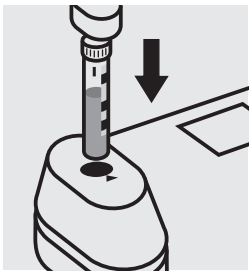
Add to each cell 5 drops of **OA-3**.

Add to each cell 0.50 ml of **OA-4** with pipette, close with the screw cap, and mix.

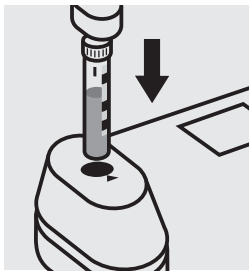
Reaction time: 3 minutes
Press (Enter) to start the countdown.

Add to each cell 5.0 ml of **OA-5** with pipette, close with the screw cap, and mix.

Reaction time: 10 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

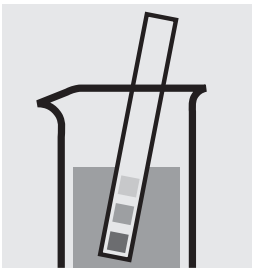
To check the measurement system (test reagents, measurement device, and handling) a standard solution must be prepared from sodium acetate anhydrous, Cat.No. 106268 (see section “Standard solutions”).

Volatile Organic Acids

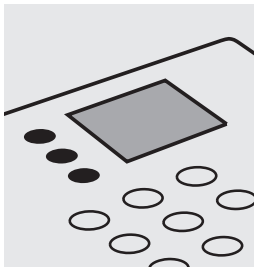
101749

Cell Test

Measuring range:	50 – 3000 mg/l volatile organic acid	(calculated as acetic acid)	16-mm cell
	71 – 4401 mg/l volatile organic acid	(calculated as butyric acid)	16-mm cell



Check the pH of the sample, specified range: pH 2 – 12.

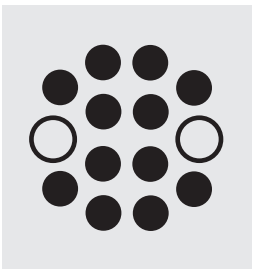


Select method (5)(3)(1).

Pipette 0.50 ml each of **OA-1K** into two reaction cells.

Add to one cell 0.50 ml of the sample with pipette, close with the screw cap, and mix.

Add to the second cell 0.50 ml of distilled water with pipette, close with the screw cap, and mix. (Blank cell)



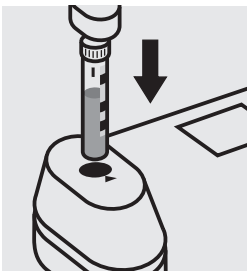
Heat both cells in the thermoreactor at 100 °C for 15 minutes. Then cool to room temperature under running water.

Add to each cell 1.0 ml of **OA-2K** with pipette.

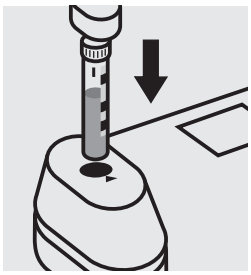
Add to each cell 1.0 ml of **OA-3K** with pipette, close with the screw cap, and mix.

Add to each cell 1.0 ml of **OA-4K** with pipette, close with the screw cap, and mix.

Reaction time:
1 minute
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

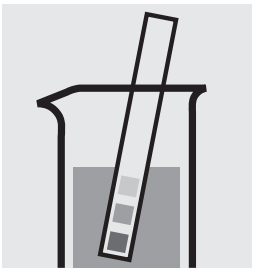
To check the measurement system (test reagents, measurement device, and handling) a standard solution must be prepared from sodium acetate anhydrous, Cat.No. 106268 (see section “Standard solutions”).

Volatile Organic Acids

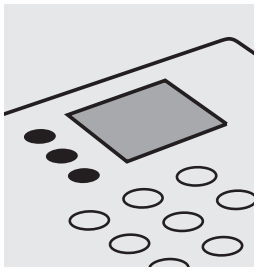
101809

Test

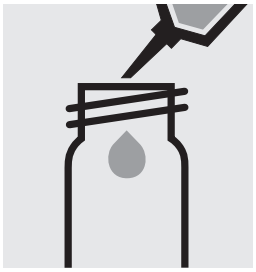
Measuring range:	50 – 3000 mg/l volatile organic acid	(calculated as acetic acid)	16-mm cell
	71 – 4401 mg/l volatile organic acid	(calculated as butyric acid)	16-mm cell



Check the pH of the sample, specified range: pH 2 – 12.



Select method (5)(3)(1).

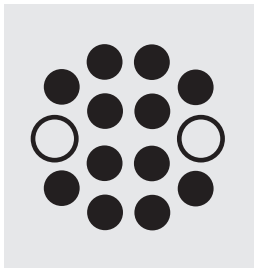


Pipette 0.75 ml each of **OA-1** into two round cells.

Add to each cell 0.50 ml of **OA-2** with pipette.

Add to one cell 0.50 ml of the sample with pipette, close with the screw cap, and mix.

Add to the second cell 0.50 ml of distilled water with pipette, close with the screw cap, and mix. (Blank cell)



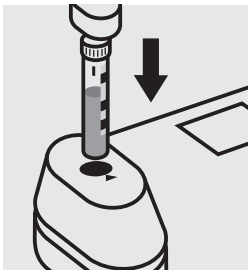
Heat both cells in the thermoreactor at 100 °C for 15 minutes. Then cool to room temperature under running water.

Add to each cell 1.0 ml of **OA-3** with pipette.

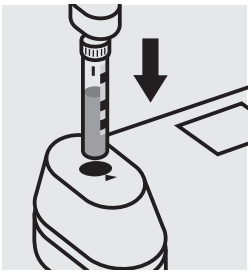
Add to each cell 1.0 ml of **OA-4** with pipette, close with the screw cap, and mix.

Add to each cell 1.0 ml of **OA-5** with pipette, close with the screw cap, and mix.

Reaction time:
1 minute
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Quality assurance:

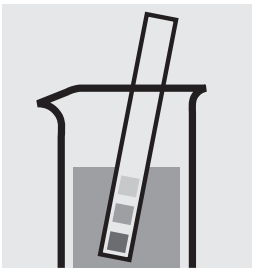
To check the measurement system (test reagents, measurement device, and handling) a standard solution must be prepared from sodium acetate anhydrous, Cat.No. 106268 (see section “Standard solutions”).

Zinc

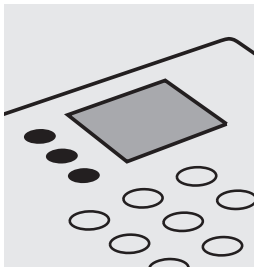
100861

Cell Test

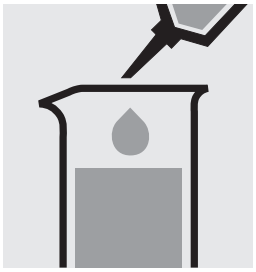
Measuring range: 25 – 1000 µg/l Zn 16-mm cell



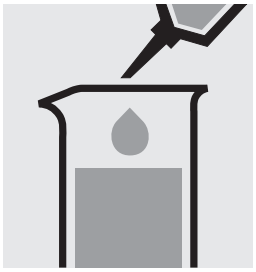
Check the pH of the sample, specified range: pH 1 – 7.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



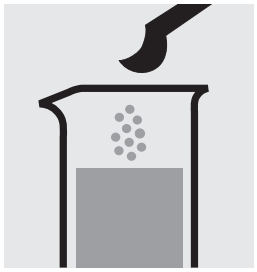
Select method (5)(4)(0).



Pipette 10 ml of the sample into a glass vessel.



Pipette 10 ml of distilled water into a second glass vessel.

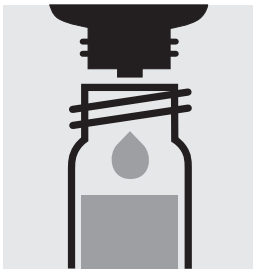


Add to each glass vessel 1 level green microspoon of **Zn-1K** and dissolve the solid substance: **pretreated sample / blank**.

Pipette 0.50 ml each of **Zn-2K** into two reaction cells, close with the screw cap, and mix.

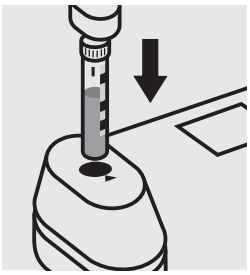
Add to one cell 2.0 ml of **pretreated sample** with pipette, close the cell with the screw cap, and mix.

Add to the second cell 2.0 ml of **pretreated blank** with pipette, close the cell with the screw cap, and mix.
(Blank cell)

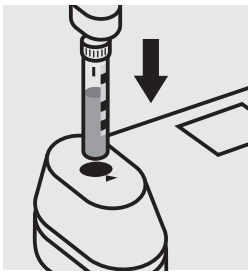


Add to each cells 5 drops of **Zn-3K**, close the cell with the screw cap, and mix.

Reaction time:
15 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Important:

For the determination of **total zinc** a pretreatment with Crack Set 10C, Cat.No. 114688, or Crack Set 10, Cat.No. 114687, and thermoreactor is necessary.

Quality assurance:

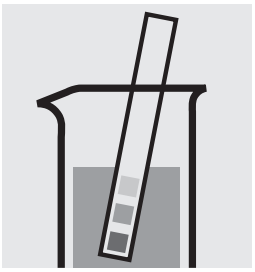
To check the measurement system (test reagents, measurement device, and handling) ready-for-use zinc standard solution CertiPUR®, Cat.No. 119806, concentration 1000 mg/l Zn, can be used after diluting accordingly.

Zinc

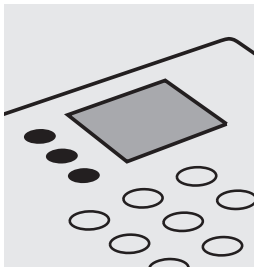
114566

Cell Test

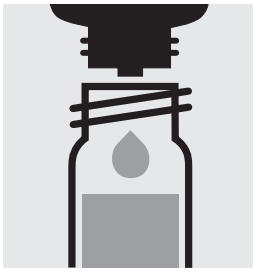
Measuring range: 0.20 – 5.00 mg/l Zn 16-mm cell



Check the pH of the sample, specified range: pH 3 – 10.
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method (5)(4)(1).



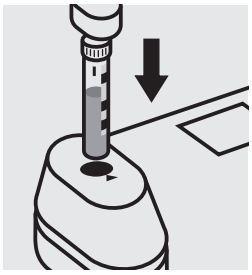
Add 5 drops each of **Zn-1K** into two reaction cells, close with the screw cap, and mix.

Add to one cell 0.50 ml of the sample with pipette, close with the screw cap, and mix.

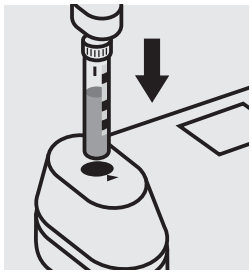
Add to the second cell 0.50 ml of distilled water with pipette, close with the screw cap, and mix. (Blank cell)

Add to each cell 5 drops of **Zn-2K**, close with the screw cap, and mix.

Reaction time: 15 minutes
Press (Enter) to start the countdown.



Insert the blank cell into the cell compartment. Align the mark on the cell with that on the photometer. Press (Zero).



Insert the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer. Press (Test).

Important:

For the determination of **total zinc** a pretreatment with Crack Set 10C, Cat.No. 114688, or Crack Set 10, Cat.No. 114687, and thermoreactor is necessary.

Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 40, Cat.No. 114692.

Ready-for-use zinc standard solution CertiPUR®, Cat.No. 119806, concentration 1000 mg/l Zn, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 40) is highly recommended.

5.2 Standard solutions

5.2.1 Use of Spectroquant® CombiCheck and ready-to-use standard solutions

CombiCheck standard solutions

CombiCheck	Cat. No.	Parameter	Can be used for Cat No.
10	114676	Ammonium	114558
		Chloride	114730
		COD	114540
		Nitrate	114773, 114556
		Phosphate	114543, 114848, 110474
		Sulfate	114548, 100617
20	114675	Ammonium	-
		Chloride	114730
		COD	114541
		Nitrate	114542
		Phosphate	114729, 100475
		Sulfate	114564
30	114677	Cadmium	114834
		Iron	114549, 100796
		Copper	114553, 114767
		Manganese	100816, 114770
40	114692	Aluminium	-
		Lead	114833, 109717
		Nickel	114554, 114785
		Zinc	114566
50	114695	Ammonium	114739, 114752
		COD	101796
		Nitrogen	114537
60	114696	Chloride	114897
		COD	114895, 114690
70	114689	Ammonium	114559, 100683
		COD	114555
		Nitrogen	-
80	114738	COD	114691
		Nitrate	-
		Phosphate	114729, 100475

Standard solutions

Test / Method	Cat. No. Test	Evaluation as	CombiCheck, Cat. No.	Confidence interval Spec. value for the standard	max. working tolerance	Diluted and ready-to-use standard solutions, CRM Cat. No.	concentration	expanded measurement uncertainty	Ready-to-use standard solution Cat. No.
Acid Capacity	101758	OH	-	5.00 mmol/l*	± 0.50 mmol/l	-			see 5.2.2
Aluminium	114825	Al	-	350 µg/l*	± 40 µg/l	-			119770**
Aluminium	100594	Al	-	0.25 mg/l*	± 0.03 mg/l	-			119770**
Ammonium	114739	NH_4-N	50, 114695	R-1: 1000 µg/l R-2: 1000 µg/l	± 100 µg/l ± 100 µg/l	125022 125023	400 µg/l 1000 µg/l	± 12 µg/l ± 40 µg/l	119812**
Ammonium	114558	NH_4-N	10, 114676	R-1: 4.00 mg/l R-2: 3.00 mg/l	± 0.30 mg/l ± 0.25 mg/l	125022 125023 125024 125025	0.400 mg/l 1.00 mg/l 2.00 mg/l 6.00 mg/l	± 0.012 mg/l ± 0.04 mg/l ± 0.07 mg/l ± 0.13 mg/l	119812**
Ammonium	114559	NH_4-N	70, 114689	R-1: 50.0 mg/l R-2: 20.0 mg/l	± 5.0 mg/l ± 2.0 mg/l	125025 125026 125027	6.00 mg/l 12.0 mg/l 50.0 mg/l	± 0.13 mg/l ± 0.4 mg/l ± 1.2 mg/l	119812**
Ammonium	114752	NH_4-N	50, 114695	R-1: 1.00 mg/l R-2: 1.00 mg/l	± 0.10 mg/l ± 0.10 mg/l	125022 125023	0.400 mg/l 1.00 mg/l	± 0.012 mg/l ± 0.04 mg/l	119812**
Ammonium	100683	NH_4-N	70, 114689	R-1: 50.0 mg/l R-2: 20.0 mg/l	± 5.0 mg/l ± 2.0 mg/l	125025 125026	6.00 mg/l 12.0 mg/l	± 0.13 mg/l ± 0.4 mg/l	119812**
AOX	100675	AOX	-	1.00 mg/l*	± 0.10 mg/l	-			100680
Arsenic	101747	As	-	50 µg/l*	± 5 µg/l	-			119773**
BOD	100687	O_2	-	210 mg/l	± 20 mg/l	-			100718
Boron	100826	B	-	1.00 mg/l*	± 0.15 mg/l	-			119500**
Bromine	100605	Br_2	-	2.50 mg/l*	± 0.25 mg/l	-			see 5.2.2
Cadmium	114834	Cd	30, 114677	R-1: 500 µg/l R-2: 300 µg/l	± 60 µg/l ± 45 µg/l	-			119777**
Cadmium	101745	Cd	-	250 µg/l*	± 10 µg/l	-			119777**
Calcium	100858	Ca	-	75 mg/l*	± 7 mg/l	-			see 5.2.2
Calcium	114815	Ca	-	80 mg/l*	± 8 mg/l	-			119778**
Chloride	114730	Cl	10, 114676 20, 114675	R-1.: 25 mg/l R-2: 25 mg/l R-1: 60 mg/l R-2: 40 mg/l	± 6 mg/l ± 6 mg/l ± 10 mg/l ± 7 mg/l	-			119897**
Chloride	114897	Cl	60, 114696	R-1: 125 mg/l R-2: 50 mg/l	± 13 mg/l ± 7 mg/l	-			119897**
Chloride	101804	Cl	-	7.5 mg/l*	± 0.8 mg/l	-			119897**
Chloride	101807	Cl	-	2.50 mg/l*	± 0.25 mg/l	-			119897**
Chlorine	100595	Cl_2	-	2.50 mg/l*	± 0.25 mg/l	-			see 5.2.2
Chlorine	100597	Cl_2	-	2.50 mg/l*	± 0.25 mg/l	-			see 5.2.2
Chlorine	100598	Cl_2	-	1.50 mg/l*	± 0.15 mg/l	-			see 5.2.2
Chlorine	100602	Cl_2	-	1.50 mg/l*	± 0.15 mg/l	-			see 5.2.2
Chlorine	100599	Cl_2	-	1.50 mg/l*	± 0.15 mg/l	-			see 5.2.2
Chlorine	100086 / 100087 / 100088	Cl_2	-	1.50 mg/l* 2.50 mg/l*	± 0.15 mg/l ± 0.25 mg/l	- -			see 5.2.2 see 5.2.2
Chlorine dioxide	100608	ClO_2	-	2.50 mg/l*	± 0.25 mg/l	-			see 5.2.2
Chromate	114552	Cr	-	1.00 mg/l*	± 0.10 mg/l	-			119780**
Chromate	114758	Cr	-	1000 µg/l*	± 100 µg/l	-			119780**
COD	101796	COD	50, 114695	R-1: 20.0 mg/l R-2: 15.0 mg/l	± 4.0 mg/l ± 3.0 mg/l	125028	20.0 mg/l	± 0.7 mg/l	see 5.2.2

* self prepared, recommended concentration

** 1000 mg/l analyte

Test / Method	Cat. No. Test	Evaluation as	CombiCheck, Cat. No.	Confidence interval Spec. value for the standard	max. working tolerance	Diluted and ready-to-use standard solutions, CRM Cat. No.	concentration	expanded measurement uncertainty	Ready-to-use standard solution Cat. No.
COD	114540	COD	10, 114676	R-1: 80 mg/l R-2: 30 mg/l	± 12 mg/l ± 8 mg/l	125029	100 mg/l	± 3 mg/l	see 5.2.2
COD	114895	COD	60, 114696	R-1: 250 mg/l R-2: 75 mg/l	± 25 mg/l ± 10 mg/l	125029 125030	100 mg/l 200 mg/l	± 3 mg/l ± 4 mg/l	see 5.2.2
COD	114690	COD	60, 114696	R-1: 250 mg/l R-2: 75 mg/l	± 25 mg/l ± 15 mg/l	125029 125030 125031	100 mg/l 200 mg/l 400 mg/l	± 3 mg/l ± 4 mg/l ± 5 mg/l	see 5.2.2
COD	114541	COD	20, 114675	R-1: 750 mg/l R-2: 200 mg/l	± 75 mg/l ± 40 mg/l	125029 125030 125031 125032	100 mg/l 200 mg/l 400 mg/l 1000 mg/l	± 3 mg/l ± 4 mg/l ± 5 mg/l ± 11 mg/l	see 5.2.2
COD	114691	COD	80, 114738	R-1: 1500 mg/l R-2: 1000 mg/l	± 150 mg/l ± 100 mg/l	125031 125032 125033	400 mg/l 1000 mg/l 2000 mg/l	± 5 mg/l ± 11 mg/l ± 32 mg/l	see 5.2.2
COD	114555	COD	70, 114689	R-1: 5.00 g/l R-2: 2.00 g/l	± 0.40 g/l ± 0.20 g/l	125032 125033 125034	1.00 g/l 2.00 g/l 8.00 g/l	± 0.01 g/l ± 0.03 g/l ± 0.07 g/l	see 5.2.2
COD	101797	COD	-	50.00 g/l*	± 5.00 g/l	125034 125035	8.00 g/l 50.0 g/l	± 0.07 g/l ± 0.9 g/l	see 5.2.2
COD	109772	COD		80 mg/l*	± 12 mg/l	125028 125029	20.0 mg/l 100 mg/l	± 0.7 mg/l ± 3 mg/l	see 5.2.2
COD	109773	COD		750 mg/l*	± 75 mg/l	125029 125030 125031 125032	100 mg/l 200 mg/l 400 mg/l 1000 mg/l	± 3 mg/l ± 4 mg/l ± 5 mg/l ± 11 mg/l	see 5.2.2
COD	117058	COD	-	30.0 mg/l COD/ 20000 mg/l Cl^-*	± 150 mg/l	-			see 5.2.2
COD	117059	COD	-	1500 mg/l COD/ 20 000 mg/l Cl^-*	± 3.0 mg/l	-			see 5.2.2
Color	-	Pt/Co (Hz)	-	500 mg/l	-	-			100246
Copper	114553	Cu	30, 114677	R-1: 2.00 mg/l R-2: 3.00 mg/l	± 0.20 mg/l ± 0.30 mg/l	-			119786**
Copper	114767	Cu	30, 114677	R-1: 2.00 mg/l R-2: 3.00 mg/l	± 0.20 mg/l ± 0.30 mg/l	-			119786**
Cyanide	114561	CN	-	200 µg/l*	± 25 µg/l	-			119533**
Cyanide	109701	CN	-	100 µg/l*	± 15 µg/l	-			119533**
Cyanuric Acid	119250	Cys	-	80 mg/l*	± 10 mg/l	-			see 5.2.2
Cyanuric Acid	119253	CyA	-	80 mg/l*	± 10 mg/l	-			see 5.2.2
Fluoride	114557	F	-	0.75 mg/l*	± 0.08 mg/l	-			119814**
Fluoride	100809	F	-	0.75 mg/l*	± 0.08 mg/l	-			119814**
Fluoride	114598	F	-	1.00 mg/l*	± 0.15 mg/l	-			119814**
Fluoride	100822	F	-	1.00 mg/l*	± 0.15 mg/l	-			119814**
Hydrazine	109711	N_2H_4	-	500 µg/l*	± 50 µg/l	-			see 5.2.2
Hydrogen-peroxide	118789	H_2O_2	-	2.00 mg/l*	± 0.20 mg/l	-			see 5.2.2
Iodine	100606	I_2	-	2.50 mg/l*	± 0.25 mg/l	-			see 5.2.2
Iron	114549	Fe	30, 114677	R-1: 1.00 mg/l R-2: 3.00 mg/l	± 0.15 mg/l ± 0.30 mg/l	-			119781**
Iron	114761	Fe	-	1.00 mg/l*	± 0.15 mg/l	-			119781**
Iron	100796	Fe	30, 114677	R-1: 1.00 mg/l R-2: 1.88 mg/l	± 0.15 mg/l ± 0.20 mg/l	-			119781**

* self prepared, recommended concentration

** 1000 mg/l analyte

Test / Method	Cat. No. Test	Evaluation as	CombiCheck, Cat. No.	Confidence interval Spec. value for the standard	max. working tolerance	Diluted and ready-to-use standard solutions, CRM Cat. No.	concentration	expanded measurement uncertainty	Ready-to-use standard solution Cat. No.
Lead	114833	Pb	40, 114692	R-1: 2.00 mg/l	± 0.20 mg/l	-			119776**
				R-2: 1.00 mg/l	± 0.15 mg/l				
Lead	109717	Pb	40, 114692	R-1: 2.00 mg/l	± 0.20 mg/l	-			119776**
				R-2: 0.63 mg/l	± 0.10 mg/l				
Magnesium	100815	Mg	-	40.0 mg/l*	± 4.0 mg/l	-			see 5.2.2
Manganese	100816	Mn	30, 114677	R-1: 1.00 mg/l	± 0.15 mg/l	-			119789**
				R-2: 1.43 mg/l	± 0.15 mg/l				
Manganese	101739	Mn	-	1.00 mg/l*	± 0.10 mg/l	-			119789**
Manganese	114770	Mn	30, 114677	R-1: 1.00 mg/l	± 0.15 mg/l	-			119789**
				R-2: 1.00 mg/l	± 0.15 mg/l				
Manganese	101846	Mn	-	1.00 mg/l*	± 0.10 mg/l	-			119789**
Molybdenum	100860	Mo	-	0.50 mg/l*	± 0.05 mg/l	-			170227**
Molybdenum	119252	Mo	-	25.0 mg/l*	± 2.5 mg/l	-			170227**
Monochloramine	101632	Cl_2	-	2.50 mg/l*	± 0.25 mg/l	-			see 5.2.2
Nickel	114554	Ni	40, 114692	R-1: 2.00 mg/l	± 0.20 mg/l	-			109989**
				R-2: 2.00 mg/l	± 0.20 mg/l				
Nickel	114785	Ni	40, 114692	R-1: 2.00 mg/l	± 0.20 mg/l	-			109989**
				R-2: 2.00 mg/l	± 0.20 mg/l				
Nitrate	114542	NO_3-N	20, 114675	R-1: 9.0 mg/l	± 0.9 mg/l	125037	2.50 mg/l	± 0.06 mg/l	119811**
				R-2: 5.0 mg/l	± 0.6 mg/l				
Nitrate	114773	NO_3-N	10, 114676	R-1: 2.50 mg/l	± 0.25 mg/l	125036	0.500 mg/l	± 0.05 mg/l	119811**
				R-2: 2.00 mg/l	± 0.40 mg/l	125037	2.50 mg/l	± 0.06 mg/l	
			20, 114675	R-1: 9.0 mg/l	± 0.9 mg/l				
				R-2: 5.0 mg/l	± 0.6 mg/l				
Nitrate	114556	NO_3-N	10, 114676	R-1: 2.50 mg/l	± 0.25 mg/l	125036	0.500 mg/l	± 0.05 mg/l	119811**
				R-2: 1.50 mg/l	± 0.20 mg/l	125037	2.50 mg/l	± 0.06 mg/l	
Nitrate	101842	NO_3-N	-	10.0 mg/l*	± 1.5 mg/l	-			119811**
Nitrite	114547	NO_2-N	-	300 µg/l*	± 30 µg/l	125041	200 µg/l	± 9 µg/l	119899**
Nitrite	114776	NO_2-N	-	200 µg/l*	± 20 µg/l	125041	200 µg/l	± 9 µg/l	119899**
Nitrit	100609	NO_2-N	-	50 mg/l*	± 5 mg/l	125042	40.0 mg/l	± 1.3 mg/l	119899**
Nitrogen	114537	N	50, 114695	R-1: 5.0 mg/l	± 0.7 mg/l	125043	2.50 mg/l	± 0.06 mg/l	see 5.2.2
				R-2: 3.0 mg/l	± 0.5 mg/l	125044	12.0 mg/l	± 0.3 mg/l	
Oxygen scavengers	119251	DEHA	-	250 µg/l*	± 30 µg/l	-			see 5.2.2
Ozone	100607	O_3	-	1.00 mg/l*	± 0.10 mg/l	-			see 5.2.2
pH	101744	pH	-	7.0	± 0.2	-			109407
Phenol	114551	C_6H_5OH	-	1.25 mg/l*	± 0.13 mg/l	-			see 5.2.2
Phenol	100856	C_6H_5OH	-	2.50 mg/l*	± 0.25 mg/l	-			see 5.2.2
Phosphate	100474	PO_4-P	10, 114676	R-1: 0.80 mg/l	± 0.08 mg/l	-			119898**
				R-2: 0.60 mg/l	± 0.07 mg/l				
Phosphate	114543	PO_4-P	10, 114676	R-1: 0.80 mg/l	± 0.08 mg/l	125046	0.400 mg/l P	± 0.016 mg/l	119898**
				R-2: 0.60 mg/l	± 0.07 mg/l				
Phosphate	100475	PO_4-P	20, 114675	R-1: 8.0 mg/l	± 0.7 mg/l	-			119898**
				R-2: 5.0 mg/l	± 0.5 mg/l				
			80, 114738	R-1: 15.0 mg/l	± 1.0 mg/l				
				R-2: 5.0 mg/l	± 0.5 mg/l				
Phosphate	114729	PO_4-P	20, 114675	R-1: 8.0 mg/l	± 0.7 mg/l	125047	4.00 mg/l P	± 0.08 mg/l	119898**
				R-2: 5.0 mg/l	± 0.5 mg/l	125048	15.0 mg/l P	± 0.4 mg/l	
			80, 114738	R-1: 15.0 mg/l	± 1.0 mg/l				
				R-2: 5.0 mg/l	± 0.5 mg/l				

* self prepared, recommended concentration

** 1000 mg/l analyte

Test / Method	Cat. No. Test	Evaluation as	CombiCheck, Cat. No.	Confidence interval Spec. value for the standard	max. working tolerance	Diluted and ready-to-use standard solutions, CRM Cat. No.	concentration	expanded measurement uncertainty	Ready-to-use standard solution Cat. No.
Phosphate	100616	PO_4-P	-	50.0 mg/l*	± 5.0 mg/l	-			119898**
Phosphate	100673	PO_4-P	-	50.0 mg/l*	± 5.0 mg/l	125047	4.00 mg/l P	± 0.08 mg/l	119898**
						125048	15.0 mg/l P	± 0.4 mg/l	
						125049	75.0 mg/l P	± 1.6 mg/l	
Phosphate	114848	PO_4-P	10, 114676	R-1: 0.80 mg/l	± 0.08 mg/l	-			119898**
				R-2: 0.30 mg/l	± 0.05 mg/l				
Phosphate	100798	PO_4-P	-	30.0 mg/l*	± 3.0 mg/l	-			119898**
Phosphate	114546	PO_4-P	-	15.0 mg/l*	± 1.0 mg/l	-			119898**
Phosphate	114842	PO_4-P	-	15.0 mg/l*	± 1.0 mg/l	-			119898**
Potassium	114562	K	-	25.0 mg/l	± 4.0 mg/l	-			170230**
Potassium	100615	K	-	150 mg/l	± 15 mg/l	-			170230**
Residual hardness	114683	Ca	-	2.50 mg/l*	± 0.30 mg/l	-			119778**
Silicate	114794	SiO_2	-	5.00 mg/l*	± 0.50 mg/l	-			170236**
Silicate	100857	SiO_2	-	50.0 mg/l*	± 5.0 mg/l	-			170236**
Silicate	101813	SiO_2	-	0.100 mg/l*	± 0.010 mg/l	-			170236**
Sodium	100885	Na	-	100 mg/l*	± 10 mg/l	-			see 5.2.2
Sulfate	114548	SO_4	10, 114676	R-1: 100 mg/l	± 15 mg/l	125050	40 mg/l	± 6 mg/l	119813**
				R-2: 40 mg/l	± 5 mg/l	125051	125 mg/l	± 6 mg/l	
Sulfate	100617	SO_4	10, 114676	R-1: 100 mg/l	± 15 mg/l	125051	125 mg/l	± 6 mg/l	119813**
				R-2: 100 mg/l	± 15 mg/l	125052	400 mg/l	± 20 mg/l	
Sulfate	114564	SO_4	20, 114675	R-1: 500 mg/l	± 75 mg/l	125051	125 mg/l	± 6 mg/l	119813**
				R-2: 150 mg/l	± 30 mg/l	125052	400 mg/l	± 20 mg/l	
						125053	800 mg/l	± 27 mg/l	
Sulfate	101812	SO_4	-	5.0 mg/l	± 0.5 mg/l	-			119813**
Sulfide	114779	S	-	0.75 mg/l*	± 0.08 mg/l	-			see 5.2.2
Sulfite	114394	SO_3	-	10.0 mg/l*	± 1.5 mg/l	-			see 5.2.2
Sulfite	101746	SO_3	-	30.0 mg/l*	± 1.0 mg/l	-			see 5.2.2
Surfactants (anionic)	114697	MBAS	-	1.00 mg/l*	± 0.20 mg/l	-			see 5.2.2
Surfactants (cationic)	101764		-	1.00 mg/l*	± 0.10 mg/l	-			see 5.2.2
Surfactants (nonionic)	101787		-	4.00 mg/l*	± 0.40 mg/l	-			see 5.2.2
Tin	114622	Sn	-	1.25 mg/l*	± 0.13 mg/l	-			170242**
TOC	114878	TOC	-	40.0 mg/l*	± 3.0 mg/l	-			109017**
TOC	114879	TOC	-	400 mg/l*	± 30 mg/l	-			109017**
Total hardness	100961	Ca	-	75 mg/l*	± 7 mg/l	-			see 5.2.2
Volatile org. acids	101763	HOAc	-	1500 mg/l*	± 80 mg/l	-			see 5.2.2
Volatile org. acids	101749	HOAc	-	1500 mg/l*	± 80 mg/l	-			see 5.2.2
Volatile org. acids	101809	HOAc	-	1500 mg/l*	± 80 mg/l	-			see 5.2.2
Zinc	100861	Zn	-	500 µg/l*	± 50 µg/l	-			119806**
Zinc	114566	Zn	40, 114692	R-1: 2.00 mg/l	± 0.40 mg/l	-			119806**
				R-2: 2.00 mg/l	± 0.40 mg/l				

* self prepared, recommended concentration

** 1000 mg/l analyte

5.2.2 Preparation of standard solutions

Standard solution of acid capacity

Reagents required:

1.09141.1000	Sodium hydroxide solution 0.1 mol/l TitriPUR®
1.16754.9010	Water for analysis EMSURE®

Preparation of a standard solution:
A sodium hydroxide solution of 0.1 mol/l (corresponds to 100 mmol/l) is used.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

Stability:
When stored in a cool place (refrigerator), the diluted investigational solutions remain stable for one week.

Standard solution of bromine analogous to DIN EN ISO 7393

Reagents required:

1.02404.0100	Potassium iodate, volumetric standard
1.05043.0250	Potassium iodide for analysis EMSURE®
1.09072.1000	Sulfuric acid 0.5 mol/l TitriPUR®
1.09136.1000	Sodium hydroxide solution 2 mol/l TitriPUR®
1.16754.9010	Water for analysis EMSURE®

Preparation of a KIO_3 stock solution:
Dissolve 1.006 g of KIO_3 in 250 ml of distilled water in a calibrated or conformity-checked 1000-ml volumetric flask. Subsequently make up to the mark with distilled water.

Preparation of a KIO_3/KI standard solution:
Transfer 11,12 ml of the KIO_3 stock solution to a calibrated or conformity-checked 1000-ml volumetric flask, add approx. 1 g of KI and make up to the mark with distilled water.
1 ml of this solution is equivalent to 0.025 mg of bromine.

Preparation of the bromine standard solution:
Pipette 10.0 ml (full pipette) KIO_3/KI standard solution into a calibrated or conformity-checked 100-ml volumetric flask, add 2.0 ml of H_2SO_4 0.5 mol/l, leave to stand for 1 min, and then add NaOH 2 mol/l dropwise (approx. 1 ml) until the solution just loses its colour. Subsequently make up the solution to the mark with distilled water.
The concentration of the solution is 2.50 mg/l bromine.

Stability:
The KIO_3 stock solution remains stable for 4 weeks when stored in a cool place (refrigerator). The KIO_3/KI standard solution can be used for 5 hours when stored in a cool place (refrigerator). The diluted bromine standard solution is not stable and must be used immediately.

Standard solution of calcium

Reagents required:

1.02121.0500	Calcium nitrate tetrahydrate for analysis EMSURE®
1.16754.9010	Water for analysis EMSURE®

Preparation of a standard solution:
Dissolve 2.946 g of calcium nitrate tetrahydrate with distilled water in a calibrated or conformity-checked 500-ml volumetric flask and make up to the mark with distilled water.
The standard solution prepared according to this procedure has a concentration of 1000 mg/l calcium.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

Stability:
The standard solution of 1000 mg/l remains stable for one week. The diluted standard solutions (investigational concentrations) remain stable for one day.

Standard solutions of free chlorine

All standard solutions described here for free chlorine yield equivalent results and are identically suited for the determination of chlorine.

Standard solution of free chlorine

Reagents required:

1.10888.0250	Dichloroisocyanuric acid sodium salt dihydrate GR for analysis
1.16754.9010	Water for analysis EMSURE®

Preparation of a standard solution:
Dissolve 1.85 g of dichloroisocyanuric acid sodium salt dihydrate GR with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.
The standard solution prepared according to this procedure has a concentration of 1000 mg/l free chlorine.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

Stability:
When stored in a cool place (refrigerator), the standard solution of 1000 mg/l and the diluted standard solutions (investigational concentrations) remain stable for one day.

Note
This is a standard solution that can be prepared particularly rapidly and easily.

Standard solution of free chlorine analogous to DIN EN ISO 7393

Preparation of a KIO_3 stock solution:
Dissolve 1.006 g of KIO_3 in 250 ml of distilled water in a calibrated or conformity-checked 1000-ml volumetric flask. Subsequently make up to the mark with distilled water.

Preparation of a KIO_3/KI standard solution:
Transfer 7.50 ml (12.50 ml) of the KIO_3 stock solution to a calibrated or conformity-checked 1000-ml volumetric flask, add approx. 1 g of KI and make up to the mark with distilled water.
1 ml of this solution is equivalent to 0.0075 mg (0.0125 mg) of free chlorine.

Preparation of the chlorine standard solution:
Pipette 20.0 ml (full pipette) KIO_3/KI standard solution into a calibrated or conformity-checked 100-ml volumetric flask, add 2.0 ml of H_2SO_4 0.5 mol/l, leave to stand for 1 min, and then add NaOH 2 mol/l dropwise (approx. 1 ml) until the solution just loses its colour. Subsequently make up the solution to the mark with distilled water.
The concentration of the solution is 1.50 mg/l (2.50 mg/l) free chlorine.

Stability:
The KIO_3 stock solution remains stable for 4 weeks when stored in a cool place (refrigerator). The KIO_3/KI standard solution can be used for 5 hours when stored in a cool place (refrigerator). The diluted chlorine standard solution is not stable and must be used immediately.

Reagents required:

1.02404.0100	Potassium iodate, volumetric standard
1.05043.0250	Potassium iodide for analysis EMSURE®
1.09072.1000	Sulfuric acid 0.5 mol/l TitriPUR®
1.09136.1000	Sodium hydroxide solution 2 mol/l TitriPUR®
1.16754.9010	Water for analysis EMSURE®

Note
This procedure involves the preparation according to a standardized method.

Standard solution of free chlorine

Preparation of a stock solution:
First prepare a 1:10 dilution using a sodium hypochlorite solution containing approximately 13 % of active chlorine. For this pipette 10 ml of sodium hypochlorite solution into a calibrated or conformity-checked 100-ml volumetric flask and then make up to the mark with distilled water.

Precise assay of the stock solution:
Pipette 10.0 ml of the stock solution into a 250-ml ground-glass-stoppered conical flask containing 60 ml of distilled water. Subsequently add to this solution 5 ml of hydrochloric acid 25 % and 3 g of potassium iodide. Close the conical flask with the ground-glass stopper, mix thoroughly, and leave to stand for 1 min.

Titrate the eliminated iodine with sodium thiosulfate solution 0.1 mol/l until a weakly yellow colour emerges. Add 2 ml of zinc iodide-starch solution and titrate from blue to colourless.

Caculation and preparation of the standard solution:

Consumption of sodium thiosulfate solution 0.1 mol/l (ml) x 355 = = content of free chlorine, in mg/l

Further investigational concentrations may be prepared from the stock solution prepared according to the procedure described above by diluting accordingly with distilled water.

Stability:
When stored in a cool place (refrigerator), a standard solution of 1000 mg/l remains stable for approximately one week. The diluted standard solutions (investigational concentrations) are stable for approximately 2 hours.

Reagents required:

1.00316.1000	Hydrochloric acid 25 % for analysis EMSURE®
1.05614.9025	Sodium hypochlorite solution techn. approx. 13 % active chlorine
1.09147.1000	Sodium thiosulfate solution 0.1 mol/l TitriPUR®
1.05043.0250	Potassium iodide GR for analysis
1.05445.0500	Zinc iodide-starch solution GR for analysis
1.16754.9010	Water for analysis EMSURE®

Note
This is a standard solution that is absolutely necessary for the preparation of the monochloramine standard.

Standard solution of total chlorine

Reagents required:

1.02426.0250	Chloramine T trihydrate GR for analysis
1.16754.9010	Water for analysis EMSURE®

Preparation of a standard solution:
Dissolve 4.00 g of chloramine T GR with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.
The standard solution prepared according to this procedure has a concentration of 1000 mg/l total chlorine.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

Stability:
When stored in a cool place (refrigerator), the standard solution of 1000 mg/l and the diluted standard solutions (investigational concentrations) remain stable for one day.

Standard solution of chlorine dioxide analogous to DIN EN ISO 7393

Reagents required:

1.02404.0100	Potassium iodate, volumetric standard
1.05043.0250	Potassium iodide for analysis EMSURE®
1.09072.1000	Sulfuric acid 0.5 mol/l TitriPUR®
1.09136.1000	Sodium hydroxide solution 2 mol/l TitriPUR®
1.16754.9010	Water for analysis EMSURE®

Preparation of a KIO_3 stock solution:
Dissolve 1.006 g of KIO_3 in 250 ml of distilled water in a calibrated or conformity-checked 1000-ml volumetric flask. Subsequently make up to the mark with distilled water.

Preparation of a KIO_3/KI standard solution:
Transfer 13.12 ml of the KIO_3 stock solution to a calibrated or conformity-checked 1000-ml volumetric flask, add approx. 1 g of KI and make up to the mark with distilled water.
1 ml of this solution is equivalent to 0.025 mg of chlorine dioxide.

Preparation of the chlorine dioxide standard solution:
Pipette 10.0 ml (full pipette) KIO_3/KI standard solution into a calibrated or conformity-checked 100-ml volumetric flask, add 2.0 ml of H_2SO_4 0.5 mol/l, leave to stand for 1 min, and then add NaOH 2 mol/l dropwise (approx. 1 ml) until the solution just loses its colour. Subsequently make up the solution to the mark with distilled water.
The concentration of the solution is 2.50 mg/l chlorine dioxide.

Stability:
The KIO_3 stock solution remains stable for 4 weeks when stored in a cool place (refrigerator). The KIO_3/KI standard solution can be used for 5 hours when stored in a cool place (refrigerator). The diluted chlorine dioxide standard solution is not stable and must be used immediately.

Standard solution of COD

Reagents required:

1.02400.0080	Potassium hydrogen phthalate GR for analysis, volumetric standard
1.16754.9010	Water for analysis EMSURE®

Preparation of a standard solution:
Dissolve 0.850 g of potassium hydrogen phthalate GR with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.
The standard solution prepared according to this procedure has a concentration of 1000 mg/l COD.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

Stability:
When stored in a cool place (refrigerator), the standard solution of 1000 mg/l remains stable for one month. When stored under appropriate cool conditions (refrigerator), the diluted standard solutions (investigational concentrations) remain stable - depending on the respective concentration - for approximately one week to one month.

Standard solution of COD/chloride

Reagents required:

1.02400.0080	Potassium hydrogen phthalate GR for analysis, volumetric standard
1.06404.0500	Sodium chloride for analysis EMSURE®
1.16754.9010	Water for analysis EMSURE®

Preparation of a chloride dilution solution:
Dissolve 32.9 g of sodium chloride GR with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.
The dilution solution prepared according to this procedure has a concentration of 20 g/l Cl^-.

Preparation of a COD/Cl^- standard solution:
Dissolve 0.850 g of potassium hydrogen phthalate GR with **dilution solution** in a calibrated or conformity-checked 100-ml volumetric flask and make up to the mark with **dilution solution**.
The standard solution prepared according to this procedure has a concentration of 10 000 mg/l COD and 20 g/l Cl^-.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with **dilution solution**.

Stability:
When stored in a cool place (refrigerator), the dilution solution of 20 g/l Cl^- and the standard solution of 10 000 mg/l COD / 20 g/l Cl^- remain stable for one month. When stored under appropriate cool conditions (refrigerator), the diluted standard solutions (investigational concentrations) remain stable - depending on the respective concentration - for approximately one week to one month.

Standard solution of cyanuric acid

Reagents required:

8.20358.0005	Cyanuric acid for synthesis
1.16754.9010	Water for analysis EMSURE®

Preparation of a standard solution:
Dissolve 1.00 g of cyanuric acid with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water. The substance is slightly soluble and the dissolution process may take several hours.
The standard solution prepared according to this procedure has a concentration of 1000 mg/l cyanuric acid.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

Stability:
When stored in a cool place (refrigerator), the standard solution of 1000 mg/l and the diluted standard solutions (investigational concentrations) remain stable for one day.

Standard solution of hydrazine

Reagents required:

1.04603.0100	Hydrazinium sulfate GR for analysis
1.16754.9010	Water for analysis EMSURE®

Preparation of a standard solution:
Dissolve 4.07 g of hydrazinium sulfate with oxyen-low (boil previously) distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with oxyen-low distilled water.
The standard solution prepared according to this procedure has a concentration of 1000 mg/l hydrazine.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with oxyen-low distilled water.

Stability:
When stored in a cool place (refrigerator), the standard solution of 1000 mg/l and the diluted standard solutions (investigational concentrations) remain stable for one day.

Standard solution of hydrogenperoxide

Preparation of a stock solution:
Place 10.0 ml of Perhydrol® 30 % H_2O_2 in a calibrated or conformity-checked 100-ml volumetric flask and make up to the mark with distilled water. Transfer 30.0 ml (full pipette) of this solution to a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water. The stock solution prepared according to this procedure has a concentration of approx. 1000 mg/l hydrogen peroxide.

Precise assay of the stock solution:
Pipette 50.0 ml (full pipette) of the hydrogen peroxide stock solution into a 500-ml conical flask, dilute with 200 ml of distilled water, and add 30 ml of sulfuric acid 25 %.
Titrate with a 0.02 mol/l potassium permanganate solution until the colour changes to pink.

Calculation and preparation of the standard solution:

Consumption of potassium permanganate solution 0.02 mol/l (ml) x 34.02 = content of hydrogen peroxide, in mg/l

Further investigational concentrations may be prepared from the stock solution exactly determined according to the procedure described above by diluting accordingly with distilled water.

Stability:
When stored in a cool place (refrigerator), the stock solution of approx. 1000 mg/l and the diluted standard solutions (investigational concentrations) remain stable for one day.

Reagents required:

1.09122.1000	Potassium per manganate solution 0.02 mol/l TitriPUR®
1.07209.0250	Perhydrol® 30 % for analysis EMSURE®
1.00716.1000	Sulfuric acid 25 % for analysis EMSURE®
1.16754.9010	Water for analysis EMSURE®

Standard solution of iodine analogous to DIN EN ISO 7393

Reagents required:

1.02404.0100	Potassium iodate, volumetric standard
1.05043.0250	Potassium iodide for analysis EMSURE®
1.09072.1000	Sulfuric acid 0.5 mol/l TitriPUR®
1.09136.1000	Sodium hydroxide solution 2 mol/l TitriPUR®
1.16754.9010	Water for analysis EMSURE®

Preparation of a KIO_3 stock solution:
Dissolve 1.006 g of KIO_3 in 250 ml of distilled water in a calibrated or conformity-checked 1000-ml volumetric flask. Subsequently make up to the mark with distilled water.

Preparation of a KIO_3/KI standard solution:
Transfer 7.00 ml of the KIO_3 stock solution to a calibrated or conformity-checked 1000-ml volumetric flask, add approx. 1 g of KI and make up to the mark with distilled water.
1 ml of this solution is equivalent to 0.025 mg of iodine.

Preparation of the iodine standard solution:
Pipette 10.0 ml (full pipette) KIO_3/KI standard solution into a calibrated or conformity-checked 100-ml volumetric flask, add 2.0 ml of H_2SO_4 0.5 mol/l, leave to stand for 1 min, and then add NaOH 2 mol/l dropwise (approx. 1 ml) until the solution just loses its colour. Subsequently make up the solution to the mark with distilled water.
The concentration of the solution is 2.50 mg/l iodine.

Stability:
The KIO_3 stock solution remains stable for 4 weeks when stored in a cool place (refrigerator). The KIO_3/KI standard solution can be used for 5 hours when stored in a cool place (refrigerator). The dilute chlorine dioxide standard solution is not stable and must be used immediately.

Standard solution of magnesium

Reagents required:

1.05853.0500	Magnesium nitrate hexahydrate for analysis EMSURE®
1.16754.9010	Water for analysis EMSURE®

Preparation of a standard solution:
Dissolve 1.055 g of magnesium nitrate hexrahydrate with distilled water in a calibrated or conformity-checked 100-ml volumetric flask and make up to the mark with distilled water. The standard solution prepared according to this procedure has a concentration of 1000 mg/l magnesium.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

Stability:
The standard solution of 1000 mg/l remains stable for one week. The diluted standard solutions (investigational concentrations) remain stable for one day.

Standard solution of monochloramine

Reagents required:

Chlor standard solution
100 mg/l Cl_2
Preparation see "Standard solution of free chlorine" with hypochlorite solution (standard solution that is absolutely necessary for the preparation of the monochloramine standard)

Ammonium standard solution
10 mg/l NH_4-N
Preparation with Ammonium standard solution CertiPUR®, Cat. No. 1.19812.0500, 1000 mg/l NH_4 = 777 mg/l NH_4-N

1.16754.9010 Water for analysis EMSURE®

Preparation of a standard solution:
Place 5.0 ml of chlorine standard solution 100 mg/l Cl_2 and 10.0 ml ammonium standard solution 10 mg/l NH_4-N in a calibrated or conformity-checked 100-ml volumetric flask and make up to the mark with distilled water.
The standard solution prepared according to this procedure has a concentration of 5.00 mg/l Cl_2 or 3.63 mg/l NH_2Cl.

Stability:
The standard solution is not stable and must be used immediately.

Standard solution of nitrogen (total)

Reagents required:

1.04201.0100 Glycine GR for analysis

1.16754.9010 Water for analysis EMSURE®

Preparation of a standard solution:
Dissolve 5.36 g of glycine GR with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.
The standard solution prepared according to this procedure has a concentration of 1000 mg/l total nitrogen.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

Stability:
When stored in a cool place (refrigerator), the standard solution of 1000 mg/l remains stable for one week. The diluted standard solutions (investigational concentrations) must be used immediately.

Standard solution of oxygen scavangers

Reagents required:

8.18473.0050 N,N-Diethylhydroxylamine for synthesis

1.16754.9010 Water for analysis EMSURE®

Preparation of a standard solution:
Dissolve 1.00 g of N,N-diethylhydroxylamine with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.
The standard solution prepared according to this procedure has a concentration of 1000 mg/l N,N-diethylhydroxylamine (DEHA).

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

Stability:
When stored in a cool place (refrigerator), the standard solution of 1000 mg/l and the diluted standard solutions (investigational concentrations) remain stable for one day.

Standard solution of ozone analogous to DIN EN ISO 7393

Reagents required:

1.02404.0100	Potassium iodate, volumetric standard
1.05043.0250	Potassium iodide for analysis EMSURE®
1.09072.1000	Sulfuric acid 0.5 mol/l TitriPUR®
1.09136.1000	Sodium hydroxide solution 2 mol/l TitriPUR®
1.16754.9010	Water for analysis EMSURE®

Preparation of a KIO_3 stock solution:
Dissolve 1.006 g of KIO_3 in 250 ml of distilled water in a calibrated or conformity-checked 1000-ml volumetric flask. Subsequently make up to the mark with distilled water.

Preparation of a KIO_3/KI standard solution:
Transfer 14.80 ml of the KIO_3 stock solution to a calibrated or conformity-checked 1000-ml volumetric flask, add approx. 1 g of KI and make up to the mark with distilled water.
1 ml of this solution is equivalent to 0.010 mg of ozone.

Preparation of the ozone standard solution:
Pipette 10.0 ml (full pipette) KIO_3/KI standard solution into a calibrated or conformity-checked 100-ml volumetric flask, add 2.0 ml of H_2SO_4 0.5 mol/l, leave to stand for 1 min, and then add NaOH 2 mol/l dropwise (approx. 1 ml) until the solution just loses its colour. Subsequently make up the solution to the mark with distilled water.
The concentration of the solution is 1.00 mg/l ozone.

Stability:
The KIO_3 stock solution remains stable for 4 weeks when stored in a cool place (refrigerator). The KIO_3/KI standard solution can be used for 5 hours when stored in a cool place (refrigerator). The dilute chlorine dioxide standard solution is not stable and must be used immediately.

Standard solution of phenol

Reagents required:

1.00206.0250	Phenol GR for analysis
1.16754.9010	Water for analysis EMSURE®

Preparation of a standard solution:
Dissolve 1.00 g of phenol GR with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.
The standard solution prepared according to this procedure has a concentration of 1000 mg/l phenol.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

Stability:
When stored in a cool place (refrigerator), the standard solution of 1000 mg/l remains stable for one week. The diluted standard solutions (investigational concentrations) must be used immediately.

Standard solution of silicate

Reagents required:

1.70236.0100 Silicone standard solution CertiPUR®

1.16754.9010 Water for analysis EMSURE®

Preparation of a standard solution:
A silicon standard solution of 1000 mg/l is used.
1000 mg/l Si corresponds to 2139 mg/l SiO_2.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

Example:
Mix 4.675 ml of silicon standard solution (1000 mg/l Si) with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.
The standard solution prepared according to this procedure has a concentration of 10.00 mg/l SiO_2.
After its preparation, the solution must be immediately transferred to a clean polyethylene vessel for further storage.
Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.
After its preparation, the solution with the desired working concentration must be immediately transferred to a clean polyethylene vessel for further storage.

Stability:
The diluted standard solutions (investigational concentrations) remain stable - depending on the respective concentration - for one day to approximately six months.

Standard solution of sodium

Reagents required:

1.19897.0500 Chloride standard solution CertiPUR®

1.16754.9010 Water for analysis EMSURE®

Preparation of a standard solution:
A chloride standard solution of 1000 mg/l is used.
1000 mg/l chloride corresponds to 649 mg/l sodium.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

Stability:
When stored in a cool place (refrigerator), the diluted standard solutions (investigational concentrations) remains stable for one month.

Standard solution of sulfide

Preparation of a stock solution:
Dissolve 5.0 g of glass-clear, if necessary washed crystals of sodium sulfide hydrate GR with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled.
The stock solution prepared according to this procedure has a concentration of approx. 1000 mg/l sulfide.

Precise assay of the stock solution:
Place 100 ml of distilled water and 5.0 ml (full pipette) of sulfuric acid 25 % in a 500-ml ground-glass-stoppered conical flask. To this solution add 25.0 ml (full pipette) of the sulfide stock solution and 25.0 ml (full pipette) of iodine solution 0.05 mol/l. Shake the contents of the flask thoroughly for about 1 min, subsequently titrate with sodium thiosulfate solution 0.1 mol/l until the yellow iodine colour has disappeared, add 1 ml of zinc iodide-starch solution, and continue to titrate until a milky, pure white colour emerges.

Calculation and preparation of the standard solution:

C1 = consumption of sodium thiosulfate solution 0.1 mol/l
C2 = quantity of iodine solution 0.05 mol/l (25.0 ml)

mg/l sulfide = (C2 – C1) x 64.1026

Further investigational concentrations may be prepared from the stock solution exactly determined according to the procedure described above by diluting accordingly with distilled water.

Stability:
When stored in a cool place (refrigerator), the stock solution of approx. 1000 mg/l remains stable for at most one day. The diluted standard solutions (investigational concentrations) must be used immediately.

Reagents required:

	Sodium sulfide hydrate approx. 60 % GR for analysis
1.09099.1000	Iodine solution 0.05 mol/l TitriPUR®
1.09147.1000	Sodium thiosulfate solution 0.1 mol/l TitriPUR®
1.00716.1000	Sulfuric acid 25 % for analysis EMSURE®
1.05445.0500	Zinc iodide-starch solution GR for analysis
1.16754.9010	Water for analysis EMSURE®

Standard solution of sulfite

Preparation of a stock solution:
Dissolve 1.57 g of sodium sulfite and 0.4 g of Titriplex® III GR with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.
The standard solution prepared according to this procedure has a concentration of approx. 1000 mg/l sulfite.

Precise assay of the stock solution:
Place 50.0 ml (full pipette) of the sulfite stock solution and 5.0 ml (full pipette) of hydrochloric acid 25 % in a 300-ml conical flask.
To this solution add 25.0 ml (full pipette) of iodine solution 0.05 mol/l and process immediately. After mixing the contents of the flask, subsequently titrate with sodium thiosulfate solution 0.1 mol/l until the yellow iodine colour has disappeared, add 1 ml of zinc iodide-starch solution, and continue to titrate from blue to colourless.

Calculation and preparation of the standard solution:

C1 = consumption of sodium thiosulfate solution 0.1 mol/l
C2 = quantity of iodine solution 0.05 mol/l (25.0 ml)

mg/l sulfite = (C2 – C1) x 80.06

Further investigational concentrations may be prepared from the stock solution exactly determined according to the procedure described above by diluting accordingly with distilled water and buffer solution pH 9.00.
This is done in the following manner:
Withdraw the desired aliquot from the stock solution, place in a calibrated or conformity-approved 1000-ml volumetric flask, add 20 ml of buffer solution pH 9.00, make up to the mark with distilled water, and mix.

Stability:
When stored in a cool place (refrigerator), the stock solution of approx. 1000 mg/l remains stable for at most one day. The diluted standard solutions (investigational concentrations) must be used immediately.

Reagents required:

1.06657.0500	Sodium sulfite anhydrous for analysis EMSURE®
1.08418.0100	Titriplex® III GR for analysis
1.09099.1000	Iodine solution 0.05 mol/l TitriPUR®
1.09147.1000	Sodium thiosulfate solution 0.1 mol/l TitriPUR®
1.00316.1000	Hydrochloric acid 25 % for analysis EMSURE®
1.05445.0500	Zinc iodide-starch solution GR for analysis
1.09461.1000	Buffer solution pH 9.00 CertiPUR®
1.16754.9010	Water for analysis EMSURE®

Standard solution of surfactants (anionic)

Reagents required:

1.12146.0005	Sodium 1-dodecane-sulfonate
1.16754.9010	Water for analysis EMSURE®

Preparation of a standard solution:
Dissolve 1.00 g of sodium 1-dodecanesulfonate with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.
The standard solution prepared according to this procedure has a concentration of 1000 mg/l anionic surfactants.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

Stability:
When stored in a cool place (refrigerator), the standard solution of 1000 mg/l remains stable for one month. The diluted standard solutions (investigational concentrations) must be used immediately.

Standard solution of surfactants (cationic)

Reagents required:

1.02342.0100	N-cetyl-N,N,N-trimethylammonium bromide GR for analysis
1.16754.9010	Water for analysis EMSURE®

Preparation of a standard solution:
Dissolve 1.00 g of N-cetyl-N,N,N-trimethylammonium bromide GR with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.
The standard solution prepared according to this procedure has a concentration of 1000 mg/l cationic surfactants.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

Stability:
When stored in a cool place (refrigerator), the standard solution of 1000 mg/l remains stable for one month. The diluted standard solutions (investigational concentrations) must be used immediately.

Standard solution of surfactants (nonionic)

Reagents required:

1.12298.0101 Triton® X-100

1.16754.9010 Water for analysis EMSURE®

Preparation of a standard solution:
Dissolve 1.00 g of Triton® X-100 GR with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.
The standard solution prepared according to this procedure has a concentration of 1000 mg/l nonionic surfactants.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

Stability:
When stored in a cool place (refrigerator), the standard solution of 1000 mg/l remains stable for one week. The diluted standard solutions (investigational concentrations) must be used immediately.

Standard solution of tin

Reagents required:

1.70242.0100 Tin standard solution CertiPur®

1.09057.1000 Hydrochloric acid 1 mol/l TitriPUR®

1.16754.9010 Water for analysis EMSURE®

Preparation of a standard solution:
A tin standard solution of 1000 mg/l is used.
Transfer 30 ml of HCl 1 mol/l to a calibrated or conformity-checked 100-ml volumetric flask, add 10.0 ml (full pipette) of the tin standard solution, and make up to the mark with distilled water.
The standard solution prepared according to this procedure has a concentration of 100 mg/l tin.

Further investigational concentrations may be prepared from the standard solution by diluting accordingly with distilled water and HCl 1 mol/l.
This is done in the following manner:
Transfer 1 ml of HCl 1 mol/l to a calibrated or conformity-checked 100-ml volumetric flask. Withdraw the desired aliquot from the tin standard solution 100 mg/l, add, make up to the mark with distilled water, and mix.

Stability:
The tin standard solution 100 mg/l remains stable for 30 minutes. The diluted standard solutions (investigational concentrations) must be used immediately.

Standard solution of total hardness

Reagents required:

1.02121.0500 Calcium nitrate tetrahydrate for analysis EMSURE®

1.16754.9010 Water for analysis EMSURE®

Preparation of a standard solution:
Dissolve 2.946 g of calcium nitrate tetrahydrate with distilled water in a calibrated or conformity-checked 500-ml volumetric flask and make up to the mark with distilled water.
The standard solution prepared according to this procedure has a concentration of 1000 mg/l calcium (corresponds to 175 °e).

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

Stability:
The standard solution of 1000 mg/l remains stable for one week. The diluted standard solutions (investigational concentrations) remain stable for one day.

Standard solution of volatile organic acids

Reagents required:

1.06268.0250 Sodium acetate anhydrous for analysis EMSURE®

1.16754.9010 Water for analysis EMSURE®

Preparation of a standard solution:
Dissolve 2.05 g of sodium acetate anhydrous with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.
The standard solution prepared according to this procedure has a concentration of 1500 mg/l acetic acid.

Stability:
When stored in a cool place (refrigerator), the standard solution remains stable for one week.

5.3 Printing measurement results

5.3.1 Setting the print parameters

The Spectroquant® Multy Colorimeter can print out data on a printer with a serial interface via the RS232 port.

The standard settings of the printer type used should be checked before printing out data. The usual settings are as follows:

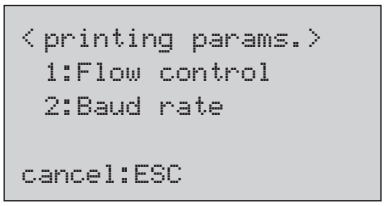
Data bits:	8	
Parity:	none	
Baud rate:	dependent on the printer type	
	e.g.	LQ 300 matrix printer: 4800
		DP 1012 ticket printer: 19200

The printing parameters of the Spectroquant® Multy Colorimeter must be aligned to match these settings accordingly. This is done in the following manner:

Press the keys **[Mode] [2] [9]** in succession.

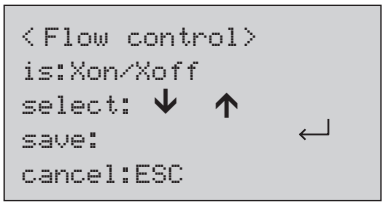
Confirm your selection by pressing **[Enter]**.

The display now shows:



Press the **[1]** key to set the flow control.

The display now shows:



Press the **[▲]** or **[▼]** arrow keys to select the desired settings depending on the type of printer in question (Xon/Xoff, none, hardware). The setting "none" must be selected for the LQ 300 unit.

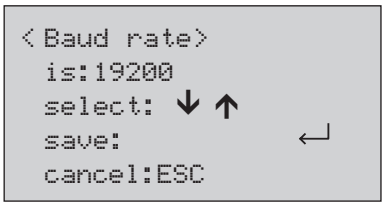
Confirm by pressing the **[Enter]** key.

Press **[Esc]** to exit this mode.

Press the **[2]** key to set the baud rate.

2

The display shows:



Press the **[▲]** or **[▼]** arrow keys to select the desired baud rate (600, 1200, 2400, 4800, 9600, 14400, 19200). For the LQ 300, for example, select the baud rate 4800.

Confirm your selection by pressing **[Enter]**.

Enter

Press [Esc] to exit this mode.

Esc

One press of the **[Esc]** key takes you back to the mode menu,

Esc

two presses of the **[Esc]** key to the method-selection list.

Esc

If you wish to transfer data, connect the colorimeter with the printer. The PC cable supplied with the photometer can be used for this purpose (an adapter may be necessary).

When the printer is installed and switched on, the measurement result can be printed out without having to be saved beforehand:

Simply press the **[F3]** key.

F3

The entire data set is printed out, stating the date, time, method, and result.

Specimen printout

163 COD 14541
25-1500 mg/l
Profi-Mode: no
2004-07-01 14:53:09
Test No.: 1
Code-No.: 007
151 mg/l

The serial number is an internal number that is automatically assigned when a measurement result is saved. This number appears only on the printout.

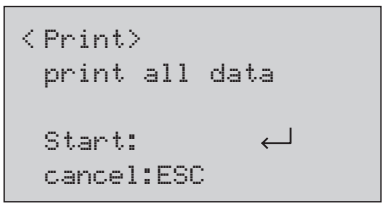
5.3.2 Printing all measurement results

In this mode all saved measurement results are printed out.

Press the keys **[Mode] [2] [0]** in succession.

Confirm your selection by pressing **[Enter]**.

The display now shows:



Pressing the **[Enter]** key prints out all saved measurement results.

After the printout operation the colorimeter returns to the mode menu.

5.3.3 Printing measurement results from a defined date range

In this mode all measurement results from a defined period of time are printed out.

If you wish to print out only one day's test results, enter the same date for both the start and end dates.

Press the keys **[Mode] [2] [1]** in succession.

Confirm your selection by pressing **[Enter]**.

The display now shows:

```
<Print>
 sorted:date
 from yy-mm-dd
      __-__-__
```

Enter the start date in the sequence year, month, day

e.g. July 14, 2006 = **[0][6] [0][7] [1][4]**.

Confirm by pressing the **[Enter]** key.

The display now shows:

```
<Print>
 sorted:date
 to   yy-mm-dd
      __-__-__
```

Enter the end date in the sequence year, month, day

e.g. July 19, 2006 = **[0][6] [0][7] [1][9]**.

Confirm by pressing the **[Enter]** key.

The display now shows:

```
<Print>
 sorted:date
 from 2006-07-14
 to   2006-07-19
 Start:        ↵
 Ende:ESC
```

Pressing the **[Enter]** key prints out the saved test results from the defined period of time.

After the printout operation the colorimeter returns to the mode menu.

5.3.4 Printing measurement results from a defined code-No. range

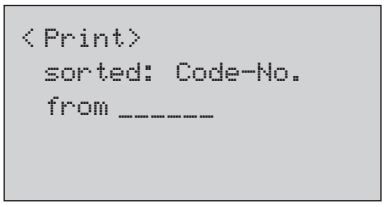
In this mode all measurement results from a defined code-No. range are printed out.

If you wish to print out only test results with the same code No., enter the same code for both the start and end codes. To print out all test results without the code No. or with the code No. 0, enter zero (0) for both the start and end code Nos.

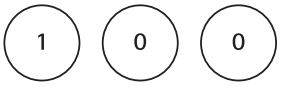
Press the keys **[Mode]** **[2]** **[2]** in succession.

Confirm your selection by pressing **[Enter]**.

The display now shows:

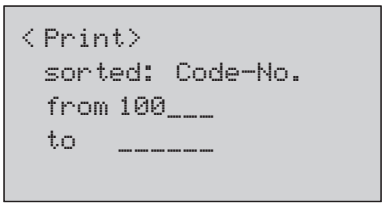


Enter the start code number (max. 6 digits), e.g. **[1]** **[0]** **[0]**.



Confirm by pressing the **[Enter]** key.

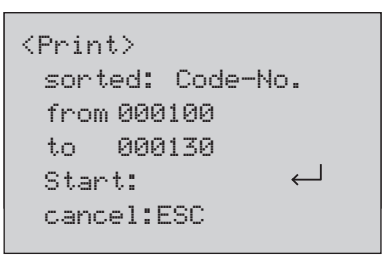
The display then shows:



Enter the end code number (max. 6 digits), e.g. **[1]** **[3]** **[0]**.

Confirm by pressing the **[Enter]** key.

The display then shows:



Pressing the **[Enter]** key prints out the saved test results from the defined code-No. range.

After the printout operation the colorimeter returns to the mode menu.

5.3.5 Printing measurement results from a defined method

In this mode all measurement results from a specific method are printed out.

Press the keys **[Mode] [2] [3]** in succession.

Confirm your selection by pressing **[Enter]**.

The display now shows:

```
<Print>
>> 10 Acid cap. 01758
   20 Aluminium 14825
   21 Aluminium 00594
   ...
```

Select the method from the list or else enter the method number directly.

Confirm by pressing the **[Enter]** key.

(In the case of differentiating methods repeat this procedure as necessary and confirm by pressing **[Enter]**.)

The display now shows:

```
<Print>
 method
 21 Aluminium 00594
 Start:          ↵
 Ende:ESC
```

Pressing the **[Enter]** key prints out the saved test results from the defined method.

After the printout operation the colorimeter returns to the mode menu.

5.4 Transferring data to a PC

The Spectroquant® Multy Colorimeter can transfer data to a PC via the **RS232** interface. The data is transferred by the **"Hyperterminal"** software contained in the standard Windows package.

The instructions given below describe the transfer of data to the **Windows® 98 HyperTerminal programme**. It can be considered equivalent also for other Windows versions (3.11, WIN95, WIN NT, WIN XP etc.).
Users of the Windows version "Windows 7" must use the **Spectroquant® Data Transfer Software** to transfer the data. This software tool together with the corresponding instructions for use can be downloaded from **www.analytical-test-kits.com** (see Multy Colorimeter "Technical info").

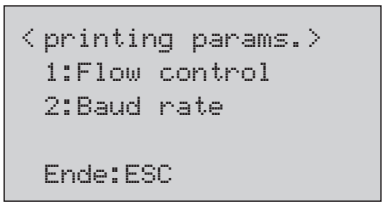
Using HyperTerminal

Connect the Spectroquant® Multy and one of the free serial interface ports of your computer using the cable supplied with the package. Switch the colorimeter on and wait for the self-check routine to end.

Press the colorimeter keys **[Mode] [2] [9]** in succession

and then the **[Enter]** key.

The display now shows:



Press the **[1]** key and use

the **[▲]** or **[▼]** arrow keys to select flow control Xon/Xoff.

Confirm by pressing **[Enter]**.

Exit the menu by pressing **[Esc]**.

Now press the **[2]** key to select the baud rate. Use the cursor keys the select the baud rate 19200.

Confirm by pressing **[Enter]**.

Exit the menu by pressing the **[Esc]** key twice.

Now exit the mode menu and return to the method-selection mode.

Start **HyperTerminal** as follows:

With the standard Windows installation go to **"Start > Programmes > Tools > Communication > HyperTerminal"**, and the window shown below (**Fig. 1,** page 2) pops up.

Double-click on **HYPERTRM.exe** (depending on the computer settings the .exe tag may not be shown) to start the **HyperTerminal** programme.

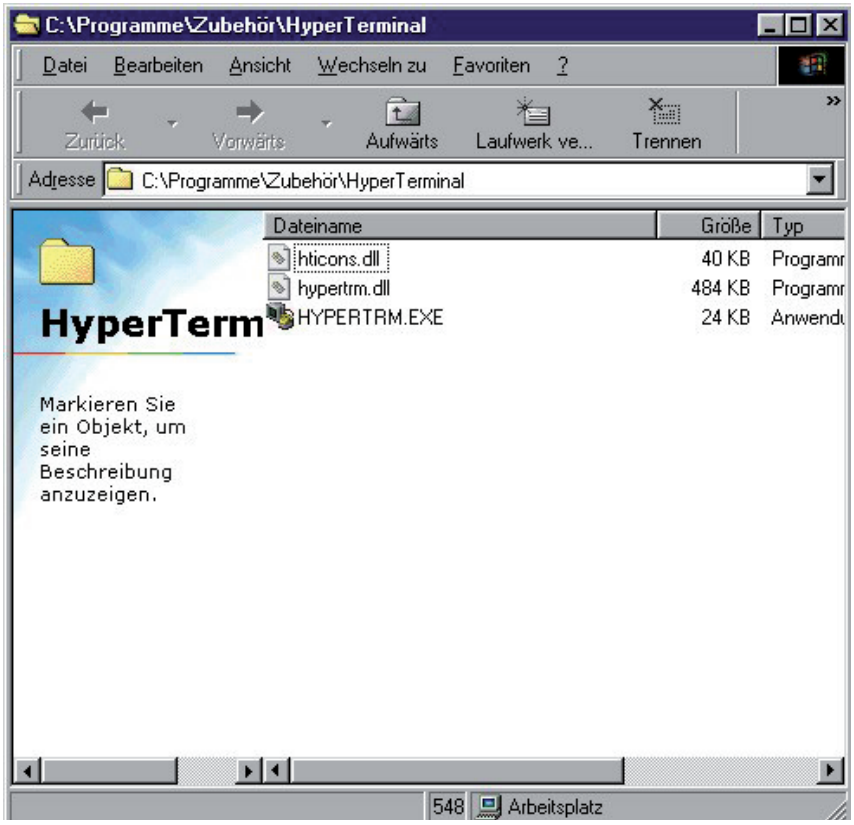


Fig. 1

The following screen appears briefly:

Fig. 2

When opened for the very first time a prompt appears regarding the installation of a modem **(Fig. 3)**:

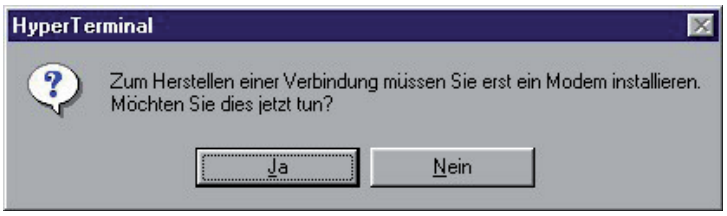


Fig. 3

Here please click on **"No"**.

The following screen appears:

Fig. 4

At "Name" enter e.g. **"Photometer"**.

Fig. 5

Click on **"OK"** after entering the name.

If a modem is already installed,
the following screen appears:

Fig. 6

Here the actual contents may differ from those shown here. Under **"Connect using:"** the **"Direct link using COMx"** is not available. Please continue for the time being as described at **"Link settings if a modem is already installed"** (see page 15).

If no modem has been installed yet the following screen appears:

Fig. 7

Selecting the COM interface
At **"Connect using:"** use the **"Direct link using COM1"**, **"Direct link using COM2"**, etc. to select the COMx interface with which the colorimeter data-transfer cable is connected.

Then click on **"OK"**.
The display now shows:

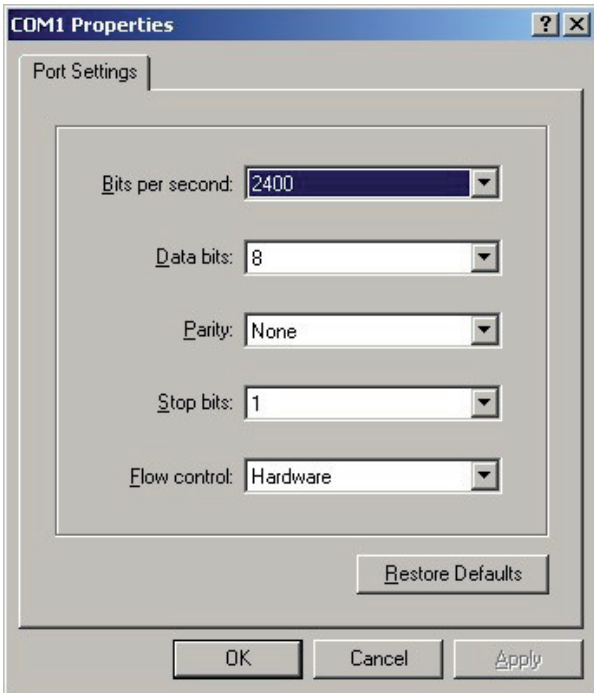


Fig. 8

Setting the interface parameters

Now you must make the following settings:

Bits per second (baud rate):	**19200**
Data bits:	**8**
Parity:	**None**
Stop bits:	**1**
Flow control:	**Xon / Xoff**

The settings for the parameters **"Flow control"** and **"Baud rate"** are now the same as those entered in the Spectroquant® Multy.

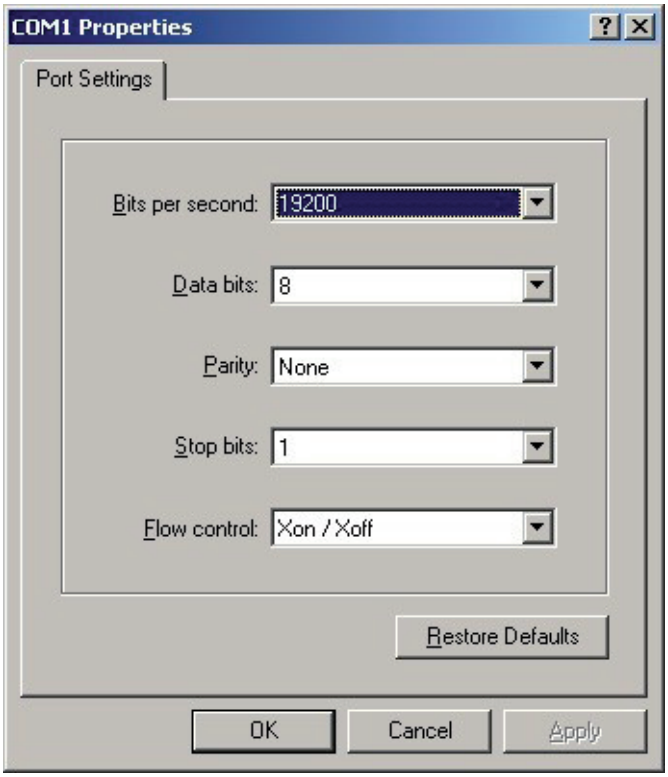


Fig. 9

Now click on **"OK"**.

If you have succeeded in getting here from the screen **"No modem installed"** (page 4), the actual HyperTerminal programme interface screen **(Fig. 10)** now appears immediately.

If you have reached this point via the screen **"Modem installed"**, in other words from page 19, Figure 27, the window shown in Figure 26 pops up again and you must once again click on **"OK"**. The actual HyperTerminal programme interface now appears **(Fig. 10)**.

Main HyperTerminal window

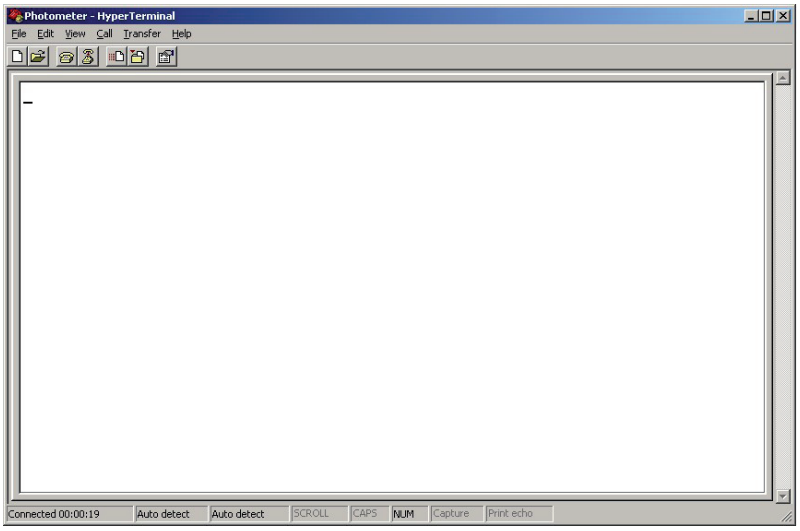


Fig. 10

If the status message in the bottom lefthand corner of the programme window does not read **"Connected..."** but **"Offline"** instead, please go to the menu **"Connect to"** and confirm the subitem **"Call"**.

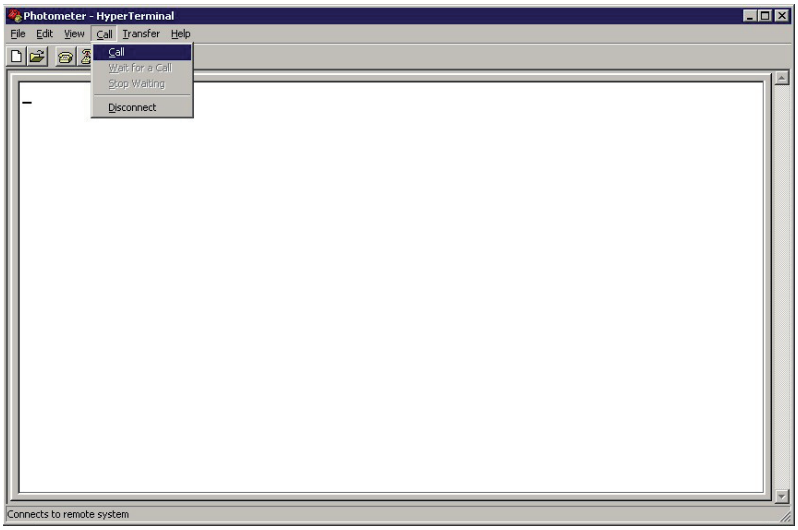


Fig. 11

The status message **"Connected..."** should now appear.

In the **"File"** menu select the submenu **"Save As..."**:

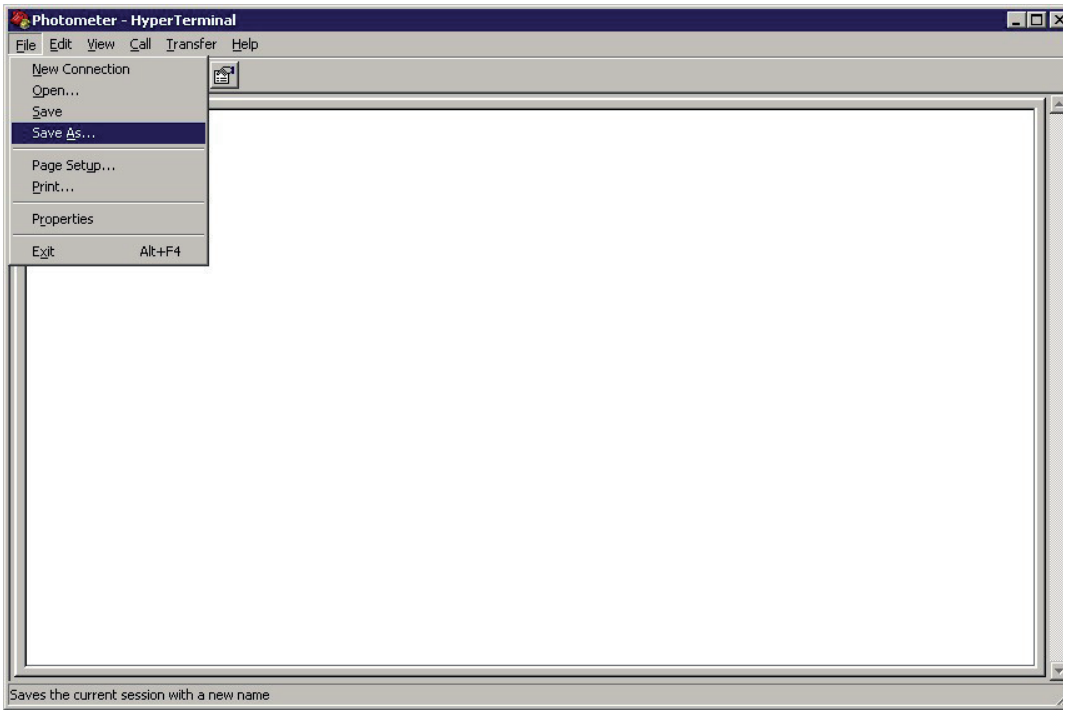


Fig. 12

Under the file name **"Photometer"** or, respectively, the name of your choice entered above, the following screen appears:

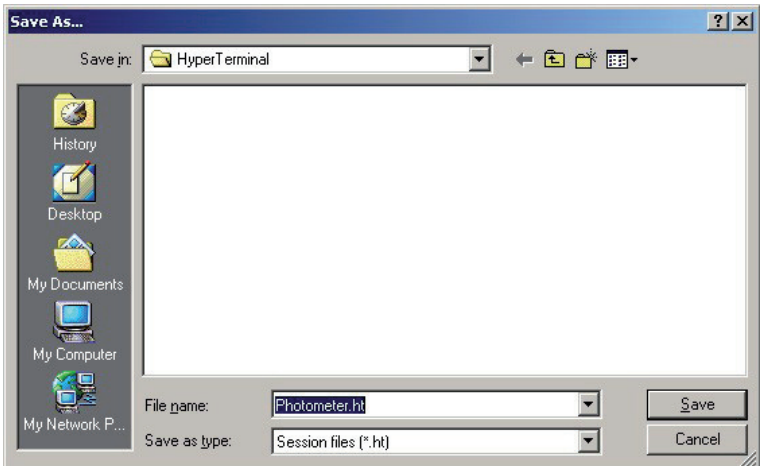


Fig. 13

Now click on **"Save"**.

This saves the set parameters in a **"session file"**. Later on **HyperTerminal** can be started by clicking on this file (see below for further instructions) and subsequently automatically uses the parameters that have already been set.

To receive data with the aim of saving them, you must now select the menu **"Data Transfer"** and there click on the submenu **"Capture Text ..."**. As mentioned above, the colorimeter should already be switched on and connected.

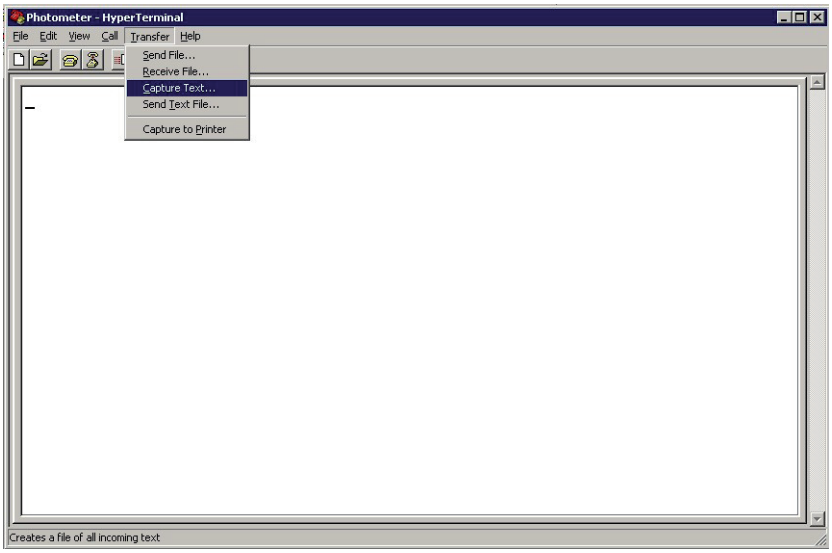


Fig. 14

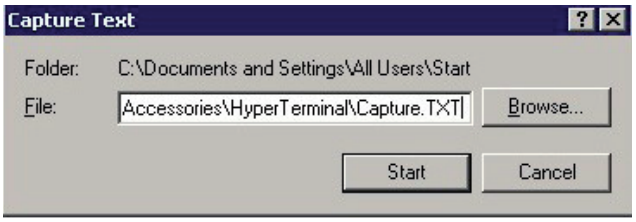


Fig. 15

The following window appears:

Here you can set the file in which the data are to be saved. In our following example we have left the basic settings the way they originally were and have thus saved the data in the file **CAPTURE.TXT** in the directory **C:\Programmes\Tools\ HyperTerminal.**
Click on **"Start"** and the programme is ready to receive data and to save them. Attention: The data are saved only after the data-transfer procedure is complete, as described below!
(See also **"End data transfer and save data"** on page 11).
On the colorimeter now activate one of the mode functions to print saved data and proceed as described in section 5.3 of the colorimeter manual.

The colorimeter now starts to transfer data. You can monitor this process in **HyperTerminal**:

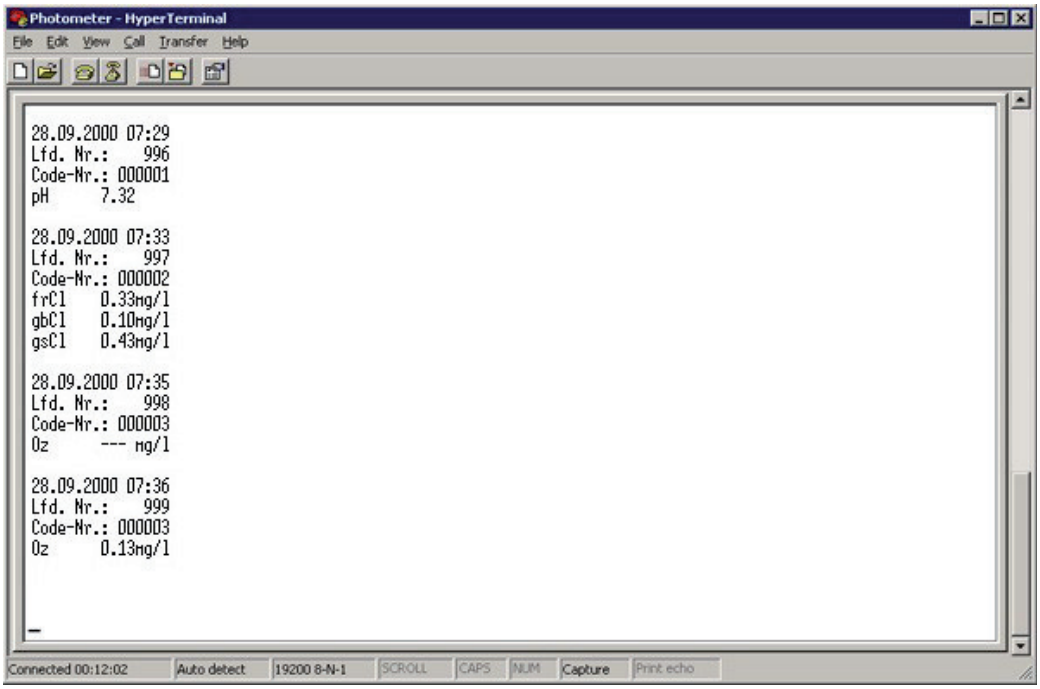


Fig. 16

End data transfer and save data

Once all data have been transferred, in **HyperTerminal** click on the menu item **"Transfer"** and there select the submenu **"Capture Text"** and click on **"End"**:

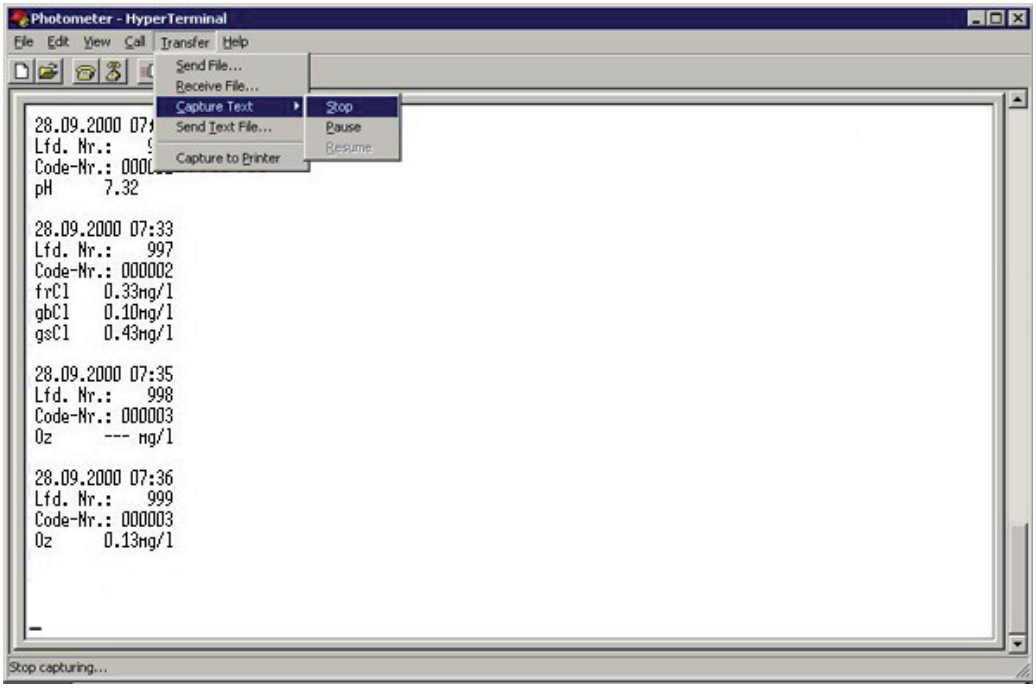


Fig. 17

The data are now saved, in our example in the file **CAPTURE.TXT** in the directory **C:\Programmes\Tools\HyperTerminal**, from where they can
be retrieved and processed as you wish.

To end the programme click on the cross in the upper righthand corner of the programme window or go to the menu item **"File"** and click on the subitem **"End"**.
In the event that a message appears informing you that the connection is still active **(Fig. 18),**

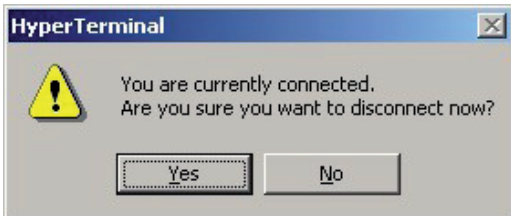


Fig. 18

please click on **"Yes"** to end the programme.

For the next data-transfer operation again go to
"Start > Programmes > Tools > Communication > HyperTerminal"
and the following window pops up:

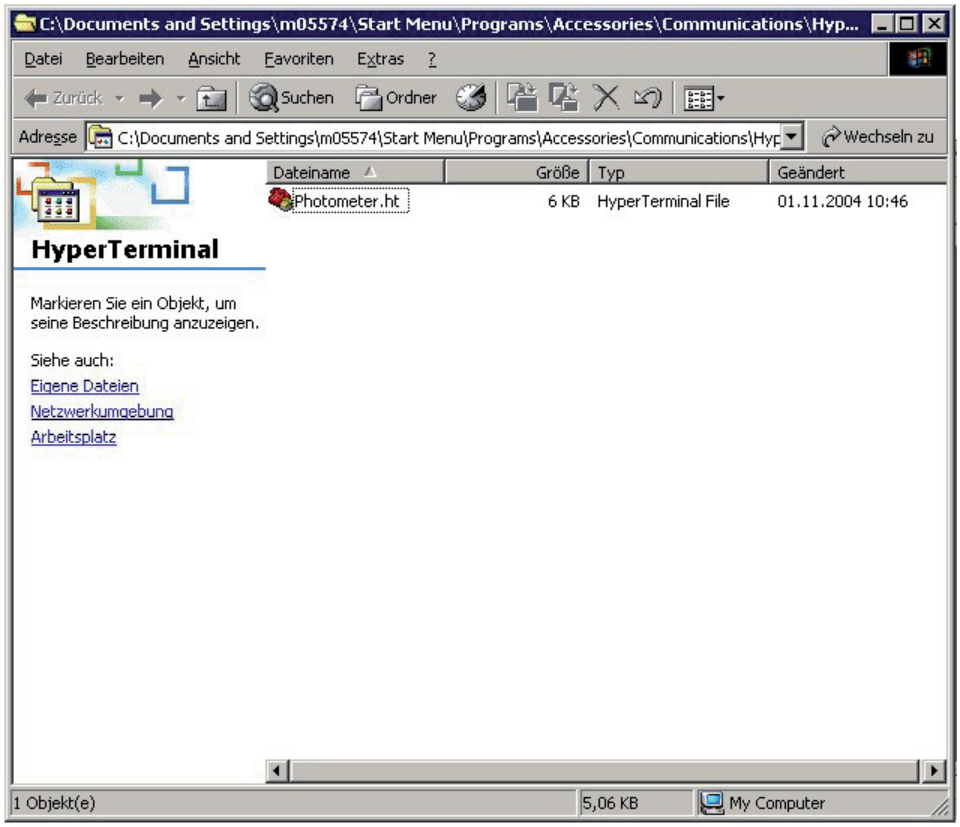


Fig. 19

This now also shows the file **"Photometer.ht"**.
This file was generated when **"Save at ..."** was executed in the **HyperTerminal** programme at the beginning of this operation after the parameters were set.
Double-clicking on this file immediately starts the Hyper-Terminal programme with the correct settings and an active connection. Naturally the colorimeter should be already connected and switched on and the self-check routine must have already ended.

Wherever necessary, you can enhance the legibility by selecting the menu item **"View"** and then **"Font"**:

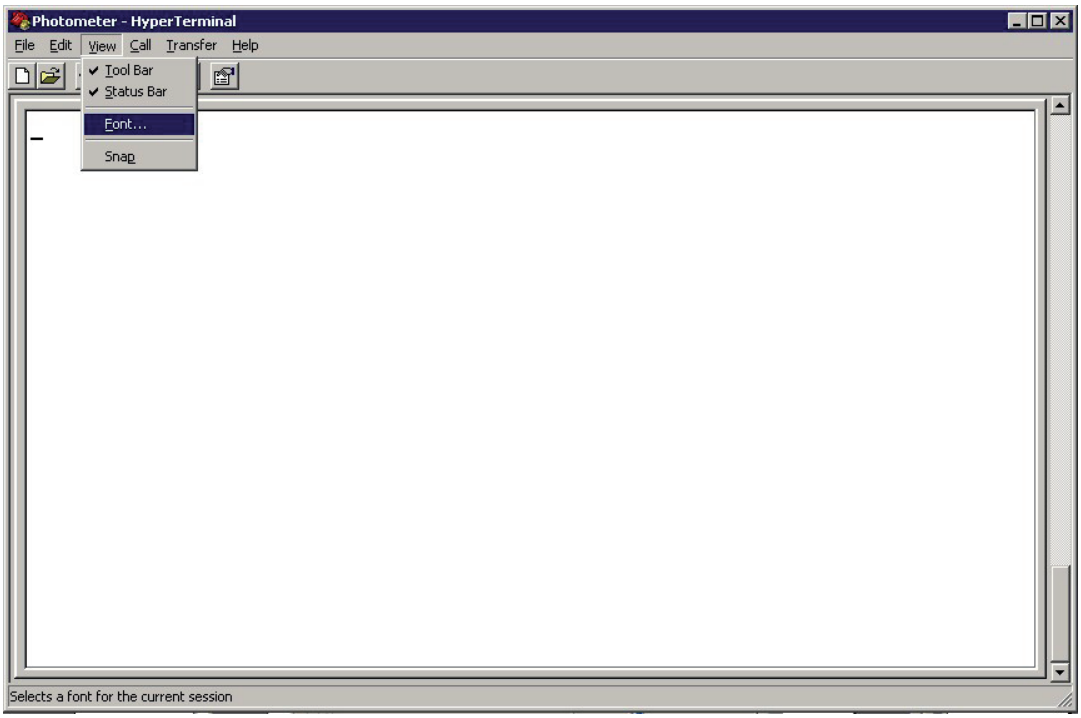


Fig. 20

Set the font to Courier New and at 10pt and click on the **"OK"** key:

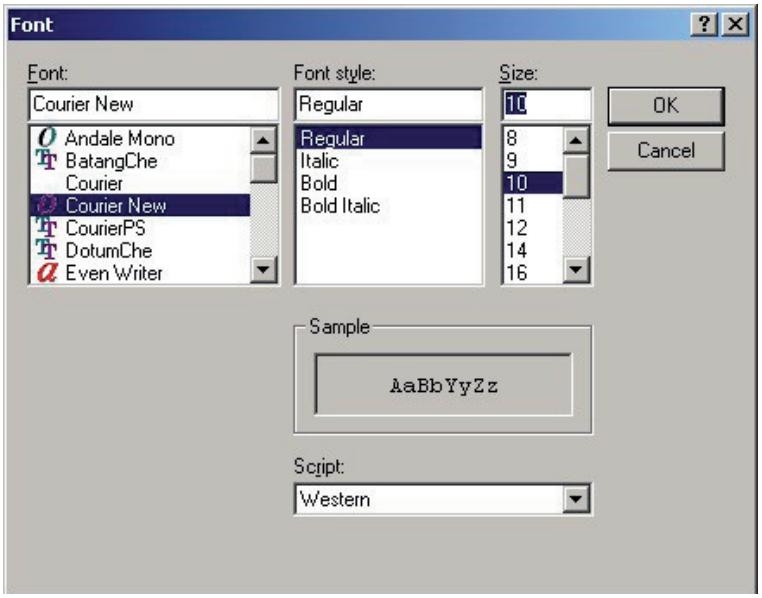


Fig. 21

Now enlarge the HyperTerminal window to **"Full image"**:

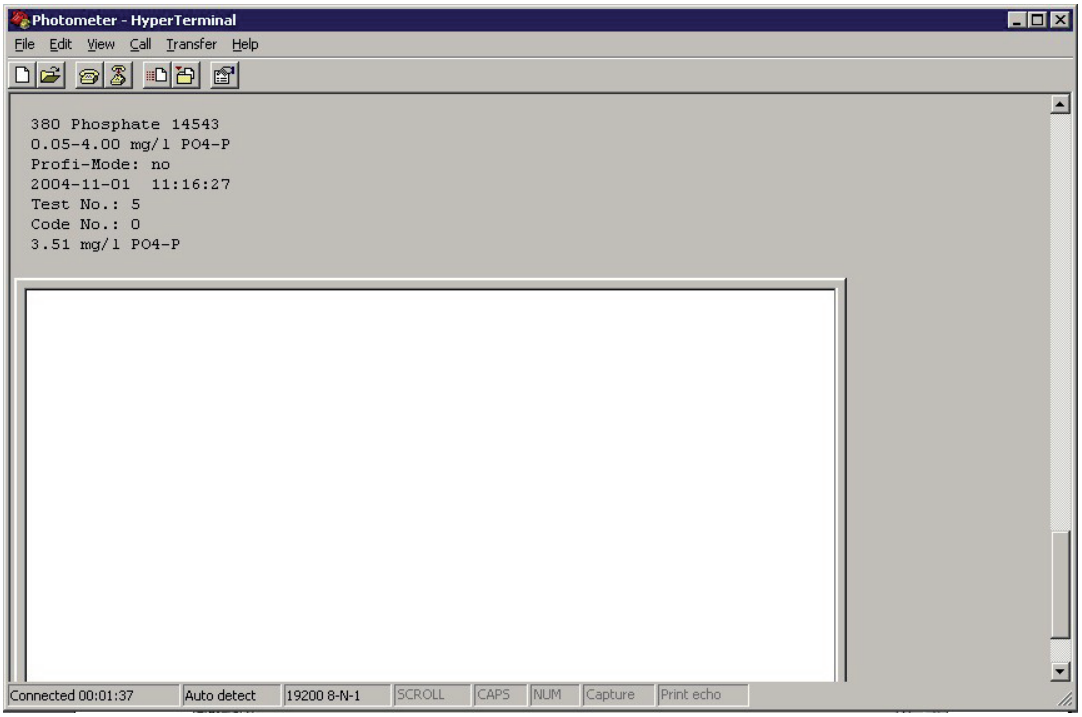


Fig. 22

This completes the operation to make all the necessary settings.

Setting the connection
when a modem is already installed

The following describes how the settings can be carried out when a modem is already installed before configuring **Hyperterminal** for the transfer of data from the colorimeter:

Fig. 6

When Figure 6 appears, click on **"Cancel"**.
This results in the main **Hyperterminal** window appearing directly **(see also Figure 10)**:

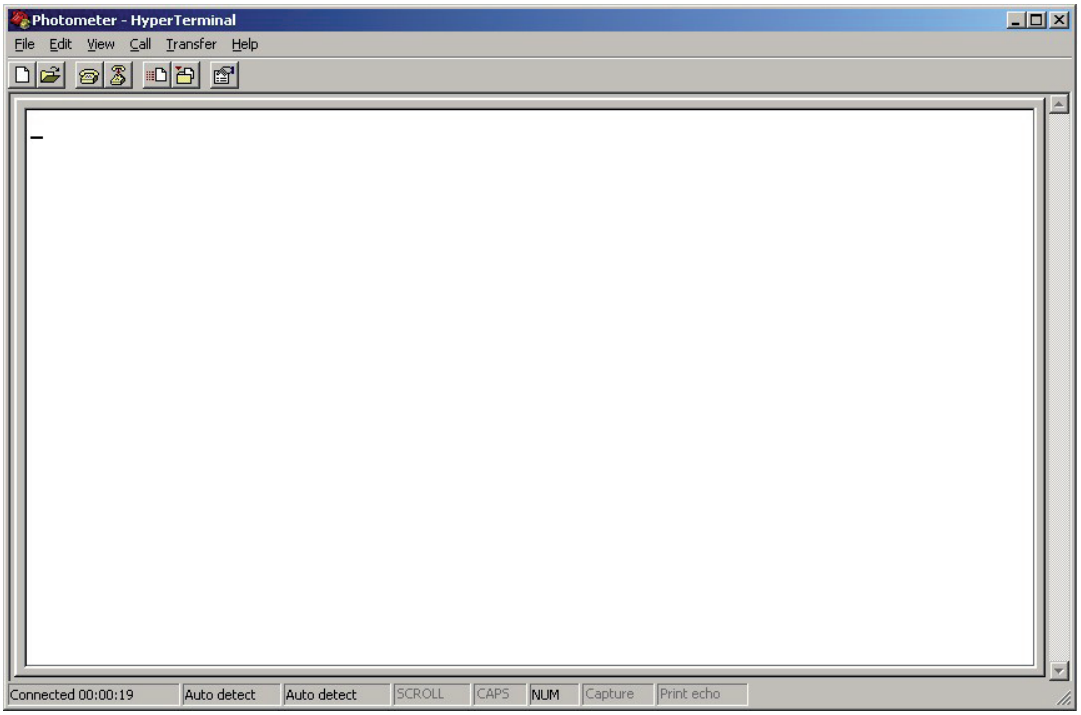


Fig. 10

Go to **"File"** and click on the subitem **"Properties"**:

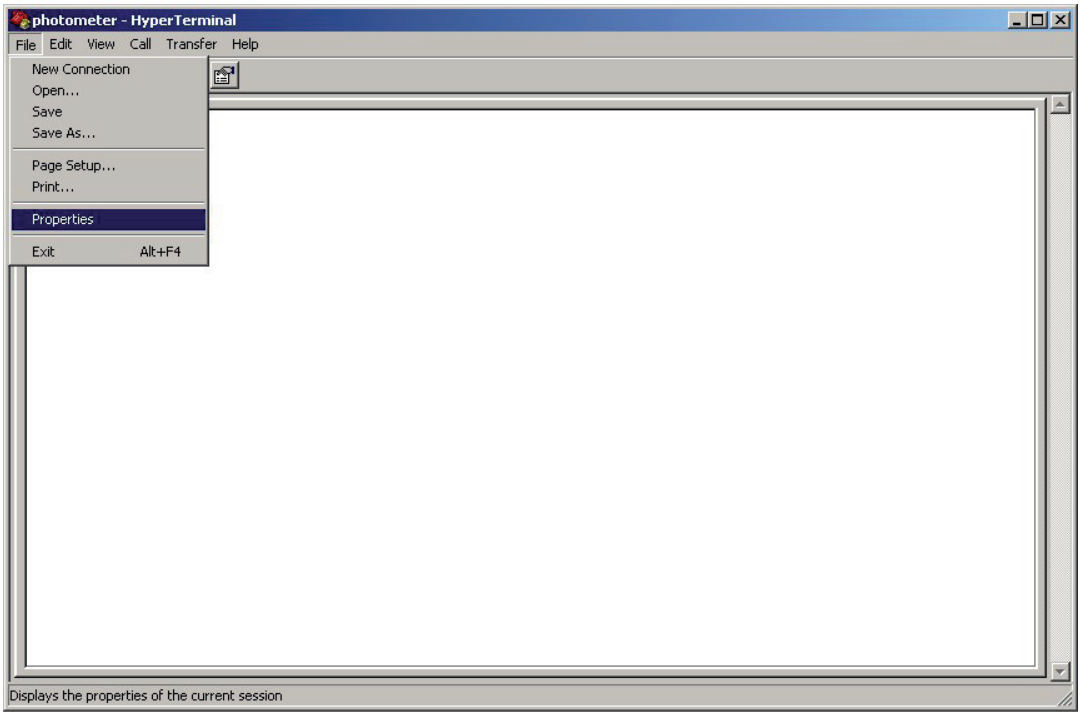


Fig. 23

The following window pops up:

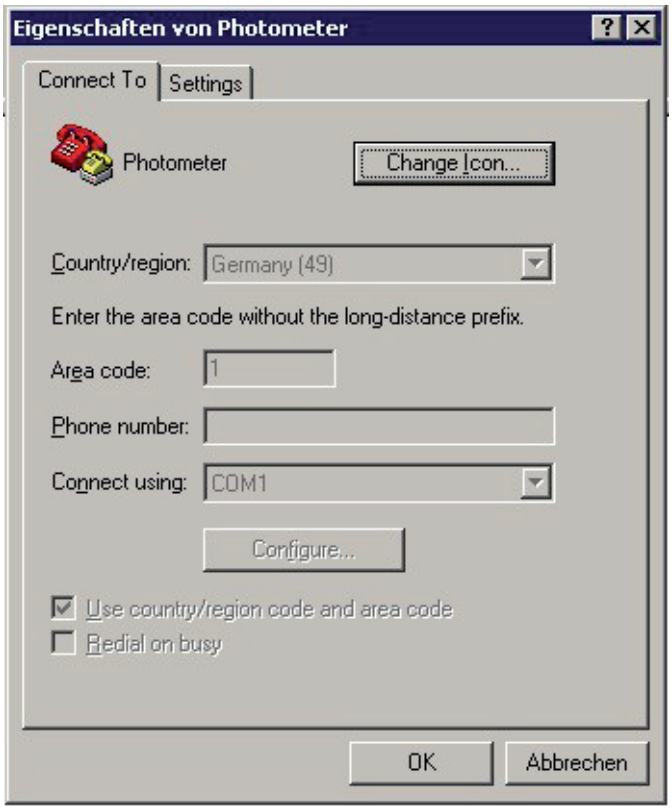


Fig. 24

Here you can again select a **COM interface** at the subitem **"Connect using:"**:

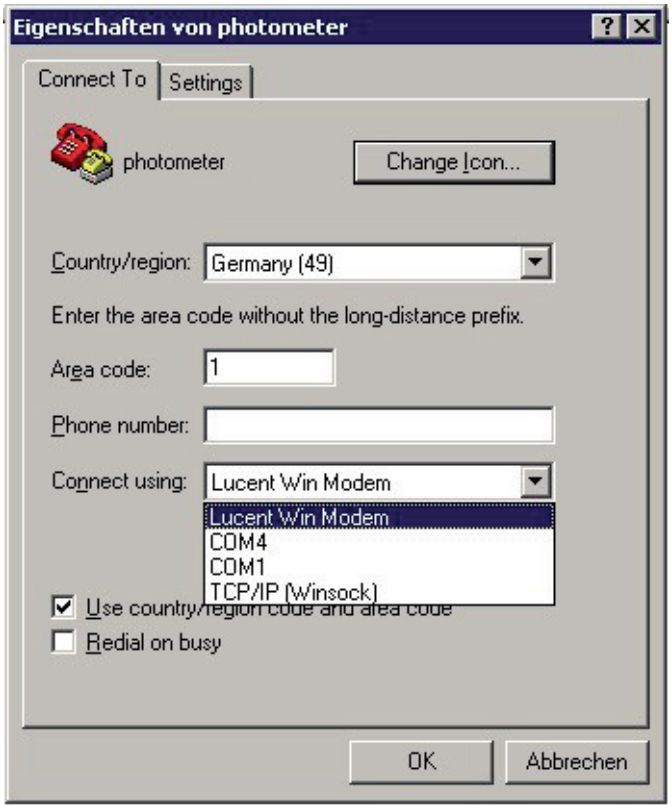


Fig. 25

At **"Connect using:"** click on **"Direct connection via COM1"**, **"Direct connection via COM2"**, etc., to select the COMx interface with which the colorimeter data-transfer cable is connected.

The window then shows e.g.:

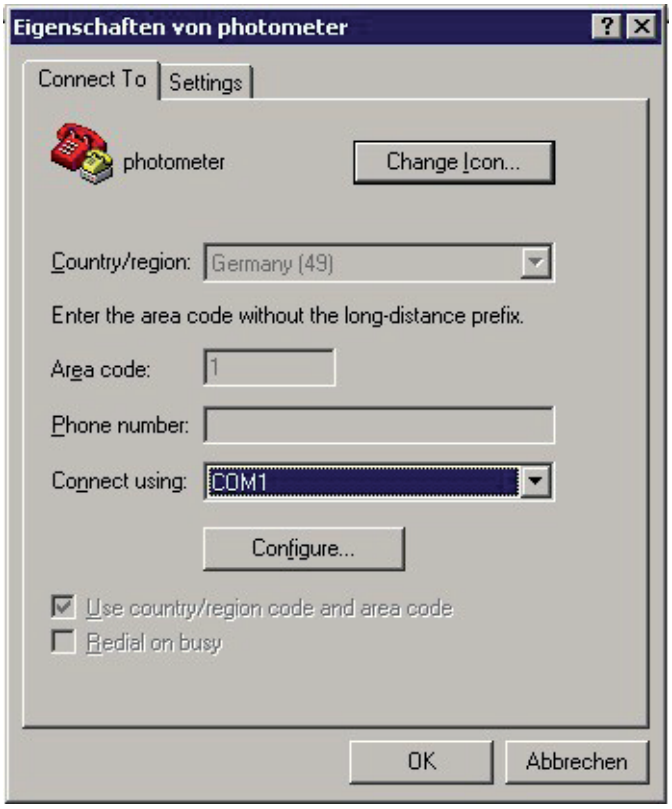


Fig. 26

Now click on **"Configure..."** to set the parameters of the interface. The following window pops up (albeit probably with other values):

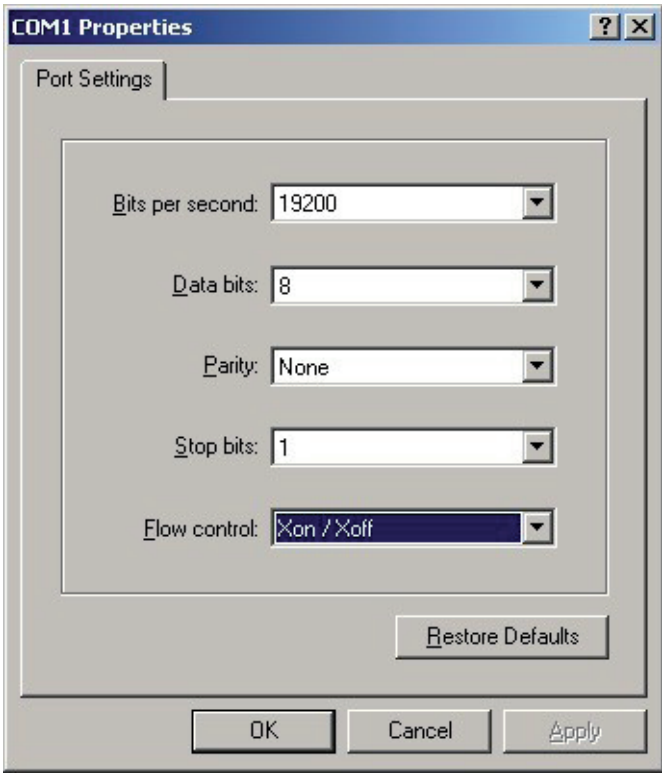


Fig. 27

From here proceed as described above at **"Setting the interface parameters"** (see page 5).

5.5 Software update via the internet

Before running the update

Save your stored measurement results by printing them out or by transferring them to your computer.

When running the update these data as well as the existing software will be entirely deleted!

Set the baud rate of the colorimeter to 19200 (mode menu, keys **[Mode] [2] [9]**;

press **[Enter]**,

then the **[2]** key,

and then use the **[▲]** or **[▼]** arrow keys to select the baud rate).

To run the update you require:

- a PC with a Windows operating system;
- the data-transfer cable supplied with the unit;
- the supplied screwdriver; and
- the files:
    - the programme **HexLoad.exe,** which is executed on the PC and transfers the update software to the photometer; (see CD, section 5.5, **"Software update via the internet"** or else go to **www.service-test-kits.com**) on the internet; and
    - the software update for the Spectroquant® Multy Colorimeter (= ***.hex file**, see at **www.service-test-kits.com** on the internet).

Download the files as necessary and save them together in a new folder that you have specially created for the update of the colorimeter. You do not need to install the **HexLoad.exe** programme, a simple copy is sufficient.

Please read the update instructions thoroughly before you start to run the update.

Follow the instructions given in the update file while performing the update.

Note
In the case of the Spectroquant® Multy Colorimeter an update always involves a method and/or programme update.

Important:
Please check whether programmes are running on your computer that use or monitor the **COM ports**. These include e.g. programmes that log the online time, the MSN Messenger programme, chat programmes, and similar. These programmes must be completely deactivated during the update process, since otherwise the **HexLoad** programme may report **"Communication timed out..."** and the update cannot be executed.

Executing the update

Disconnect the mains supply. Open the battery compartment and remove the batteries. Beneath the battery compartment is an opening in which two slide-action switches can be seen. Slide both switches in the direction of the back of the unit (terminal jacks for PC and mains adapter).
Connect the colorimeter to the free serial port **(COMx)** of the PC using the data-transfer cable. Reconnect the mains supply, but do not switch the unit on again for the time being.

Double-click on the **HexLoad** symbol in the folder to start the **HexLoad** programme **(see figure)**.

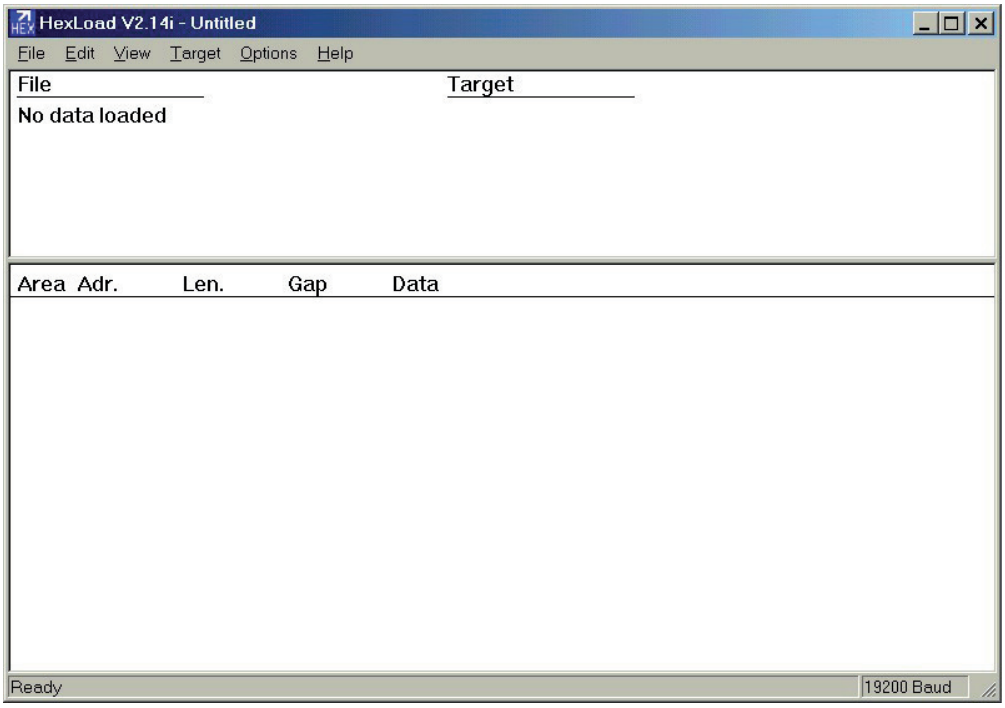


Fig. 1

Go to **"Options > Communication parameters"** and set the **baud rate** to **19200** and **ComPort** to **"AUTO"** (or the number of the connected **COM port**, e.g. Com-Port 1). Then click on **"OK"**.

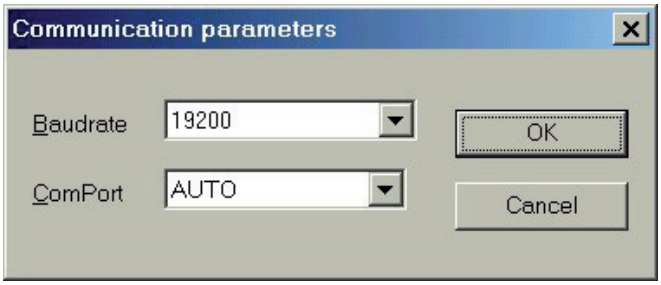


Fig. 2

After this go to the menu item **"File > Open.."**. for **HexLoad** to load the software update **(*.hex file)**. Now switch the colorimeter on. When a connection to **HexLoad** has been established, the **display** of the **Spectroquant® Multy Colorimeters** remains **blank**.
HexLoad should now look similar to the example below, although the figures actually shown may vary:

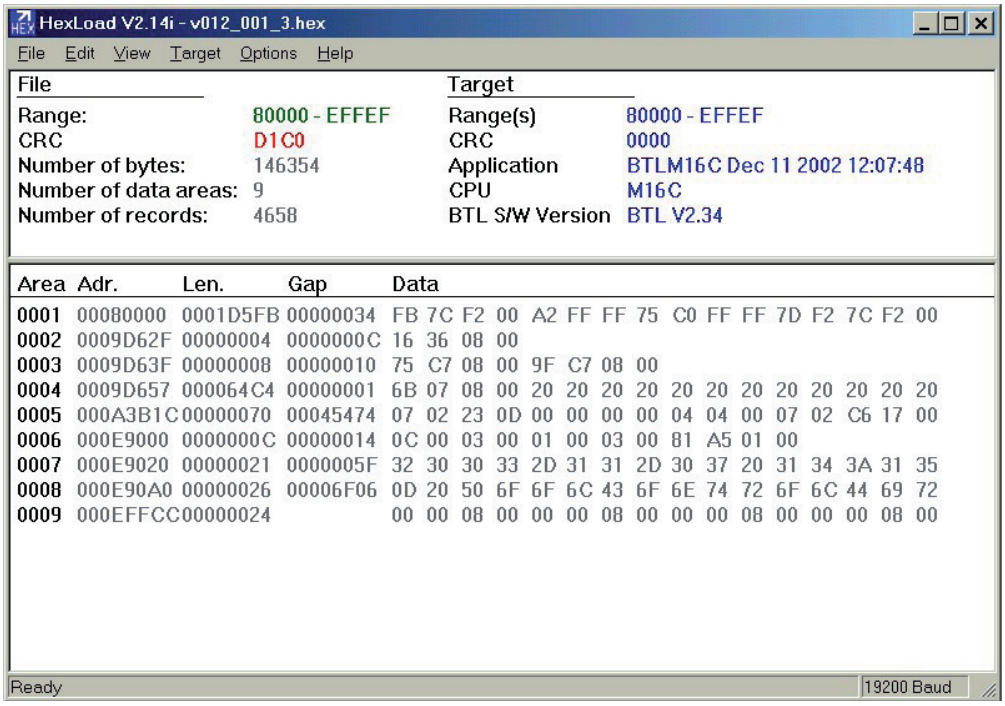


Fig. 3

It is essential that:

- under **"File"** in the top lefthand corner the message **"No data loaded"** has changed and been replaced by values similar to those shown above; and
- under **"Target"** in the top righthand corner values (in blue type) are now shown.

In the event that no values are shown under **"Target"**, this indicates that it has not been possible to establish a connection between the colorimeter and the PC. In this case please check the cable connection and the communication settings.

Now press the **F9** key on your PC to prompt **HexLoad** to start the update sequence. The following stati are now displaced.

The previous software is deleted:

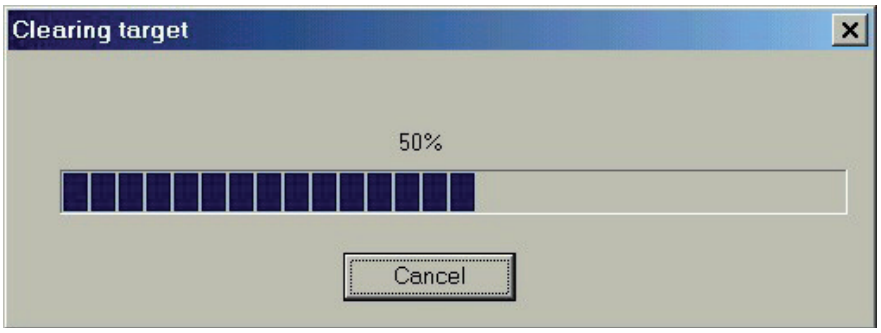


Fig. 4

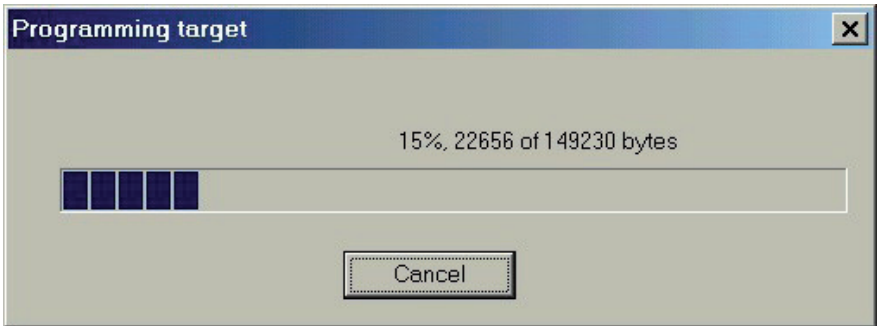


Fig. 5

... and the new software is saved:

In the event that the error message **"Communication time out"** appears at this stage, this indicates that other programmes are still running in the background that are interfering with the software-update routine. Close these programmes and repeat the software-update procedure.

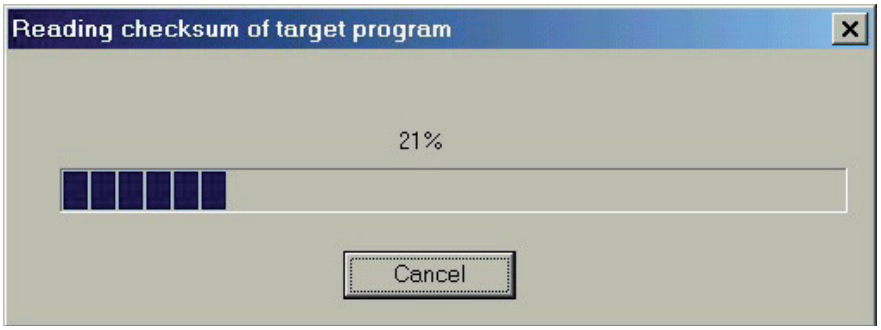


Fig. 6

The new software is now checked.

The check was successful and the new software is now active:

Fig. 7

Click on **"OK"** to exit and close **HexLoad.**

Disconnect the data-transfer cable from the unit.
Disconnect the instrument from the mains supply.
Turn the unit around and slide the two switches in the battery compartment towards the front of the unit.
Re-insert the batteries into the battery compartment and close the compartment.
The instrument is now ready for use again with the new software.

Press the keys **[Mode] [3] [4]** to delete any data and thus to initialize the memory system (section 1.7).

5.6 User methods

The software provides two possibilities for saving user-specific methods in the instrument. For the user-concentration method (section 5.6.1), prepared standards are measured and the instrument defines the programming. The programme "User polynomials" (section 5.6.2) enables the user to specify polynomials and thus also, on the one hand, to correctly enter polynomials of higher orders and, on the other, to better control the course of the curves and to maintain the quality of the prepared standards.

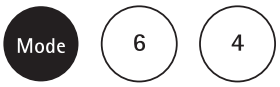
5.6.1 User-concentration method

Up to ten specific user-concentration methods can be entered and stored. This requires two to 14 standards of known concentrations and a zero factor (distilled water or a reagent blind). The accuracy of the method rises in direct proportion to the number of standard solutions measured. It is thus advisable to user five to ten standard concentrations spread equidistantly over the measuring range. The standards should be measured in the rising sequence of the concentrations, from the lightest to the darkest colour. The limits for "Underrange" and "Overrange" are set at -2600 mAbs* and 2600 mAbs*.
After a user-concentration method is called up, the concentrations of the lowest and highest standards measured are shown on the display as the measuring-range limits.
In actual fact the lower limit of the measuring range is given either by the nonlinearity of the calibration function or by the limit of determination. The limit of determination is the lowest concentration of an analyte that can be quantitatively determined with a defined probability (e.g. 99 %). The upper limit of the measuring range is defined as the point at which there is no longer any linear correlation between the concentration and the absorbance. (The exact determination of the actual limits of the measuring range can be taken from the corresponding literature references.)
The sample should, where necessary, be diluted to ideally lie in the middle of the working range (measurement with the lowest error).

*1000 mAbs = 1 Abs = 1 E

Entering a concentration method

Press the keys **[Mode] [6] [4]** in succession.



Confirm your selection by pressing **[Enter]**.

The display now shows:

```
<User concentr.>
choose no.: _____
(850-859)
```

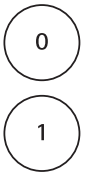
Press the number keys to select a method number in the range 850 to 859, e.g.: **[8] [5] [0]**

Confirm your selection by pressing **[Enter]**.

Note
In the event that the entered number is already being used as a storage slot for a concentration method, the following message appears on the display:

```
overwrite conc.meth.?
YES: 1     NO: 0
```

- Press key **[0]** or **[Esc]** to return to method-No. prompt.
- Press key **[1]** to continue the entry.

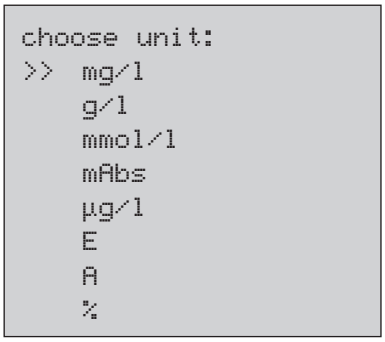


The display now shows:

```
wavelength:
1: 530 nm   4: 430 nm
2: 560 nm   5: 580 nm
3: 610 nm   6: 660 nm
```

Press the number keys to select the desired wavelength, e.g.: **[2]** for 560 nm.

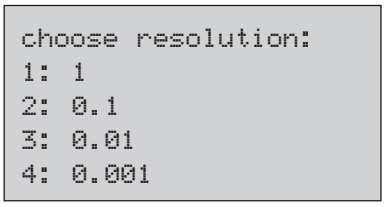
The display now shows:



Press the arrow key **[▲]** or **[▼]** to select the desired unit.

Confirm your selection by pressing **[Enter]**.

The display now shows:



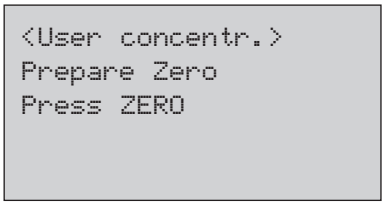
Press
the number keys to select the desired resolution, e.g.: **[2]** for 0.1.

Note
Please adjust the desired resolution according to the following criteria:

Range	max. Resolution
0.000 ...9,999	0.001
10.00 ...99,99	0.01
100.0 ...999,9	0.1
1000 ...9999	1

Measurement mode with standards of known concentrations

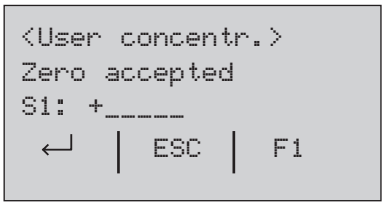
The display now shows:



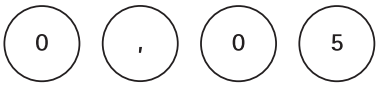
Prepare zero and press **[Zero]**.

Note
Use distilled water or a reagent blank.

The display now shows:



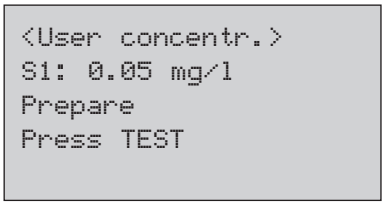
Enter the concentration of the first standard;
e.g.: **[0]** **[,]** **[0]** **[5]** for 0.05



- Back with the key **[Esc]**.
- Backout the entry with the key **[F1]**.

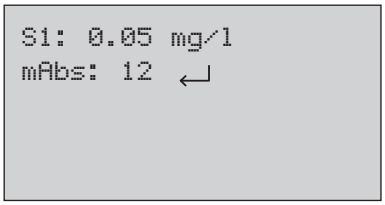
Confirm your selection by pressing **[Enter]**.

The display now shows:



Prepare the first standard and press **[Test]**.

The display shows the entered value and the measured absorbance value:



Confirm your selection by pressing **[Enter]**.

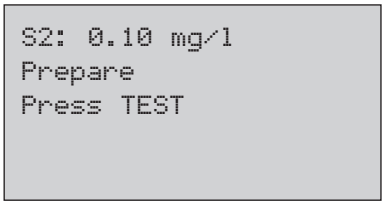
The display now shows:

Enter the concentration of the second standard;
e.g.: **[0] [,] [1]** for 0.1.

- Back with the key **[Esc]**.
- EBackout the entry with the key **[F1]**.

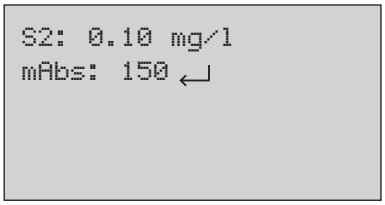
Confirm your selection by pressing **[Enter]**.

The display now shows:



Prepare the second standard and press **[Test]**.

The display shows the entered value and the measured absorbance value:



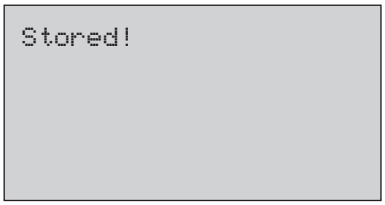
Confirm your selection by pressing **[Enter]**.

Note

- To measure further standards, follow the above procedure.
- At least two standards must be measured.
- A maximum of 14 standards (S1 to S14) can be measured.

When the desired number of standards or the maximum number of 14 standards have been measured, press the key **[Store]**.

The display now shows:



The colorimeter automatically returns to the mode menu.
The concentration method is now stored in the instrument, and the method can be directly selected either by entering the method number or else via the method-selection list.

Tip
Save all data relating to a specific user concentration in written form, since in the event of a loss of power (e.g. when changing the battery) all concentration data are lost and must be entered anew.
The instrument has a feature enabling the user to transfer measurement data to a PC via mode 67 (see section 5.6.4).

5.6.2 User polynomials

Up to 25 user polynomials can be enetered and stored. The programme enables the user to use polynomials up to the fifth degree:

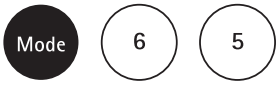
$y = A + Bx + Cx^2 + Dx^3 + Ex^4 + Fx^5$

If a polynomial of a lower degree is required, the remaining coefficients are set at zero (0); e.g. for a polynomial of the second degree D, E, F are set at 0.

The values for the coefficients A, B, C, D, E, F must be entered in accordance with scientific conventions with at most six decimal places; e.g. 121.35673 = 1.213567E+02.

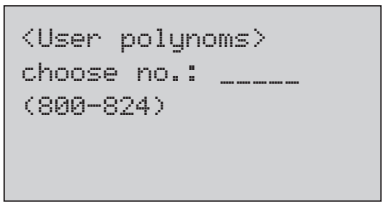
Entering a user polynomial

Press the keys **[Mode] [6] [5]** in succession.

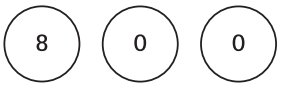


Confirm your selection by pressing **[Enter]**.

The display now shows:

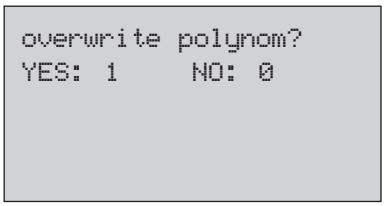


Press the number keys to select a method number in the range 800 to 824, e.g.: **[8] [0] [0]**

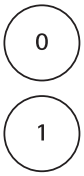


Confirm your selection by pressing **[Enter]**.

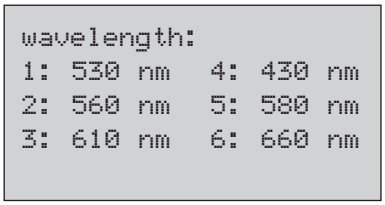
Note
In the event that the entered number is already being used as a storage slot for a polynomial, the following message appears on the display:



- Press key **[0]** or **[Esc]** to return to method-No. prompt.
- Press key **[1]** to continue the entry.

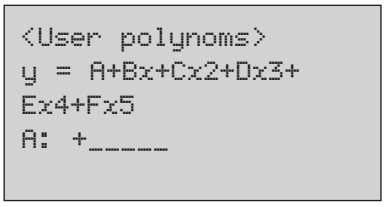


The display now shows:



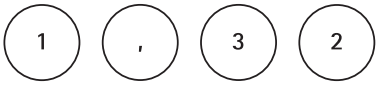
Press the number keys to select the desired wavelength, e.g.: **[2]** for 560 nm.

The display now shows:



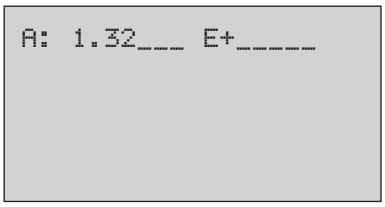
- Press the arrow key **[▲]** or **[▼]** to select between the plus and minus signs.

- Enter the data of coefficient A including the decimal point, e.g.: **[1] [,] [3] [2]** for 1.32.



Confirm your selection by pressing **[Enter].**

The display now shows:

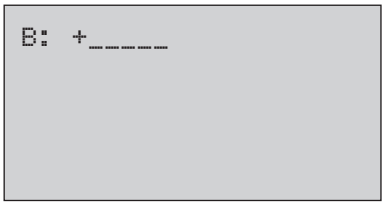


- Press the arrow key **[▲]** or **[▼]** to select between the plus and minus signs.

- Enter the exponent of coefficient A, e.g.: **[3]** for 3.

Confirm your selection by pressing **[Enter]**.

The display now shows:



The data for the other coefficients are prompted in sequence (B, C, D, E and F).

Note
Entering zero **[0]** for the value of a given coefficient automatically negates any entry of the exponent.

Confirm each selection by pressing **[Enter]**.

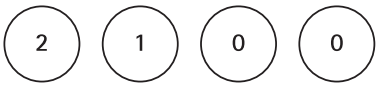
The display now shows:

```
measurement range
Min mAbs: +____
Max mAbs: +____
```

Enter the measurement-range limits in the range between -2600 and +2600 mAbs.

- Press the arrow key **[▲]** or **[▼]** to select between the plus and minus signs.

- Enter the lower limit (Min) and the upper limit (Max) in the unit absorbance (mAbs),
  e.g.: **[2] [1] [0] [0]** for 2100 mAbs.



Confirm each selection by pressing **[Enter]**.

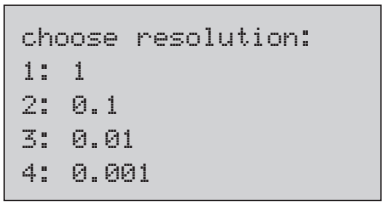
The display now shows:

```
choose unit:
>>  mg/l
    g/l
    mmol/l
    mAbs
    µg/l
    E
    A
    %
```

Press the arrow key **[▲]** or **[▼]** to select the desired unit.

Confirm your selection by pressing **[Enter]**.

The display now shows:

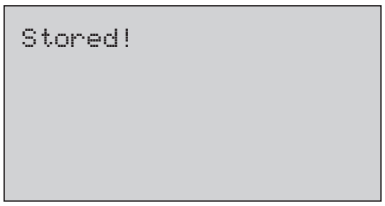


Press
the number keys to select the desired resolution, e.g.: **[2]** for 0.1.

Note
Please adjust the desired resolution according to the following criteria:

Range	max. Resolution
0.000 ...9,999	0.001
10.00 ...99,99	0.01
100.0 ...999,9	0.1
1000 ...9999	1

The display now shows:



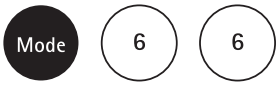
The colorimeter automatically returns to the mode menu. The polynomial is now stored in the instrument and the method can be directly selected either by entering the method number or else via the method-selection list.

Tipp
Save all data relating to a specific user concentration in written form, since in the event of a loss of power (e.g. when changing the battery) all polynomial data are lost and must be entered anew.
The instrument has a feature enabling the user to transfer measurement data to a PC via mode 67 (see section 5.6.4).

5.6.3 Deleting a user method (concentration or polynomial)

As a rule every user method can be overwritten. An existing user method (concentration or polynomial) can, however, also be completely deleted and subsequently no longer appears in the method-selection list.

Press the keys **[Mode] [6] [6]** in succession.

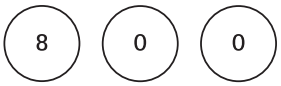


Confirm your selection by pressing **[Enter]**.

The display now shows:

```
<User m. clear>
choose no.: _____
(800-824), (850-859)
```

Press the number keys to select the user method to be deleted (in the range between 800 and 824 or, respectively, 850 and 859), e.g.: **[8] [0] [0]**



Confirm your selection by pressing **[Enter]**.

The display now shows the prompt message:

```
M800
delete?
YES: 1     NO: 0
```

- Press key **[1]** to delete the selected user method.

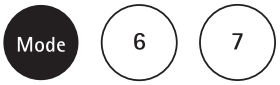
- Press key **[0]** to reject the deletion of the method.

The colorimeter automatically returns to the mode menu.

5.6.4 Printing data of a user method (concentration and polynomial)

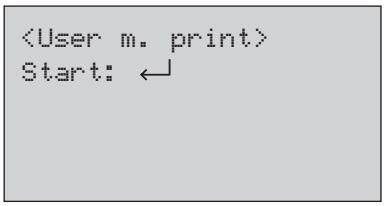
This mode function enables all entered data for stored user-concentration methods and user polynomials to be printed out or, respectively, to be transferred to a PC via Hyperterminal.

Press the keys **[Mode] [6] [7]** in succession.



Confirm your selection by pressing [Enter].

The display now shows:



Press key **[Enter]** to print out all concentration and polynomial data (e.g. wavelength, unit,...) or to transfer them to a PC.

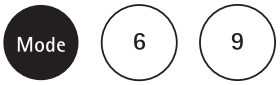
The display shows e.g. the message:

After printing out the data the colorimeter automatically returns to the mode menu.

5.6.5 Initializing the user-method system (concentration and polynomial)

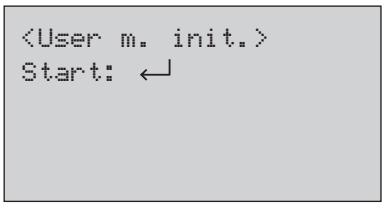
A loss of power results in incoherent data for stored user methods. The user-method system must then by initialized with this mode function to return it to a default standard.

Press the keys **[Mode] [6] [9]** in succession.



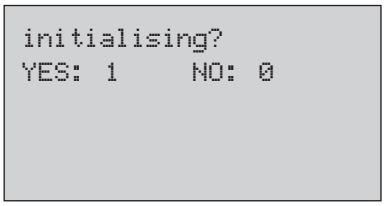
Confirm your selection by pressing **[Enter]**.

The display now shows:



Confirm your selection by pressing [Enter].

The display now shows the prompt message:



- Press key **[1]** to start the initializing procedure.

Attention:
All stored concentration methods and polynomials are deleted by the initializing procedure!

- Press key **[0]** to abort the initializing procedure.

The colorimeter automatically returns to the mode menu.

5.7 User-specific calibration

In principle it is possible for the user to make his/her own calibration. It is, however, advisable to retain the factory calibration, since this was performed using a 10-item calibration procedure.

A user-specific calibration is made using a standard with a known concentration. This concentration should be equivalent to that of the water sample. Here it is possible to use e.g. Spectroquant® CombiCheck standards or ready-to-use standard solutions (see chapter 5.2).

In the case of differentiated methods, only the simple form is calibrated, i.e. with the chlorine methods only free chlorine is calibrated, and the calibration then automatically applies for the other two variants (total and differentiated).

The following methods cannot be user-specifically calibrated:

Method No.:	Parameter
10	Acid cap. 01758
20	Aluminium 14825
21	Aluminium 00594
70	BOD 00687
90	Bromine 00605
110	Calcium 00858
140	Chlorine dioxide
170	Colour
560	HydroPerox 18789
240	Iodine 00606
270	Magnesium 00815
290	Molybdenum 00860
300	Monochloramine
322	Nitrate 14556
550	Oxygen 14694
555	Oxyg. scavengers
350	Ozone 00607
360	pH 01744
400	Potassium 14562
401	Potassium 00615
410	Residual hardness 14683
440	Sulfate 14548
441	Sulfate 00617
442	Sulfate 14564
450	Sulfide 14779
480	Suspended solids
490	Tin 14622
510	Total hardness 00961
520	Turbidity

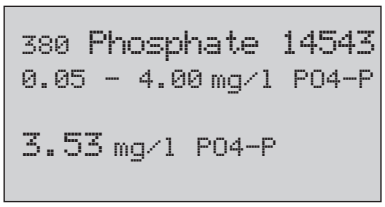
Method No.:	Parameter
600	A 430 nm
610	A 530 nm
620	A 560 nm
630	A 580 nm
640	A 610 nm
650	A 660 nm

User-calibrated methods are indicated in the selection list by inversely shown method names (light type against a dark background).

After the user-specific calibration is deleted, the original factory calibration becomes reactivated.

5.7.1 Saving the user-specific calibration

Perform the measurement using a standard of known concentration following the procedure described for the method in question.

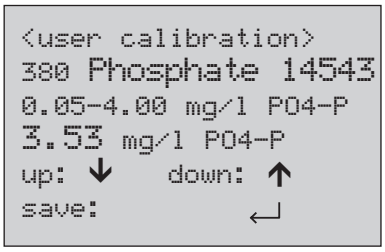


When the test result appears on the display

press the keys **[Mode] [4] [5]** in succession.

Confirm by pressing **[Enter]**.

The display now shows:

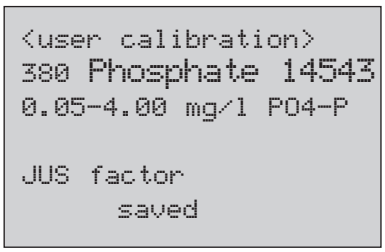


Pressing the **[▲]** key raises the displayed value; pressing the **[▼]** key reduces the displayed value. Press the buttons until the displayed value matches the specified value for the standard used.

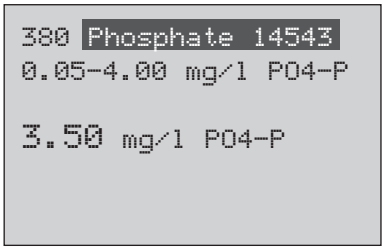
Confirm the set value by pressing **[Enter]**.

(Pressing the **[Esc]** key aborts the calibration procedure without saving a new factor.)

After the set value has been confirmed, the display shows:



Subsequently the test result calculated on the basis of the new calibration appears and the method name is shown in inverse form:



5.7.2 Deleting the user-specific calibration

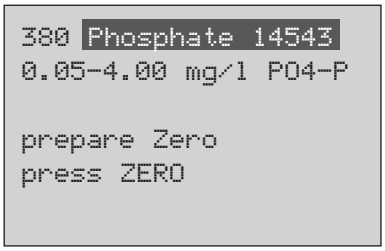
The user-specific calibration can be deleted only for those methods with which this can be used.

Call up the method in question, e.g. **[3] [8] [0]**

[Enter].

In the case of methods with a countdown function, skip this function by pressing the **[Enter]** key twice.

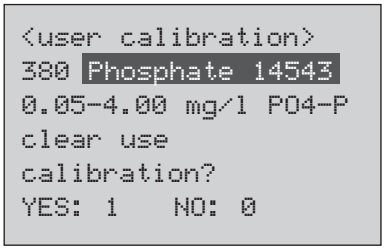
The display now shows:



If a prompt for zero calibration appears, press the keys **[Mode] [4] [6]** in succession.

Confirm by pressing **[Enter]**.

The display now shows:



Pressing the **[1]** key deletes the user-specific calibration. The original factory calibration is reactivated.
Pressing the **[0]** key retains the user-specific calibration for further use.

The instrument then returns to the countdown mode or, respectively, in the case of methods without a countdown function, to the zero-calibration prompt.

5.8 Calculating the Langelier saturation index

The Langelier saturation index (LSI) is a measure of the corrosivity of water.

When the LSI is below –0.5, the water is corrosive, and the pH and/or alkalinity should be raised.

When the LSI is over 0.5, the water is very hard and there is a risk of calcification. Here the pH and/or alkalinity should be reduced.

When the LSI is zero, the water is ideally conditioned.

The following parameters exert an influence on the corrosive behaviour or, respectively, the water hardness:

- pH
- Temperature
- Calcium hardness
- Acid capacity up to pH 4.3 = total alkalinity = = alkalinity-m = m value
- TDS = Total dissolved solids (sum of dissolved salts (mg/l))

After determining these parameters, make a note of the measurement results and enter them into the programme for calculating the Langelier saturation index as described below.

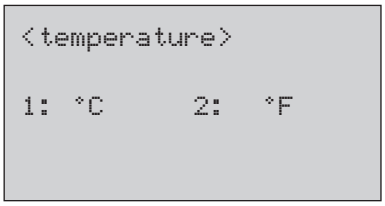
Setting the temperature unit

The temperature can be entered in degrees Celsius or degrees Fahrenheit. For this the following presetting procedure must be carried out (once only):

Press the keys **[Mode] [7] [1]** in succession.

Confirm your selection by pressing **[Enter]**.

The display now shows:



Pressing the **[1]** key selects the ° Celsius unit.

Pressing the **[2]** key selects the ° Fahrenheit unit.

The instrument then returns to the mode menu.

Program for calculating the Langelier saturation index

Press the keys **[Mode]** **[7]** **[0]** in succession.

Confirm your selection by pressing **[Enter]**.

The display now shows:

```
<Langelier>
temperature  °C:
3°C <= T <= 53°C
+ _ _ _ _
```

Enter the value for the temperature (T) within the range 3°C to 53°C and confirm by pressing **[Enter]**. If you have selected the ° Fahrenheit unit, a value within the range 37°F to 128°F must be entered.

The display now shows:

```
<Langelier>
Calcium hardn.
50 <= CH <= 1000
+ _ _ _ _
```

Enter the value for the calcium hardness (CH) within the range 50 to 1000 mg/l $CaCO_3$ and confirm by pressing **[Enter]**.

The display now shows:

```
<Langelier>
tot. Alkalinity
5 <= TA <= 800
+ _ _ _ _
```

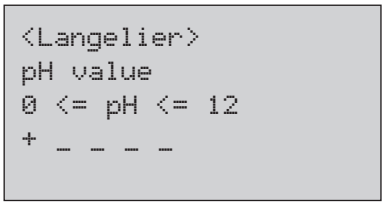
Enter the value for the total alkalinity (TA) within the range 5 and 800 mg/l $CaCO_3$ and confirm by pressing **[Enter]**.

The display now shows:

```
<Langelier>
total dissol. Solids
0 <= TDS <= 6000
+ _ _ _ _
```

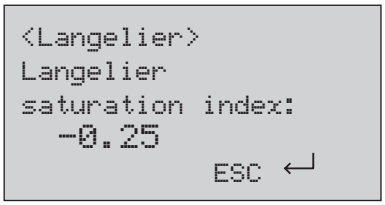
Enter the value for **TDS** (total dissolved solids) within the range 0 and 6000 mg/l and confirm by pressing **[Enter]**.

The display now shows:



Enter the pH within the range 0 and 12 and confirm by pressing **[Enter]**.

The display now shows the Langelier saturation index:

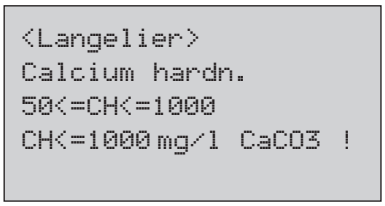


Pressing the **[Enter]** key starts the entry mode anew (entry of the temperature result).

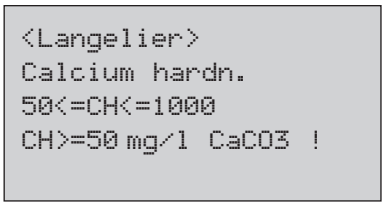
Pressing the **[Esc]** key takes the instrument back to the mode menu.

Note:
If a result is entered that is beyond the defined range of entries, an additional message appears in the display, e.g.

Value too high.



Value too low.



Acknowledge this message by pressing **[Enter]** and enter a value that is within the defined range.

5.9 Technical specifications

Display

Graphic display (7 lines, 21 characters)

Serial interface

RS232 for printer and PC connection
9-pole D-subjack, data format ASCII,
8-bit data, parity: none, 1 start bit, 1 stop bit,
baud rate and flow control: configurable

Pinout:

Pin 1 = free	Pin 6 = free
Pin 2 = Rx data	Pin 7 = RTS
Pin 3 = Tx data	Pin 8 = CTS
Pin 4 = free	Pin 9 = free
Pin 5 = GND	

Optics

Light diodes and photosensor amplifier in protected measurement-compartment array.

Wavelength ranges:

$\lambda 1$ = 430 nm IF	$\Delta \lambda$ (nm) = 5
$\lambda 2$ = 530 nm IF	$\Delta \lambda$ (nm) = 5
$\lambda 3$ = 560 nm IF	$\Delta \lambda$ (nm) = 5
$\lambda 4$ = 580 nm IF	$\Delta \lambda$ (nm) = 5
$\lambda 5$ = 610 nm IF	$\Delta \lambda$ (nm) = 6
$\lambda 6$ = 660 nm IF	$\Delta \lambda$ (nm) = 5

IF = interference filter

Photometric accuracy

0.100 Abs ± 0.008 Abs
1.000 Abs ± 0.020 Abs
(measured with standard solutions)

Operation

Acid- and solvent-resistant tactile film keyboard with acoustic feedback via integrated beeper

Power supply

7 nickel-cadmium batteries (type AA with 750 mAh);
External mains adapter (Input: 100-240 V, 47-63 Hz, 400 mA, output: 15V =/ 1A) with country-specific wall-socket adapters
Lithium powerpack (CR 2032, 3V), for data storage when no power is being supplied via the battery pack or mains adapter

Charging time

approx. 10 hours

Dimensions

approx. 265 x 195 x 70 mm (instrument)
approx. 440 x 370 x 140 mm (case)

Weight (instrument)

approx. 1000 g (incl. mains adapter and battery pack)

Operating conditions

5 - 40°C at max. 30 - 90 % rel. humidity
(free from condensation)

Language options

German, English, French, Italian, Spanish

Storage capacity

approx. 1,000 data sets

Design and specifications are subject to change without notice!

Note:
The stated tolerances / measurement accuracies apply only when the device is used in electromagnetically controllable environments as per DIN EN 61326. In particular mobile phones and messaging devices may not be used in the immediate vicinity of the instrument.

Merck KGaA, 64271 Darmstadt, Germany, Tel. +49(0)6151 72-2440
www.analytical-test-kits.com

EMD Millipore Corporation, 290 Concord Road, Billerica,
MA 01821, USA, Tel. +1-978-715-1335

05/2013