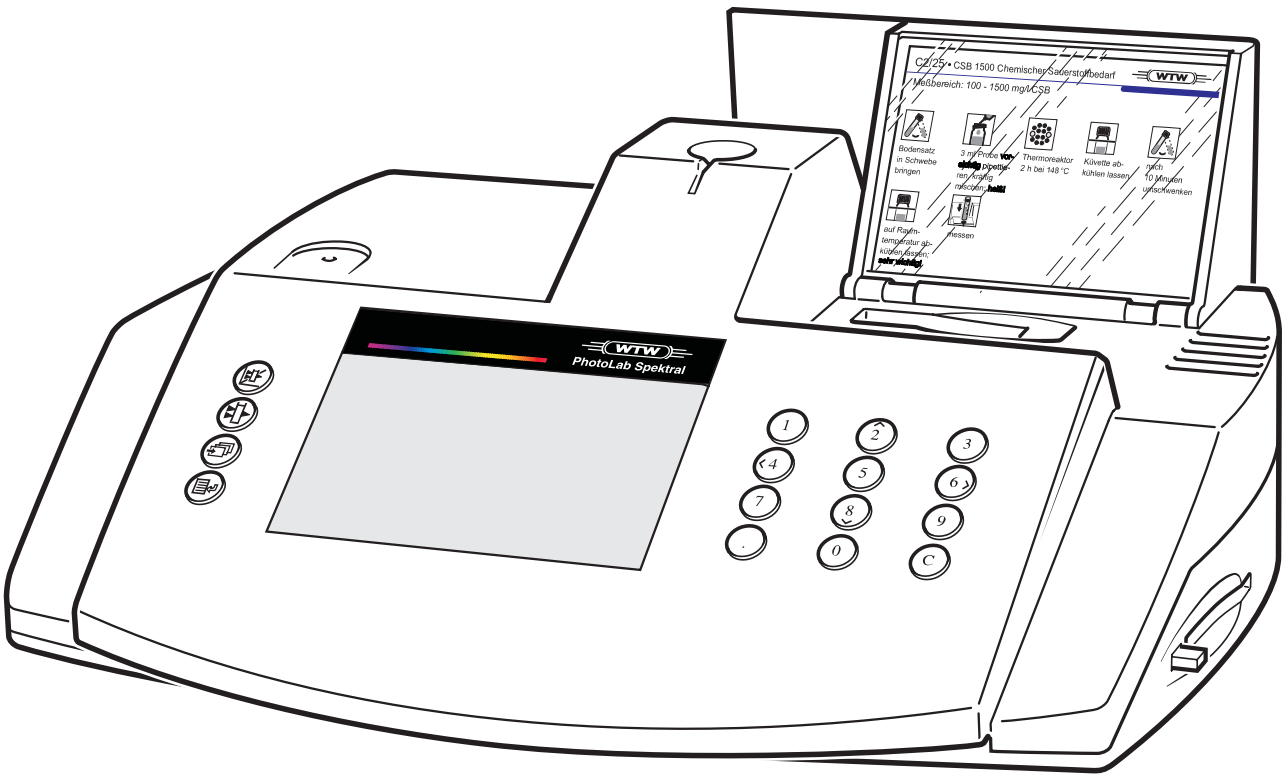
PhotoLab Spektral



Operating Instructions

Part 1: General Information

Part 2: Functional Description

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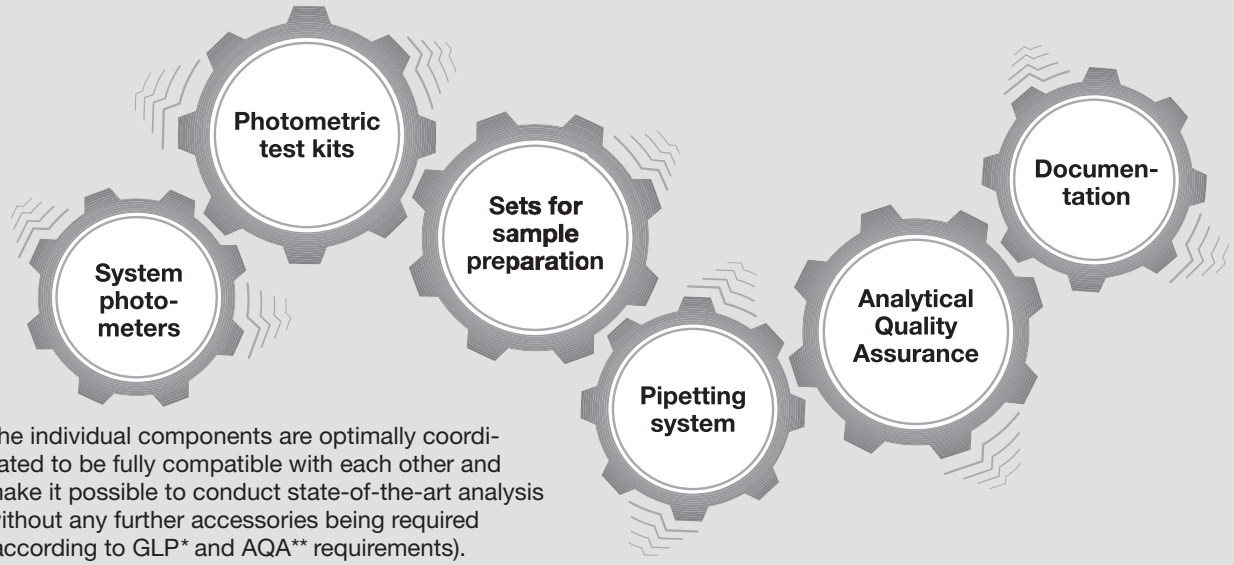
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The **Spectroquant® Analysis System** consists of the following components:

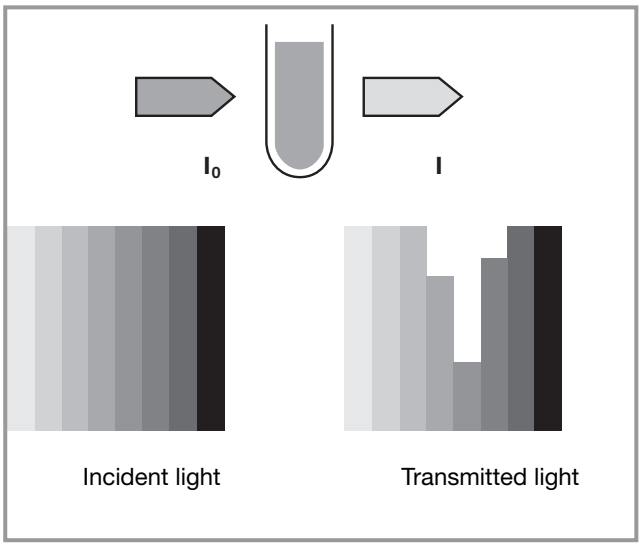


The individual components are optimally coordinated to be fully compatible with each other and make it possible to conduct state-of-the-art analysis without any further accessories being required (according to GLP* and AQA** requirements).

1. Photometers

1.1 Photometry

When a beam of light is transmitted through a coloured solution, then this beam loses its intensity, in other words a part of the light is absorbed by the solution. Depending on the substance in question, this absorption occurs at a specific wavelength.



The wavelength is selected from the overall spectrum of white light emitted by a tungsten-halogen lamp using narrow-band interference filters or other monochromators.

The intensity of the absorption can be characterized using the transmittance T (or, respectively, T in percent).

$$T = I/I_0$$

I_0 = Initial intensity of the light
I = Intensity of the transmitted light

If the light is not absorbed at all by a solution, then this solution has a transmittance of 100 %; a complete absorption of the light in the solution means 0 % transmittance.

The measure generally used for the absorption of light is the absorbance (A), since this correlates directly with the concentration of the absorbing substance. The following connection exists between absorbance and transmittance:

$$A = -\log T$$

Experiments by BOUGUER (1698–1758) and LAMBERT (1728–1777) showed that the absorbance is dependent on the thickness of the absorbing layer of the cell used. The relationship between the absorbance and the concentration of the analyte in question was discovered by BEER (1825–1863). The combination of these two natural laws led to the derivation of *Lambert-Beer's* law, which can be described in the form of the following equation:

$$A = \varepsilon_\lambda \times c \times d$$

ε_λ = Molar absorptivity, in l/mol x cm
d = Path length of the cell, in cm
c = Concentration of the analyte, in mol/l

*GLP – Good Laboratory Practice **AQA – Analytical Quality Assurance

1. Photometers

1.2 The Photometers

The photometers that belong to the Spectroquant® Analysis System differ from conventional photometers in the following important aspects:

- The calibration functions of all test kits are electronically stored.
- The measurement value can be immediately read off from the display in the desired form.
- The method is selected via the AutoSelect function (bar code on the cells/on the AutoSelector for reagent tests).
- The photometers possess AQA (Analytical Quality Assurance) functions to assure the quality of the measurement.
- New methods can be downloaded from our homepage www.merck.de and stored permanently in your photometer.

For technical data and instructions for use please refer to the section “Function description”.

2. Photometric Test Kits

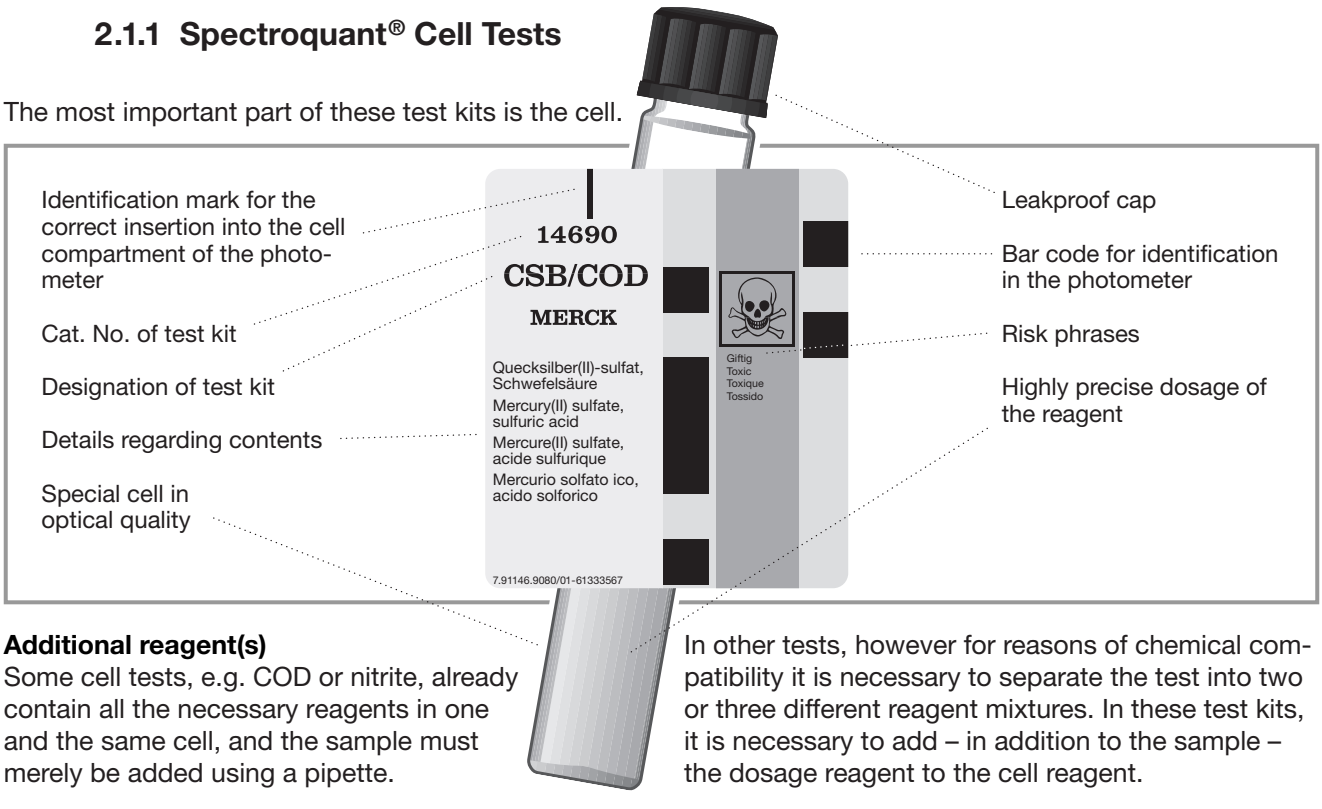
2.1 Basic Principle

By means of reagents, the component of a sample to be analyzed is converted into a coloured compound in a specific reaction. The reagents or reagent mixtures contain – in addition to the reagent selective for the parameter to be determined – a number of auxiliary substances that are essential for the course of the reaction. These include, for example, buffers for adjusting the pH to the optimal value for the reaction, and masking agents that suppress or minimize the influence of interfering ions.

The colour reactions are in most cases based on modified classical – in many cases also normed – analytical procedures. Details on the respective reference procedures are stated in the package insert or else in the parameter overview.

2.1.1 Spectroquant® Cell Tests

The most important part of these test kits is the cell.



Additional reagent(s)
Some cell tests, e.g. COD or nitrite, already contain all the necessary reagents in one and the same cell, and the sample must merely be added using a pipette.

In other tests, however for reasons of chemical compatibility it is necessary to separate the test into two or three different reagent mixtures. In these test kits, it is necessary to add – in addition to the sample – the dosage reagent to the cell reagent.

2.1.2 Spectroquant® Reagent Tests

The principle behind the reagent tests is that the reagents necessary for the colour reaction are combined in the form of liquid concentrates or solid-substance mixtures. In these tests, a few drops of the respective reagent concentrate are added to, for example, 5 ml of sample. This means that there is no need to dilute the sample, which in turn enhances the sensitivity of the detection. The making up of a sample in a volumetric flask to a defined volume usual in conventional photometry can be dispensed with.

2.2 Notes for Practical Use

2.2.1 Measuring Range

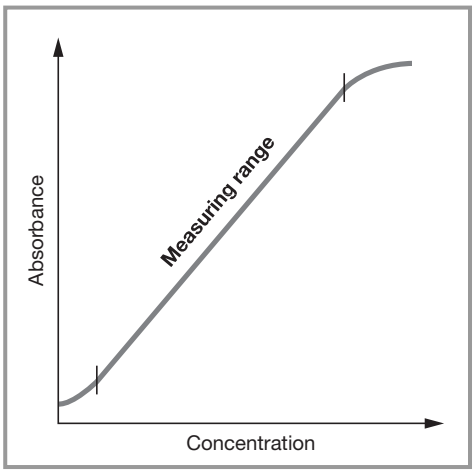
The intensity of the colour of a solution, measured as the absorbance, is proportional to the concentration of the respective analyte only within a specific range. This measuring range (effective range) is electronically stored in the photometers for each individual test kit (see overview table in section 1.3).

Below the specified measuring range, either a different cell or else another procedure must be used. The **lower limit of the measuring range** either takes the form of nonlinearity of the calibration curve, as shown in the figure below, or else is given by the limit of detection. The **limit of detection** of a given analytical method is the lowest concentration that differs from the zero concentration with a defined probability (e.g. 99%).

The **upper limit of the measuring range** is characterized by there no longer being any linear correlation between analyte concentration and absorbance. In such a case the sample must be diluted accordingly so that it lies ideally in the middle of the effective range (least-error measurement).

In photometry it is conventional practice to measure against the reagent blank value. Here the analysis is carried out “blind”, i.e. without any analyte added. Instead of the sample volume, the corresponding quantity of distilled or DI water is used. This **reagent blank value is already electronically stored** in the system photometers, meaning that a separate measurement is not necessary. It is possible, however, to enhance the accuracy of the determination at the measuring-range limit by measuring against a self-prepared reagent blank solution (for adjustment see Function description, “Blank-value correction”).

There are, however, also cases in which the colour intensity of the solution and thus the absorbance drop off again at **very high analyte concentrations**. These exemplary cases are listed in the table below. The values indicated in the display are correct up to the concentrations specified in the third column, and false measuring values are obtained above these concentrations. In such a case it is necessary to conduct a plausibility check by running preliminary tests using test strips or dilution.



Art.	Method	Correct indication of result up to sample conc.	Colour change
14752	Ammonium	25 mg/l	turquoise instead of green
14558	CT Ammonium	250 mg/l	turquoise instead of green
14544	CT Ammonium	100 mg/l	turquoise instead of green
14559	CT Ammonium	5000 mg/l	turquoise instead of green
14828	Chlorine	30 mg/l	yellow instead of red
14557	CT Fluoride	4 mg/l	brownish-yellow instead of violet
14553	CT Copper	25 mg/l	light blue/turquoise instead of blue
14767	Copper	25 mg/l	light blue/turquoise instead of blue
14551	CT Phenol	100 mg/l	weakening of colour
14831	Silver	5 mg/l	no change (flocculation)

2.2.2 Influence of pH

Chemical reactions follow an optimal course only within a certain pH range. The reagents contained in the test kits produce an adequate buffering of the sample solutions and ensure that the pH optimal for the reaction in question is obtained.

Highly acidic (pH < 2) and strongly alkaline (pH > 12) solutions can prevent the pH from being adjusted to an optimal range, since under certain circumstances the buffering capacity of the test-kit reagents may not be sufficient. In such cases the pH must be corrected by adding diluted sulfuric acid (0.5 mol/l; lowers the pH) or diluted sodium hydroxide solution (1 mol/l; raises the pH) dropwise, testing the pH with suitable indicator strips after each drop is added. The addition of the acid or lye results in a dilution of the test solution. When up to five drops are added to 10 ml of sample, the change in the volume can be neglected, since the resultant error is lower than 2 %. The addition of larger quantities should be duly considered by adjusting the sample volume accordingly.

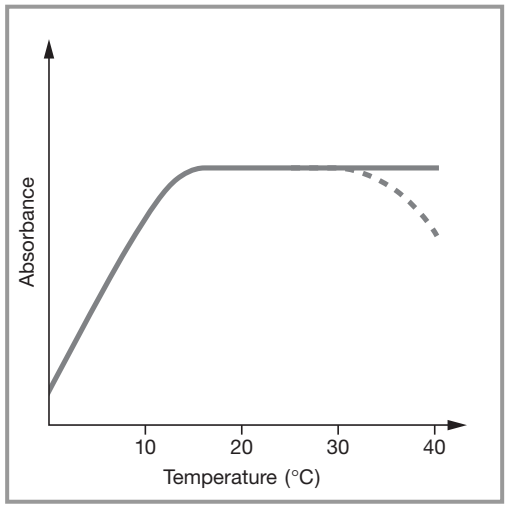
The specified pH values for the sample solution and, wherever applicable, for the measurement solution are defined in the respective package inserts and in the analysis instructions in chapter 3 of the manual.

2.2.3 Influence of Temperature

The temperature of the sample solution and reagents has a varying influence on the colour reaction and thus on the measurement result. The typical temperature course is illustrated in the figure at the right.

If the sample temperature is lower than 15 °C, false-low results must be reckoned with. Temperatures exceeding 30 °C generally influence the stability of the compound that is formed in the reaction. The optimal temperature for the colour reaction is stated in the package inserts of the respective Spectroquant® test kits.

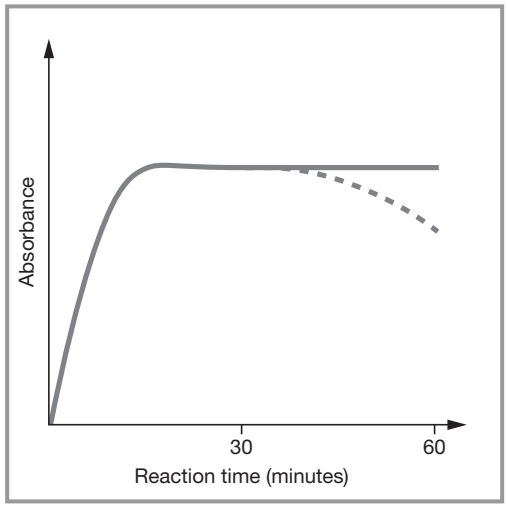
Attention! After thermic decomposition procedures, the determination of COD or total contents of nitrogen, phosphorus, or metal, a sufficient waiting time must be allowed for to permit the solution cool to room temperature.



2.2.4 Time Stability

Most of the colour reactions require a certain time to reach the maximum colour intensity. The solid curve in the figure at the right gives a schematic impression of a typical time course. The behaviour of relatively instable colour reactions with time is shown by the dotted curve.

The reaction time specified in the working instructions refers to the period of time from the addition of the last reagent until the actual measurement. In addition, the package inserts for the individual test kits also state the time interval in which the measurement value does not change. The maximum time interval is 60 minutes; this time should not be exceeded, even in the case of stable colour reactions.



2.2.5 Influence of Foreign Substances

Foreign substances in the sample solution can

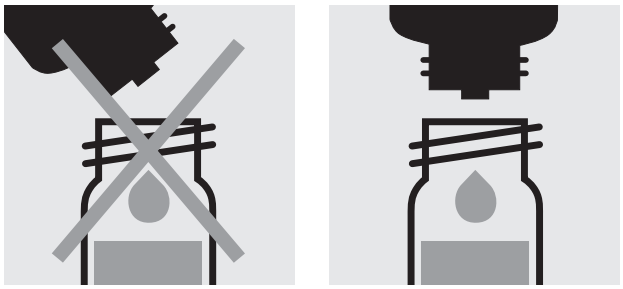
- raise the measurement value as a result of an amplification of the reaction, or
- lower the measurement value as a result of a prevention of the reaction.

A quantification of the effects is stated in tabular form in the respective package inserts for the most important foreign ions. The tolerance limits have been determined for the individual ions; they may not be evaluated cumulatively.

Suitability for use in salt water
A tabular survey (see pages XVI–XVII) provides information on the suitability of the tests in connection with salt water and also on the tolerances for salt concentrations.

2.2.6 Dosing the Reagents

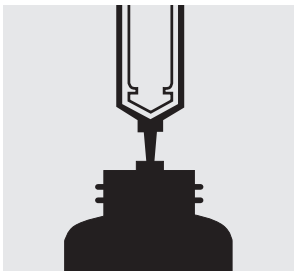
Small amounts of liquids are dosed by counting the number of drops from the leakproof bottle.



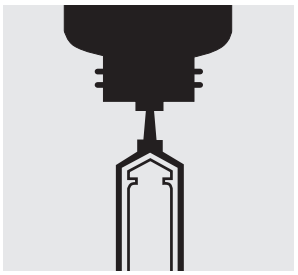
When using a dropping bottle, it is imperative that the bottle be held vertically and the reagent be slowly added dropwise (approx. 1 drop per second). Otherwise the correct drop size will not be achieved and the amount of reagent will be incorrect.

Larger amounts of liquids are dosed with the piston syringe enclosed with the respective test kit.

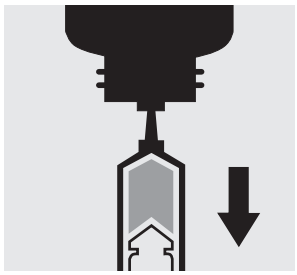
Handling:



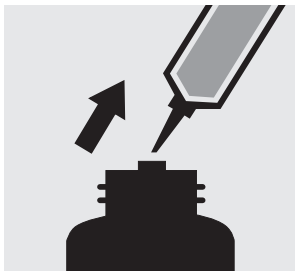
Depress the piston of the syringe to the zero position. Place the tip of the syringe firmly on the leakproof attachment of the bottle.



Turn the bottle with the piston syringe 180° so that the piston syringe is positioned underneath the bottle.



Slowly withdraw the piston downwards to the required volume (orientation aid: upper edge of the piston ring!). In the event that air bubbles are drawn into the syringe with the reagent, the syringe contents must be pressed back into the bottle and the filling process repeated.



Once the syringe has been filled free of air bubbles, turn the bottle with the piston syringe 180° back to the original position. Remove the filled piston syringe from the attachment of the bottle and carefully inject the contents into the reaction vessel.

In some cases in which an exact dosage of – generally small – quantities of reagent is called for, it is necessary to conduct the dosage procedure using a positive-displacement pipette; this is described in detail in the analysis instructions.

Solid substances are dosed either with the dose-metering cap or with microspoons that are integrated into the screw cap of the respective reagent bottle. The dose-metering cap (colour green: volume 0.025 ml; blue: 0.050 ml) can be used in cases when the solid substance or mixture is free-flowing. In all other cases the substances are dosed using the microspoon (colour grey: volume 0.01 ml; green: 0.03 ml; blue: 0.1 ml).

2. Photometric Test Kits

2.2.7 Shelf-life of the Reagents

The Spectroquant® test kits can be kept for up to three years when stored cool and dry. A few tests have a shorter shelf-life, 18 or 24 months, or must else be stored in the refrigerator. The exception here are all COD cell tests, which must be stored protected from light; then the three-year shelf-life is guaranteed.

The expiry date is printed on the outer label. The shelf-life may become shortened when the reagent bottles are not reclosed tightly after use.

3. Sample Preparation

Sample preparation covers all the steps necessary before the actual analysis can be performed.

3.1 Taking Samples

The taking of samples is the first and **most important step** on the way to obtaining the correct analysis result. Not even the most exact method of analysis can correct any mistakes made in the taking of the sample. The objective of the sampling procedure is to gain a sample with a representative composition. The most important precondition for **gaining a representative sample** is the identification of the suitable sampling site. Here it must be borne in mind that the solution to be investigated can display varying concentrations in different places at different times.

In sampling, a distinction is made between manual and automatic methods. In many cases a true picture of the average composition of the sample can be obtained only once several individual samples have been collected; this can be done manually or with an automatic sampler.

Clean plastic containers with a volume of 500 or 1000 ml are suitable for collecting samples. They should be rinsed several times, under vigorously shaken, with the water to be investigated, and then filled free of air bubbles and immediately closed tightly. The containers must be protected against the effects of air and heat and then be forwarded for the further analytical steps as soon as possible. In exceptional cases, preservation measures in the form of short-term refrigeration at +2 to +5 °C and chemical conservation can be taken.

Parameter	Preservation
COD	+2 to +5 °C max. 24 h or –18 °C max. 14 days
N compounds: NH_4-N, NO_3-N, NO_2-N	analyze immediately, only in exceptional cases +2 to +5 °C max. 6 h
P compounds: PO_4-P, P total	short-term storage, no preservation; with nitric acid to ph 1, max. 4 weeks
Heavy metals	short-term storage, no preservation; with nitric acid to ph 1, max. 4 weeks

Correct measurement results can be obtained only within the measuring range specified for each individual parameter. When dealing with sample solutions of an unknown concentration, it is advisable to establish whether the sample concentration is indeed within the specified measuring range, ideally roughly in the middle of the range.

Preliminary tests enhance the analytical reliability and make the determination of the necessary dilution ratios in the case of high concentrations easier. **Merckoquant® Test Strips** are very well suited for preliminary tests.

3.3 Dilution

Dilution of samples is necessary for two reasons:

- The concentration of the parameter under investigation is too high, i.e. it lies outside the measuring range.
- Other substances contained in the sample interfere with the determination (matrix interference); false-high or false-low results may ensue.

The following auxiliaries are absolute prerequisites for the dilution of the sample:

- Volumetric flasks of varying sizes (e.g. 50, 100 and 200 ml)
- Positive-displacement pipette
- Distilled or DI water

Only dilutions carried out with these auxiliary products are of sufficient reliability in the area of trace analysis, to which photometry belongs (for the simplified procedure see below).

An important aspect here is that once the volumetric flask has been filled up to the mark with distilled water the flask is closed and the contents are thoroughly mixed.

The **dilution factor (D_F)** resulting from the dilution procedure is calculated as follows:

$$D_F = \frac{\textbf{Final volume} \text{ (total volume)}}{\textbf{Initial volume} \text{ (sample volume)}}$$

The analytical result is subsequently multiplied by the dilution factor.

A calculation can be dispensed with when the dilution is programmed into the photometer. The **dilution number** (see the table at the right) is entered and the measurement value is subsequently calculated correctly and immediately displayed (for settings see Function description, “Method parameters: Dilution”).

All dilutions should be made in such a way that the measurement value lies in the middle of the measuring range. As a rule, the dilution factor should never be greater than 100. In the event that yet larger dilutions become necessary all the same, then this must be done in two separate steps.

Example:

Step 1: Make up 2 ml of sample to 200 ml with distilled water;
D_F = 100, dilution number 1+99

Step 2: Take 5 ml of the above solution and make up to 100 ml;
D_F = 20, dilution number 1+19

The dilution factor for the total dilution is calculated by multiplying the individual dilutions:

$D_{F\,total} = D_{F1} \times D_{F2} = 100 \times 20 = 2000$, dilution number 1+1999

Simplified procedure
Dilutions up to 1:10 can also be prepared without volumetric flasks in a glass beaker, measuring the volumes of the sample and the dilution water using a previously calibrated positive-displacement pipette (see table below for instructions).

Desired dilution	Volume of sample in ml	Volume of dist. water in ml	Dilution factor	Dilution number
1:2	5	5	2	1+1
1:3	5	10	3	1+2
1:4	2	6	4	1+3
1:5	2	8	5	1+4
1:10	1	9	10	1+9

Strongly turbid samples require pretreatment before they can determined in a photometer, since the effect of turbidity can result in considerable variations in the measurement values and in false-high readings. Care must be taken here to ensure that the substance to be determined is not contained in the suspended material, in which case a sample decomposition must be carried out.

Compounds that always occur in dissolved form (for example ammonium, nitrate, nitrite, chlorine, chloride, cyanide, fluoride, orthophosphate, and sulfate) permit a previous filtration, even when the sample solution is strongly turbid.

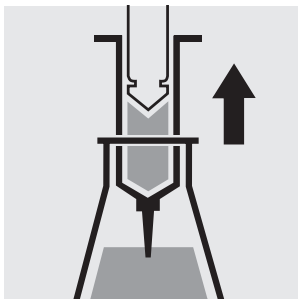
Weak turbidity is eliminated by the **automatic turbidity-correction** feature built into the photometer (see Function description, “Device set-up/Correction function”); in such cases it is not necessary to filter the sample before analysis.

3. Sample Preparation

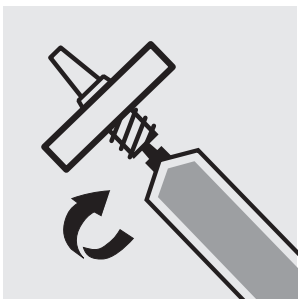
As a measure to distinguish between dissolved and undissolved water-borne substances, the water sample can be filtered through a simple paper filter.

Following the recommendations stated in the reference methods, membrane filters with a pore size of 0.45 µm are required for fine filtration.

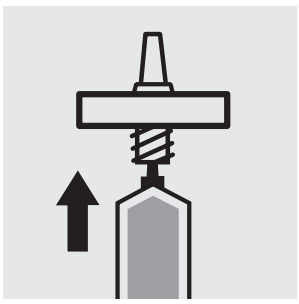
Procedure for microfiltration



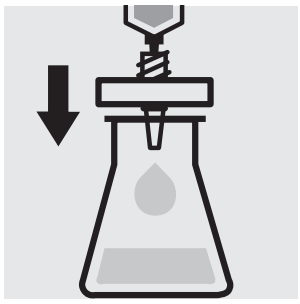
Draw out the liquid to be filtered with the syringe.



Screw the syringe tightly into the front side of the membrane-filter attachment.



Hold the syringe upright and slowly depress the piston upwards until the membrane-filter is fully wetted free of air bubbles.



Filter the contents of the syringe into the intended glass vessel.

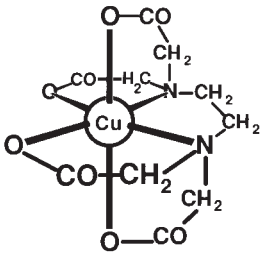
3.5 Homogenization

As a measure to ensure that a representative sample can be taken in the presence of suspended matter in the water sample in question, for certain parameters (for example COD, total content of heavy metals) the sample must be homogenized. This must be carried out using a magnet stirrer (2 minutes at 700 – 900 rpm and taking the sample while stirring; cf. DIN 38402 A30).

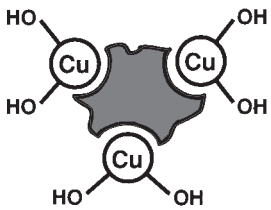
Water-borne substances can be present in the sample for investigation in a variety of forms: as the ion, bound more or less solidly in a complex, or as a solid substance.



Ion



Complex

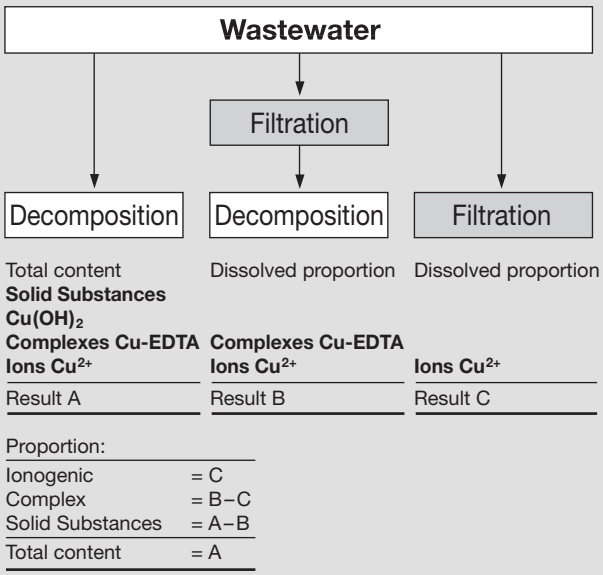


Solid substance

3. Sample preparation

The manner in which the sample is pretreated enables the three proportions to be distinguished from each other. This can be illustrated using a copper-containing wastewater sample as an example.

Example



Decomposition converts the substance to be determined into an analyzable form. In most cases, decomposition agents take the form of acids in combination with oxidizing agents; in exceptional cases (e.g. in the determination of total nitrogen) an alkaline decomposition is more effective. The type of decomposition procedure used depends on the analyte to be determined and the sample matrix.

The ready-to-use sample-decomposition products **Spectroquant® Crack Set** 10 and 20 are suited for the preparation of the sample materials for the determinations stated in the table below.

Determination of	Sample preparation with
Phosphorus total*	Crack Set 10/10C**
Chromium total* [= sum of chromate and chromium(III)]	Crack Set 10/10C
Metal total [= sum of free and complex-bound metal]	Crack Set 10/10C
Nitrogen total*	Crack Set 20

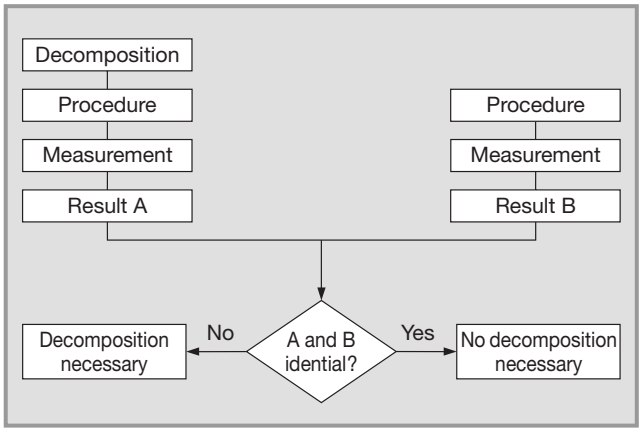
* The decomposition reagents are already contained in the packs of the respective cell tests.

** Decomposition cells are included in the pack; empty cells are required for the decomposition for Crack Sets 10 and 20.

The decomposition processes are carried out in the **thermoreactor** (capacity: 8/12 decomposition cells) at 120 °C or, respectively, 100 °C. Details regarding the heating times and further treatment can be found in the package inserts contained in the **Spectroquant® Crack Set** packs.

In the event that the sample to be analyzed is a highly contaminated material (high proportion of organic substances) or water-insoluble samples, decomposition using concentrated acids and other agents is indispensible. Corresponding examples are described in the **Application Compendium** (obtainable from your local Merck representative; see Appendix), a collection of analytical specifications for real samples.

The necessity for decomposition can be checked according to the following diagram:



For wastewater with a consistent composition, this check as a rule need be carried out only once. It is, however, advisable to check the result periodically.

4. Pipetting System

Positive-displacement pipettes permit

- an exact dosage of the sample volume, and
- a precise measurement of sample and reagent volumes and of the volumes of water for dilution purposes.

Pipettes of varying volumes and also ones with a fixed volume are available.

Sources of error and hints on how to avoid them:

- Closely follow the instructions for use contained with the pipette in question.
- Check the pipetted volumes by weighing using analytical scales (weighing accuracy ±1 mg), 1 ml of water at 20 °C = 1.000 g ±1 mg.
- Check the pipetted volume using Spectroquant® PipeCheck; this is a photometric check of the pipette, and scales are not necessary (see section "AQA").
- Avoidance of spread effects by rinsing the pipette several times with the solution to be pipetted.
- Always exchange the pipette tip.
- Draw up the liquid slowly and depress piston completely to discharge the liquid.

5. Analytical Quality Assurance (AQA)

The objective of analysis must always be to determine the true content of the analyte in question as accurately and precisely as possible.

Analytical Quality Assurance represents a suitable and indispensible method by which the quality of the user's own work can be assessed, errors in the measurement system diagnosed, and the comparability with the results obtained using the respective reference methods demonstrated.

Details regarding the necessity of AQA can be found in the memorandum M 704 of the German "Abwassertechnische Vereinigung" (ATV, Wastewater-technical Association) and in the corresponding self-control/self-monitoring regulations of the German federal states (available in english).

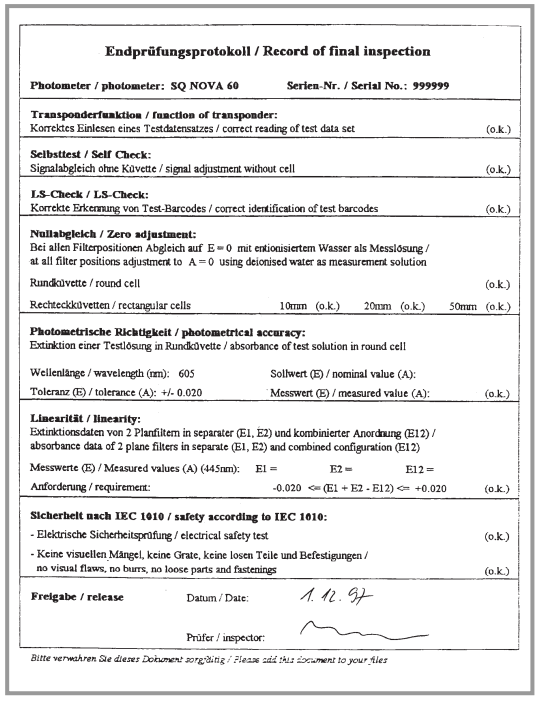
Causes for errors can include:

- the working materials used;
- the handling; and/or
- the sample under investigation.

These errors have effects on both the accuracy and precision of the results obtained.

Photometers and photometric test kits possess specifications that are adhered to and above all else also documented by the manufacturer.

The **certificate for the photometer** enclosed with each device documents the quality of the measuring device.



Endprüfungsprotokoll / Record of final inspection

Photometer / photometer: SQ NOVA 60 **Serien-Nr. / Serial No.: 999999**

Transponderfunktion / function of transponder:
Korrektes Einlesen eines Testdatensatzes / correct reading of test data set (o.k.)

Selbsttest / Self Check:
Signalabgleich ohne Küvette / signal adjustment without cell (o.k.)

LS-Check / LS-Check:
Korrekte Erkennung von Test-Barcodes / correct identification of test barcodes (o.k.)

Nullabgleich / Zero adjustment:
Bei allen Filterpositionen Abgleich auf E = 0 mit entionisiertem Wasser als Messlösung /
at all filter positions adjustment to A = 0 using deionised water as measurement solution

Rundküvette / round cell (o.k.)

Rechteckküvetten / rectangular cells 10mm (o.k.) 20mm (o.k.) 50mm (o.k.)

Photometrische Richtigkeit / photometrical accuracy:
Extinktion einer Testlösung in Rundküvette / absorbance of test solution in round cell

Wellenlänge / wavelength (nm): 605 Sollwert (E) / nominal value (A):

Toleranz (E) / tolerance (A): +/- 0.020 Messwert (E) / measured value (A): (o.k.)

Linearität / linearity:
Extinktionsdaten von 2 Planfiltern in separater (E1, E2) und kombinierter Anordnung (E12) /
absorbance data of 2 plane filters in separate (E1, E2) and combined configuration (E12)

Messwerte (E) / Measured values (A) (445nm): E1 = E2 = E12 =

Anforderung / requirement: -0.020 <= (E1 + E2 - E12) <= +0.020 (o.k.)

Sicherheit nach IEC 1010 / safety according to IEC 1010:
- Elektrische Sicherheitsprüfung / electrical safety test (o.k.)
- Keine visuellen Mängel, keine Grate, keine losen Teile und Befestigungen /
no visual flaws, no burrs, no loose parts and fastenings (o.k.)

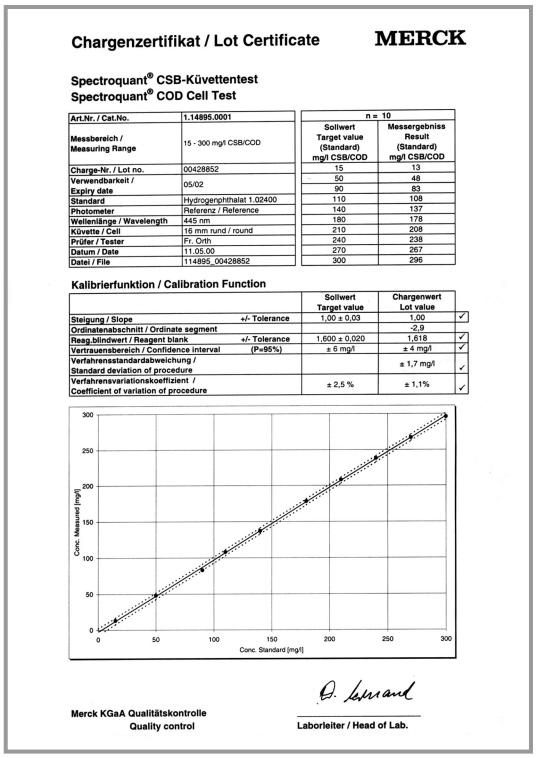
Freigabe / release Datum / Date: 1.12.97

Prüfer / inspector:

Bitte verwahren Sie dieses Dokument sorgfältig / Please add this document to your files

5. Analytical Quality Assurance (AQA)

The **certificate for the test kit,** available for each lot produced, documents the quality of the reagents contained in the test kit.



Chargenzertifikat / Lot Certificate MERCK

Spectroquant® CSB-Küvettentest
Spectroquant® COD Cell Test

Art.Nr. / Cat.No.	1.14895.0001
Messbereich / Measuring Range	15 - 300 mg/l CSB/COD
Charge-Nr. / Lot no.	00428852
Verwendbarkeit / Expiry date	05/02
Standard	Hydrogenphthalat 1.02400
Photometer	Referenz / Reference
Wellenlänge / Wavelength	445 nm
Küvette / Cell	16 mm rund / round
Prüfer / Tester	Fr. Orth
Datum / Date	11.05.00
Datei / File	114895_00428852

n = 10

Sollwert Target value (Standard) mg/l CSB/COD	Messergebniss Result (Standard) mg/l CSB/COD
15	13
50	48
90	83
110	108
140	137
180	178
210	208
240	238
270	267
300	296

Kalibrierfunktion / Calibration Function

		Sollwert Target value	Chargenwert Lot value	
Steigung / Slope	+/- Tolerance	1,00 ± 0,03	1,00	✓
Ordinatenabschnitt / Ordinate segment			-2,9	
Reag.blindwert / Reagent blank	+/- Tolerance	1,600 ± 0,020	1,618	✓
Vertrauensbereich / Confidence interval	(P=95%)	± 6 mg/l	± 4 mg/l	✓
Verfahrensstandardabweichung / Standard deviation of procedure			± 1,7 mg/l	✓
Verfahrensvariationskoeffizient / Coefficient of variation of procedure		± 2,5 %	± 1,1%	✓

Merck KGaA Qualitätskontrolle
Quality control

Laborleiter / Head of Lab.

Calibration function:
The calculated function must agree, within specified tolerances, with the function electronically stored in the photometer.

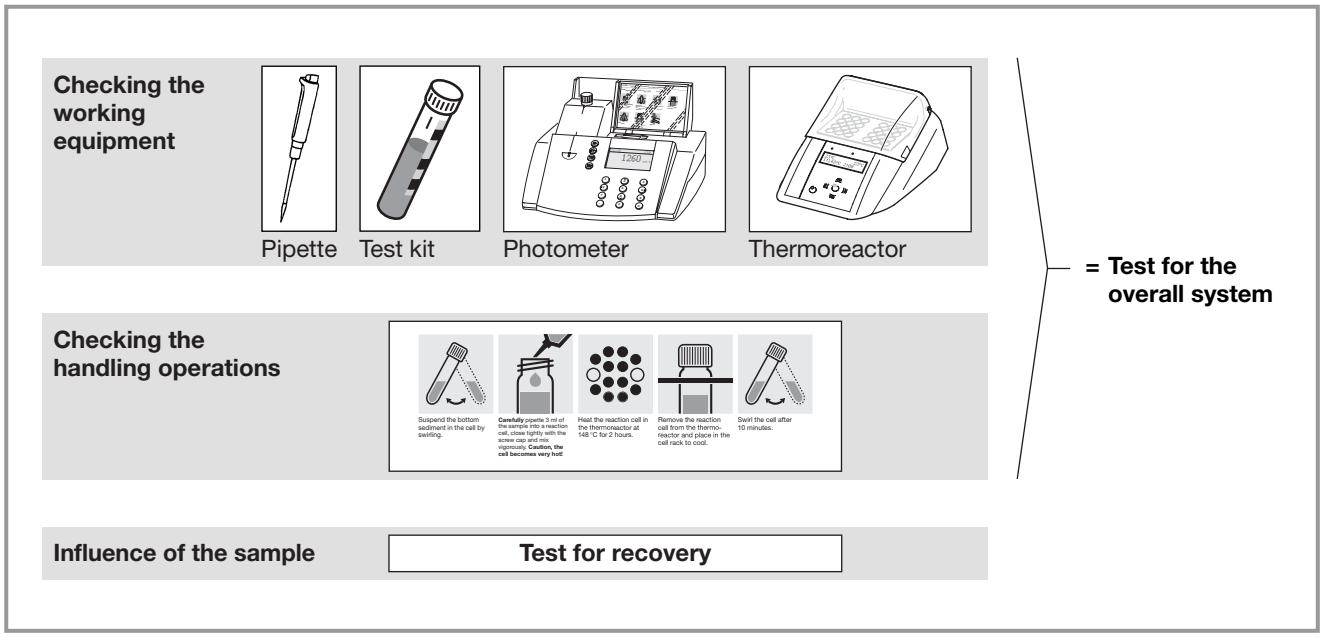
Confidence interval:
Maximum deviation from the desired value over the entire measuring range; every measurement value can be affected by this deviation; this parameter is a measure for the accuracy.

Standard deviation for the procedure:
Measurement for the dispersion of the measurement values over the entire measuring range, expressed in ± mg/l.

Coefficient of variation for the procedure:
Measurement for the dispersion of the measurement values over the entire measuring range, expressed in %. The smaller the standard deviation/coefficient of variation for the procedure, the more pronounced the linearity of the calibration curve.

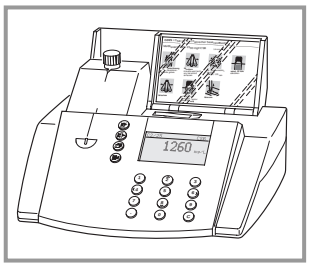
A complete check comprises the entire system, i.e. the working equipment and the mode of operation. The photometer offers an optimum degree of support in this regard, in the form of the different quality mode. The instrument, or the whole system (including reagents and all accessories) will be checked, depending on which quality mode selected. All of checking operations can thus be supported by the photometer and the check values accordingly documented as per GLP (Good Laboratory Practice) recommendations (see Function description, “Analytical Quality Assurance”).

The following diagram provides an overview regarding internal quality-assurance aspects:



5.2.1 Checking the Photometer

As soon as the photometer is activated it is running a Self-Check. This means the hardware and the software of the photometer is checked and compared with internal standards.



The photometer itself is checked in the **AQA 1 mode** using the **Spectroquant® PhotoCheck.** The pack includes round cells containing stable test solutions **(secondary standards)** for checking the photometer at the 445, 525, and 690 nm wavelengths. The test solutions are measured in a reference photometer monitored with primary standards, and the absorbance values are documented in the package insert. These desired values with the permissible tolerances are entered into the photometer or else handwritten into the control chart. For the measurement the cell is placed in the compartment for the round cell and identified by the photometer via the bar code, and the measured absorbance is compared with the desired value. The absorbance is shown in the display and can be entered into the corresponding control chart.

The measurement of at least one cell (preferably cell -2 or -3) per wavelength is recommended when checking the photometer. The measurement of four cells for a given wavelength tests – in addition to the wavelength accuracy – also the linearity of the absorbance over the effective range.

The verification of the instrument, as it is required by DIN/ISO 9000 or GLP, can be easily performed by using the PhotoCheck. The PhotoCheck allows you to check the linearity of the filters, hence offering the possibility to check the instrument. All of the corresponding documentation, required by these certification guidelines, is done by the photometer automatically. We guarantee for the Spectroquant® PhotoCheck a 2 year warrantee.

5.2.2 Checking the Overall System

Test for the overall system includes checking the working equipment and checking the handling operations.

The **overall system** can be checked using standard solutions of a known content, preferably with the Spectroquant® CombiCheck; this corresponds with the **AQA 2 mode** in the photometer.

Spectroquant® CombiCheck are ready-to-use standard solutions that in terms of the analyte concentration are finely adjusted to the individual test kits. They contain a mixture of several analytes that do not interfere with each other. The standard solution (R-1) is used in the same way as a sample. A double determination is recommended as a measure to diagnose any random errors.

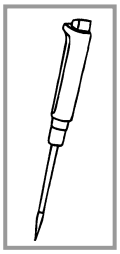
The desired values with the permissible tolerances are already electronically stored with the method in the photometer. The AQA check mode is selected for the measurement, which can be prompted using the **MemoChip AQA.** The cells containing the standard solution are then identified as test solutions by the photometer, and the measured concentration is then compared with the desired value. When the result agrees with desired value within the permissible tolerance range, the display shows the measurement value and the “OK” sign.

In addition to the CombiCheck, it is also possible to use ready-to-use single-element standard solutions for this checking procedure. These contain 1000 mg of the respective analyte per liter of solution. They can be diluted to different final concentrations, which should preferably lie approximately in the middle of the measuring range of the respective test kit.
The table on page XVIII provides an overview of the available CombiCheck and ready-to-use standard solutions.

Due to limited shelf-life characteristics, there are no CombiCheck or ready-to-use standard solutions for certain parameters. Attached to the table are the instructions describing the reagents and working steps necessary to make your own solutions of a defined concentration. This allows the control of parameters where there are no simple to prepare solutions available.

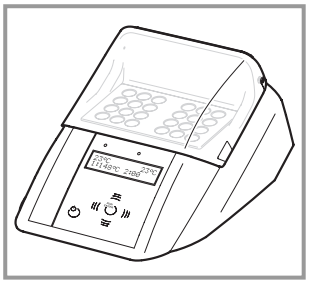
The individual results are flagged as AQA2 if the AQA-Check of the entire system has passed. If not, an error message is given and the individual components of the instrument have to be checked in detail.

5.2.3 Checking the Pipettes



The **Spectroquant® PipeCheck** is used to check the pipettes. The pack contains cells filled with colour-dye concentrates. After the addition of a predefined volume of water using the pipette in question, the cell is measured against a corresponding reference cell also contained in the pack. The difference in the absorbance values of the measurement cell and reference cell may not exceed the tolerances given in the package insert. If the tolerances are exceeded, the instructions given in the section “Pipetting system” must be followed accordingly.

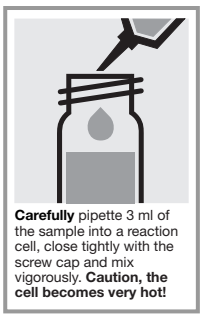
5.2.4 Checking Thermoreactors



The thermoreactors are checked at 100/120 and 148 °C. Here a round cell filled to one half with glycerol is place in any one of the compartments of the thermoreactor, and the thermoreactor is heated as described in the instructions for use. After the control lamp has gone out, the temperature in the cell is measured using a calibrated thermometer. The following desired temperatures must be achieved:

Block temperature 100 °C = desired temp. 100 ±3°C*
Block temperature 120 °C = desired temp. 120 ±3°C*
Block temperature 148 °C = desired temp. 148 ±3°C*

5.2.5 Testing for Handling Errors



Carefully pipette 3 ml of the sample into a reaction cell, close tightly with the screw cap and mix vigorously. **Caution, the cell becomes very hot!**

The user’s own mode of operation must also be subjected to an exact analysis. The following questions may serve as a guide in this regard:

- Is the test kit optimal for the measurement assignment in question?
- Is the test kit’s measuring range suitable?
- Were the operating instructions for the test followed?
- Was the sample volume correct?
- Was the pipette handled properly?
- Was a new pipette tip used?
- Is the pH correct?
- Was the reaction time adhered to?
- Does the sample and reagent temperature lie within the correct range?
- Is the cell clean?
- Has the expiry date for the test kit been exceeded?

The influence of other substances contained in the sample may, under certain circumstances, be so great that their recovery rates lie in the region of several percent. It is recommended to check for any influence by using the addition solution contained in the Spectroquant® CombiCheck pack.

A defined quantity of the **addition solution** (R-2), which contains a known concentration of the respective analyte, is added to the sample and the recovery rate is determined.

The following difference is then calculated:

Result (sample + addition solution) – Result (sample)

If the calculated difference is equal to the concentration of analyte of addition solution that was added, the recovery rate is 100 %. If the difference is less than 90 %, then a matrix interference is present.

* The block temperature compensates for any heat lost due to insufficient heat transfer.

5.4 Definition of Errors

It is obvious that measurement results as a rule may be associated with errors. This applies equally to standardized methods of analysis (reference methods) and to routine analysis. The discovery and the minimization of errors must be the objective here.

A distinction is made between systematic errors and random errors.

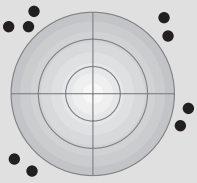
Systematic errors are present when all the results of an analysis deviate from the true value with the same algebraic sign. Examples here include: a wrong sample volume, a wrong pH, a wrong reaction time, a sample-matrix influence, etc. Systematic errors thus affect the **accuracy** of the method of analysis.

Accuracy = Deviation of the measured concentration from the true concentration

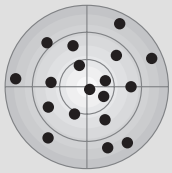
Random errors manifest themselves in the form of a wide range of deviation of the results of a given sample. These can be kept to a minimum by ensuring good operating techniques and multiple determination with calculation of the mean values. Random errors make the result of the analysis unreliable; they influence the **precision**.

Precision = Dispersion of the results among each other

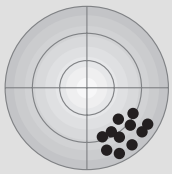
The following diagram illustrates the aspects of accuracy and precision:



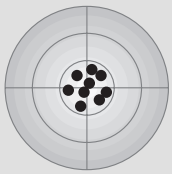
Accuracy: poor
Precision: poor
Major errors have been made!



Accuracy: good
Precision: poor
Calculation of the mean values from at least three – or better even more – parallel determinations yields an approximation of the true value.



Accuracy: poor
Precision: good
The high degree of precision mistakenly indicates a correct value!



Accuracy: good
Precision: good
The ideal objective!

Suitability of Test Kits for Testing Salt Water

Test kit	Art.	Seawater	Limit of tolerance, salts in %		
			NaCl	$NaNO_3$	Na_2SO_4
Acid Capacity Cell Test	01762	no	–	–	–
Alcohol Cell Test	14965	no	–	–	–
Aluminium Test	14825	yes	10	20	20
Ammonium	A5/25	yes	20	10	15
Ammonium Cell Test	14739	no	5	5	5
Ammonium Cell Test	14558	yes	20	10	15
Ammonium Cell Test	14544	yes	20	15	20
Ammonium Cell Test	14559	yes	20	20	20
Ammonium Test	14752	no	10	10	20
Ammonium Test	00683	yes	20	20	20
AOX Cell Test	00675	no	0.4	20	20
Arsenic Test	01747	no	10	10	10
BOD Cell Test	00687	yes	20	20	20
Boron Cell Test	00826	yes	10	20	20
Boron Test	14839	no	20	5	20
Bromine Test	00605	no	10	10	10
Cadmium Cell Test	14834	no	1	10	1
Cadmium Test	01745	no	1	10	1
Calcium Cell Test	00858	no	2	2	1
Calcium Test	14815	yes	20	20	10
Chlorine Cell Test	00595	no	10	10	10
Chlorine Cell Test	00597	no	10	10	10
Chlorine Test	00598	no	10	10	10
Chlorine Test	00602	no	10	10	10
Chlorine Test	00599	no	10	10	10
Chlorine dioxide Test	00608	no	10	10	10
Chloride Cell Test	14730	yes	–	20	1
Chloride Test	14897	yes	–	10	0,1
Chromate Cell Test	14552	yes	10	10	10
Chromium total Cell Test	14552	no	5	10	10
Chromate Test	14758	yes	10	10	10
COD	C1/25	no	0.4	10	10
COD	C2/25	no	0.4	10	10
COD Cell Test	14560	no	0.4	10	10
COD Cell Test	14540	no	0.4	10	10
COD Cell Test	14895	no	0.4	10	10
COD Cell Test	14690	no	0.4	20	20
COD Cell Test	14541	no	0.4	10	10
COD Cell Test	14691	no	0.4	20	20
COD Cell Test	14555	no	1.0	10	10
COD Cell Test (Hg free)	09772	no	0	10	10
COD Cell Test (Hg free)	09773	no	0	10	10
Copper Cell Test	14553	yes	15	15	15
Copper Test	14767	yes	15	15	15
Cyanide Cell Test	14561	no	10	10	10
Cyanide Test	09701	no	10	10	10
Fluoride Cell Test	14557	no	10	10	10
Fluoride Test	14598	yes	20	20	20
Formaldehyde Cell Test	14500	no	5	0	10
Formaldehyde Test	14678	no	5	0	10
Gold Test	14821	yes	10	20	5
Hardness, see Total Hardness Cell Test					
Hydrazine Test	09711	no	20	5	2
Hydrogenperoxide Cell Test	14731	yes	20	20	20
Iodine Test	00606	no	10	10	10
Iron Cell Test	14549	yes	20	20	20
Iron Cell Test	14896	no	5	5	5
Iron Test	14761	yes	20	20	20
Iron Test	00796	yes	20	20	20
Lead Cell Test	14833	no	20	20	1
Lead Cell Test	09717	no	20	5	15
Magnesium Cell Test	00815	yes	2	2	1
Manganese Cell Test	00816	no	20	20	20
Manganese Test	01739	no	20	25	5
Manganese Test	14770	yes	20	20	20
Molybdenum Cell Test	00860	no	20	20	5
Monochloramine Test	01632	no	10	10	20
Nickel Cell Test	14554	no	20	20	20
Nickel Test	14785	no	20	20	20
Nitrate	N1/25	no	0.2	–	20
Nitrate Cell Test	14542	no	0.4	–	20
Nitrate Cell Test	14563	no	0.2	–	20
Nitrate Cell Test	14764	no	0.5	–	20
Nitrate Cell Test	00614	no	2	–	20

Suitability of Test Kits for Testing Salt Water

Test kit	Art.	Seawater	Limit of tolerance, salts in %		
			NaCl	$NaNO_3$	Na_2SO_4
Nitrate Test	14773	no	0.4	–	20
Nitrate Test	09713	no	0.2	–	20
Nitrate Cell Test (salt water)	14556	yes	20	–	20
Nitrate Test (salt water)	14942	yes	20	–	20
Nitrite	N4/25	yes	20	20	15
Nitrite Cell Test	14547	yes	20	20	15
Nitrite Test	14776	yes	20	20	15
Nitrogen (total) Cell Test	14537	no	0.5	–	10
Nitrogen (total) Cell Test	00613	no	0.2	–	10
Nitrogen (total) Cell Test	14763	no	2	–	20
Oxygen Cell Test	14694	no	10	5	1
Ozone Test	00607	no	10	10	10
pH Cell Test	01744	yes	–	–	–
Phenol Cell Test	14551	yes	20	20	15
Phenol Test	00856	yes	20	20	20
Phosphate	P4/25	yes	5	10	10
Phosphate/P total	P4/25	no	1	10	10
Phosphate	P5/25	yes	20	20	20
Phosphate/P total	P5/25	yes	5	20	20
Phosphate Cell Test	14543	yes	5	10	10
Phosphate Cell Test/P total	14543	no	1	10	10
Phosphate Cell Test	14729	yes	20	20	20
Phosphate Cell Test/P total	14729	yes	5	20	20
Phosphate Cell Test	00616	yes	20	20	20
Phosphate Test	14848	yes	5	10	10
Phosphate Test	00798	yes	15	20	10
Phosphate Cell Test	14546	yes	20	20	20
Phosphate Test	14842	yes	20	20	20
Potassium Cell Test	14562	yes	20	20	20
Potassium Cell Test	00615	yes	20	20	20
Residual Hardness Cell Test	14683	no	0.01	0.01	0.01
Silicate (Silicic Acid) Test	14794	yes	5	10	5
Silicate (Silicic Acid) Test	00857	no	5	10	2.5
Silver Test	14831	no	0	1	5
Sodium Cell Test	00885	no	–	10	1
Sulfate Cell Test	14548	yes	10	20	–
Sulfate Cell Test	00617	yes	10	20	–
Sulfate Cell Test	14564	yes	10	20	–
Sulfate Test	14791	no	0.2	0.2	–
Sulfide Test	14779	no	0.5	1	1
Sulfite Cell Test	14394	no	20	20	20
Sulfite Test	01746	no	20	20	20
Surfactants (anionic) Cell Test	14697	no	0.1	0.01	10
Surfactants (cationic) Cell Test	01764	no	0.1	0.1	20
Surfactants (nonionic) Cell Test	01787	no	2	5	2
Tin Cell Test	14622	yes	20	20	20
TOC Cell Test	14878	no	0,5	10	10
TOC Cell Test	14879	no	5	20	20
Total Hardness Cell Test	00961	no	2	2	1
Volatile Organic Acids Cell Test	01763	no	20	20	10
Zinc Cell Test	00861	no	20	20	1
Zinc Cell Test	14566	no	10	10	10
Zinc Test	14832	no	5	15	15

Spectroquant® CombiCheck and Standard Solutions

Test kit, Art.	CombiCheck, Art.	Evaluation as	Confidence interval Spec. value for the standard	tolerance	Other standards** Art.
Acid Capacity Cell Test, 01762	–	OH	5.00 mmol/l	± 0.50 mmol/l	see prep. instr.
Alcohol Cell Test, 14965	–	C_2H_3OH	3 g/l	± 0.3 g/l	09008
Aluminium Test, 14825	CombiCheck 40, 14692	Al	0.75 mg/l	± 0.08 mg/l	19770
Ammonium, A5/25	CombiCheck 10, 14676	NH_4-N	4.00 mg/l	± 0.30 mg/l	19812
Ammonium Cell Test, 14739	CombiCheck 50, 14695	NH_4-N	1.00 mg/l	± 0.10 mg/l	19812
Ammonium Cell Test, 14558	CombiCheck 10, 14676	NH_4-N	4.00 mg/l	± 0.30 mg/l	19812
Ammonium Cell Test, 14544	CombiCheck 20, 14675	NH_4-N	12.0 mg/l	± 1.0 mg/l	19812
Ammonium Cell Test, 14559	CombiCheck 70, 14689	NH_4-N	50.0 mg/l	± 5.0 mg/l	19812
Ammonium Test, 14752	CombiCheck 50, 14695	NH_4-N	1.00 mg/l	± 0.10 mg/l	19812
Ammonium Test, 00683	CombiCheck 70, 14689	NH_4-N	50.0 mg/l	± 5.0 mg/l	19812
AOX Cell Test, 00675	–	AOX	1.00 mg/l*	± 0.10 mg/l	00680
Arsenic Test, 01747	–	As	0.050 mg/l	± 0.005 mg/l	19773
BOD Cell Test, 00687	–	O_2	210 mg/l	± 20 mg/l	00718
Boron Cell Test, 00826	–	B	1.00 mg/l*	± 0.15 mg/l	19500
Boron Test, 14839	–	B	0.400 mg/l*	± 0.040 mg/l	19500
Bromine Test, 00605	–	Br_2	4,00 mg/l	± 0,40 mg/l	see prep. instr.
Cadmium Cell Test, 14834	CombiCheck 30, 14677	Cd	0.500 mg/l	± 0.060 mg/l	19777
Cadmium Test, 01746	–	Cd	0.250 mg/l	± 0.010 mg/l	19777
Calcium Cell Test, 00858	–	Ca	75 mg/l*	± 7 mg/l	19778
Calcium Test, 14815	–	Ca	80 mg/l*	± 8 mg/l	19778
Chlorine Cell Test, 00595	–	Cl_2	4.00 mg/l*	± 0.40 mg/l	see prep. instr.
Chlorine Cell Test, 00597	–	Cl_2	4.00 mg/l*	± 0.40 mg/l	see prep. instr.
Chlorine Test, 00598	–	Cl_2	4.00 mg/l*	± 0.40 mg/l	see prep. instr.
Chlorine Test, 00602	–	Cl_2	4.00 mg/l*	± 0.40 mg/l	see prep. instr.
Chlorine Test, 00599	–	Cl_2	4.00 mg/l*	± 0.,40 mg/l	see prep. instr.
Chlordioxide Test, 00608	–	ClO_2	4.00 mg/l*	± 0.40 mg/l	see prep. instr.
Chloride Cell Test, 14730	CombiCheck 20, 14675	Cl	60 mg/l	± 10 mg/l	19897
	CombiCheck 10, 14676		25 mg/l	± 6 mg/l	19897
Chloride Test, 14897	CombiCheck 60, 14696	Cl	125 mg/l	± 13 mg/l	19897
	–		12.5 mg/l	± 0.13 mg/l	19897
Chromate Cell Test, 14552	–	Cr	1.00 mg/l	± 0.10 mg/l	19780
Chromate Test, 14758	–	Cr	1.00 mg/l	± 0.10 mg/l	19780
COD 160, C1/25	CombiCheck 10, 14676	COD	80 mg/l	± 12 mg/l	see prep. instr.
COD 1500, C2/25	CombiCheck 20, 14675	COD	750 mg/l	± 75 mg/l	see prep. instr.
COD Cell Test, 14560	CombiCheck 50, 14695	COD	20.0 mg/l	± 4.0 mg/l	see prep. instr.
COD Cell Test, 14540	CombiCheck 10, 14676	COD	80 mg/l	± 12 mg/l	see prep. instr.
COD Cell Test, 14895	CombiCheck 60, 14696	COD	250 mg/l	± 20 mg/l	see prep. instr.
COD Cell Test, 14690	CombiCheck 60, 14696	COD	250 mg/l	± 25 mg/l	see prep. instr.
COD Cell Test, 14541	CombiCheck 20, 14675	COD	750 mg/l	± 75 mg/l	see prep. instr.
COD Cell Test, 14691	CombiCheck 80, 14738	COD	1500 mg/l	± 150 mg/l	see prep. instr.
COD Cell Test, 14555	CombiCheck 70, 14689	COD	5000 mg/l	± 400 mg/l	see prep. instr.
COD Cell Test, 09772	CombiCheck 10, 14676	CSB	80 mg/l	± 12 mg/l	see prep. instr.
COD Cell Test, 09773	CombiCheck 20, 14675	CSB	750 mg/l	± 75 mg/l	see prep. instr.
Copper Cell Test, 14553	CombiCheck 30, 14677	Cu	2.00 mg/l	± 0.20 mg/l	19786
Copper Test, 14767	CombiCheck 30, 14677	Cu	2.00 mg/l	± 0.20 mg/l	19786
Cyanide Cell Test, 14561	–	CN	0.250 mg/l*	± 0.030 mg/l	19533
Cyanide Test, 09701	–	CN	0.250 mg/l*	± 0.030 mg/l	19533
Fluoride Cell Test, 14557	–	F	0.75 mg/l*	± 0.08 mg/l	19814
Fluoride Test, 14598	–	F	1.00 mg/l*	± 0.15 mg/l	19814
			10.0 mg/l*	± 1.2 mg/l	19814
Formaldehyde Cell Test, 14500	–	HCHO	5.00 mg/l*	± 0.50 mg/l	see prep. instr.
Formaldehyde Test, 14678	–	HCHO	4.50 mg/l*	± 0.50 mg/l	see prep. instr.
Gold Test, 14821	–	Au	6.0 mg/l*	± 0.6 mg/l	70216
Hardness, see Total Hardness Cell Test					
Hydrazine Test, 09711	–	N_2H_4	1.00 mg/l*	± 0.10 mg/l	see prep. instr.
Hydrogenperoxide Cell Test, 14731	–	H_2O_2	10.0 mg/l*	± 1.0 mg/l	see prep. instr.
Iodine Test, 00606	–	I_2	4.00 mg/l	± 0.40 mg/l	see prep. instr.
Iron Cell Test, 14549	CombiCheck 30, 14677	Fe	1.00 mg/l	± 0.15 mg/l	19781
Iron Cell Test, 14896	–	Fe	25.0 mg/l*	± 2.5 mg/l	19781
Iron Test, 14761	CombiCheck 30, 14677	Fe	1.00 mg/l	± 0.15 mg/l	19781
Iron Test, 00796	CombiCheck 30, 14677	Fe	1.00 mg/l	± 0.15 mg/l	19781
Lead Cell Test, 14833	CombiCheck 40, 14692	Pb	2.00 mg/l	± 0.20 mg/l	19776
Lead Test, 09717	CombiCheck 40, 14692	Pb	2.00 mg/l	± 0.20 mg/l	19776
Magnesium Cell Test, 00815	–	Mg	40.0 mg/l*	± 4.0 mg/l	19788
Manganese Cell Test, 00816	CombiCheck 30, 14677	Mn	1.00 mg/l	± 0.15 mg/l	19789
Manganese Test, 01739	–	Mn	1.00 mg/l	± 0.10 mg/l	19789
Manganese Test, 14770	CombiCheck 30, 14677	Mn	1.00 mg/l	± 0.15 mg/l	19789
Molybdenum Cell Test, 00860	–	Mo	0,50 mg/l*	± 0.05 mg/l	70227
Monochloramine Test, 01632	–	Cl_2	5.00 mg/l	± 0.50 mg/l	see prep. instr.
Nickel Cell Test, 14554	CombiCheck 40, 14692	Ni	2.00 mg/l	± 0.20 mg/l	09989
Nickel Test, 14785	CombiCheck 40, 14692	Ni	2.00 mg/l	± 0.20 mg/l	09989
Nitrate, N1/25	CombiCheck 20, 14675	NO_3-N	9.0 mg/l	± 0.9 mg/l	19811
Nitrate Cell Test, 14542	CombiCheck 20, 14675	NO_3-N	9.0 mg/l	± 0.9 mg/l	19811

Spectroquant® CombiCheck and Standard Solutions

Test kit, Art.	CombiCheck, Art.	Evaluation as	Confidence interval Spec. value for the standard	tolerance	Other standards** Art.
Nitrate Cell Test, 14563	CombiCheck 20, 14675	NO_3-N	9.0 mg/l	± 0.9 mg/l	19811
Nitrate Cell Test, 14764	CombiCheck 80, 14738	NO_3-N	25.0 mg/l	± 2.5 mg/l	19811
Nitrat Cell Test, 00614	–	NO_3-N	100 mg/l	± 10 mg/l	19811
Nitrate Test, 14773	CombiCheck 20, 14675	NO_3-N	9.0 mg/l	± 0.9 mg/l	19811
Nitrate Test, 09713	CombiCheck 20, 14675	NO_3-N	9.0 mg/l	± 0.9 mg/l	19811
Nitrate Cell Test, 14556	CombiCheck 10, 14676	NO_3-N	1.50 mg/l	± 0.15 mg/l	19811
Nitrate Test, 14942	CombiCheck 20, 14675	NO_3-N	8.0 mg/l	± 0.8 mg/l	19811
Nitrite, N4/25	–	NO_2-N	0.300 mg/l*	± 0.030 mg/l	19899
Nitrite Cell Test, 14547	–	NO_2-N	0.300 mg/l*	± 0.030 mg/l	19899
Nitrite Test, 14776	–	NO_2-N	0.50 mg/l*	± 0.05 mg/l	19899
Nitrogen (total) Cell Test, 14537	CombiCheck 50, 14695	N	5.0 mg/l	± 0.7 mg/l	see prep. instr.
Nitrogen (total) Cell Test, 00613	CombiCheck 50, 14695	N	5.0 mg/l	± 0.7 mg/l	see prep. instr.
Nitrogen (total) Cell Test, 14763	CombiCheck 70, 14689	N	50 mg/l	± 7 mg/l	see prep. instr.
Oxygen Cell Test, 14694	–	O_2	–	± 0.6 mg/l	compare with O_2-Sensor
Ozone Test, 00607	–	O_3	4.00 mg/l	± 0.40 mg/l	see prep. instr.
pH Cell Test, 01744	–	pH	7.0	± 0.2	09407
Phenol Cell Test, 14551	–	Phenol	1.25 mg/l*	± 0.13 mg/l	see prep. instr.
Phenol Test, 00856	–	C_6H_5OH	2.50 mg/l	± 0.25 mg/l	see prep. instr.
Phosphate, P4/25	CombiCheck 10, 14676	PO_4-P	0.80 mg/l	± 0.08 mg/l	19898
Phosphate, P5/25	CombiCheck 20, 14675	PO_4-P	8.0 mg/l	± 0.7 mg/l	19898
Phosphate Cell Test, 14543	CombiCheck 10, 14676	PO_4-P	0.80 mg/l	± 0.08 mg/l	19898
Phosphate Cell Test, 14729	CombiCheck 80, 14738	PO_4-P	15.0 mg/l	± 1.0 mg/l	19898
	CombiCheck 20, 14675		8.0 mg/l	± 0.7 mg/l	19898
Phosphat Cell Test, 00616	–	PO_4-P	50.0 mg/l*	± 5.0 mg/l	19898
Phosphate Test, 14848	CombiCheck 10, 14676	PO_4-P	0.80 mg/l	± 0.08 mg/l	19898
Phosphate Test, 00798	–	PO_4-P	50.0 mg/l*	± 5.0 mg/l	19898
Phosphate Cell Test, 14546	–	PO_4-P	15.0 mg/l*	± 1.0 mg/l	19898
Phosphate Test, 14842	–	PO_4-P	15.0 mg/l*	± 1.0 mg/l	19898
Potassium Cell Test, 14562	–	K	25.0 mg/l*	± 4.0 mg/l	70730
Potassium Cell Test, 00615	–	K	150 mg/l*	± 15 mg/l	70730
Residual Hardness Cell Test, 14683	–	Ca	2.50 mg/l	± 0.30 mg/l	19778
Silicate (Silicic Acid) Test, 14794	–	Si	2.50 mg/l*	± 0.25 mg/l	70236
	–		0.375 mg/l*	± 0.040 mg/l	70236
Silicate (Silicic Acid) Test, 00857	–	Si	25.0 mg/l*	± 2.5 mg/l	70236
Silver Test, 14831	–	Ag	1.50 mg/l*	± 0.20 mg/l	19797
Sodium Cell Test, 00885	–	Na	100 mg/l*	± 10 mg/l	see prep. instr.
Sulfate Cell Test, 14548	CombiCheck 10, 14676	SO_4	100 mg/l	± 15 mg/l	19813
Sulfat Cell Test, 00617	CombiCheck 10, 14676	SO_4	100 mg/l	± 15 mg/l	19813
Sulfate Cell Test, 14564	CombiCheck 20, 14675	SO_4	500 mg/l	± 75 mg/l	19813
Sulfate Test, 14791	CombiCheck 10, 14676	SO_4	100 mg/l	± 15 mg/l	19813
Sulfide Test, 14779	–	S	0.75 mg/l*	± 0.08 mg/l	see prep. instr.
Sulfite Cell Test, 14394	–	SO_3	12.5 mg/l*	± 1.5 mg/l	see prep. instr.
Sulfite Test, 01746	–	SO_3	30.0 mg/l	± 1.0 mg/l	see prep. instr.
Surfactants (anionic) Cell Test, 14697	–	MBAS	1.00 mg/l*	± 0.20 mg/l	see prep. instr.
Surfactants (cationic) Cell Test, 01764	–	k-Ten	1.00 mg/l*	± 0.10 mg/l	see prep. instr.
Surfactants (nonionic) Cell Test, 01787	–	n-Ten	4.00 mg/l*	± 0.40 mg/l	see prep. instr.
Tin Cell Test, 14622	–	Sn	1.25 mg/l*	± 0.13 mg/l	70242
TOC Cell Test, 14878	–	TOC	40.0 mg/l*	± 3.0 mg/l	09017
TOC Cell Test, 14879	–	TOC	400 mg/l*	± 30 mg/l	09017
Total Hardness Cell Test, 00961	–	Ca	75 mg/l*	± 7 mg/l	19778
Volatile Organic Acids Cell Test, 01763	–	HOAc	1500	± 80	see prep. instr.
Zinc Cell Test, 00861	–	Zn	0.500 mg/l	± 0.050 mg/l	19806
Zinc Cell Test, 14566	CombiCheck 40, 14692	Zn	2.00 mg/l	± 0.40 mg/l	19806
Zinc Test, 14832	–	Zn	1.25 mg/l*	± 0.20 mg/l	19806

* Self prepared, recommended concentration
** c = 1000 mg/l analyte

Instructions for the Preparation of Standard Solutions

Standard solution of acid capacity

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 stock solution by diluting accordingly.

▼

Stability:
When stored in a cool place (refrigerator), the diluted investigational solutions remain stable for one week.

▼

Reagents required:

1.09141.1000	Sodium hydroxide solution 0.1 mol/l
1.16754.9010	Water GR for analysis

Standard solution of bromine acc. to DIN EN ISO 7393

Preparation of a KIO_3 stock solution:
Dissolve 1.005 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 8.90 ml of the KIO_3 stock solution to a calibrated or conformity-checked 1000-ml volumetric flask, add approx. 1g of KI and make up to the mark with distilled water.
1 ml of this solution is equivalent to 0.020 mg of bromine.

▼

Preparation of the bromine standard solution:

Pipette 10 ml 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 2.00 mg/l bromine.

▼

Stability:
The KIO_3 stock solution remains stable for 4 weeks when stored in a cool place. The KIO_3/KI standard solution can be used for 5 hours when stored in a cool place. The dilute bromine standard solution is not stable and must be used immediately.

▼

Reagents required:

1.02404.0100	Potassium iodate, volum. standard
1.05043.0250	Potassium iodide GR for analysis
1.09072.1000	Sulfuric acid 0.5 mol/l
1.09136.1000	Sodium hydroxide solution 2 mol/l
1.16754.9010	Water GR for analysis

Instructions for the Preparation of Standard Solutions

Standard solution of free chlorine

Preparation of a stock solution of free chlorine:
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 for free chlorine:
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% GR. and 3 g of potassium iodide. Close the conical flask with the ground-glass stopper, mix thoroughly, and leave to stand for 5 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.

▼

Calculation:

1 ml sodium thiosulfate solution = 3.55 mg free chlorine

Further investigational concentrations may be prepared from the stock solution prepared according to the procedure described above by diluting accordingly.

▼

Stability:
When stored in a cool place (refrigerator), the stock solution remains stable for approximately one week. The diluted investigational solutions are stable for approximately 2 hours.

▼

Reagents required:

1.00316.1000	Hydrochloric acid 25 % GR for analysis
1.05614.9025	Sodium hypochlor. solution techn. approx. 13 % active chlorine
1.09147.1000	Sodium thiosulfate solution 0.1 mol/l 0.1 N solution
1.05043.0250	Potassium iodide GR for analysis
1.05445.0500	Zinc iodide-starch solution GR for analysis
1.16754.9010	Water GR for analysis

Standard solution of free chlorine

Preparation of a standard solution:
Dissolve 1.85 g of dichloroisocyanuric acid, sodium salt, GR with distilled water in 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 1000 mg/l free chlorine.

Further investigational concentrations may be prepared from this stock solution by diluting accordingly.

▼

Stability:
When stored in a cool place (refrigerator), the stock solution and the diluted investigational solutions remain stable for one day.

▼

Reagents required:

1.02426.0250	Dichloroisocyanuric acid, sodium salt, GR for analysis
1.16754.9010	Water GR for analysis

Standard solution of total chlorine

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 stock solution prepared according to this procedure has a concentration of 1000 mg/l total chlorine.

Further investigational concentrations may be prepared from this stock solution by diluting accordingly.

▼

Stability:
When stored in a cool place (refrigerator), the stock solution and the diluted investigational solutions remain stable for one day.

▼

Reagents required:

1.02426.0250	Chloramine T GR for analysis
1.16754.9010	Water GR for analysis

Standard solution of chlorine dioxide acc. to DIN EN ISO 7393

Preparation of a KIO_3 stock solution:
Dissolve 1.005 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 10.5 ml of the KIO_3 stock solution to a calibrated or conformity-checked 1000-ml volumetric flask, add approx. 1g of KI and make up to the mark with distilled water.
1 ml of this solution is equivalent to 0.020 mg of chlorine dioxide.

▼

Preparation of the chlorine dioxide standard solution:

Pipette 10 ml 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 2.00 mg/l chlorine dioxide.

▼

Stability:
The KIO_3 stock solution remains stable for 4 weeks when stored in a cool place. The KIO_3/KI standard solution can be used for 5 hours when stored in a cool place. The dilute chlorine dioxide standard solution is not stable and must be used immediately.

▼

Reagents required:

1.02404.0100	Potassium iodate, volum. standard
1.05043.0250	Potassium iodide GR for analysis
1.09072.1000	Sulfuric acid 0.5 mol/l
1.09136.1000	Sodium hydroxide solution 2 mol/l
1.16754.9010	Water GR for analysis

Standard solution of COD

Preparation of a standard solution:
Dissolve 0.850 g of potassium hydrogen phthalate GR in 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 1000 mg/l COD.

Further investigational concentrations may be prepared from this stock solution by diluting accordingly.

▼

Stability:
When stored in a cool place (refrigerator), the stock solution remains stable for one month. When stored under appropriate cool conditions (refrigerator), the diluted investigational solutions remain stable – depending on the respective concentration – for approximately one week to one month.

▼

Reagents required:

1.02400.0080	Potassium hydrogen phthalate GR for analysis, volumetric standard
1.16754.9010	Water GR for analysis

Standard solution of formaldehyde

Preparation of a stock solution:
In a calibrated or conformity-checked 1000-ml volumetric flask make up 2.50 ml of formaldehyde solution min. 37 % GR to the mark with distilled water. The stock solution prepared according to this procedure has a concentration of approximately 1000 mg/l formaldehyde.

▼

Precise assay of the standard solution (stock solution) for formaldehyde:
Pipette 40.0 ml (full pipette) of the formaldehyde stock solution of approximately 1000 mg/l into a 300-ml ground-glass conical flask, and add 50.0 ml (buret) of iodine solution 0.05 mol/l and 20 ml of sodium hydroxide solution 1 mol/l.

Leave to stand for 15 minutes and subsequently add 8 ml of sulfuric acid 25 % GR. Add 1 ml of zinc iodide-starch solution and subsequently titrate to the end point with sodium thiosulfate solution 0.1 mol/l.

▼

Calculation of the exact content of the formaldehyde solution:
C1 = consumption of sodium thiosulfate solution 0.1 mol/l
C2 = quantity of iodine solution 0.05 mol/l

$$mg/l\ Formaldehyde = (C2 - C1) \times 37.525$$

Further investigational concentrations may be prepared from the stock solution exactly determined according to the procedure described above by diluting accordingly.

▼

Stability:
When stored in a cool place (refrigerator), the stock solution remains stable for one week. After this time, the stock solution must be determined anew and the corresponding value must be duly accounted for in the further use. The diluted investigational solutions must be used immediately.

▼

Reagents required:

1.04003.1000	Formaldehyde solution min. 37 % GR for analysis
1.09099.1000	Iodine solution 0.05 mol I2/l 0.1 N solution
1.09147.1000	Sodium thiosulfate solution 0.1 mol/l 0.1 N solution
1.09137.1000	Sodium hydroxide solution 1 mol/l 1 N solution
1.00716.1000	Sulfuric acid 25 % GR for analysis
1.05445.0500	Zinc iodide-starch solution GR for analysis
1.16754.9010	Water GR for analysis

Standard solution of hydrazine

Preparation of a standard solution:
Dissolve 4.07 g of hydrazinium sulfate GR with oxygen-low (boil previously) distilled water in 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 1000 mg/l hydrazine.

Further investigational concentrations may be prepared from this stock solution by diluting accordingly.

▼

Stability:
When stored in a cool place (refrigerator), the stock solution and the further diluted investigational solutions remain stable for one day.

▼

Reagents required:

1.04603.0100	Hydrazinium sulfate GR for analysis
1.16754.9010	Water GR for analysis

Instructions for the Preparation of Standard Solutions

Standard solution of hydrogen peroxide

Preparation of a stock solution:
Place 10 ml of Perhydrol 30 % H_2O_2 GR in a calibrated or conformity-checked 100-ml volumetric flask and make up to the mark with distilled water. Transfer 30 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 approximately 1000 mg/l hydrogen peroxide.

▼

Precise assay of the standard solution (stock solution) for hydrogen peroxide:
Pipette 50.0 ml (full pipette) of the hydrogen peroxide stock solution of approx. 1000 mg/l into a 500-ml conical flask, dilute with 200 ml of distilled water, and add 30 ml of sulfuric acid 25 % GR. Titrate with a 0.02 mol/l potassium permanganate solution until the colour changes to pink.

▼

Calculation of the exact content of the hydrogen peroxide concentration:

Consumption of potassium permanganate (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.

▼

Stability:
When stored in a cool place (refrigerator), the stock solution and the further diluted investigational solutions remain stable for one day.

▼

Reagents required:

1.09122.1000	Potassium permanganate solution 0.02 mol/l 0.1 N
1.07209.0250	Perhydrol 30 % GR for analysis
1.00716.1000	Sulfuric acid 25 % GR for analysis
1.16754.9010	Water GR for analysis

Standard solution of iodine acc. to DIN EN ISO 7393

Preparation of a KIO_3 stock solution:
Dissolve 1.005 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 5.60 ml of the KIO_3 stock solution to a calibrated or conformity-checked 1000-ml volumetric flask, add approx. 1g of KI and make up to the mark with distilled water.
1 ml of this solution is equivalent to 0.020 mg of iodine.

▼

Preparation of the iodine standard solution:

Pipette 10 ml 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 2.00 mg/l iodine.

▼

Stability:
The KIO_3 stock solution remains stable for 4 weeks when stored in a cool place. The KIO_3/KI standard solution can be used for 5 hours when stored in a cool place. The dilute iodine standard solution is not stable and must be used immediately.

▼

Reagents required:

1.02404.0100	Potassium iodate, volum. standard
1.05043.0250	Potassium iodide GR for analysis
1.09072.1000	Sulfuric acid 0.5 mol/l
1.09136.1000	Sodium hydroxide solution 2 mol/l
1.16754.9010	Water GR for analysis

Standard solution monochloramine

Preparation of a standard solution:
Place 5.0 ml of chlorine standard solution and 10.0 ml ammonium standard solution in a calibrated or conformity-checked 100-ml volumetric flask and make up to the mark with distilled water.
The 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 solution must be used immadiately.

▼

Reagents required:

	Chlorine standard solution 100 mg/l Cl_2 Preparation see preparation instruction free chlorine with hypochlorite solution
	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 GR for analysis

Standard solution of total nitrogen

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 stock solution prepared according to this procedure has a concentration of 1000 mg/l total nitrogen.

Further investigational concentrations may be prepared from this stock solution by diluting accordingly.

▼

Stability:
When stored in a cool place (refrigerator), the stock solution remains stable for one week. The diluted investigational concentrations must be used immediately.

▼

Reagents required:

1.04201.0100	Glycine GR for analysis
1.16754.9010	Water GR for analysis

Standard solution of ozone acc. to DIN EN ISO 7393

Preparation of a KIO_3 stock solution:
Dissolve 1.005 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 14.8 ml of the KIO_3 stock solution to a calibrated or conformity-checked 1000-ml volumetric flask, add approx. 1g 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 20 ml 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 2.00 mg/l ozone.

▼

Stability:
The KIO_3 stock solution remains stable for 4 weeks when stored in a cool place. The KIO_3/KI standard solution can be used for 5 hours when stored in a cool place. The dilute ozone standard solution is not stable and must be used immediately.

▼

Reagents required:

1.02404.0100	Potassium iodate, volum. standard
1.05043.0250	Potassium iodide GR for analysis
1.09072.1000	Sulfuric acid 0.5 mol/l
1.09136.1000	Sodium hydroxide solution 2 mol/l
1.16754.9010	Water GR for analysis

Instructions for the Preparation of Standard Solutions

Standard solution of phenol

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 stock solution prepared according to this procedure has a concentration of 1000 mg/l phenol.

Further investigational concentrations may be prepared from this stock solution by diluting accordingly.

▼

Stability:
When stored in a cool place (refrigerator), the stock solution remains stable for one week. The diluted investigational solutions must be used immediately.

▼

Reagents required:

1.00206.0250	Phenol GR for analysis
1.16754.9010	Water GR for analysis

Standard solution of sodium

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 stock solution by diluting accordingly.

▼

Stability:
When stored in a cool place (refrigerator), the diluted investigational solutions remain stable for one month.

▼

Reagents required:

1.19897.0500	Chloride standard solution CertiPur®
1.16754.9010	Water GR for analysis

Standard solution of sulfide

Preparation of a stock solution:
Dissolve 7.2 g of glass-clear, if necessary washed crystals of sodium sulfide hydrate approx. 35 % 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 standard solution (stock solution) for sulfide:
Place 100 ml of distilled water and 5 ml (full pipette) of sulfuric acid 25 % GR in a 500-ml ground-glass conical flask. To this solution add 25.0 ml (full pipette) of the sulfide stock solution of approx. 1000 mg/l and 25.0 ml (full pipette) of iodine solution 0.05 mol/l. Shake the contents of the flask thoroughly for about one minute, 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 of the exact content of the sulfide solution:
C1 = consumption of sodium thiosulfate 0.1 mol/l
C2 = quantity of iodine solution 0.05 mol/l (25.0 ml)

$$mg/l\ sulfide = (C2 - C1) \times 64{,}1026$$

Further investigational concentrations may be prepared from the stock solution exactly determined according to the procedure described above by diluting accordingly.

▼

Stability:
When stored in a cool place (refrigerator), the stock solution remains stable for at most one day. The diluted investigational solutions must be used immediately.

▼

Reagents required:

1.09099.1000	Iodine solution 0.05 mol I2/l 0.1 N solution
1.06638.0250	Sodium sulfide hydrate approx. 35 % GR for analysis
1.09147.1000	Sodium thiosulfate solution 0.1 mol/l 0.1 N solution
1.00716.1000	Sulfuric acid 25 % GR for analysis
1.05445.0500	Zinc iodide-starch solution GR for analysis
1.16754.9010	Water GR for analysis

Standard solution sulfite

Preparation of a standard solution:
Dissolve 1.57 g of sodium sulfite GR 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 stock solution prepared according to this procedure has a concentration of 1000 mg/l sulfite.

Further investigational concentrations may be prepared from this stock solution by diluting accordingly.

▼

Stability:
When stored in a cool place (refrigerator), the stock solution remains stable for only one day.

▼

Reagents required:

1.06657.0500	Sodium sulfite GR for analysis
1.08418.0100	Titriplex® III GR for analysis
1.16754.9010	Water GR for analysis

Standard solution of anionic surfactants

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 stock solution prepared according to this procedure has a concentration of 1000 mg/l anionic surfactants.

Further investigational concentrations may be prepared from this stock solution by diluting accordingly.

▼

Stability:
When stored in a cool place (refrigerator), the stock solution remains stable for one month. The diluted investigational solutions must be used immediately.

▼

Reagents required:

1.12146.0005	Sodium 1-dodecanesulfonate
1.16754.9010	Water GR for analysis

Standard solution of cationic surfactants

Preparation of a standard solution:
Dissolve 1.00 g of N-cetyl-N,N,N-trimethyl-ammonium 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 stock solution prepared according to this procedure has a concentration of 1000 mg/l cationic surfactants.

Further investigational concentrations may be prepared from this stock solution by diluting accordingly.

▼

Stability:
When stored in a cool place (refrigerator), the stock solution remains stable for one month. The diluted investigational solutions must be used immediately.

▼

Reagents required:

1.02342.0100	N-cetyl-N,N,N-trimethylammonium bromide GR for analysis
1.16754.9010	Water GR for analysis

Instructions for the Preparation of Standard Solutions

Standard solution of nonionic surfactants

Preparation of a standard solution:
Dissolve 1.00 g of Triton® X-100 with distilled water in 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 1000 mg/l nonionic surfactants.

Further investigational concentrations may be prepared from this stock solution by diluting accordingly.

▼

Stability:
When stored in a cool place (refrigerator), the stock solution remains stable for one week. The diluted investigational solutions must be used immediately.

▼

Reagents required:

1.12298.0101	Triton® X-100
1.16754.9010	Water GR for analysis

Standard solution of volatile organic acids

Preparation of a standard solution:
Dissolve 3.40 g of sodium acetate trihydrate GR with distilled water in 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 1500 mg/l acetic acid.

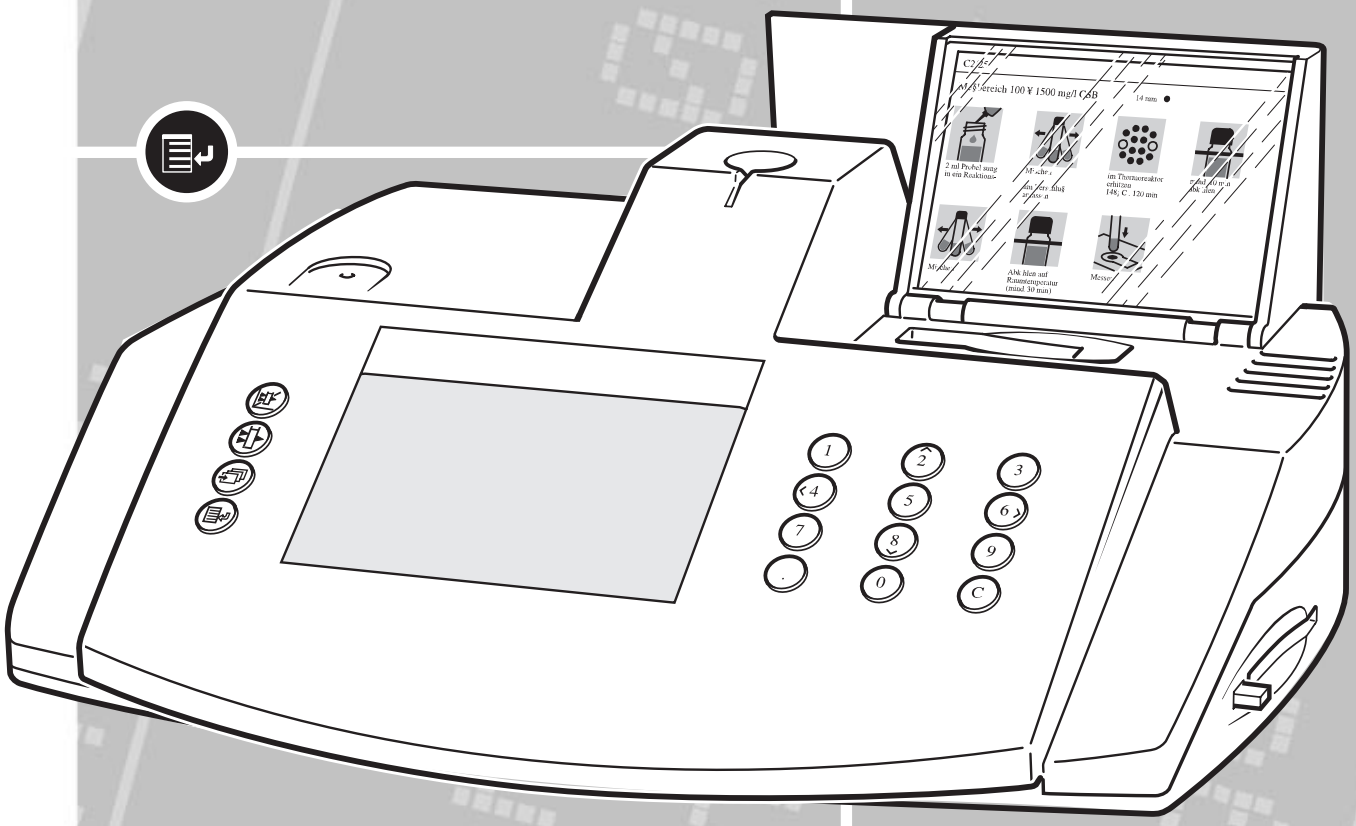
▼

Stability:
When stored in a cool place (refrigerator), the stock solution remains stable for one week.

▼

Reagents required:

1.06267.0500	Sodium acetate trihydrate GR for analysis
1.16754.9010	Water GR for analysis



Functional description

Edition date 04/2004 Order no. ba41111e08

Notes on this functional description

Read part 1 **General information** of this operating manual before starting to work with the photometer.

- To ensure that you become rapidly acquainted with your photometer, the first chapter contains an overview of the instrument.
- The second chapter contains notes for the safe operation of the meter.
- Chapter 3 describes the commissioning of the photometer
- Chapter 4 shows a short manual with the most important operating steps
- The remaining chapters provide a comprehensive description of the functions and technical data of the photometer.

Symbols used

Warning

indicates safety instructions that must be followed – for your own safety and the safety of others.

Caution

indicates notes that you must read to protect your instrument from being damaged.

indicates notes that make working easier or draw your attention to special features.

→ indicates instructions to do something

Warranty

The designated meter is covered by a warranty of 2 years from the date of purchase.
The meter warranty extends to manufacturing faults that are determined within the period of warranty. The warranty excludes components that are replaced during maintenance, such as batteries, accumulators, lamps etc.

The warranty claim extends to restoring the meter to readiness for use but not, however, to any further claim for damages. Improper handling or unauthorized opening of the instrument invalidates any warranty claim.

To ascertain the warranty liability, return the meter and proof of purchase together with the date of purchase freight paid or prepaid.

General information

Accuracy when going to press

The use of advanced technology and the high quality standard of our instruments are the result of continuous development. This may result in differences between this operating manual and your meter. We cannot guarantee that there are absolutely no errors in this manual. We are sure you will understand that we cannot accept any legal claims resulting from the data, figures or descriptions. The information in this manual is subject to change without notice.

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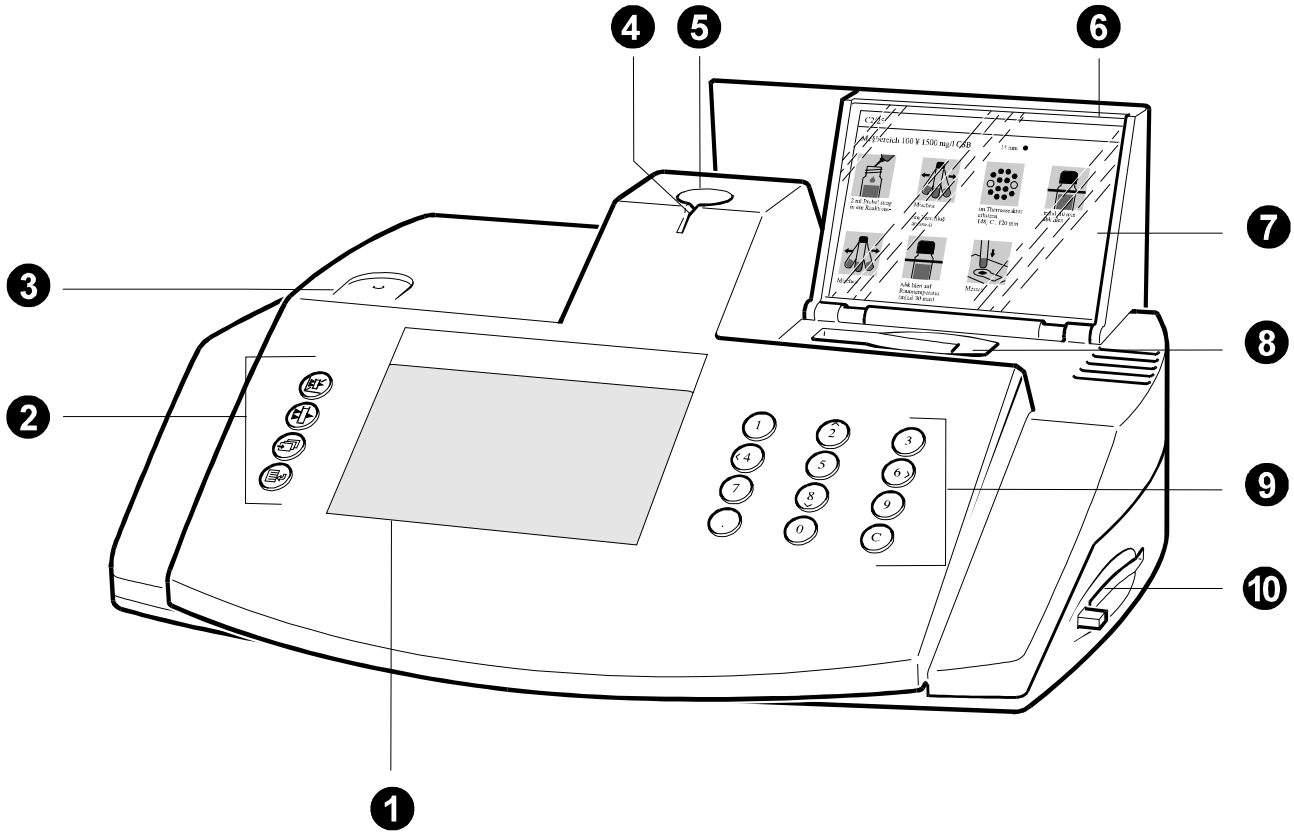
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1.1 Description of the operating elements



1. Display
2. Function keys
3. Recess for MemoChip
4. Notch for cell alignment
5. Round cell shaft
6. Analysis specifications (short form)
7. Cover with integrated on/off switch
8. Rectangular cell shaft
9. Keypad with softkeys 1 ‹4 7 .
10. Opening for Memory Card

1.2 Keys

Function keys:



Concentration measurement key:
Call up the concentration measurement mode



Absorbance/Transmission measurement key:
Call up the Absorbance/Transmission measuring mode



Scroll key:
Select menu items, scroll



Call up/Enter key:
Call up menu items, confirm inputs, start measuring, switch to the configuration menu from the measuring mode

Keypad:



Enter the number 1, softkey (see section 1.3.2)



Enter the number 2, move the cursor upward



Enter the number 3



Enter the number 4, move the cursor one digit to the left, softkey (see section 1.3.2)



Enter the number 5



Enter the number 6, move the cursor one digit to the right



Enter the number 7, softkey (see section 1.3.2)



Enter the number 8, move the cursor downward



Enter the number 9



Enter the point in decimal numbers, softkey (see section 1.3.2)



Enter the number 0



Input correction key: Move the cursor one digit back in order to correct inputs

1.3 Operation

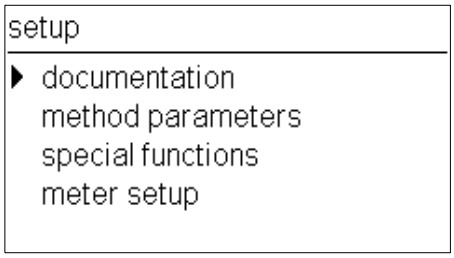
In this section, only the principles of the operation are explained.
Please commission the photometer according to chapter 3 COMMISSIONING before trying out the operation.

1.3.1 Selecting and calling up the menu items

→ Starting point: *Concentration* or *Absorbance/ Transmission* measuring mode.

→ Press ..

The following display appears:

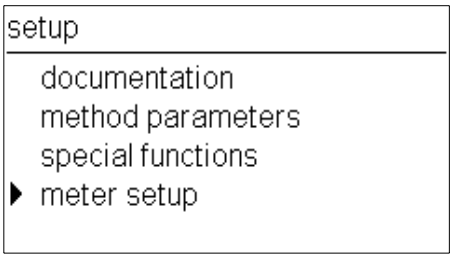


Example:
The *documentation* menu item is preselected in the *setup* menu (▶).

→ Select a menu item, e. g. *meter setup*:

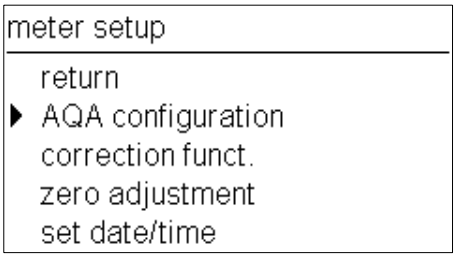
Press or 2 8 until the arrow (▶) is in front of the required menu item.

The following display appears:



The *meter setup* menu item is preselected (▶).

→ Call up the *meter setup* menu item by pressing .



Select the required menu item with

→ or 2 8

→ confirm with .

Selection lists:

- Changes to the settings are accepted after confirmation by pressing 
- Current settings are marked by "+"
- Change to other configuration levels by
  – Selecting the menu item, *return*
  – Pressing .
- Scroll/select by pressing  or .

Character input:

→ Using the numeric keypad or by  where the digit to be entered is shown in reverse video

→ Confirm the input using .

Instructions to do something:

Instructions to do something are marked by an arrow, as for example:

→ Enter the factor via the numeric keypad or using 

→ Confirm the input using .

Lists:

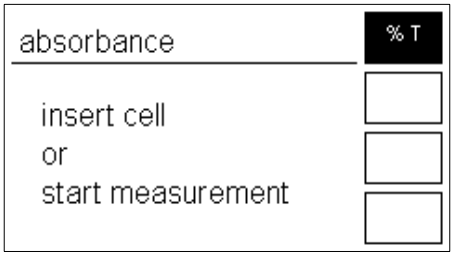
Lists are marked by points, as for example:

- Wavelength
- Cell type
- Method designation

1.3.2 Actuating the softkeys

At some function levels, function fields appear in the display with different functions and labels in each case. These fields are actuated by the adjacent key of the keypad, the so-called softkeys 1 4 7 .

Sample displays:

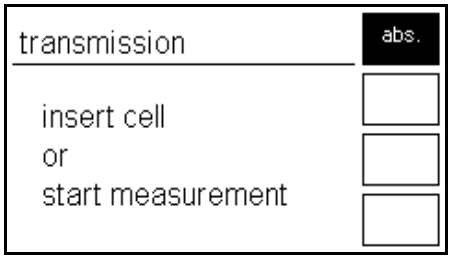


Softkeys to operate the function fields:

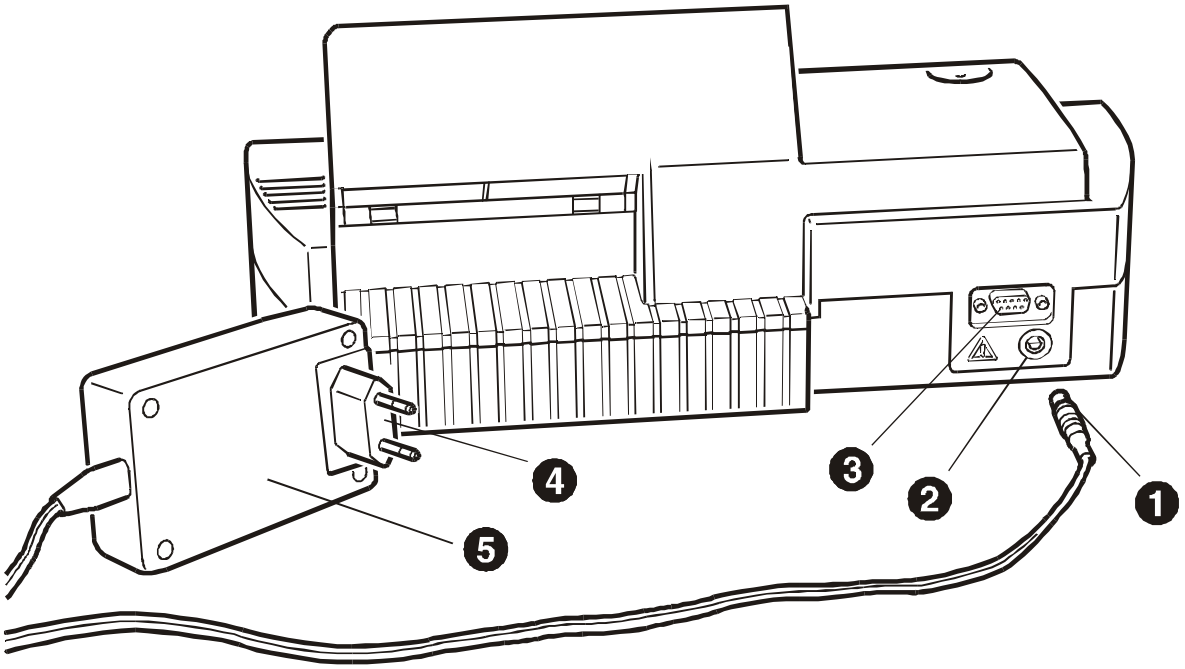
The keys that have a function field next to them (in this example 1) act as softkeys to actuate the function fields. They lose their original function. If the function field next to the softkey is merely framed, the original function of the key is retained, as shown here in the keys 4 7 .

To switch to the transmission measuring mode:

→ Press 1.



1.4 Identifying the connectors



1. Plug of the power supply unit
2. Socket for the power supply unit
3. RS 232 Serial interface
4. Line adaptor
5. Plug-in power supply unit

This operating manual contains basic instructions to be followed in the commissioning, operation and maintenance of the meter. Consequently, all responsible personnel must read this operating manual before working with the meter.

The operating manual must always be available in the vicinity of the meter.

2.1 Target group

The photometer was developed for use in the laboratory.
Thus, we assume that, as a result of their professional training and experience, the operators will know the necessary safety precautions to take when handling chemicals.

The personnel responsible for the commissioning, operation and maintenance must have the necessary qualifications for this work. If the personnel do not have the required skills they have to be instructed.

Furthermore, it must be ensured that the personnel read and completely understand the present operating manual.

2.2 Authorized use

The photometer is authorized exclusively for analyzing substances in water and aqueous solutions using round cells or rectangular cells (optical special glass) according to this operating manual. Observe the technical specifications of the cells according to chapter 19 TECHNICAL DATA.

Only the operation and running of the photometer according to the instructions in this operating manual is authorized. Any other use is unauthorized.

2.3 General instructions

The photometer is constructed and tested according to the EN 61010-1 safety regulations for electronic measuring instruments. It left the factory in a safe and secure technical condition.

The smooth functioning and operational safety of the photometer can only be guaranteed if the generally applicable safety measures and the specific safety instructions in this operating manual are followed during operation. The smooth functioning and operational safety of the photometer can only be guaranteed under the climatic conditions specified in chapter 19 TECHNICAL DATA of this operating manual.

Opening the photometer or adjustment, maintenance and repair work must only be performed by personnel authorized by the manufacturer. The only exceptions to this are the activities described in chapter 17 MAINTENANCE AND CLEANING. Unauthorized modifications and changes of the photometer are not allowed.

Non-compliance results in the loss of warranty claims.

Follow the points listed below when operating the photometer:

- For safety reasons, only use the plug-in power supply unit supplied (see chapter 19 TECHNICAL DATA)
- Connect the plug-in power supply unit with the mains so that it is easily accessible and the photometer can easily be separated from the mains
- Ensure that the ventilation slots on the photometer remain unblocked

Warning

Observe the notes supplied with the reagents and accessories (safety instructions, protective measures, application, handling, disposal etc.)!

Warning

Observe the regulations when dealing with dangerous substances

- Follow the operating instructions at the workplace
- Use only original spare parts.

2.3.1 Designation of notes

Warning

indicates safety instructions that must be followed – for your own safety and the safety of others.

Caution

indicates notes that you must read to protect your instrument from being damaged.

indicates notes that make working easier or draw your attention to special features.

2.3.2 Dangers of disregarding the safety instructions

Disregarding the safety instructions can adversely affect the safety of both the user and the environment as well as the equipment.

Non-compliance with the safety instructions will result in the loss of any warranty claims.

2.3.3 Safe operation

It is the responsibility of the operator to continuously observe the overall technical condition (externally recognizable deficits and damage as well as alterations to the operational behavior) of the meter.

If safe operation is no longer possible, the equipment must be taken out of service and secured against inadvertent operation.

Safe operation is no longer possible if

- the equipment has been damaged in transport
- the equipment has been stored under adverse conditions for a lengthy period of time
- the equipment is visibly damaged
- the equipment no longer operates as prescribed
- the authorized use is no longer possible.

If you are in any doubt, please contact the supplier of the photometer.

2.3.4 Disposal

The photometer is sent out in a protective transport packing.
We recommend: Keep the packing material. The original packing protects the photometer against damage during transport.

Dispose of the photometer as electronic waste at an appropriate collection point.
It is illegal to dispose of it in household refuse.

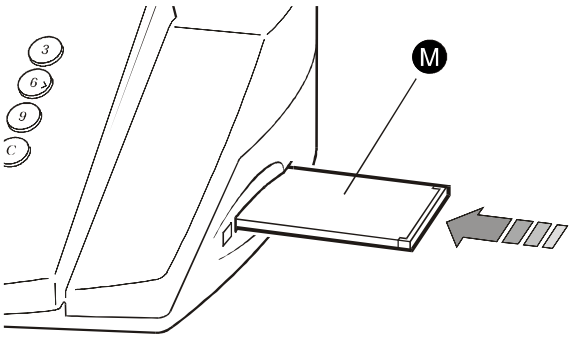
The photometer operates at an environmental temperature of + 5 °C to + 35 °C. During transport from cold to warm surroundings, condensation can form resulting in the malfunction of the meter. Before putting the photometer into service, wait until it has adapted to the new environmental conditions (see also chapter 19 TECHNICAL DATA).

The photometer is a sensitive measuring instrument. Take this into consideration when choosing the surroundings. Especially avoid vapors and gases that might attack mechanical, optical and electronical components of the photometer.
Do not do anything to the photometer that you would not do to your hightec camera.

3.1 Preparing the photometer

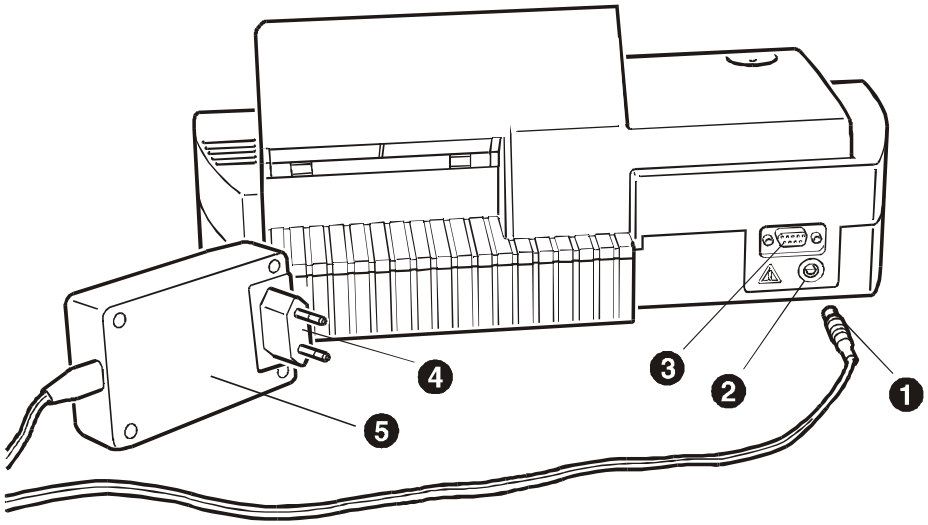
Caution

Place the photometer on a hard, flat surface and protect it against intensive light and heat.

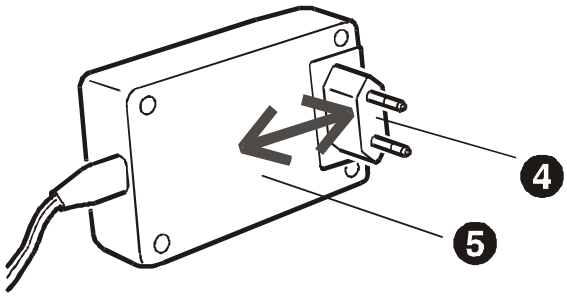


→ Insert the Memory Card Ⓜ into the lateral opening at the photometer up to the stop. The label with the type designation and software version must point upwards.

The Memory Card contains all data relevant for the operation of the photometer.



→ Connect the plug ❶ of the plug-in power supply unit supplied to the socket ❷ of the photometer

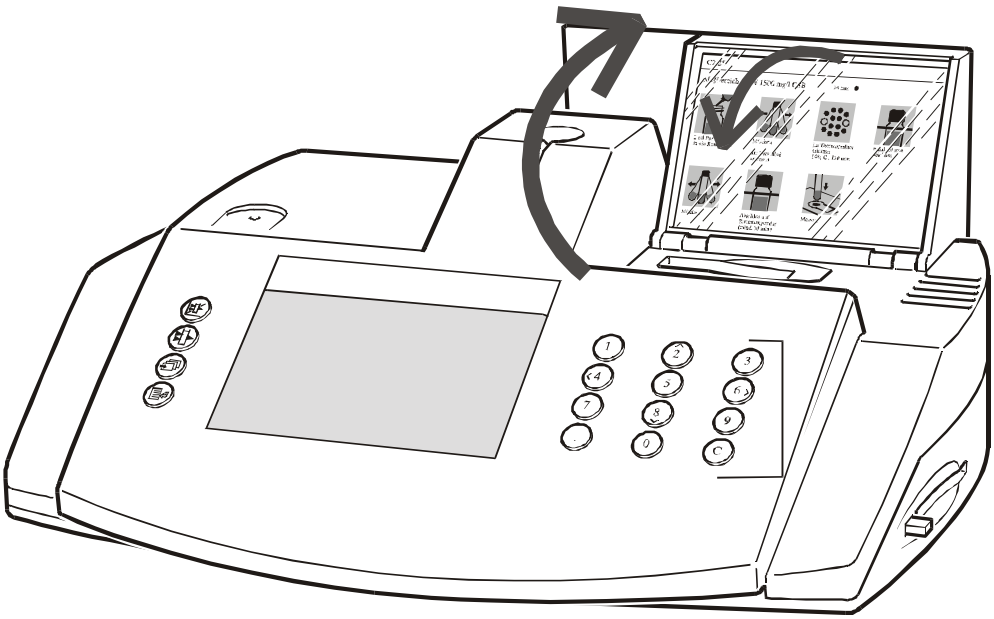


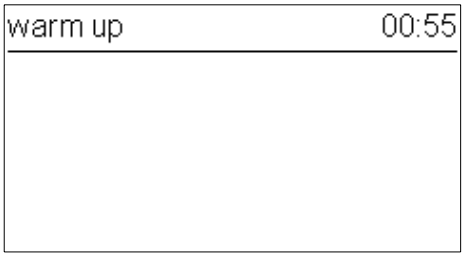
→ Plug the suitable adaptor ❹ onto the plug-in power supply unit ❺ . By pushing the adaptor upwards, it can be removed and replaced by a different one if necessary (see arrow)

→ Plug the plug-in power supply unit into the mains socket. An adjustment to the respective line voltage is not necessary.

3.2 Switching on the photometer

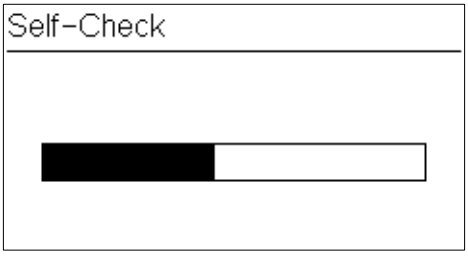
→ To switch on the photometer, open the cover.
→ Insert the cards with the analysis specifications into the compartment in the cover. To do so, pull out the transparent lid, insert the cards and push the lid back again.





The 15 minutes warm-up time of the photometer runs. The clock shows the countdown so that the remaining warm-up time is displayed. The meter always requires this warm-up time, even if it has only been switched off for a brief period.

after 15 minutes:



Self-check of the photometer: The photometer performs a check (SelfCheck, including AutoCheck) of the entire system and then switches automatically to the concentration measuring mode.

The AutoCheck function automatically checks and calibrates the optical measuring unit. To do this, the photometer performs cyclical measurements without a cell.

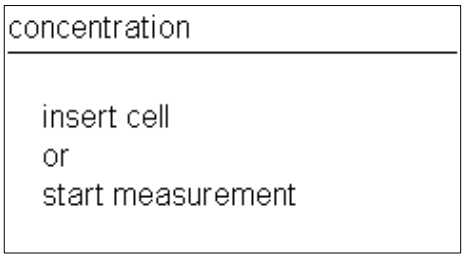
The photometer checks whether the signal level of the optical unit in the meter lies within the allowable tolerances. Furthermore, the photometric zero point of the meter is calibrated.

After the warm-up time, the first AutoCheck is performed as part of the SelfCheck. From this point in time, the AutoCheck is repeated every 5 minutes as long as no cell is inserted in the cell shaft. If an AutoCheck cannot be performed because a cell is inserted, it is automatically repeated as soon as the cell is removed.

During the measurement of the kinetic (see section 10.2 KINETICS), the photometer cannot perform an AutoCheck due to the inserted cell. Thus, you must wait for a warm-up period of 2 hours in this case.

After this time, the stability of the signals is so high that the measuring accuracy is retained over longer periods of time even without an AutoCheck.

After 5 seconds:



Automatic change to the *concentration* measuring mode

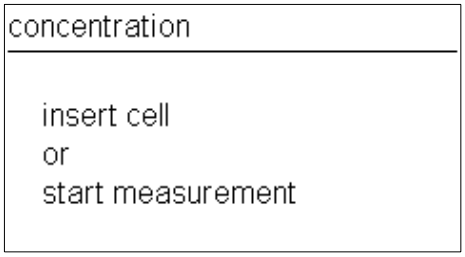
→ To switch off the photometer, close the cover.

The short manual lists all of the steps necessary to determine the concentration of a sample and to activate AQA2 at a glance (AQA = Analytical Quality Assurance; AQA2 = Check of the entire system).

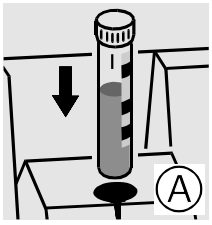
→ Put the photometer into operation (see chapter 3 COMMISSIONING).

4.1 Measuring the concentration

→ To switch on the photometer, open the cover. After the 15 minutes warm-up time (clock display shows countdown) the photometer performs a SelfCheck of the entire system and automatically switches to the *concentration* measuring mode.

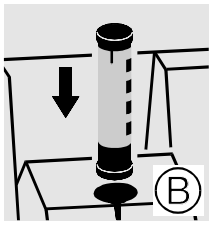


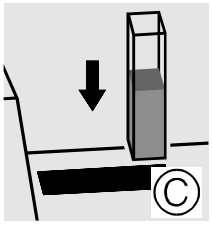
Measuring mode, *concentration*



→ Insert the round cell with barcode containing the prepared sample Ⓐ into the round cell shaft until it clicks into place

or

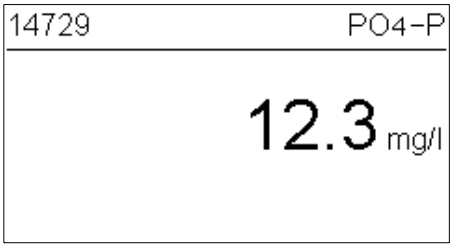




→ First insert the AutoSelector Ⓑ into the round cell shaft, then insert the rectangular cell containing the prepared sample Ⓒ into the rectangular cell shaft.

→ Align the line mark to the notch of the photometer.

If the *select method* menu is displayed, align the line mark of the round cell or AutoSelector to the notch of the photometer.



The measured value appears on the display.

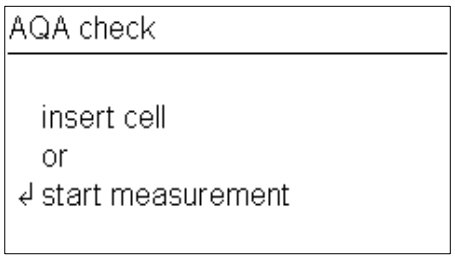
→ Repeat the measurement: Press .

The duration of the measurement depends on the measured value. The maximum duration is 10 s.

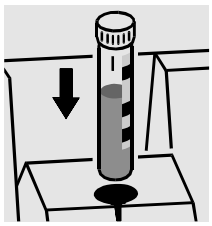
4.2 Checking the system (AQA2)

→ Place the AQA MemoChip in the recess on the photometer. The following display appears:





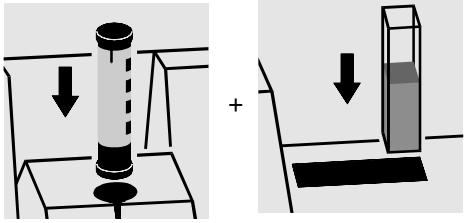
The action of placing the AQA MemoChip in the recess directly activates the AQA check without having to press any key.



→ Insert a cell with the prepared standard solution that is ready to be measured (e. g. using the Spectroquant® CombiCheck).

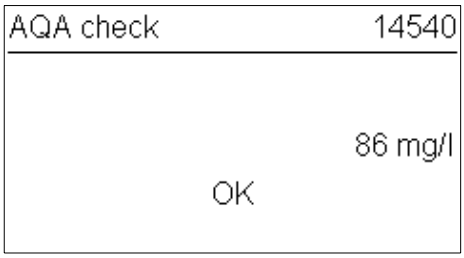
The photometer reads the barcode, identifies the method and performs the AQA check.

or



Standard concentrations ready to use and tolerances are listed in the table SPECTROQUANT® COMBICHECK AND STANDARD SOLUTIONS in the first part of this operating manual, **General information**.

After the measurement is finished:

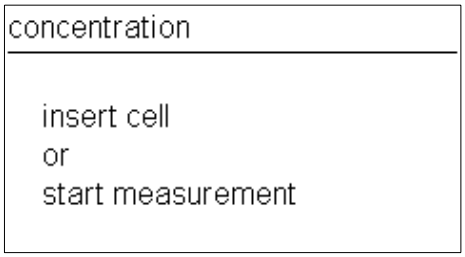


For photometrical concentration measurements, it is always necessary to prepare the sample to be measured. Information on sample preparation can be found in the first part, **General information** and in the third part, **Analytical procedures** of this operating manual.

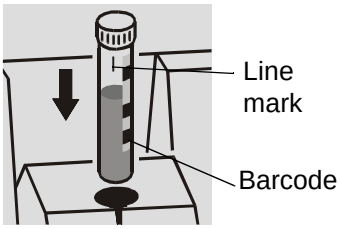
Warning

It is essential to follow the safety instructions and notes on protective measures when handling chemicals, in order to avoid damage to your health and the environment. They can be found on the packages of the coded cell tests and reagent test sets.

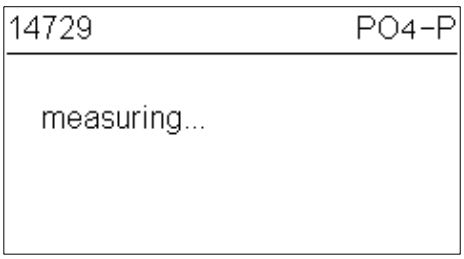
→ Call up the *concentration* measuring mode by pressing .



5.1 Measuring using coded cell tests



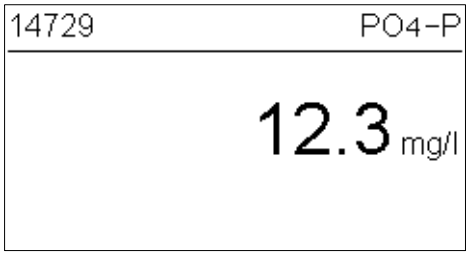
→ Insert the round cell with barcode into the round cell shaft until it clicks into place.
Align the line mark to the notch of the photometer.



The photometer reads the barcode of the round cell and automatically selects the relevant method.

Method and citation form are displayed in the header of the display.

After the measurement is finished:

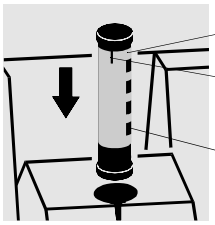


The measured value appears on the display.

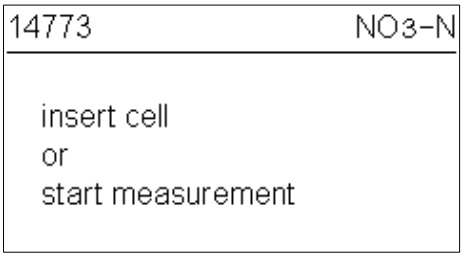
Measured values outside the specified measuring range are output in small numerals.

If the *select method* menu appears, the photometer has not yet recognized the barcode of the AutoSelector. Align the line mark of the AutoSelector to the notch of the photometer.

5.2 Measuring using reagent tests with AutoSelector



→ Insert the AutoSelector into the round cell shaft. The AutoSelector serves to transmit the code for the reagent test to the photometer.
→ Align the line mark to the notch of the photometer.



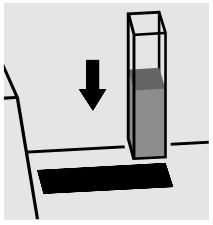
The photometer reads the barcode and automatically selects the relevant method.

Method and citation form are displayed in the header of the display.

Always align rectangular cells as follows:

- vertically
- at the right stop of the cell shaft
- the frosted side to the front

The 10 mm cell, unlike the 20 mm and 50 mm cells, stands loose in the cell shaft and is not guided.
Place the cell in the right end of the cell shaft. The cell aligns automatically to the correct position due to gravity.



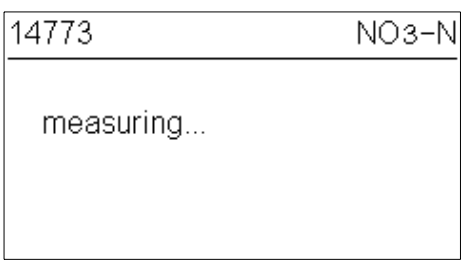
→ Insert the rectangular cell.

If the photometer does not recognize the rectangular cell inserted,

→ Press once again,

→ with or select the relevant rectangular cell (10 mm, 20 mm, 50 mm),

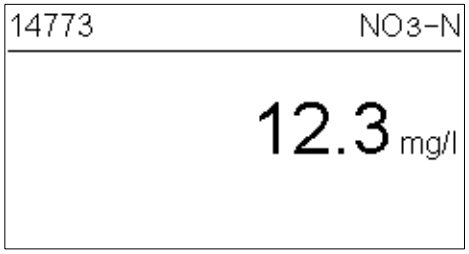
→ confirm with .



The measurement starts automatically.

If the *select method* menu appears, the photometer has not yet recognized the barcode of the AutoSelector. Align the line mark of the AutoSelector to the notch of the photometer.

After the measurement is finished:



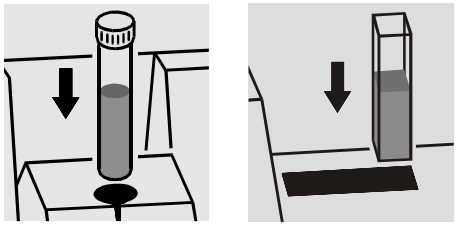
The measured value appears on the display.

Measured values outside the specified measuring range are output in small numerals.

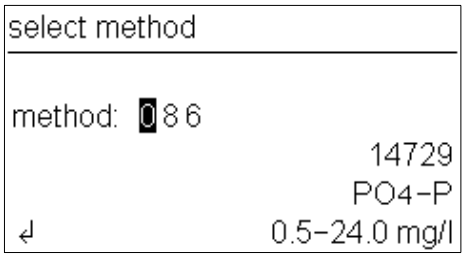
5.3 Measuring using tests without barcode (manual method selection)

When measuring using tests without barcode or reagent tests without AutoSelector, the method must be selected manually. The sequence of operations also applies to user-defined methods.

Always measure using one cell only. The cell shaft which is not used has to be empty.



→ Insert the round cell or rectangular cell.



The last method set up manually appears on the display.

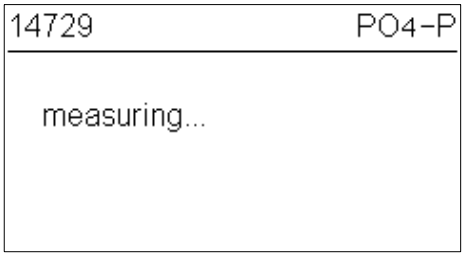
The method numbers are listed in the table, AVAILABLE TEST SETS in the third part, **Analytical procedures** of this operating manual.

→ Enter the required method number via the numeric keypad
(if a cell is inserted, the photometer only accepts those methods for input that are available for this cell type).

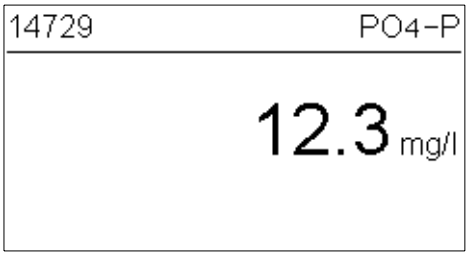
or

→ Select the method by scrolling with (if a cell is inserted, the photometer only offers those methods that are available for this cell type).

→ Confirm with .



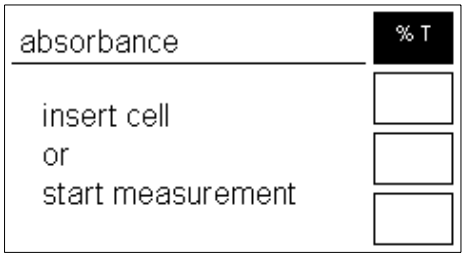
After the measurement is finished:



The measured value appears on the display.

Call up the *Absorbance/Transmission* measuring mode

→ Press .

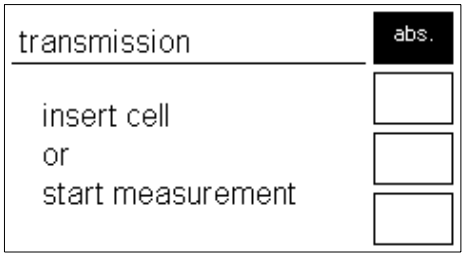


Absorbance measurement

To switch to the transmission measuring mode:

→ Press 1.

If a cell is left in the cell shaft while you switch between the absorbance and transmission measurement, you have to insert the cell once again to start the measurement.



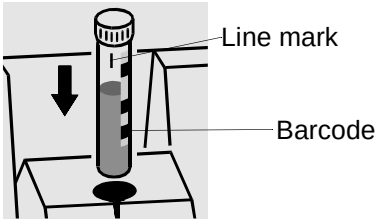
Transmission measurement

To switch to the absorbance measuring mode:

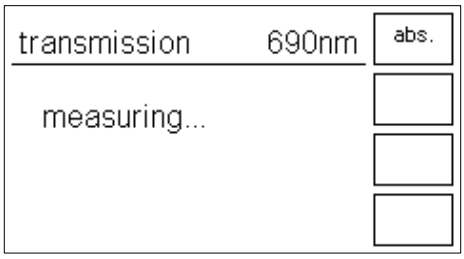
→ Press 1.

The transmission measurement is not described separately in the following example as it operates in exactly the same way as the absorbance measurement. However, the result of the measurement is displayed as % Transmission instead of A for Absorbance.

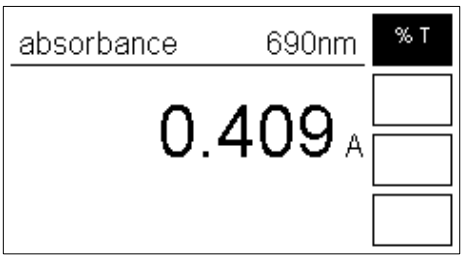
6.1 Measuring using coded cell tests



→ Insert the round cell with barcode into the round cell shaft until it clicks into place.
→ Align the line mark to the notch of the photometer.

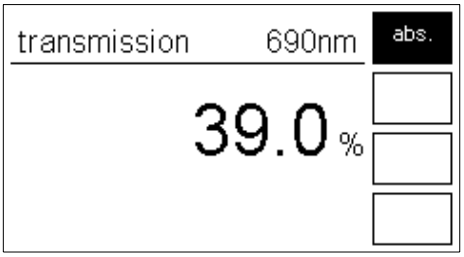


After the measurement is finished:



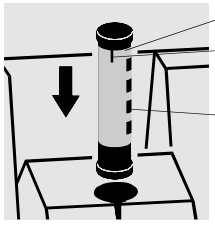
The measured value for the wavelength displayed at the top right appears.

This measured value is automatically stored.

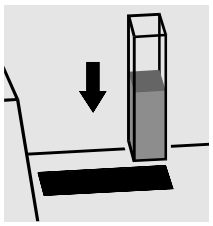


Sample display for transmission measurement.

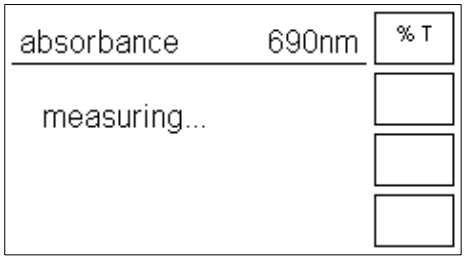
6.2 Measuring using reagent tests with AutoSelector



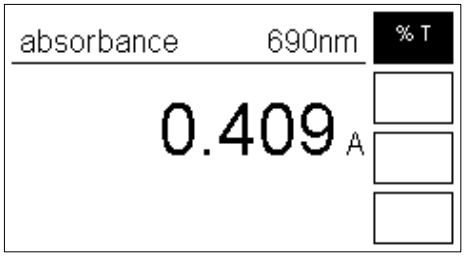
→ First insert the AutoSelector into the round cell shaft.
→ Align the line mark to the notch of the photometer.



→ Then insert the rectangular cell into the rectangular cell shaft.



After the measurement is finished:



The measured value for the wavelength displayed at the top right appears.

This measured value is automatically stored.

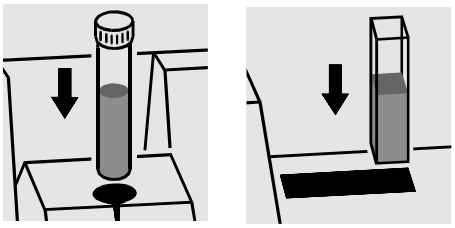
Always align rectangular cells as follows:

- vertically
- at the right stop of the cell shaft
- the frosted side to the front

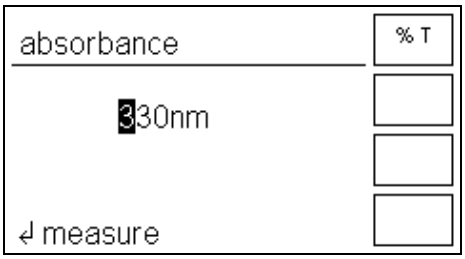
The 10 mm cell, unlike the 20 mm and 50 mm cells, stands loose in the cell shaft and is not guided. Place the cell in the right end of the cell shaft. The cell aligns automatically to the correct position due to gravity.

6.3 Measuring using tests without barcode

Always measure using one cell only. The cell shaft which is not used has to be empty.



→ Insert the round cell or rectangular cell.

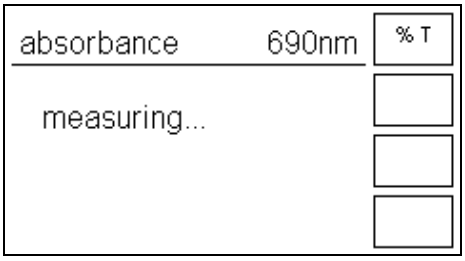


The last wavelength selected manually appears on the display.

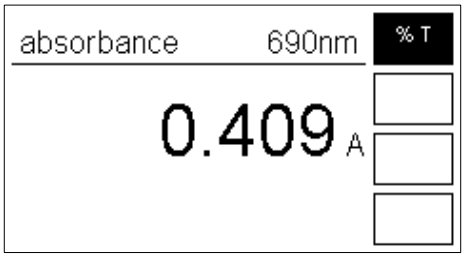
→ Select the wavelength:
using the numeric keys of the numeric keypad

→ Start the measurement:

Press .



After the measurement is finished:



The measured value for the wavelength displayed at the top right appears.

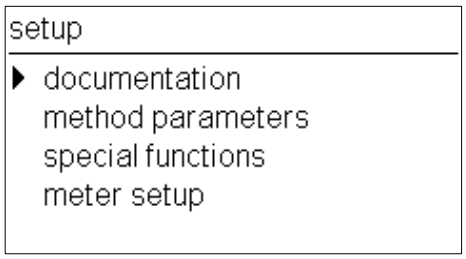
This measured value is automatically stored.

The measured values are documented as follows:

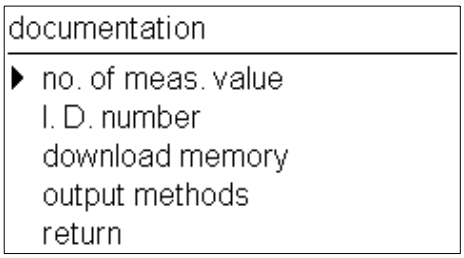
- Storage in the measured value memory (automatic)
- Output to a connected printer via the serial interface (automatic when a printer is connected)
- Transmission to a PC for further processing (by using the relevant software, e. g. Multi/ACHAT II or – less conveniently – by means of a Terminal program).

→ Press to call up the *setup* menu

The following display appears:



→ Call up the *documentation* menu using .

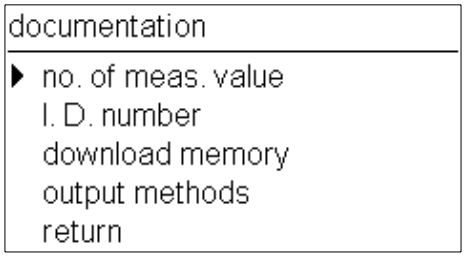


The following functions can be selected:

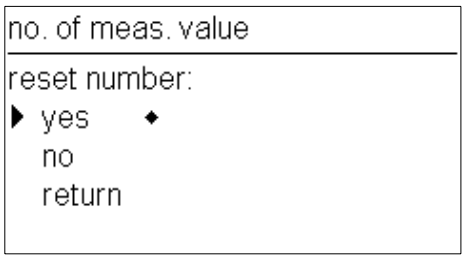
- *no. of measured value*
  - reset the number
- *ID number*
  - On / Off
- *download memory*
  - total
  - from date
  - with ID number xxx
  - for method xxx
  - AQA
- *output methods*
  - all
  - user defined methods

The current settings are marked by "✣" in the selection lists of the respective submenus.

7.1 Resetting the number of the measured value



→ Call up the *no. of measured value* submenu.



- *yes*
  The numbering of the measured values begins at 000 again (default)
- *no*
  Consecutive numbering of the measured values (from 000 to 999)

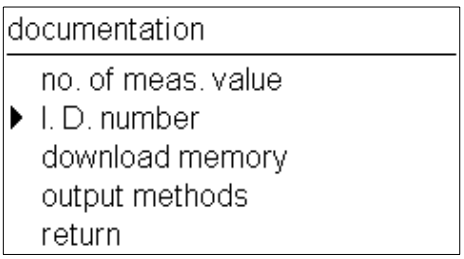
→ Select the menu item:

Press or

→ Confirm with .

7.2 Activating the ID number

If the *ID number* function is active, a sequence of up to 6 alphanumeric characters (ID number) is allocated to a measurement (e. g. sample location, customer number, river kilometer). The ID number is stored and saved together with the corresponding measured value.

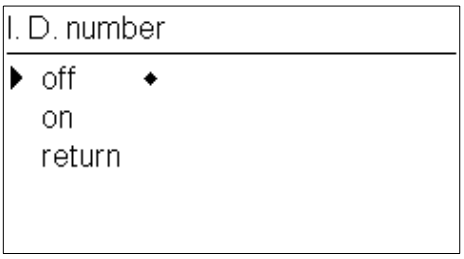


Call up the *ID number* submenu.

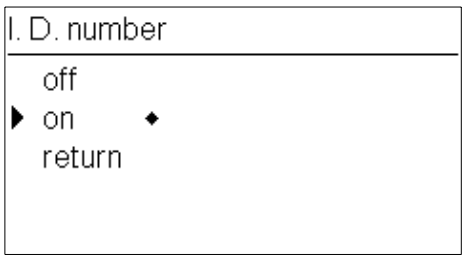
→ Select the menu item:

Press or

→ Confirm with .



- *off*
  It is not possible to enter an ID number (default).
- *on*
  Input an ID number for each measured value.



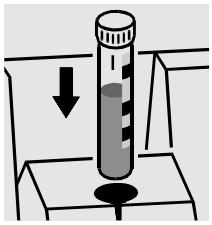
→ Select the menu item, *on*, by pressing

→ Confirm with .

Measuring using the activated "ID number" function

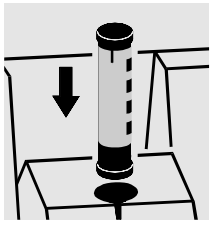
→ Call up the *concentration* measuring mode by pressing

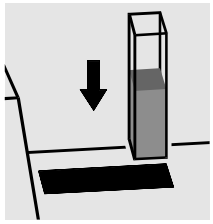
→ Insert the round cell and align it.



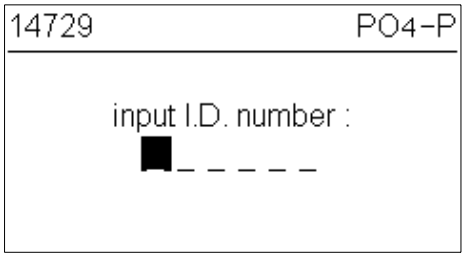
or

→ Insert the AutoSelector and rectangular cell.





The following display appears:



→ Input the required ID number

Default:
The ID number that was last entered (initially, it is underscores).

The input is made as follows:

→ Capital letters using

→ Numerals via the numeric keypad or using

→ Confirm the input using .
Confirming the input without entering any characters terminates the input.

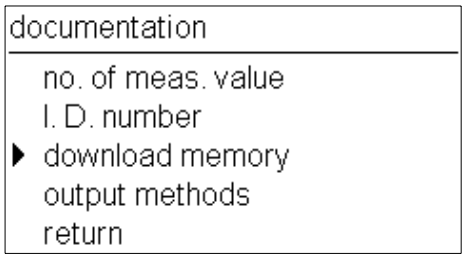
The measurement starts after the input is finished.
The ID number appears in the documentation only.

To erase incorrect inputs:

→ Pressing C moves the cursor (black rectangle) one digit back. This digit can be input once more and thus corrected.

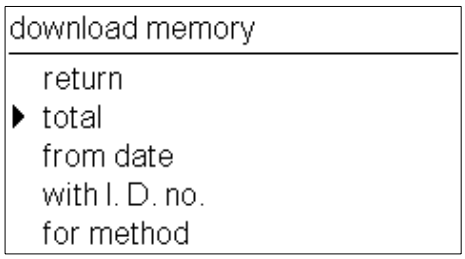
7.3 Download memory

The measured value storage can be selectively downloaded to either the display or serial interface. The selection of the output medium is made after the specification of the sorting criteria.



→ Call up the *download memory* submenu.

The *download memory* menu item only appears after at least one measurement has been performed.



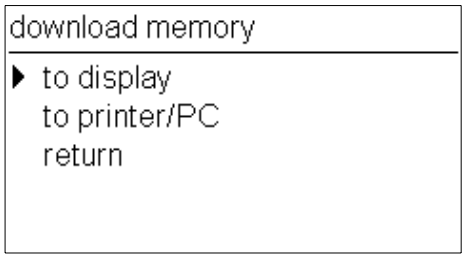
The following sorting criteria can be set:

- *total*
  all stored measured values
- *from date*
  all measured values from a special date
- *with ID no.*
  all measured values of a specific ID number
- *for method*
  all measured values of a special method
- *AQA*
  all AQA check measurements

→ Select a menu item using or .

→ Confirm with .

Selecting *total*



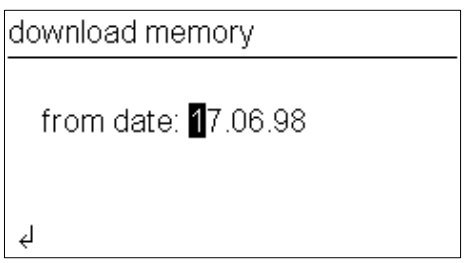
Select the output medium:

- *to display*
- *to printer/PC* (serial interface).

→ Select a menu item using or .

→ Confirm with to start the memory download.

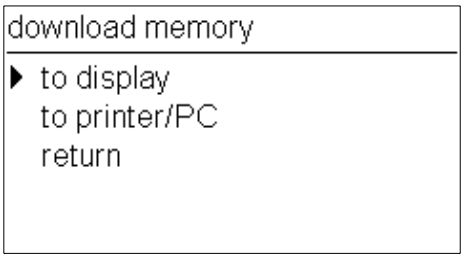
Selecting *from date*



→ Input the date via the numeric keypad

→ Delete the input using C

→ Confirm with .



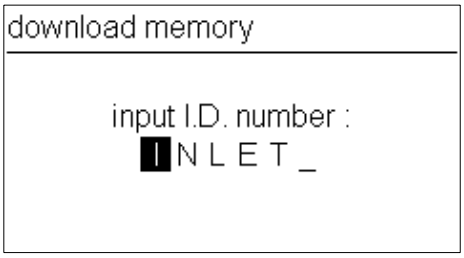
Select the output medium:

- *to display*
- *to printer/PC* (serial interface).

→ Select a menu item using or .

→ Confirm with to start the memory download.

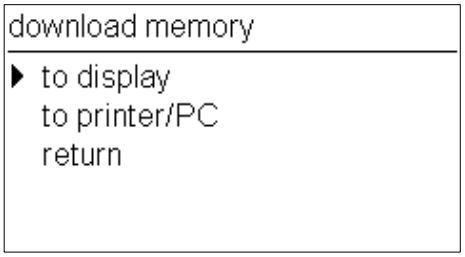
Selecting *with ID number*



Input the ID number

→ Input the method:
The last ID number entered is preselected.

→ Confirm the input using .



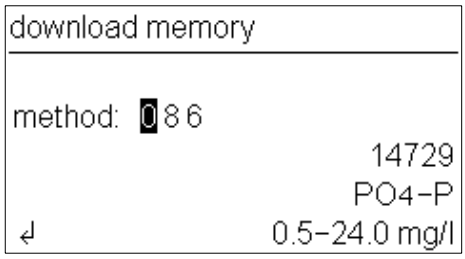
Select the output medium:

- *to display*
- *to printer/PC* (serial interface).

→ Select a menu item using or .

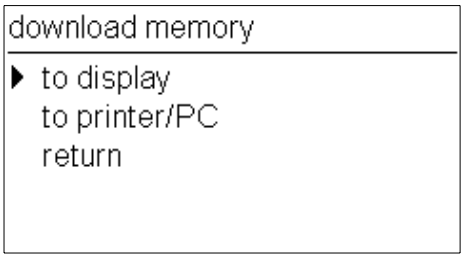
→ Confirm with to start the memory download.

Selecting *for method*



→ Input the method
Default:
The last method set up manually appears on the display.

→ Confirm with .



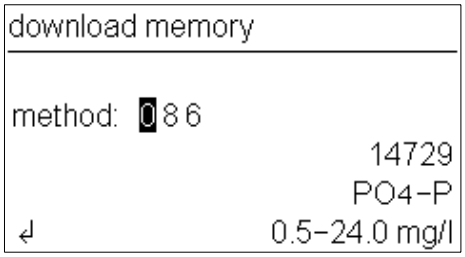
Select the output medium:

- *to display*
- *to printer/PC* (serial interface).

→ Select a menu item using or .

→ Confirm with to start the memory download.

Selecting *AQA*

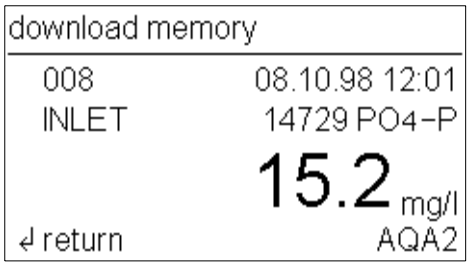


→ Input the method
Default:
The last method set up manually appears on the display.

→ Confirm with ↵ to start the memory download.

Only values of AQA check measurements are output.

Memory download *to display*

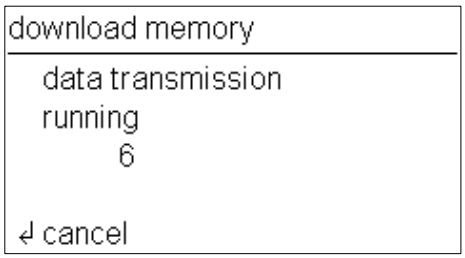


Each data record appears individually on the display beginning with the data record just measured. The display shows:

- No. of measured value
- Date/Time
- ID number
- Method designation
- Citation form
- Measured value
- Unit
- Where necessary, dilution
- Where necessary, AQA I. D., e. g. AQA2, if the measurement was made using a monitored method

→ Scroll using ⇆ or 2 8.

Memory download *to printer/PC:*



Memory download to the serial interface:

- Display of the transmitted no. of measured value (continuation display) beginning with the last measured value.

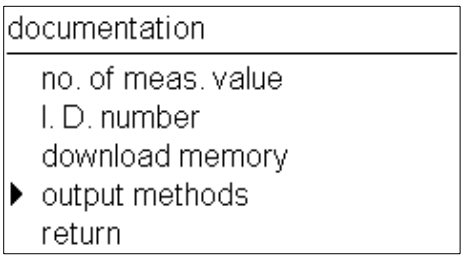
→ Cancel using ↵.

Sample printout:

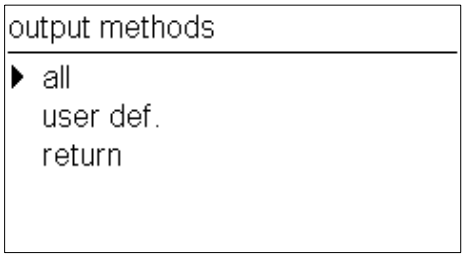
003	14542	INLET	25.05.99	12:25:56	14	mg/l	NO3-N
002	14773		25.05.99	12:23:04	0.890	E	690nm
001	14729	OUTLET	25.05.99	12:13:16	7.0	mg/l	PO4-P

7.4 Output of the methods list

The stored methods can be selectively downloaded to either the display or serial interface. The selection of the output medium is made after the selection *all/user def.* methods.



→ Call up the *output methods* submenu.



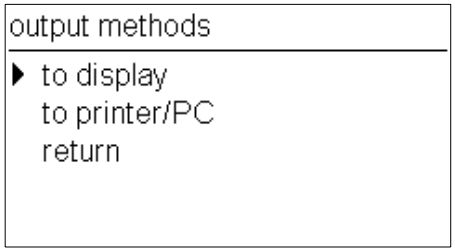
The following parameters can be set:

- *all*
  Output of all stored methods
- *user def.*
  Output of user-defined methods.

The menu item, *user def.,* appears only after user-defined methods have been input.

Select a menu item using or .

→ Confirm with .



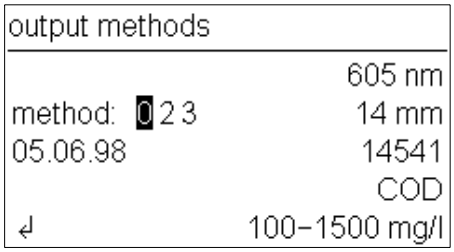
Select the output medium:

- *to display*
- *to printer/PC* (serial interface).

→ Select a menu item using or .

→ Confirm with to start the method output.

7.5 Method output to the display

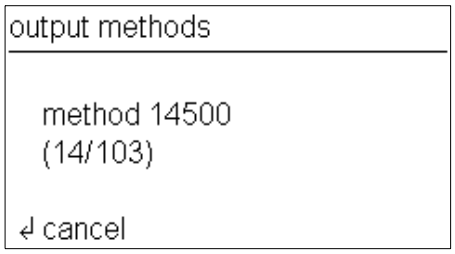


Each method appears individually on the display. The display shows:

- Method number
- Version (date) of the method
- Wavelength
- Cell type
- Method designation
- Citation form
- Measuring range

→ Scroll through the methods using or enter the method via the numeric keypad.

7.6 Method output to the printer/PC:



Method output to the serial interface:

Display of the transmitted method (continuation display, e. g. the 14th one of 103 methods).

→ Cancel using .

Sample printout:

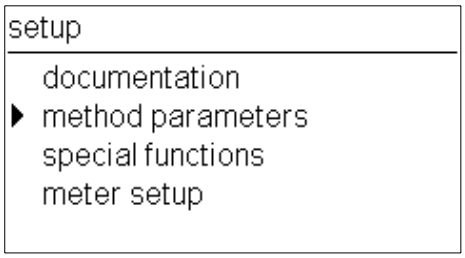
059	14542	0.5	- 18.0	mg/l	NO3-N	14	525nm	25.05.99
060	14773	0.5	- 20.0	mg/l	NO3-N	10	525nm	25.05.99
062	14828	- 0.10	- 7.50	mg/l	Cl2	10	545nm	25.05.99
063	14897	10	- 250	mg/l	Cl	10	500nm	25.05.99
064	14548	5	- 250	mg/l	SO4	14	525nm	25.05.99
065	14791	25	- 300	mg/l	SO4	10	525nm	25.05.99

The following parameters can be set in the *method parameters* submenu:

- Citation form
- Unit
- Dilution

→ Call up the *setup* menu.

The following display appears:

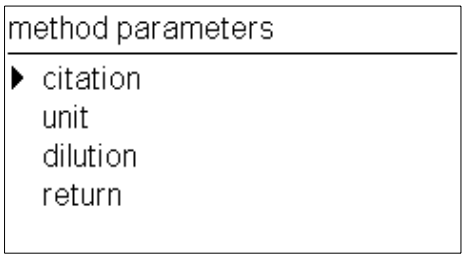


→ Call up the *method parameters* submenu.



→ Scroll through the methods using or enter the method number via the numeric keypad

→ Confirm with .



→ Select the menu item:

Press or 2 8

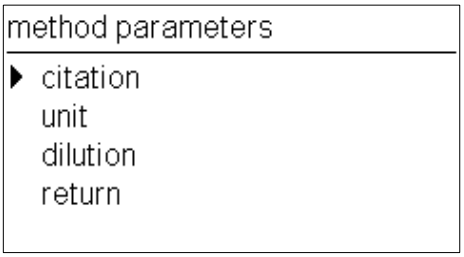
→ Call up the parameter:

Press .

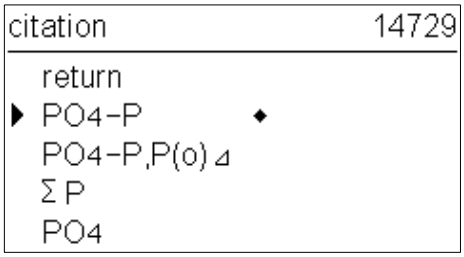
8.1 Citation form

8.1.1 Changing the citation form

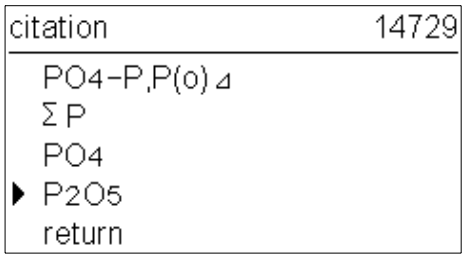
Example: Change the citation form from "PO4-P" to "P2O5".



→ Select the *citation* submenu.

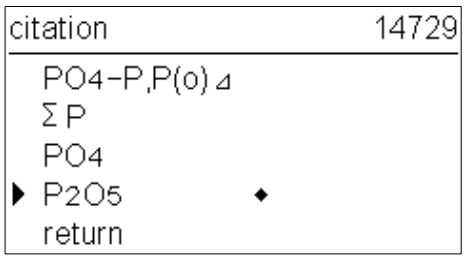


The current setting: *PO4-P* ( ).



→ Using or scroll to *P2O5*

→ Confirm with .



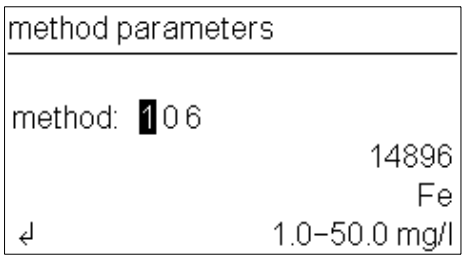
The citation form is set to *P2O5* ( ).

8.1.2 Performing a difference measurement

For some methods, it is possible to perform a difference measurement (e. g. iron II/III, Ca/Mg hardness).

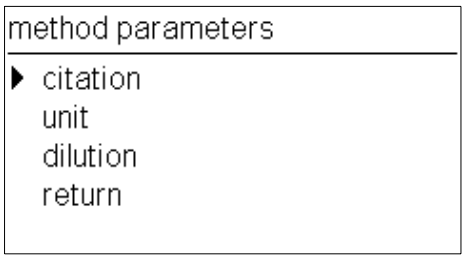
Further information on this is given in the third part, **Analytical procedures** of this operating manual.

Example: Determination of iron (II) and iron (III).

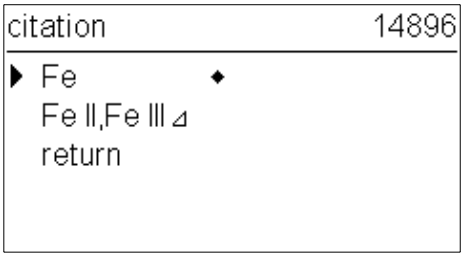


→ Enter method *106*

→ Confirm with .



→ Call up the menu item, *citation*



→ Using or scroll to *Fe II, Fe III* Δ

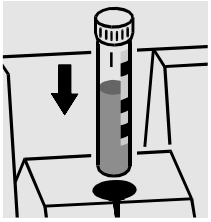
→ Confirm with .



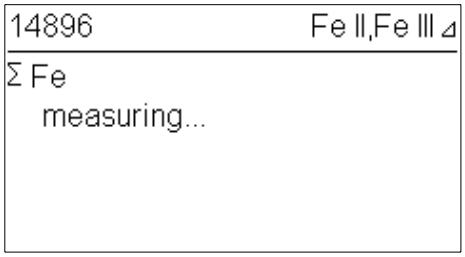
The citation form is set to *Fe II, Fe III* Δ ( ).

→ Switch to the *concentration* measuring mode*:*

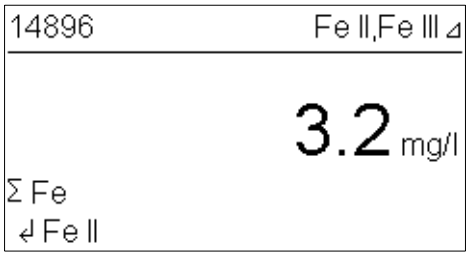
Press .



→ Start the 1st measurement by inserting cell 1.



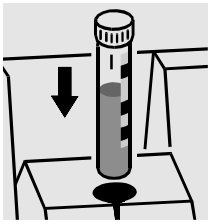
After the measurement is finished:



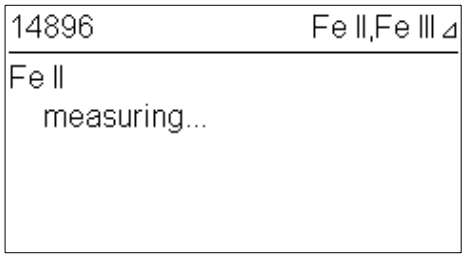
The 1st measured value appears on the display.
∑ *Fe*.

→ Remove cell 1

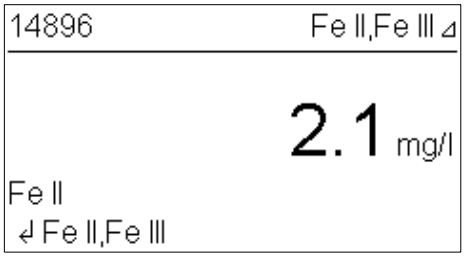
→ Press .



→ Start the 2nd measurement by inserting cell 2.

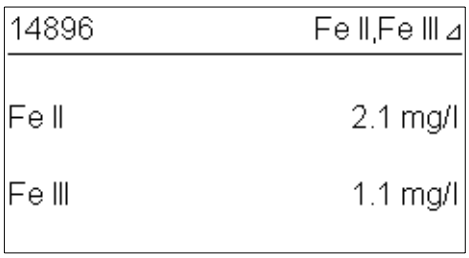


After the measurement is finished:



The 2nd measured value appears on the display.
Fe II.

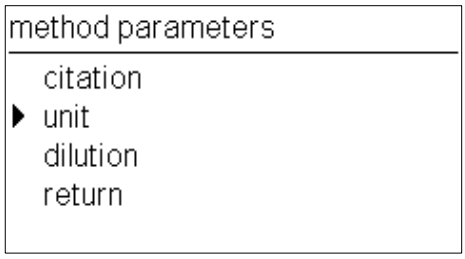
→ Continue to the display of both measured values using .



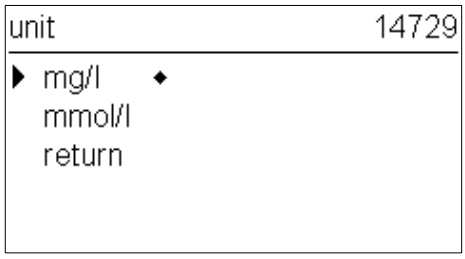
Display of both measured values as a summary.

8.2 Selecting the unit

The preset unit is “mg/l”. This can be changed to “mmol/l”.



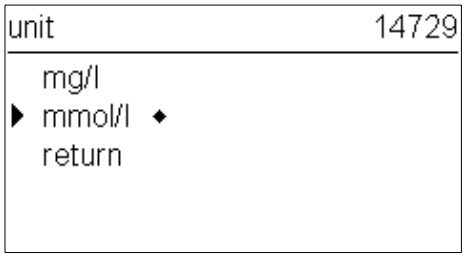
→ Call up the *unit* submenu.



The current setting: *mg/l* ( ).

→ Using or , scroll to *mmol/l*

→ Confirm with .



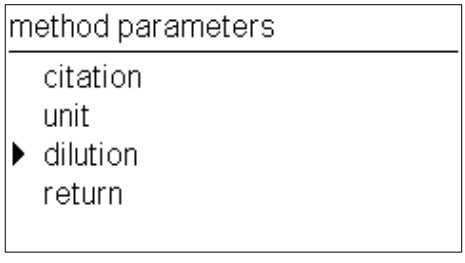
The unit is set to *mmol/l* ( ).

8.3 Entering the dilution

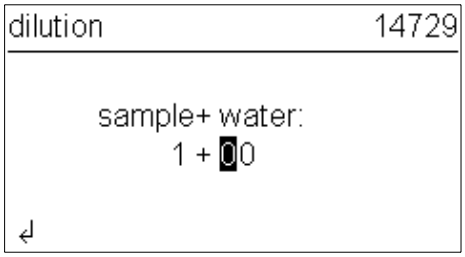
Diluting a sample with distilled water enables the measuring range to be extended. The photometer automatically includes any dilution factor entered when calculating the measured value.

Values from 0 to 99 can be entered as dilution factors.

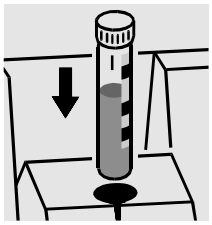
Example: Input of a dilution of 1:20 (i. e. 1 part sample + 19 parts distilled water).



→ Call up the *dilution* submenu.

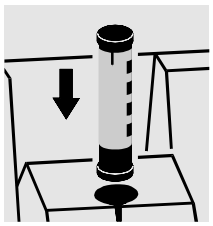


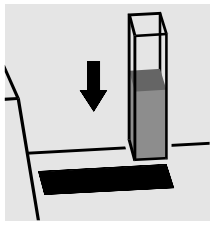
→ Input the dilution factor 19 via the numeric keypad
→ Confirm with .

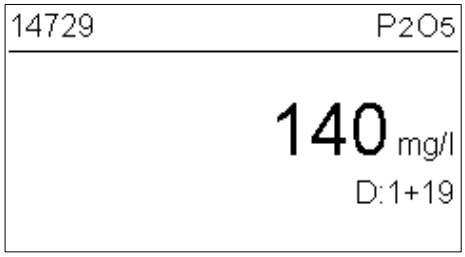


→ Call up the *concentration* measuring mode using
→ Insert the cell
→ Confirm the method.

or







The measured value is displayed together with the dilution factor.

Repeat measurements:
→ Insert the cell, or start the measurement
→ Confirm the dilution factor.

Erase the dilution factor by:
- Changing the method
- Switching off the photometer
- Entering a factor of 00.

The analytical quality assurance (AQA) can be performed in two steps:

- AQA1: monitoring of the photometer
- AQA2: monitoring of the total system (photometer, accessories and the operator's way of working)

AQA1 photometer monitoring and AQA2 method-specific system monitoring are conducted completely separately in the photometer.

See also part 1 **General information** of this operating manual for further information on Analytical Quality Assurance (AQA).

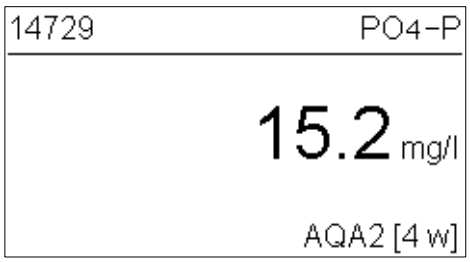
The AQA mode must be activated in the photometer. In the delivery state it is switched off.

The AQA mode is activated by:

- Inserting the AQA MemoChip and performing an AQA check measurement
  - monitoring the total system (AQA2)
  - monitoring the photometer (AQA1)
- Using a menu to select
  - monitoring the photometer (AQA1)
  - monitoring the total system (AQA2)

After the AQA mode has been activated, the *AQA check* menu item appears in the *setup* menu permanently.

The measured values are identified with AQA1/AQA2 and the remaining time (countdown) up to the next due AQA check.



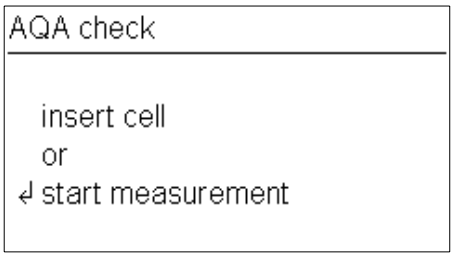
Sample display:
Measured value of a monitored method.

9.1 Activating AQA

9.1.1 Activating AQA using the MemoChip AQA



→ Place the AQA MemoChip in the recess on the photometer. The following display appears:

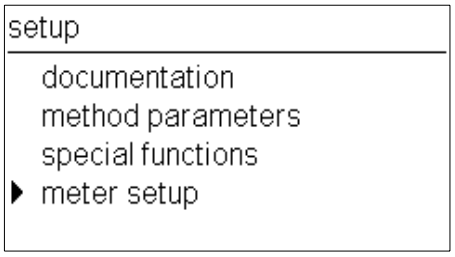


The action of placing the AQA MemoChip in the recess directly activates the AQA check without having to press any key.

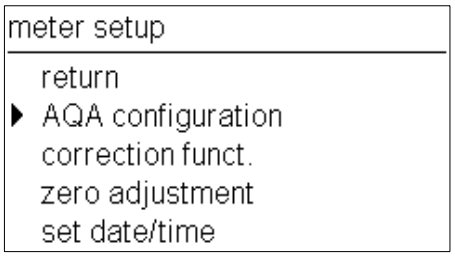
→ Perform the AQA check for the photometer (see 9.2.3 PERFORMING PHOTOMETER MONITORING) or for the system (see 9.3.4 PERFORMING TOTAL SYSTEM MONITORING).

9.1.2 Activating AQA via the menu guide

→ Call up the *setup* menu.



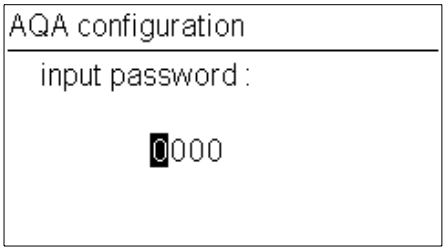
→ Call up the *meter setup* submenu.



The *meter setup* submenu appears with the *AQA configuration* menu item preselected.

→ Confirm with .

A password request appears:

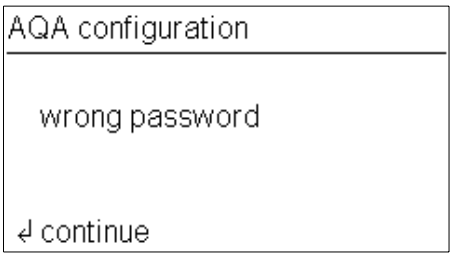


A user-defined password protects the settings of the AQA configuration against unauthorized access (changing the password, see section 9.1.5).

→ Input the password
Default: *0000)*:
- Numerals via the numeric keypad or using
- Capital letters using

→ Confirm with .

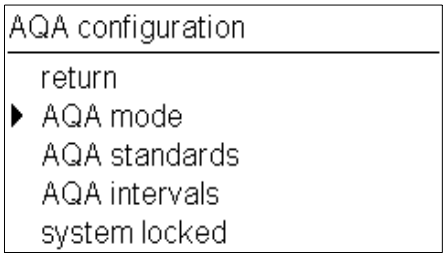
If the input was incorrect:



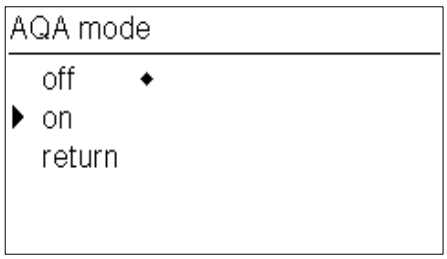
→ Repeat the input.

If you have forgotten the password, contact the service department of the supplier.

After the password has been successfully input, the *AQA configuration* submenu appears:



→ Call up the *AQA mode* function.



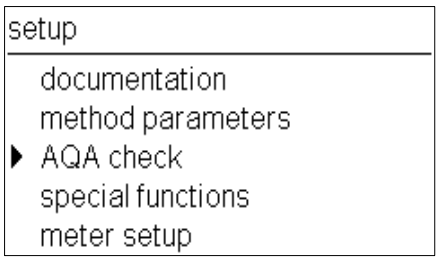
Default: *off* (no monitoring)

→ Select the menu item, *on*, by pressing

or

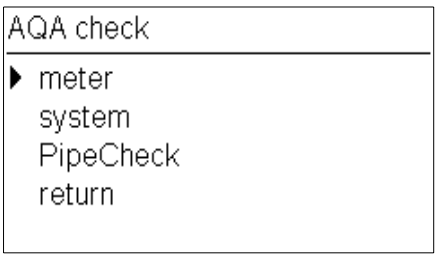
→ Confirm with .

→ *return* to the setup menu.



→ To go to the setup menu, twice select and confirm the *return* menu item.

→ In the *setup* menu, call up the *AQA check* submenu.



Select the unit to be monitored:

- *meter* (AQA1)
- *system* (AQA2)
- *PipeCheck*

Pipettes can be monitored under the *PipeCheck* menu item (see section 9.2.4 PERFORMING THE PIPECHECK). This monitoring does not affect AQA1 and AQA2.

9.1.3 Changing AQA intervals

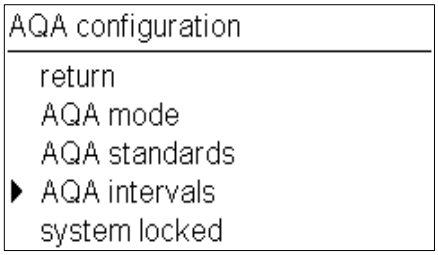
The AQA intervals specify the time interval between two AQA checks. Two separate intervals can be set up for both photometer and system monitoring.

After an interval has expired, the following consequences become effective:

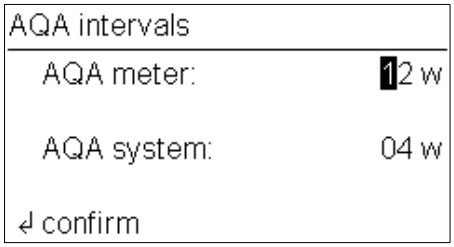
- Warning and loss of AQA identification
- Locking of the method for concentration measurements (as long as the locking is active).

Setting ranges:

- Photometer monitoring (AQA1):
  1 to 52 weeks (default: 12 w)
- Total system monitoring (AQA2)
  1 to 52 weeks (default: 4 w)



→ In the *AQA configuration* menu, call up the *AQA intervals* submenu.



→ Return without making any changes by pressing three times

→ Input the time interval for *AQA meter* via the numeric keypad or using , confirm using

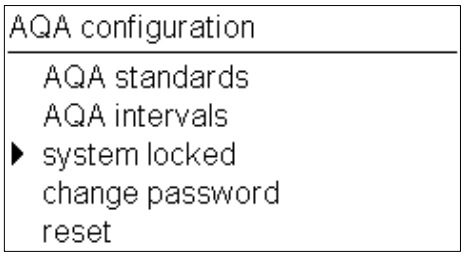
→ Input the time interval for *AQA system* via the numeric keypad or using , confirm using .

9.1.4 Locking the system

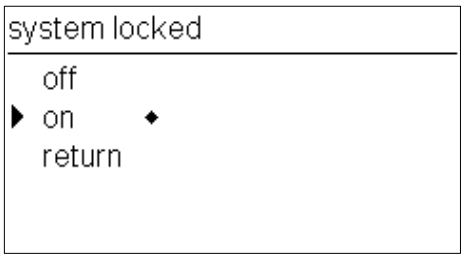
The function *system locked* is effective if, for a monitored method,

- no AQA check was performed,
- The AQA check “system” has expired.

As a result, a concentration measurement is not possible for this method. The system locking is canceled after the “system” AQA check has been successfully performed for this method.



→ Call up the *system locked* submenu.

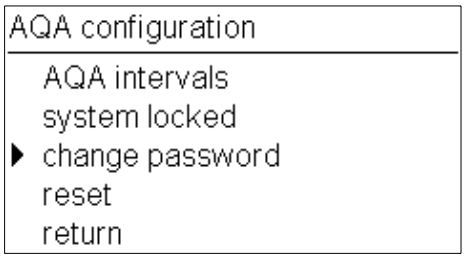


→ Select a menu item using or .

→ Confirm with .

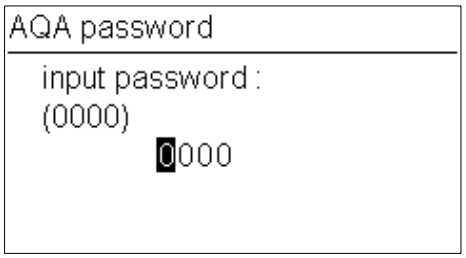
9.1.5 Changing the password

When delivered, the default password is *0000*. This password can be changed as follows:

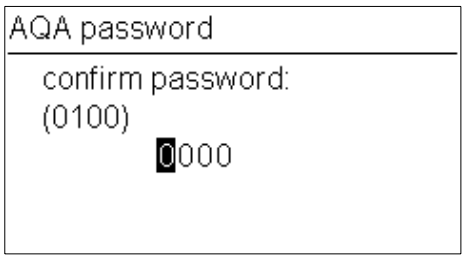


→ Call up the *change password* submenu

→ Confirm with .



→ Input the required password, e. g. *0100*:
- Numerals via the numeric keypad or using
- Capital letters using
- Confirm the input using .

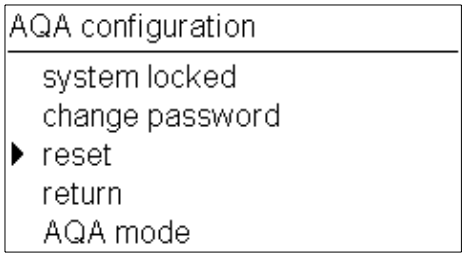


→ Input the password once again:

→ Confirm with .

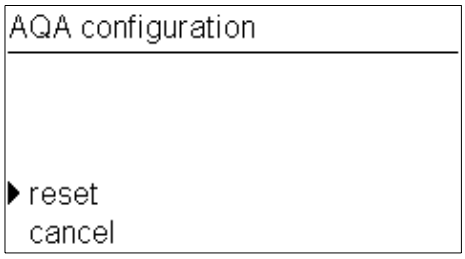
9.1.6 Performing an AQA reset

If you want to reset the Analytical Quality Assurance to the delivery state, use the *reset* function in the *AQA configuration* submenu.



→ Call up the *reset* submenu.

→ Confirm with .



→ Select the *reset* menu item

→ Confirm with .

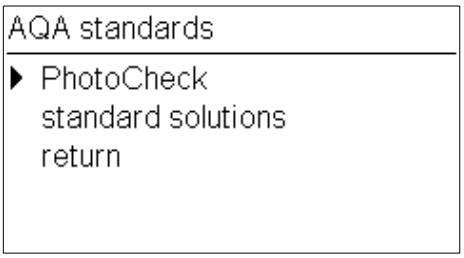
An AQA reset is performed.

9.2 Photometer monitoring (AQA1)

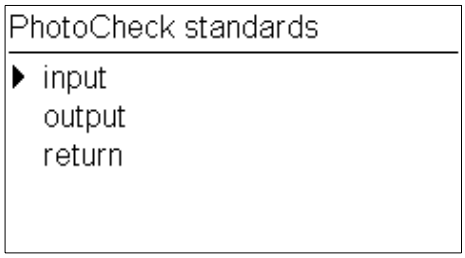
9.2.1 Entering PhotoCheck standards

A Spectroquant® PhotoCheck is required to perform the photometer monitoring. The theoretical values (absorbances) of all 12 available standards are already stored in the photometer. If these values differ from the theoretical values in the lot certificate of the Spektroquant® PhotoCheck, they have to be corrected in the photometer.

→ In the *setup* menu, call up the *meter setup* submenu
→ Call up the *AQA configuration* submenu
→ Input the password
→ Call up the *AQA standards* submenu and the following display appears:



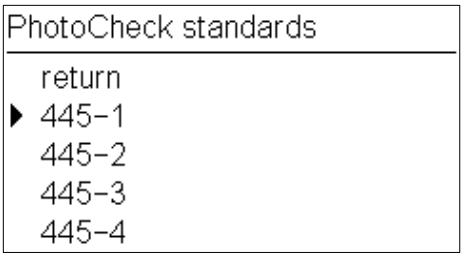
→ Call up the *PhotoCheck* submenu.



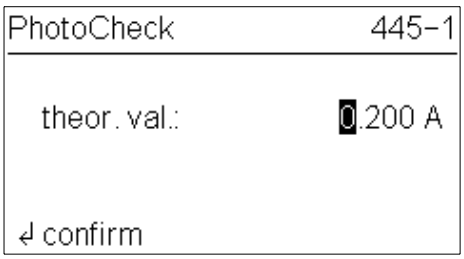
Select between

- *input*
  If necessary, the values stored in the photometer can be overwritten
- *output*
  Print/display theoretical values

Example: 445-1 nm, theoretical value (absorbance) 0.200, tolerance range ± 0.020 is to be changed to theoretical value 0.120, tolerance range ± 0.012



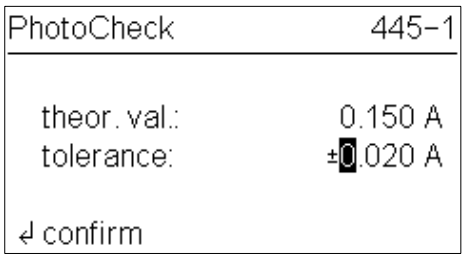
→ Select using or
→ Quit via the menu item, *return*
→ Confirm with .



The value of the pre-stored standard appears on the display.

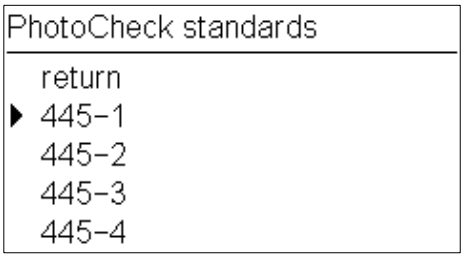
→ Input the new theoretical value 445-1 via the numeric keypad

→ Confirm with .



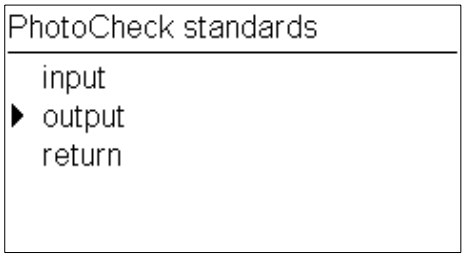
→ Input the tolerance via the numeric keypad

→ Confirm with .

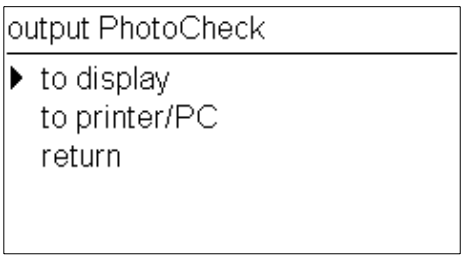


→ If required, select the next standard by pressing and proceed in the same way.

9.2.2 Output of PhotoCheck standards



→ In the *PhotoCheck standards* submenu call up the *output* menu item.



Select the output medium:

- *to display*
- *to printer/PC* (serial interface).

→ Select using or

→ Confirm with to start the output.

Example: Report output

AQA check of meter AQA1
26.08.99 13:19

AQA interval 12 W.

test solution	Unit	theor. value	tolerance	AQA date
445-1	A	0.200	0.020	26.08.99
445-2	A	0.500	0.030	26.08.99
445-3	A	1.000	0.040	26.08.99
445-4	A	1.500	0.050	26.08.99
525-1	A	0.200	0.020	26.08.99
...				

9.2.3 Performing Photometer monitoring

Photometer monitoring includes a check of the

- Light barriers using the L1/L2 cells (contained within the scope of delivery of the Spectroquant® PhotoCheck)
- Absorbance measurement using PhotoCheck standards.

When using a new Spektroquant® PhotoCheck packet, check the theoretical values stored in the photometer and if necessary correct them according to section 9.2.1 ENTERING PHOTOCHECK STANDARDS.

AQA entry

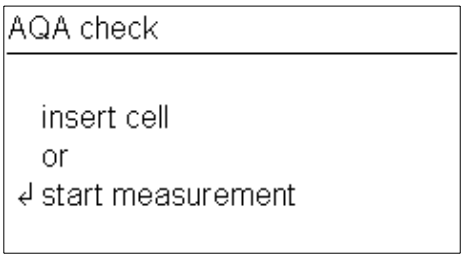
Using AQA MemoChip...

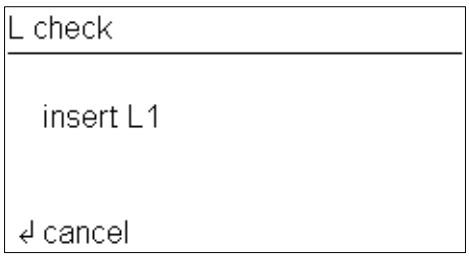


→ Insert the AQA MemoChip.

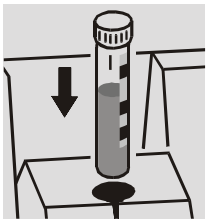
...or via a menu

→ In the *setup* menu, call up the *AQA check* submenu.
→ Call up the *meter* submenu.
The following display appears:

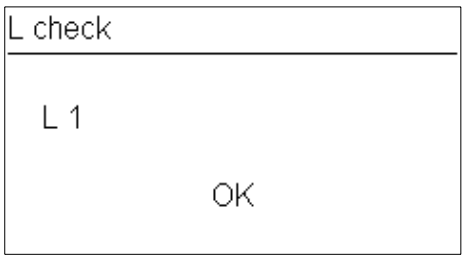




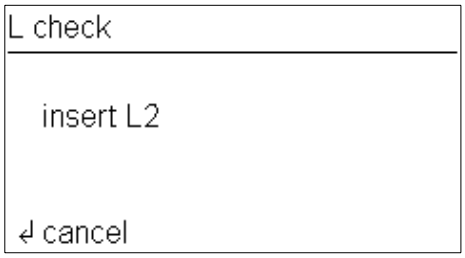
→ Insert the L1 cell.



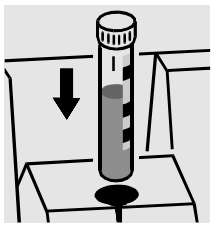
After the measurement is finished:



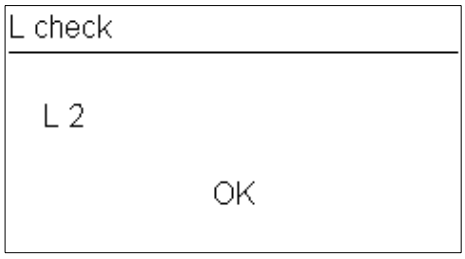
If the *error* message appears, clean the cell shaft with a damp, lint-free cloth and repeat the check.
If the message reoccurs, inform the service department.



→ Insert the L2 cell.

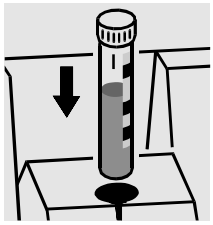


After the measurement is finished:

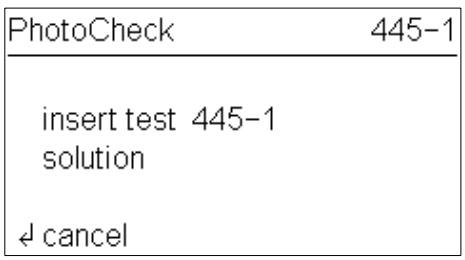


After successful light barrier testing, the PhotoCheck standards (test solutions) are measured.

Example:



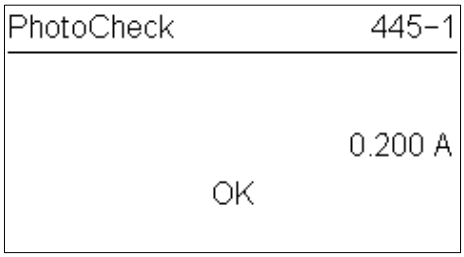
→ Insert a cell with the test solution, 445-1.



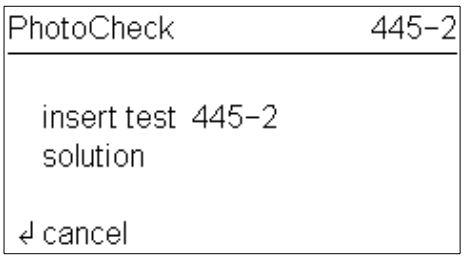
The photometer measures the absorbance of the test solution and compares the result with the value entered.

After the measurement is finished:

Absorbance test OK...

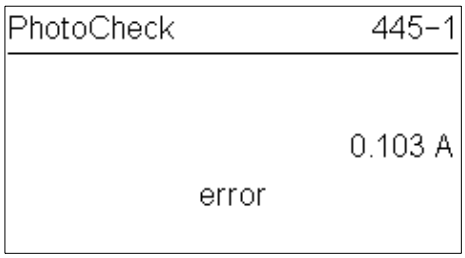


After approx. 3 s:



→ Insert the next test solution
→ Cancel:
To cancel the check means no release for the next “meter" AQA interval!
→ Continue until the photometer has measured all 12 test solutions.

...or error message



After approx. 5 s:

The last measurement is repeated.

Clearing the error:

→ Compare the theoretical absorbance to the lot values (see section 9.2.1 ENTERING PHOTOCHECK STANDARDS)
→ Repeat the measurement
(plug the cell in again)
→ Exchange the test solution (each packet contains two identical test solutions)
→ If necessary, perform a zero adjustment and repeat the check
→ Use a new Spectroquant® PhotoCheck packet
→ Quit and have the photometer checked in the factory

If the meter monitoring is canceled, the photometer is not released. Each time the photometer is switched on, the warning message "Check meter" appears until the meter monitoring was successfully performed or the AQA mode is switched off. After confirming with

the measuring can be continued as usual.

Example: Report output

AQA check of meter AQA1
26.08.99 10:23
Operator:

AQA interval 12 W.
AQA check of meter ok

L check ok

test solution	Measured value	Unit	theor. value	tolerance	result
445-1	0.209	A	0.200	0.020	ok
445-2	0488	A	0.500	0.030	ok
445-3	0.986	A	1.000	0.040	ok
445-4	1.487	A	1.500	0.050	ok
525-1	0.210	A	0.200	0.020	ok

...

9.2.4 Performing the PipeCheck

The PipeCheck rapidly and easily determines any potential pipette errors. While doing so, the photometer identifies pipettes with volume errors of more than 5 % as faulty.

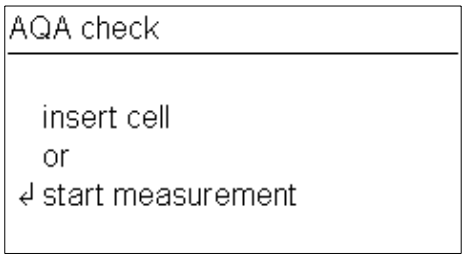
A Spectroquant® PipeCheck is required to perform the PipeCheck.

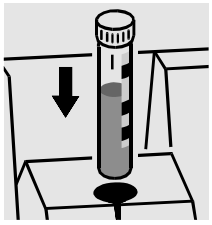
AQA entry

Using AQA MemoChip...

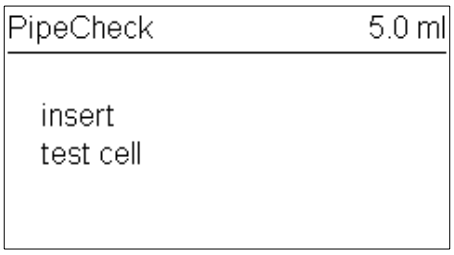


→ Insert the AQA MemoChip.





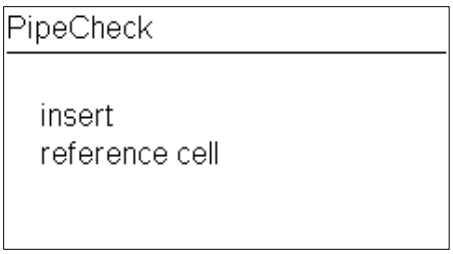
After approx. 5 s:



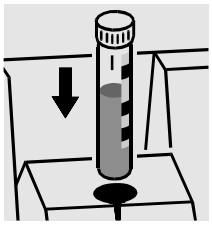
...or via a menu

→ In the *setup* menu, call up the *AQA check* submenu.
→ Call up the *PipeCheck* submenu.

The following display appears:



→ Insert the reference cell.

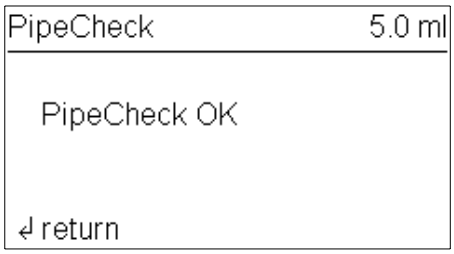


→ Insert the test cell.

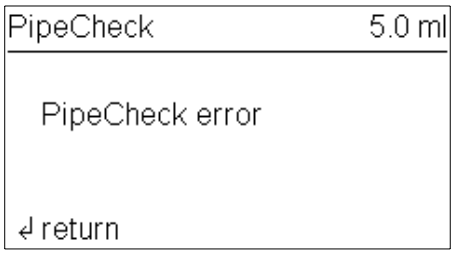
If a test cell unsuitable for the reference cell is inserted, the meter does not accept it and still displays: *insert test cell.*

PipeCheck OK ...

After approx. 5 s:



...or error message



→ Return to the *AQA check* menu using .

Example: Report output

AQA check		PipeCheck
15.06.99		15:38
Operator:		
PipeCheck	result	
---	---	
3.0 ml	PipeCheck ok	

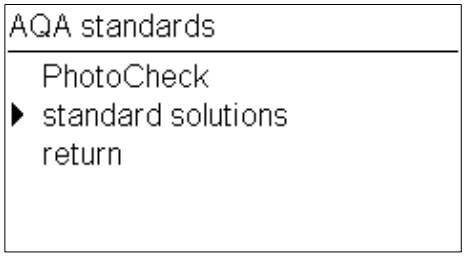
9.3 Total system monitoring (AQA2)

9.3.1 Entering standards

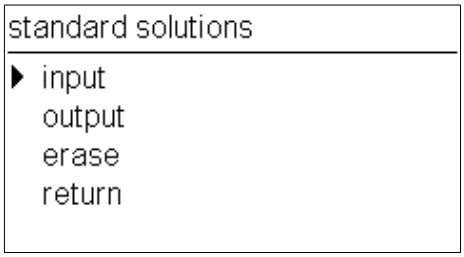
The standards compiled in the table “Spectroquant® CombiCheck and standard solutions” (see part 1 **General information** of this operating manual) are already stored in the photometer. These values can be overwritten.

For system monitoring, only one standard per test can ever be stored.
The input of a standard is only complete when the tolerances for finding it again have been input, i. e. it is then first stored (no premature quitting).

→ In the *setup* menu, call up the *meter setup* submenu
→ Call up the *AQA configuration* submenu
→ Input the password
→ Call up the *AQA standards* submenu and the following display appears:

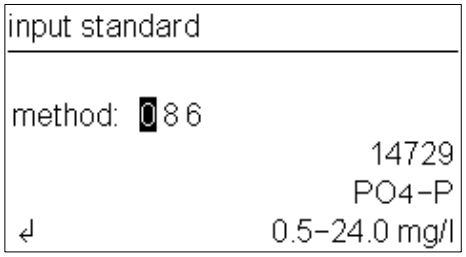


→ Call up the *standard solutions* submenu



Select between

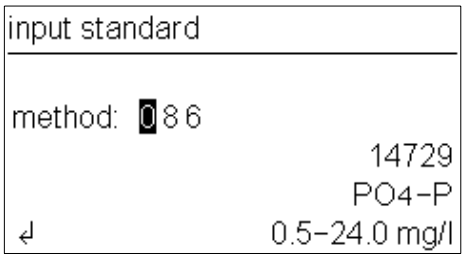
- *input*
  Input standards
- *output*
  Print/display standards
- *erase*
  Erase standards.



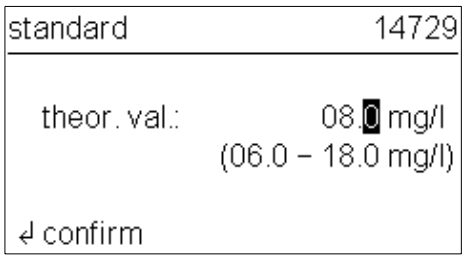
Displays the last selected method.
→ Select the method and confirm it
→ Input the standard.

Example:
Method 14729 with a preset theoretical value of 15.0 mg/l and tolerance of 1.0 mg/l (CombiCheck 80).

Change to: theoretical value = 8 mg/l, tolerance = 0.7 mg/l (CombiCheck 20).

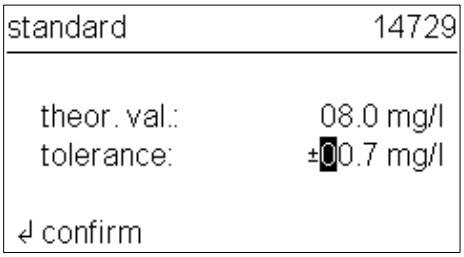


→ Confirm with .



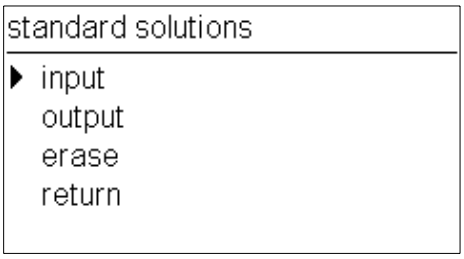
→ Input the new theoretical value, e. g. 8.0 mg/l, via the numeric keypad.
Values in parentheses indicate the range in which the theoretical value should move.

→ Confirm with .



→ Input the tolerance (0.7 mg/l) via the numeric keypad.

→ Confirm with .

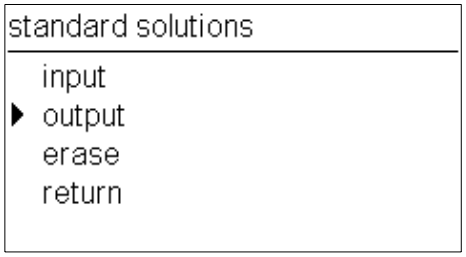


Both standard and tolerance values have been overwritten.

The photometer returns to the *standard solutions* submenu.

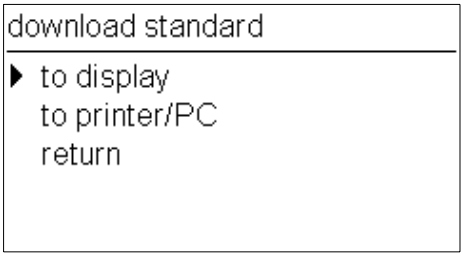
9.3.2 Output of standards

The current list of stored standards can be output via the RS 232 interface (PC/printer) or via the display.



→ Select the *output* submenu

→ Confirm with .



Select the output medium:

- *to display*
- *to printer/PC* (serial interface).

→ Select using or

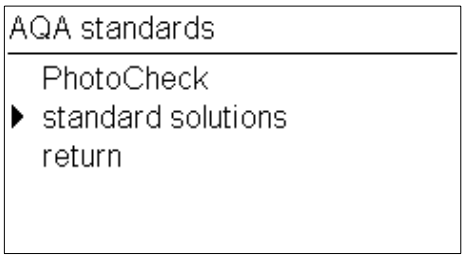
→ Confirm with to start the output.

Example: Report output

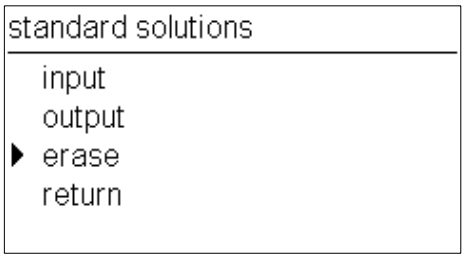
AQA check of system			AQA2	
26.08.99			13:57	
AQA interval			4 W.	
system locked			on	
method	Unit	theor. value	tolerance	AQA date
14729	mg/l	8.0	0.7	26.08.99
14554	mg/l	2.00	0.20	26.08.99
14555	mg/l	5000	400	26.08.99
...				

9.3.3 Erasing standards

Erasing the method-specific standard solutions leads to the change of the measured value identification from AQA2 to AQA1 (with activated AQA mode and successfully performed meter monitoring).

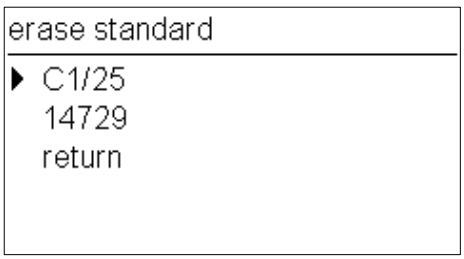


→ Call up the *standard solutions* submenu.



→ Select the *erase* functions with or .

→ Confirm with .



→ Select the standard to be erased with

or .

→ Erase using .

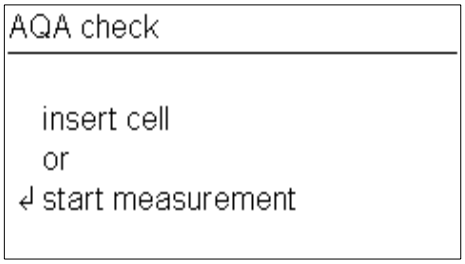
9.3.4 Performing total system monitoring

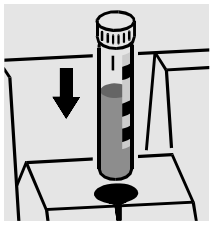
AQA entry

Using AQA MemoChip...

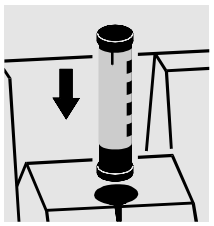


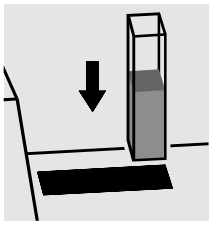
→ Insert the AQA MemoChip.





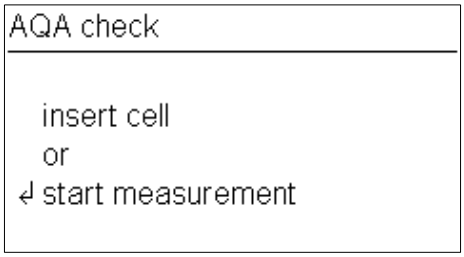
or





...or via a menu

→ In the *setup* menu, call up the *AQA check* submenu.
→ Call up the *system* submenu.

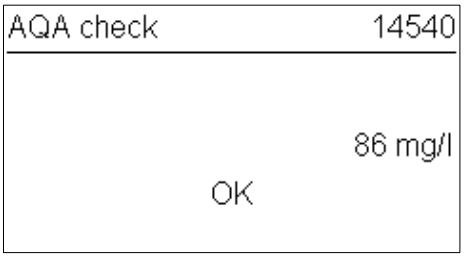


→ Insert a cell with the prepared standard solution that is ready to be measured (e. g. using the Spectroquant® CombiCheck). The photometer reads the barcode, identifies the method and performs the AQA check.

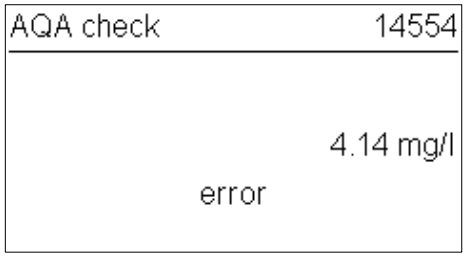
→ Insert the reference cell.

After the measurement is finished:

AQA check OK ...



...or error message



→ Repeat the check
→ If the error is repeated, perform troubleshooting of the error.
See ANALYTICAL QUALITY ASSURANCE in part 1 **General information** of this operating manual.

The AQA check *system* must be performed separately for each method monitored. The release is stored with the date and the "system" AQA interval set up for the respective method is restarted.

Example: Report output

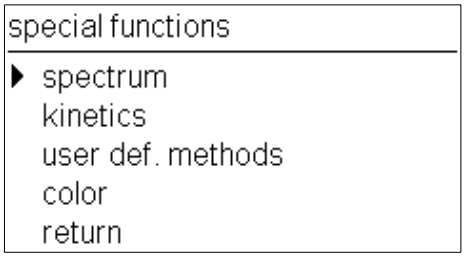
AQA check of system AQA2
26.08.99 11:02
Operator:
AQA interval 4 W.

method	Measured value	Unit	theor. value	tolerance	result
14554	3.45	mg/l	2.00	0.20	error
14554	1.93	mg/l	2.00	0.20	ok
14555	5200	mg/l	5000	400	ok
...					

10.1 Spectrum

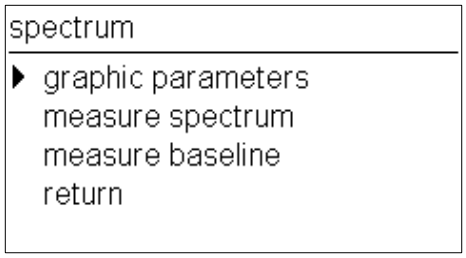
The *spectrum* function facilitates to measure the absorbance at several wavelengths simultaneously. The course of the absorbance is presented graphically or in the form of a table in a selectable range within 330 nm to 850 nm (smallest range 10 nm).

→ In the *setup* menu, call up the *special functions* submenu.
The following display appears:

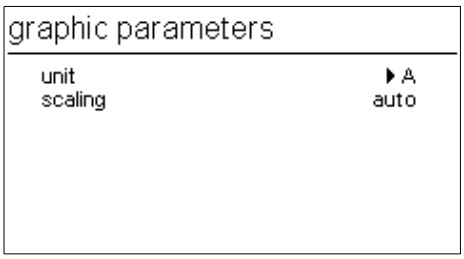


→ Call up the *spectrum* menu item.

10.1.1 Setting up the graphic parameters



→ In the *spectrum* menu, call up the *graphic parameters* menu item.



Possible settings for the spectrum graphic:
Dimension of the y axis:

→ Use or to select between

- *A* (Absorbance)
- *%T* (Transmission)

→ Confirm with .

Scaling:

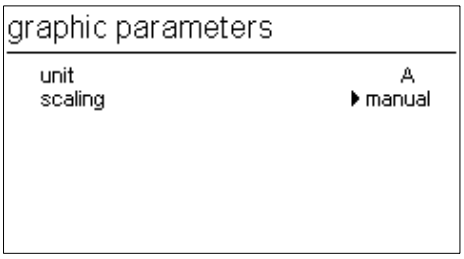
→ Use or to select between

- *auto* (wavelength range 330 nm to 850 nm; scaling of the absorbance or transmission range is automatic)
- *manual* (wavelength range and absorbance or transmission range are determined individually)

→ Confirm with .

Example:

Setting to manual scaling of the axes, changing the coordinate limits to the wavelength range 400 nm to 800 nm (default 330 nm to 850 nm) and absorbance range 0.000 A to 2.000 A (default 0.000 A to 2.500 A).

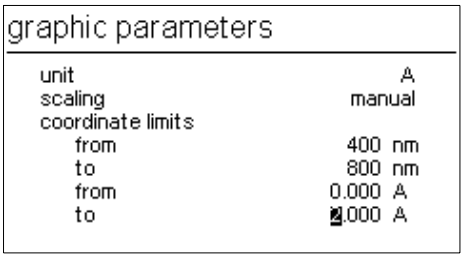


graphic parameters submenu:

→ Confirm *unit A* with

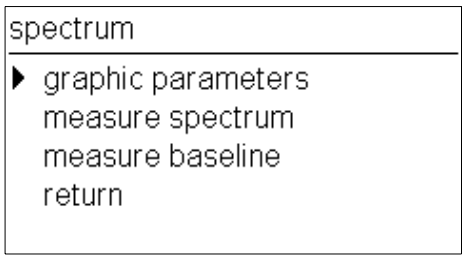
→ Use or to select *manual scaling*

→ Confirm with .



→ Input the coordinate limits required for both axes via the numeric keypad

→ Confirm each time using .

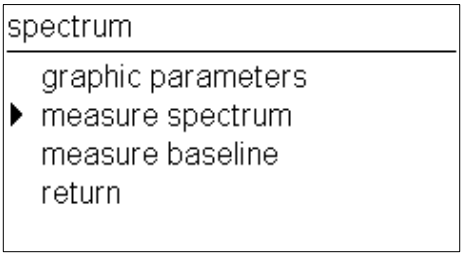


The graphic parameters are stored.
The meter returns to the *spectrum* menu.

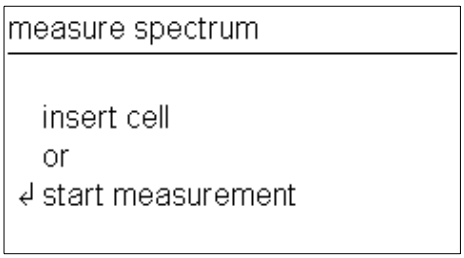
Erasing the graphic parameters:

- change the measuring mode
- switch off the photometer
- overwrite or set to *auto.*

10.1.2 Measuring the spectrum

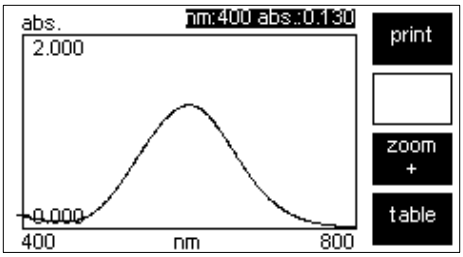


→ In the *spectrum* menu, call up the *measure spectrum* menu item.



→ Insert the cell or use ↵ to start the measurement.

The message *measuring ...* appears.



The spectrum for the selected method appears as a graphic with the specified parameters.

The cursor keys are active:

Pressing 6 › or ‹ 4 moves the cursor on the curve to the right or the left.

The ^ 2 key moves the cursor to the highest point of the curve. The 8 v key moves the cursor to the lowest point of the curve.

The upper display line indicates the current cursor position.

print: Pressing 1 produces a printout of the display

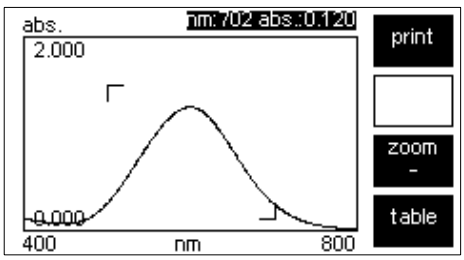
LQ300 printer with printer cable required (accessories).

To return to the *spectrum* menu:

→ Press . (*table*), then 7 (*return*).

Zooming a section of the spectrum

zoom +: Press 7 to activate the zoom function.

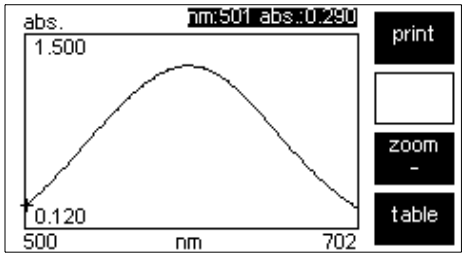


→ Use the cursor keys to determine the upper left-hand corner of the zoom window followed by the lower right-hand corner.

→ Confirm each time using ↵.

The smallest possible zoom window is limited to 10 nm in the x axis.

The smallest adjustable distance in the y axis is 0.1 A (Absorbance) or 10% T (Transmission), depending on the unit selected.

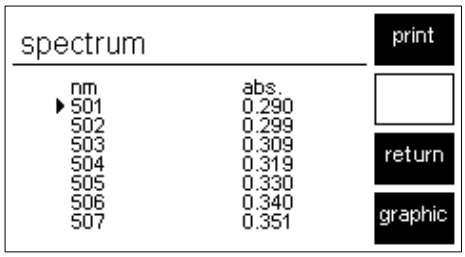


The contents of the zoom window are displayed enlarged.

zoom -: return to the original graphic with 7 .

Tabular display of the spectrum

→ *table*: Press . to display the spectrum as a table.



The table lists the wavelengths of the measured spectrum (in steps of 1 nm) and the respective absorbance or transmission values.

→ Press 2 or 8 to bring the maximum or minimum value into the upper line of the table

→ Scroll through the wavelengths with

print: Print using 1

graphic: Switch to the graphic using .

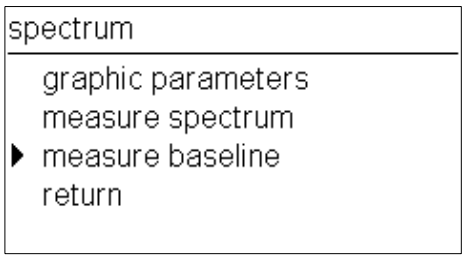
return: Return to the *spectrum* menu, not to the graphic, using 7.

Sample printout:

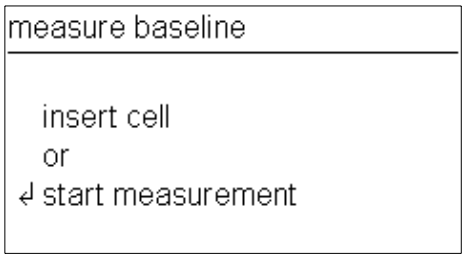
```
26:05:99                17:09:26
spectrum from 330 nm to 850 nm
    [nm]                abs.
1   330                 2.417
2   331                 2.424
3   332                 2.431
...
```

10.1.3 Measuring the baseline

This function is used to newly determine the reference absorbance or transmission for a wavelength range. The baseline is stored and is used as a new reference value for the spectrum measurement.

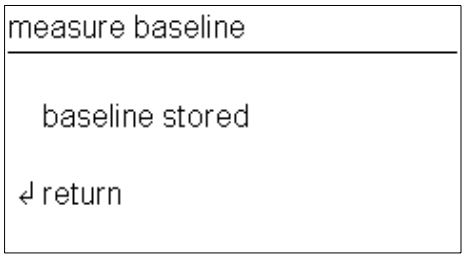


→ Select the *measure baseline* function from the *spectrum* menu.



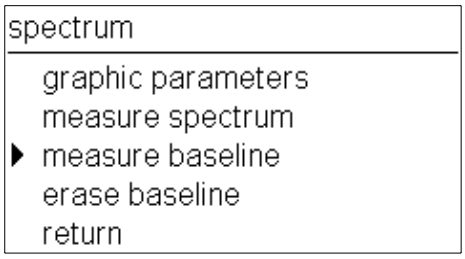
→ Insert the cell to start the measurement.
The message *measuring...* appears on the display.

After the measurement is finished:



The baseline has been measured and stored.

→ Return to the *spectrum* menu using .



→ Select the *measure spectrum* function from the *spectrum* menu.
→ Measure as described in section 10.1.2 MEASURING THE SPECTRUM. While the message *measuring...* is displayed, *Baseline: OK* appears in the upper display line to indicate that the measurement is being conducted against a new baseline.

The measured baseline remains valid for all the following spectrum measurements in the same wavelength range and with the same cell type.

Erasing the baseline

The baseline can be erased by

- using the menu item, *erase baseline*
- switching off the meter.

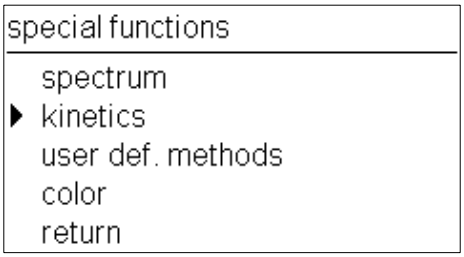
10.2 Kinetics

The *kinetics* function enables the tracking of time-dependent changes in concentration or absorbance by repeat measurements. When doing this, the photometer measures at an adjustable time interval (setting: 00:10 to 10:00 min with the smallest interval of 10 seconds). The wavelength can also be selected.

The kinetic measured values are stored in the memory in the same way as the measured values from single measurements (older measured values are overwritten). The duration of the measurement can be input: minimum 1 minute, maximum 999 times the measuring interval. The maximum number of measuring cycles of a kinetic measurement is 1000 measurements (until the memory is full of kinetic measured values). The current measured value number appears in the header of the display. When the memory is full, the meter aborts the kinetic measurement. The oldest values of the kinetic are not overwritten.

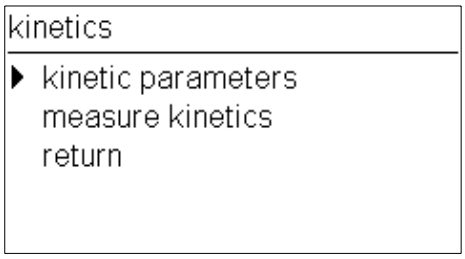
Kinetic measuring requires a minimum 2 hour warm-up period of the photometer.

→ In the *setup* menu, call up the *special functions* submenu.
The following display appears:

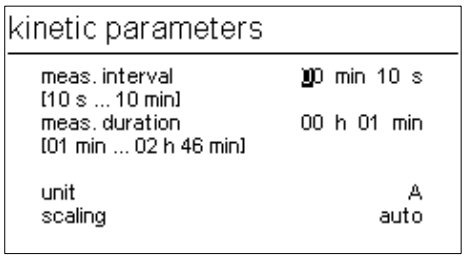


→ Call up the menu item, *kinetics*

10.2.1 Setting the kinetic parameters



→ Call up the menu item, *kinetic parameters*.



→ Input the measuring interval via the numeric keypad (default: 10 sec).
Possible settings:
00:10 to 10:00

→ Confirm with .

→ Input the measuring duration via the numeric keypad (default: 1 min).

Depending on the measuring interval selected, the photometer calculates and displays the maximum measuring duration (= measuring interval x 999).

→ Confirm with .

Possible settings for the graphic:

Dimension of the y axis

→ Use or to select between

- *c* (concentration)
- *A* (Absorbance)
- *%T* (Transmission)

→ Confirm with .

Scaling:

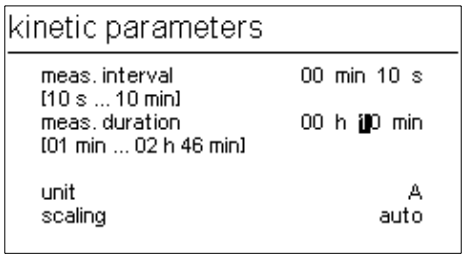
→ Use or to select between

- *auto* (the scaling of the absorbance/transmission or concentration range is made automatically)
- *manual* (absorbance or transmission ranges are determined individually) - can only be selected for the units %T and A.

→ Confirm with .

Example:

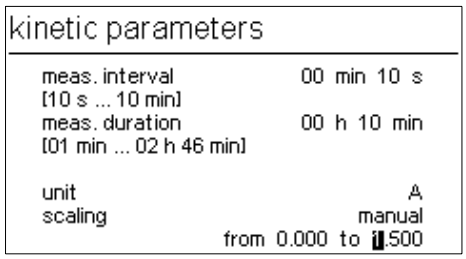
Setting a measuring interval of 10 s, measuring duration 10 min, unit A, manual scaling of the y axis, absorbance range 0.000 A to 1.500 A (default 0.000 A to 2.500 A).



kinetic parameters submenu:

→ Input the required measuring interval and measuring duration via the numeric keypad.

→ Confirm each time using .

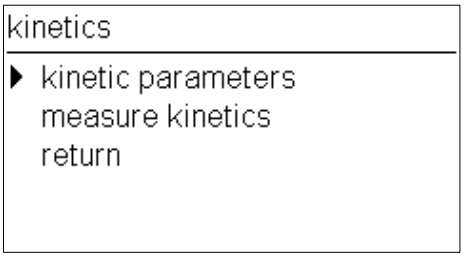


→ Confirm *unit A* with

→ Use or to select *manual scaling*

→ Input the coordinate limits required for the y axis via the numeric keypad

→ Confirm each time using .

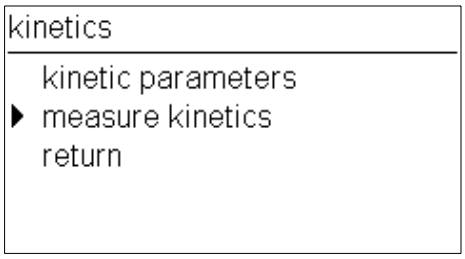


The kinetic parameters are stored.
The meter returns to the *kinetics* menu.

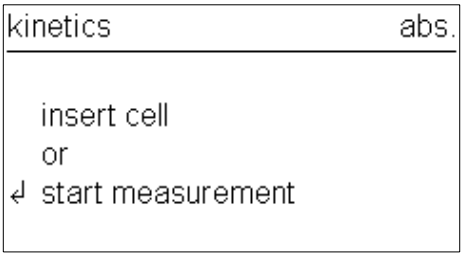
The settings are retained until the meter is switched off.

The measuring duration of the photometer increases with the absorbance measured. Therefore, in case of very short intervals (e. g. 10 s), the next measurement may be due while the current measurement is not yet finished. In this case, the measurement is left out. We recommend to select a longer measuring interval.

10.2.2 Measuring the kinetics



→ Call up the *measure kinetics* menu item in the *cinetics* menu.

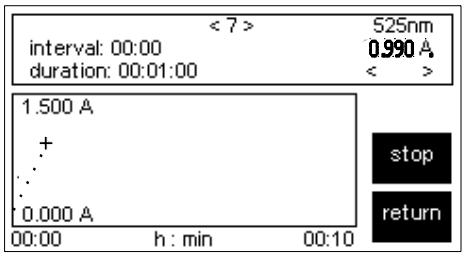


→ Insert the cell or use ↵ to start the measurement.

The message *measuring ...* appears.

The sample warms up during kinetic measurements with long measuring durations.

After the measurement is finished:



The measuring process appears as a graphic with the specified parameters.

The kinetic measurements are performed continually at the specified intervals.

The following information is given in the upper display area (from left to right):

- the time until the next single measurement (the countdown runs)
- the present duration of the measurement (the time runs)
- the number of the last single measurement
- the wavelength
- the last measured value

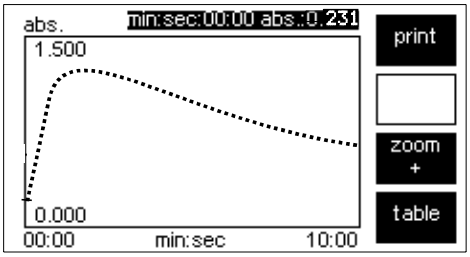
The cursor is always positioned on the last measured value.

stop: Terminate the measuring process and display the results in a graphic (see below) using 7.

return: Return to the *kinetics* menu using .

After the measurement is finished, the photometer automatically changes to the graphical display of the kinetics.

Graphical display of the kinetics



The cursor keys are active:

Pressing 6 › or ‹ 4 moves the cursor on the curve to the right or the left.

The ^ 2 key moves the cursor to the highest point of the curve. The 8 ⌄ key moves the cursor to the lowest point of the curve.
The upper display line indicates the current cursor position.

print: Pressing 1 produces a printout of the display

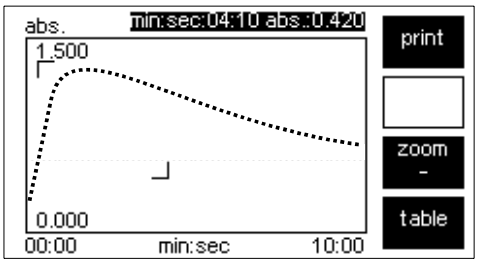
LQ300 printer with printer cable required (accessories).

Return to the *kinetics* menu:

→ Press . (*table*), then 7 (*return*).

Zooming a section of the kinetics

zoom +: Press 7 to activate the zoom function.

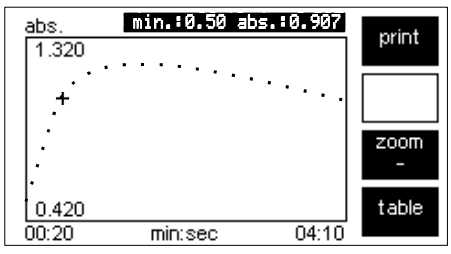


→ Use the cursor keys to determine the upper left-hand corner of the zoom window followed by the lower right-hand corner.

→ Confirm each time using ↵.

The smallest possible zoom window is limited by the measuring interval in the x axis.

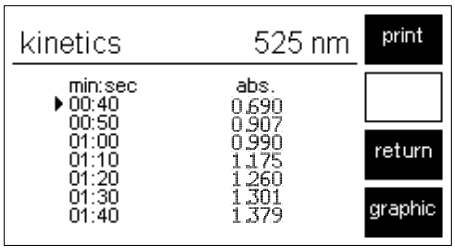
The smallest adjustable distance in the y axis is 0.1 A (Absorbance) or 10% T (Transmission), depending on the selected unit, or 1 % of the measuring range in concentration measurement.



The contents of the zoom window are displayed enlarged.

zoom -: return to the original graphic with 7.

Tabular display of the kinetics



→ *table*: Press . to display the kinetics as a table.

The table lists the times of the kinetic measurements and the corresponding measured values.

→ Press 2 or 8 to bring the maximum or minimum value into the upper line of the table

→ Scroll through the measuring times with

print: Print using 1

graphic: Switch to the graphic using .

return: Return to the *kinetics* menu, not to the graphic, using 7.

Sample printout:

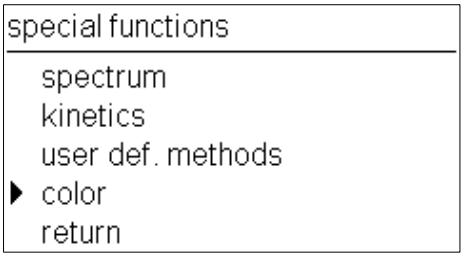
kinetics start	09.11.99 15:46:08			
000 abs.	09.11.99 00:00:00	0.231	A	605nm
001 abs.	09.11.99 00:00:10	0.359	A	605nm
002 abs.	09.11.99 00:00:20	0.492	A	605nm
003 abs.	09.11.99 00:00:30	0.555	A	605nm
004 abs.	09.11.99 00:00:40	0.690	A	605nm
005 abs.	09.11.99 00:00:50	0.907	A	605nm
...				
...				
060 abs.	09.11.99 00:00:10	0.695	A	605nm
kinetics stop	09.11.99 15:56:08			

10.3 Color

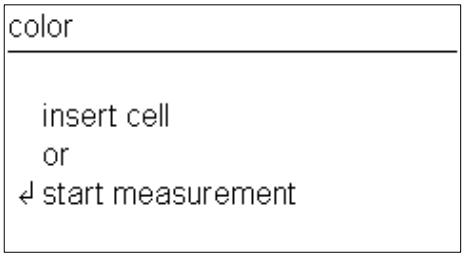
The *color* function facilitates the convenient measurement of the color of a solution at three different wavelengths (436 nm, 525 nm, 620 nm) at the same time, according to EN ISO 7887 of 1994. The photometer gives the result of the color measurement in m^{-1}. All cell types are accepted for color measurement.

The color values are stored in the memory in the same way as the measured values of the difference measurements; the three values of each color measurement are given the same consecutive number or ID number.

→ In the *setup* menu, call up the *special functions* submenu.
The following display appears:



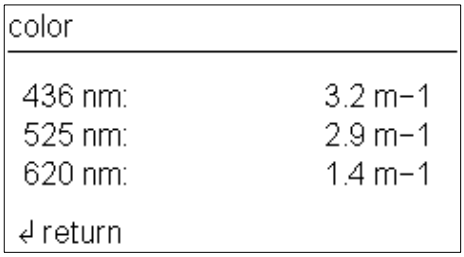
→ Call up the menu item, *color*.



→ Insert the measuring cell.

The message *measuring ...* appears.

After the measurement is finished:

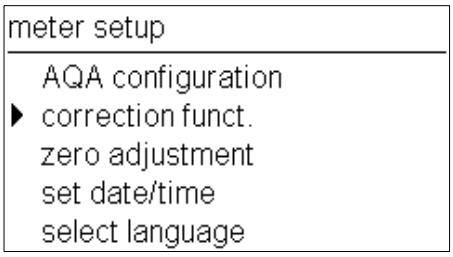


The measured values appear on the display.

Sample printout:

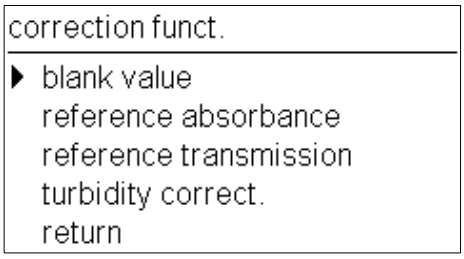
018 FB	25.05.99	13:58:44	5.6	m-1	436nm
018 FB	25.05.99	13:58:44	6.4	m-1	525nm
018 FB	25.05.99	13:58:44	2.0	m-1	620nm

→ In the *setup* menu, call up the *meter setup* submenu.
The following display appears:



Call up the *correction funct.* submenu.

The following display appears:



Select the correction function:

- *blank value*
- *reference absorbance*
- *reference transmission*
- *turbidity correct.*

→ Confirm with .

11.1 Blank value

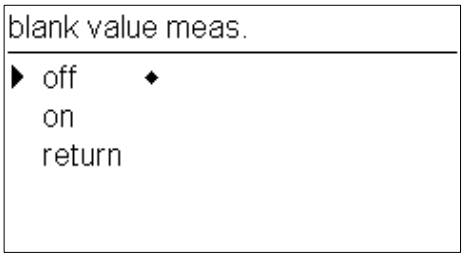
The blank value (= reagent blank value) for each method is stored in the photometer.
When the *blank value* function is active, the stored value is ignored and the measured value of a self-prepared reagent blank solution is used instead. This procedure increases the measuring accuracy for some tests (for more information, see part 3 **Analytical procedures** of this operating manual).
The blank value only applies to the method just called up.
The *blank value* function is not active when delivered.

The measured blank value is stored until

- the photometer is switched off
- the method is changed
- it is manually erased using the *erase blank value* function.

→ Call up the *blank value* submenu in the *correction functions* menu.

The following display appears:

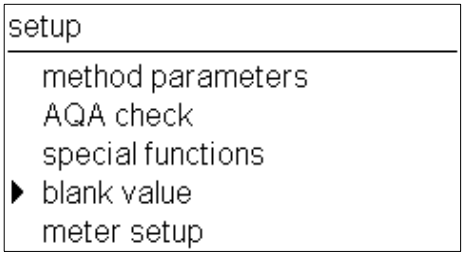


The *blank value meas.* function appears:

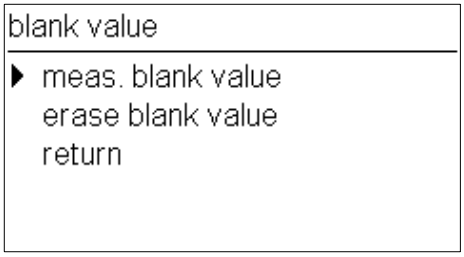
→ Select the menu item, *on*

→ Confirm with .

The *blank value* function is active and appears in the *setup* menu:

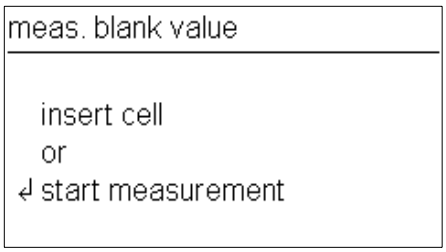


→ To measure the blank value, call up the *blank value* submenu in the *setup* menu.



→ Call up the *meas. blank value* menu item.

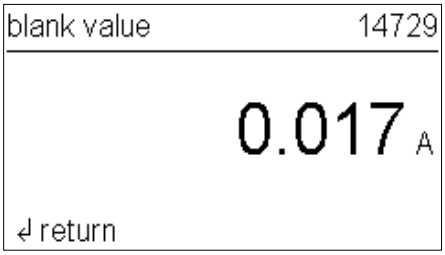
The *erase blank value* menu item first appears after a blank value has been measured.



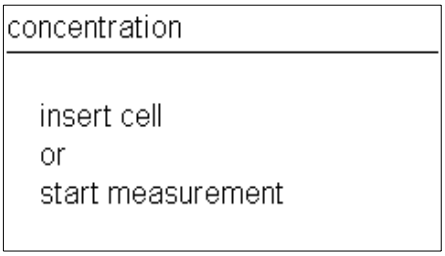
→ Insert a cell with blank solution to start a measurement.
The message *measuring...* appears on the display.

The measured blank value applies for all subsequent measurements using the identical method (the photometer only stores one single blank value each time for a whole series of measurements).

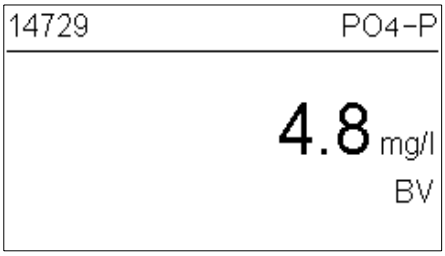
After the measurement is finished:



→ Call up the *concentration* measuring mode by pressing .

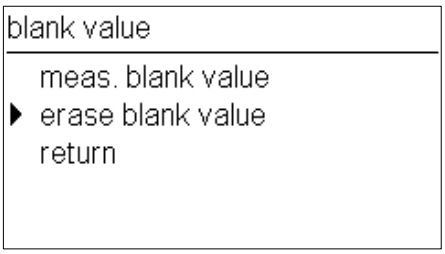


→ Insert the measuring cell.



The value measured against the prepared blank solution is displayed. The measured value is identified by *BV*.

Erasing a blank value



→ Select the menu item, *erase blank value*

→ After confirming with the stored blank value is erased.

The *erase blank value* menu item first appears after a blank value has been measured.

11.2 Reference absorbance

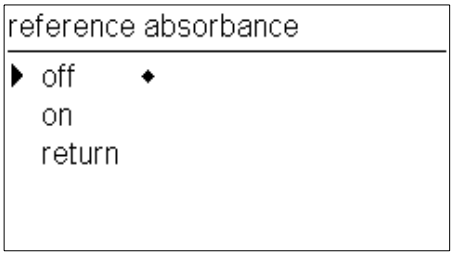
Each absorbance measurement is made against the basic absorbance stored in the meter.
When measuring the *reference absorbance*, this value is ignored and the value measured as the reference absorbance is used instead.

The *reference absorbance* function is not active when delivered.

The measured *reference absorbance value* remains stored until

- the photometer is switched off
- the cell type (10mm, 20mm, 50mm, round) is changed
- the wavelength is changed
- the measuring mode, reference absorbance, is left
- it is manually erased using the *erase ref. absorb. function*

→ In the *correction functions* menu, call up the *reference absorbance* menu item.
The following display appears:



reference absorbance function:

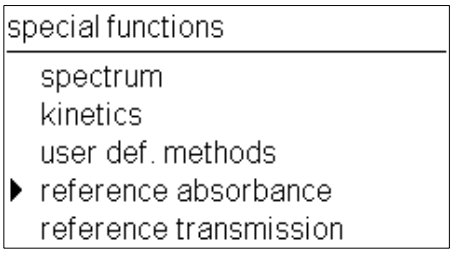
→ Select the menu item, *On*

→ Confirm with .

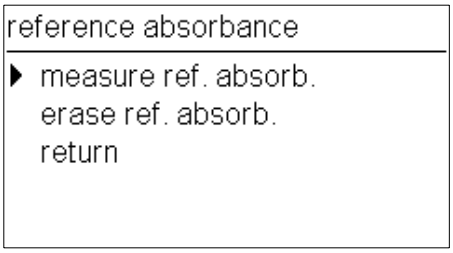
The *reference absorbance* function is active and appears in the *special functions* menu.

→ To measure the reference absorbance, call up the *special functions* submenu in the *setup* menu.

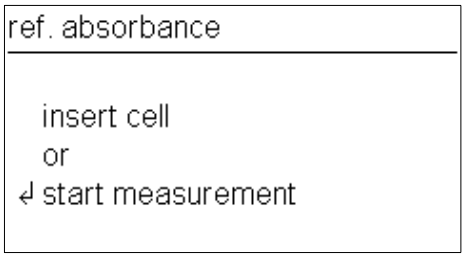
→ Call up the *reference absorbance* menu item.



→ Call up the menu item, *measure ref. absorb.*

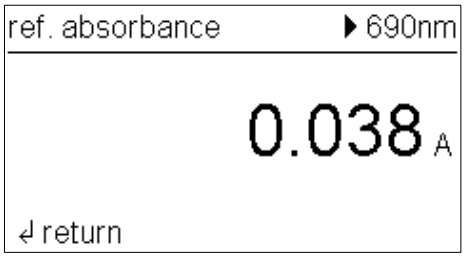


The menu item, *erase ref. absorb.* first appears after at least one reference absorbance has been measured.



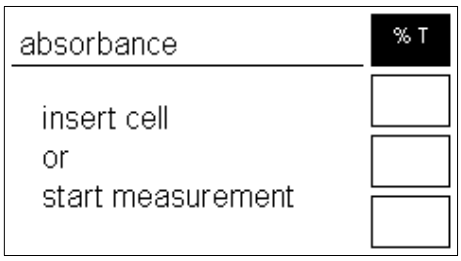
→ Insert the cell to start a measurement.
The message *measuring...* appears on the display.

After the measurement is finished:



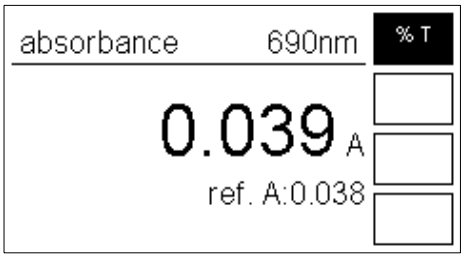
The measured value for the wavelength displayed at the top right appears.

→ Call up the *absorbance* measuring mode by pressing .



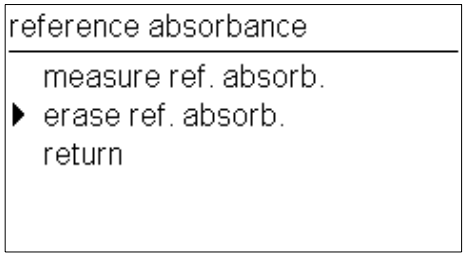
→ Insert the measuring cell.

After the measurement is finished:



The measured value corrected by the reference absorbance is displayed.

Erasing the reference value



→ Call up the menu item, *erase ref. absorb.*

→ After confirming with , the reference absorbance value is erased.

11.3 Reference transmission

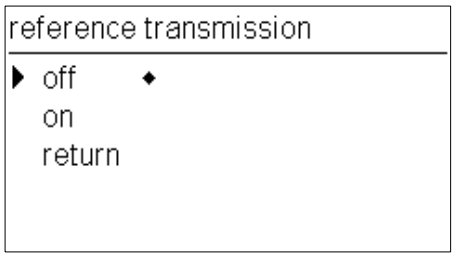
Each transmission measurement is made against the basic transmission stored in the meter.
When measuring the *reference transmission*, this value is ignored and the value measured as the reference transmission is used instead.

The *reference transmission* function is not active when delivered.

The measured reference transmission value remains stored until

- the photometer is switched off
- the cell type (10 mm, 20 mm, 50 mm, round) is changed
- the wavelength is changed
- the measuring mode, reference transmission, is left
- it is manually erased using the *erase ref. transmission function*
- the function, *reference transmission*, is switched off.

→ In the *correction functions* menu, call up the *reference transmission* menu item.
The following display appears:



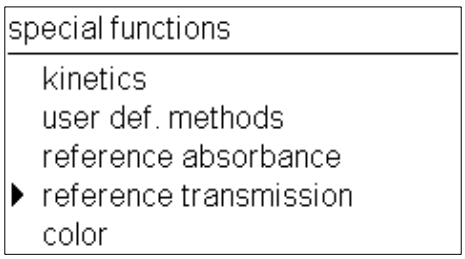
reference transmission function:

→ Select the menu item, *On*

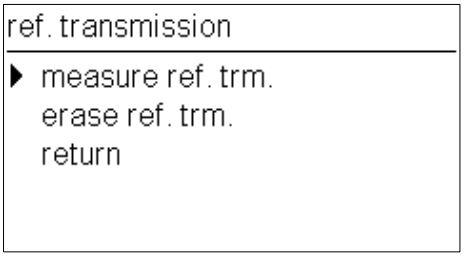
→ Confirm with .

The function, *reference transmission* is active and appears in the *special functions* menu.

→ To measure the reference transmission, call up the *special functions* submenu in the *setup* menu.

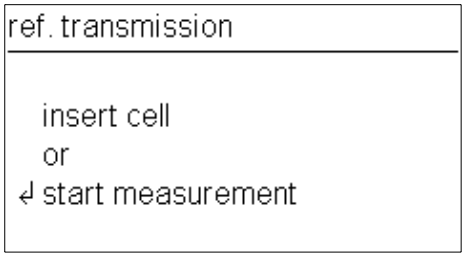


→ Call up the *reference transmission* menu item.



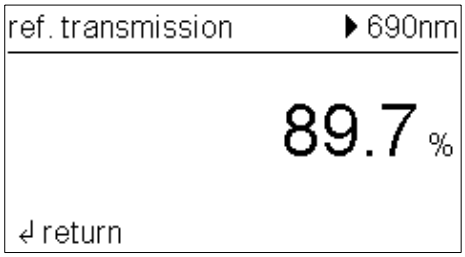
→ Call up the *measure ref. trm.* menu item.

The *erase ref. trm.* menu item first appears after at least one reference absorbance has been measured.



→ Insert the cell to start a measurement.
The message *measuring...* appears on the display.

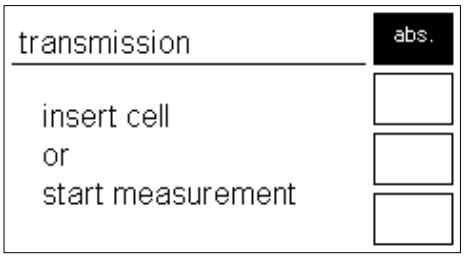
After the measurement is finished:



The transmission value for the wavelength displayed at the top right appears.

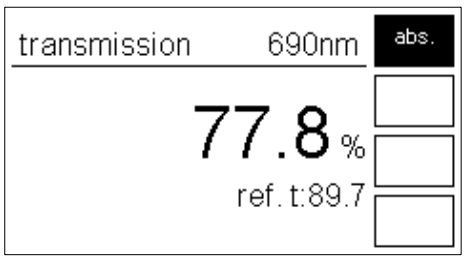
→ Call up the *absorbance/transmission* measuring mode by pressing .

→ Press 1 to call up the *transmission* measuring mode.



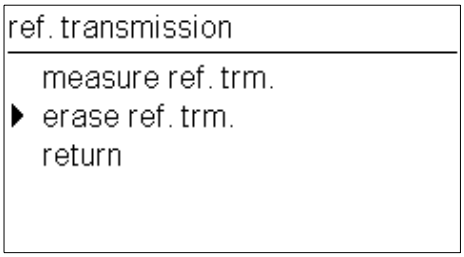
→ Insert the measuring cell.

After the measurement is finished:



The measured value corrected by the reference transmission is displayed.

Erasing the reference value



→ Call up the *erase ref. trm.* menu item

→ After confirming with , the reference transmission value is erased.

11.4 Turbidity correction

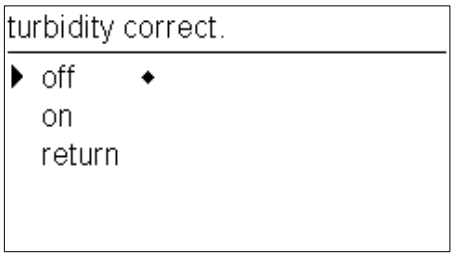
Turbidity correction is used in sample solutions that contain finely distributed suspended particles.
The suspended particles cause a light absorption.
This leads to incorrect (too high) measured values.

The function remains permanently switched on after it has been activated. Values that were measured using turbidity correction are given an identifier in the display and in the documentation (printout and storage).

The *turbidity correction* function is not active when delivered.

This function is not necessary, or useful, in all methods. If the turbidity correction is active, the photometer automatically decides whether to perform the function or not depending on the method.

→ Call up the *turbidity correct.* submenu in the *correction functions* menu.
The following display appears:



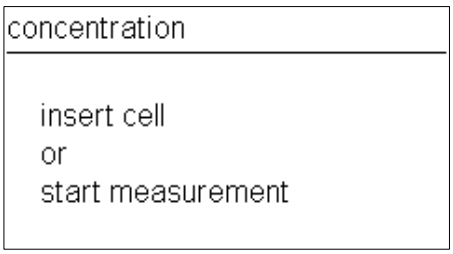
The *turbidity correct.* function appears:

→ Select the menu item, *on*

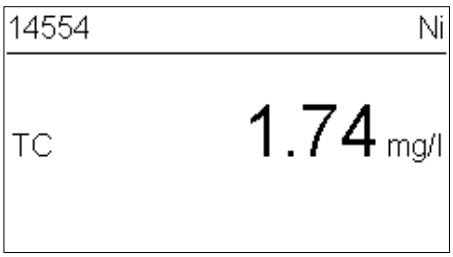
→ Confirm with .

→ Call up the *concentration* measuring mode by pressing .

→ Insert the measuring cell.



After the measurement is finished:



Display of the measured value with turbidity correction switched on:
Identified by *TC*.



Warning of excessive turbidity:
If the turbidity absorbance of *0.100 A* is exceeded, the photometer displays the measured value together with a warning (*high turb.*).

Zero adjustment is necessary

- after changing the lamp
- after the error message *PhotoCheck* occurs (AQA1)
- after changing the Memory Card
- on initial commissioning
- if the photometer was mechanically stressed, e.g. percussion, transport
- if the ambient temperature changed by more than 5 °C since the last zero adjustment
- at least every six months.

When performing the zero adjustment with a **round cell** observe the following points:

When performing the zero adjustment observe the following points:

- Only use a clean, scratch-free round cell with distilled water. A prepared zero cell is provided with your photometer. In addition, a prepared zero cell is contained in the scope of delivery of the *PhotoCheck* (article 14693).
- If the round cell is visibly contaminated, or at least every 24 months, clean and refill it (minimum filling level 20 mm). Then check the cell for scratches.

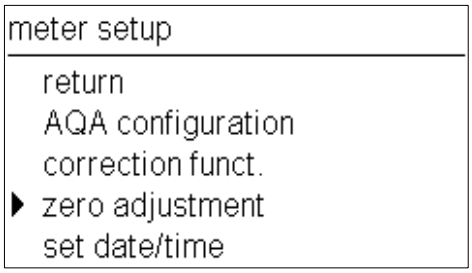
When performing the zero adjustment with a **rectangular cell** observe the following points:

- With rectangular cells, the adjustment must be made using the same cell type (manufacturer) as for the measurement. This is important because glass of different manufacturers has different absorption behavior. When changing the cell type always repeat the zero adjustment with the new type.
- Clean the rectangular cell before performing the zero adjustment and fill it with distilled water (minimum filling level 20 mm).
- For measurement, always insert rectangular cells in the cell shaft with the same orientation as during the zero adjustment (e.g. cell labeling always on the left side).

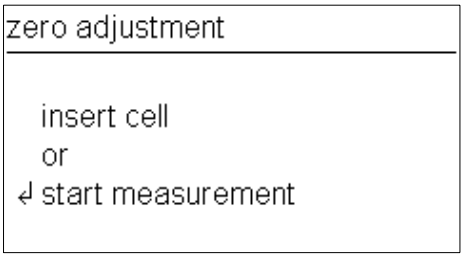
→ In the *setup* menu, call up the *meter setup* submenu.

The following display appears:

→

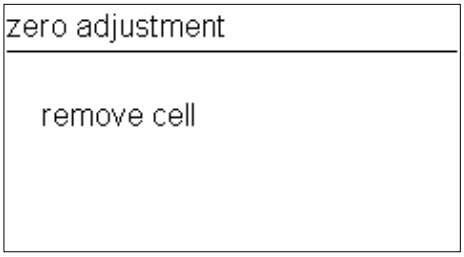


→ Call up the *zero adjustment* submenu.



→ Insert a cell with distilled water.
The message *measuring...* appears on the display.

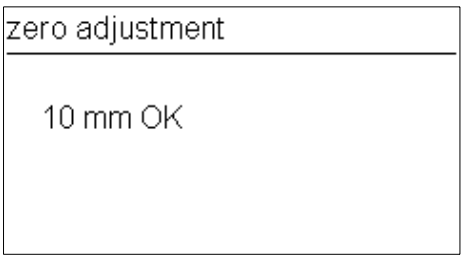
After approx. 2 s:



→ Remove the cell.

The photometer performs an AutoCheck measurement.

After approx. 5 s:



Successful zero adjustment for the 10 mm square cell.

User-defined methods can be stored under code numbers. Numbers from 301 to 399 are allowed. These code numbers are used to fast-find user-defined methods when setting methods.

A total of 99 user-defined methods can be stored. The 100th user-defined method causes the *meth. error* message to appear; in this case erase an old method.

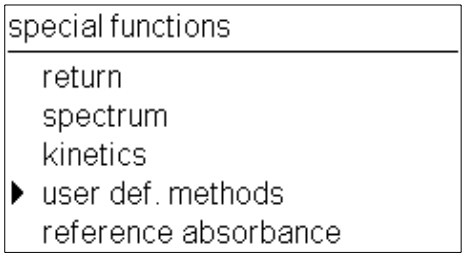
If you input a method number that is already stored in the photometer, the characteristics are displayed and you can modify them. If the input is successful, the meter displays the accepted method.

The photometer automatically restricts the measuring range (no message) if the entered method data allows absorbance values > 3.0 A.

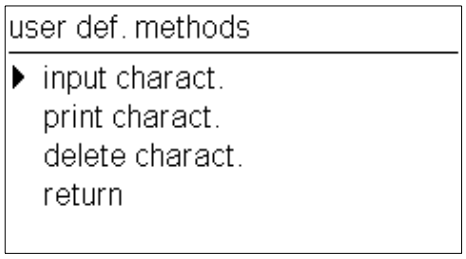
→ In the *setup* menu, call up the *special functions* submenu.

The following display appears:

→



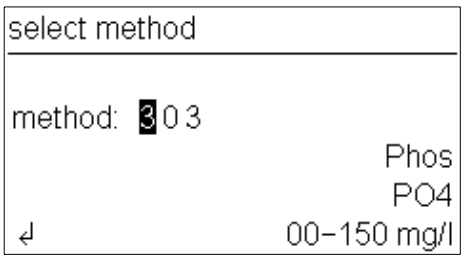
→ Call up the *user def. methods* submenu.



The *user def. methods* submenu appears:

- *input charact.*
  Entering characteristics for user-defined methods.
- *print charact.*
  Printing the characteristics for user-defined methods; first appears after characteristics have been input.
- *delete charact.*
  Erasing single or all user-defined methods; first appears after characteristics have been input.

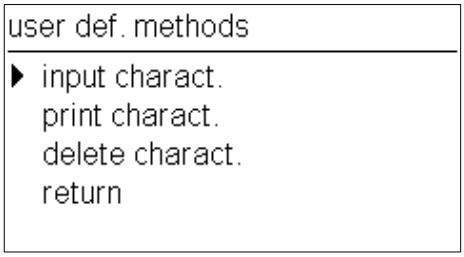
Measuring with user-defined methods:



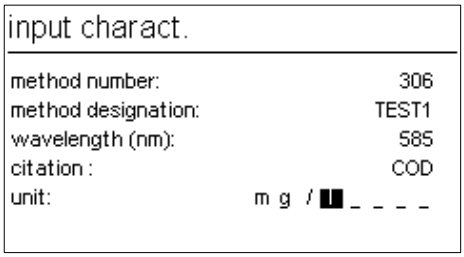
→ Insert a measuring cell (without barcode)
→ Input a method number via the numeric keypad
→ Confirming with ↲ starts the measurement.

The photometer only allows the input of method numbers for which a method is stored.

13.1 Entering characteristics via the keyboard



→ Call up the *input charact.* submenu.



→ Input the method number (301 to 399) via the numeric keypad

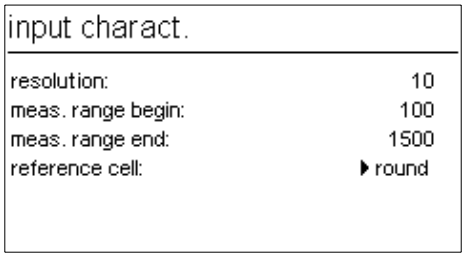
→ Confirm with .

Confirming without entering a character terminates the input for the current field; continues with the next field.

Input further characteristics, as for example the method designation TEST1, wavelength 585, citation form COD, unit mg/l:

→ Enter letters using ,
numerals via the numeric keypad

→ Confirm each time using .



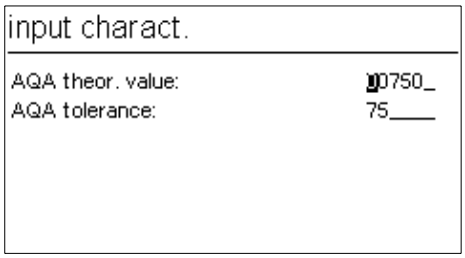
Selecting the resolution defines the numeric display of the beginning and end of the measuring range.

→ Select the resolution using
Possible selections:
- 0.001
- 0.01
- 0.1
- 1
- 2
- 5
- 10
- 100

→ Input the beginning and end of the measuring range via the numeric keypad

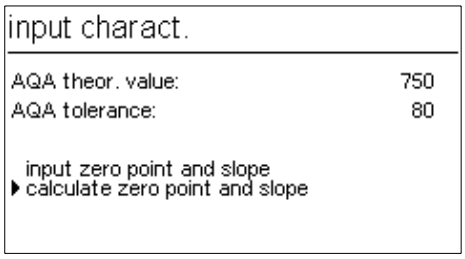
→ Select the reference cell using
Possible selections:
- round (14 mm)
- 10 mm
- 20 mm
- 50 mm

→ Confirm each time using .



At this point, the photometer provides practical default values for the AQA theoretical value and tolerance. They can be overwritten using the numeric keypad.

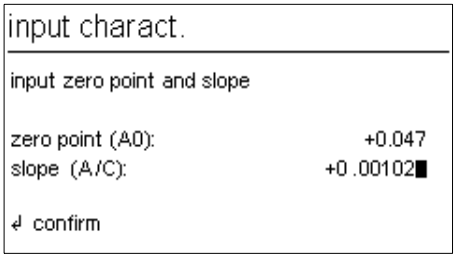
→ Confirm each time using .



→ Use to select between
- *input zero point and slope*
- *calculate zero point and slope.*

→ Confirm with .

Selecting *input zero point and slope*:

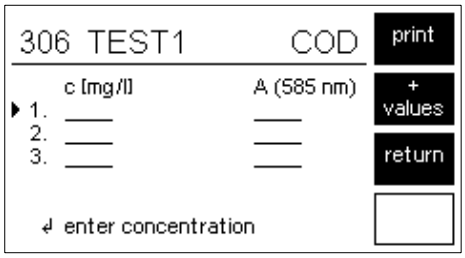


→ Input the zero point and slope

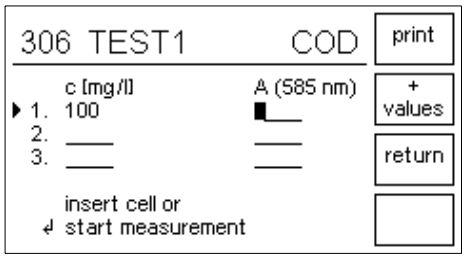
→ Select the sign (+/–) using
- Numbers from 0 to 9
- Confirm each time using .

Selecting *calculate zero point and slope*:

When entering user-defined methods, the photometer offers the option to measure/input and store the characteristics in a single step. In doing so, minimum 3 up to maximum 10 standard solutions are measured; from these, the photometer determines the slope and zero point of the new method.



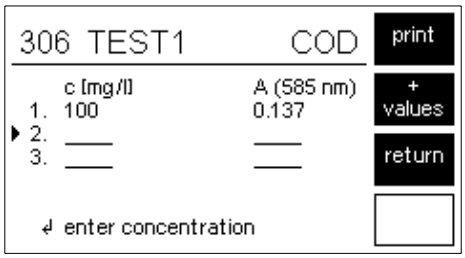
→ Press and input the concentration of the first standard solution, e. g. 100 mg/l.



→ To measure the absorbance, insert a cell (without barcode) with standard solution

or

→ Input the absorbance via the numeric keypad.



The absorbance value of the first standard solution appears on the display.

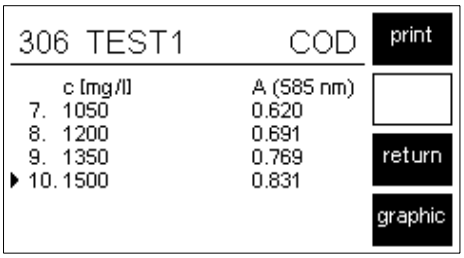
→ Remove the cell

→ Use to continue with the input of the concentration of the second solution.

Continue until the values of all standard solutions (minimum 3, maximum 10) have been input or measured.



+ *values*: After pressing 4 you can input additional pairs of values.



The cursor is positioned on the selected pair of values.

→ Scroll in the table using

Erase: If the input or measurement is incorrect or in case of “outliers”, a pair of values can be erased by pressing C twice. It is then possible to measure once again.

On leaving the table, the photometer calculates the slope S, zero point A0 and correlation coefficient r2 from the data of the available value pairs.
The following options are available for leaving the table:

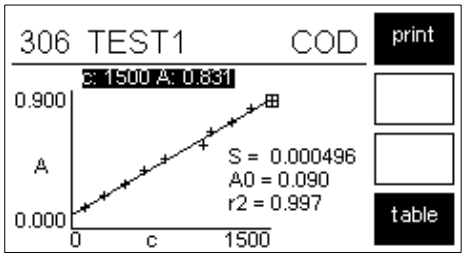
- *print*: Pressing 1 prints value pairs, zero point, slope and correlation coefficient of the new method
- *return:* Pressing 7 terminates the input. Please note that the graphical and tabular display is no longer available. The display shows the data of the new method; it can be stored.
- *graphic*: Pressing . swaps between the graphical and tabular display of the characteristics.

Sample printout:

27:05:99	11:33:09
306 TEST1	COD
c [mg/l]	A (585 nm)
1 100	0.137
2 250	0.214
3 400	0.290
4 550	0.369
5 700	0.445
...	
zero point:	0.090
slope (A/c):	0.000496
corr. coefficient:	0.997

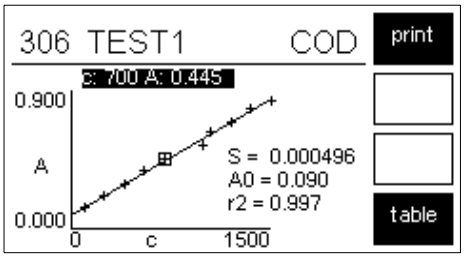
Graphical display of the characteristics

graphic: Pressing . displays the characteristics of the user-defined method graphically.



The graphic shows the course of the absorbance in the defined measuring range. In addition, the slope S, zero point A0 and correlation coefficient r2 are displayed.

The current cursor position is displayed on a black background.



→ 6 › and ‹ 4 move the cursor on the straight line.

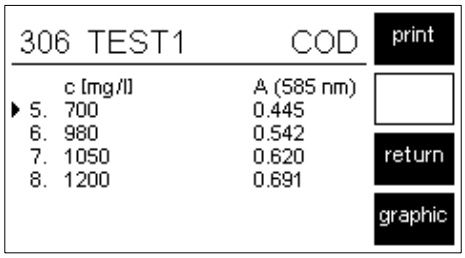
print: Print using 1

LQ300 printer with printer cable required (accessories).

table: Return to the table using .

In the table, the ▶ sign appears on the data record that was previously marked in the graphic.

Storing the characteristics:



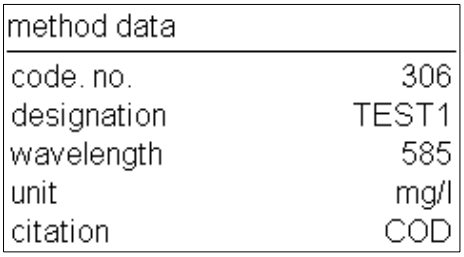
Starting point: table:

→ Storing the characteristics:

return: Pressing 7 displays the code number and characteristics as a list.

→ Terminating without storing:

Use ⏻ or ⏻ to switch to the measuring mode.



→ Scroll using ⏻.

→ To store the new method and return, press ⏻.

The method data is automatically printed.

The *method data* display is used to view the data of the new user-defined method again. The photometer stores the new data only after ⏻ has been pressed.

Sample display of the method data:

27:05:99	11:37:43
user-def. methods	
code no.	306
designation	TEST1
wavelength	585
unit	mg/l
citation form	COD
resolution	10
zero point:	+0.090
slope	+0.000496
MRB	100
MRE	1500
reference cell	round
AQA theor. value	750
AQA tolerance	80

13.2 Entering characteristics via the PC

Data format of the method data:
The data of user-defined methods is transferred in a string. The individual datablocks of the string are separated by spaces:



Further information is given in the chapter 16 RS 232 C INTERFACE.

Datablock	Maximum no. of characters	Example
Input user-defined methods	4	CEME
Method number	3	301
Method designation	5	TEST1
Wavelength	5	690nm
Unit	9	mmol/l
Citation form	12	C6H5OH
Zero point	5	0.009
Slope	5	2.12
Meas. range begin	5	0.1
Meas. range end	5	22.3
Reference cell	2	14 (= round)
Resolution	5	0.1
AQA theor. value	10	10.0
AQA tolerance	10	1.0

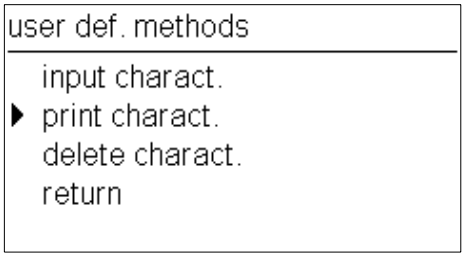
Example: CEME 301 Test1 690nm mmol/l C6H5OH 0.009 2.12 0.1 22.3 14 0.1 10.0 1.0 <CR>

Error message "INVALID COMMAND"

The following inputs lead to this error message:

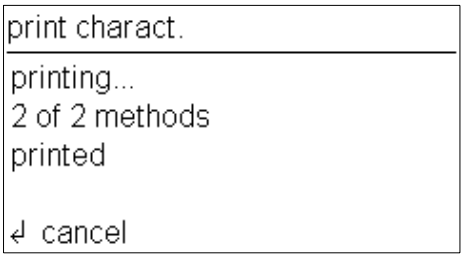
- Slope = 0 *or* < -32000, > 32000
- Zero point > 32000
- Meas. range begin < 0 *or* > 32000
- Meas. range end < 0 *or* > 32000
- Meas. range begin ≥ Meas. range end
- Reference cell not equal to 10 mm, 14 mm, 20 mm or 50 mm
- Designation of the wavelength does not agree with the photometer
- Resolution not 0.1, 0.01, ...

13.3 Printing characteristics



→ Call up the *print charact.* submenu.

→ Start printing using .



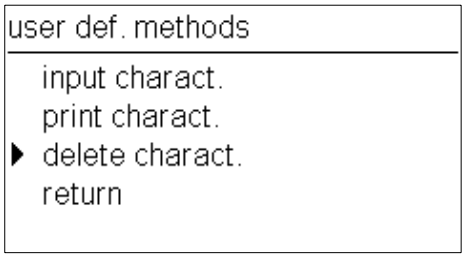
The characteristics of all user-defined methods are printed sequentially as a list.

→ Cancel using .

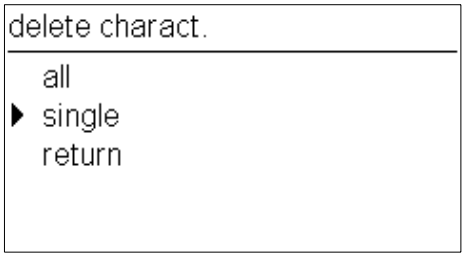
Example: Report printout

Date	Time
user-def. methods:	
code no.	301
designation	TEST1
wavelength	690 nm
unit	mmol/l
citation form	C6H5OH
resolution	0.1
zero point	+0.009
slope	+2.12
MRE	0.1
MRB	22.3
reference cell	round
AQA theor. value	10.0
AQA tolerance	1.0

13.4 Erasing user-defined methods



→ Call up the *delete charact.* submenu.



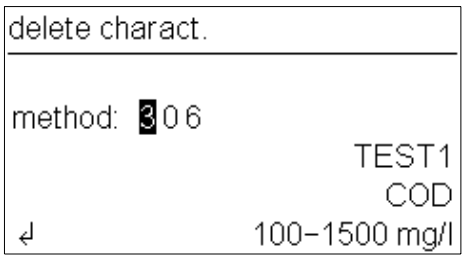
Select the required menu item:

- *all*
  Erase all user-defined methods
- *single*
  Selectively erase individual methods

→ Confirm with .

Selecting *single*

Example: Erase TEST1

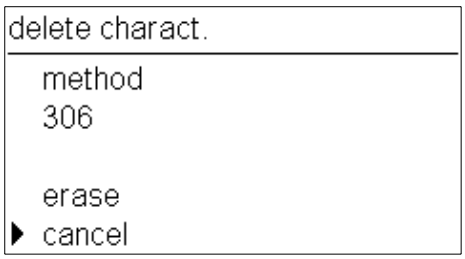


→ Select the method, e. g. TEST1:
  – Input the method number (306) via the numeric keypad

or

  – Scroll with

→ Confirm with .

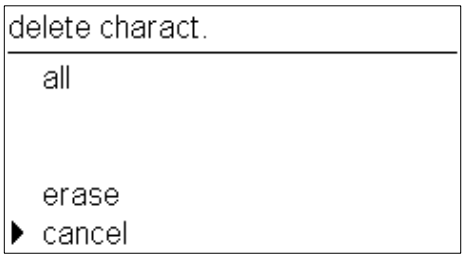


→ Select the menu item, *erase*

→ Confirm with .

The message *method is erased...* appears

Selecting *all*



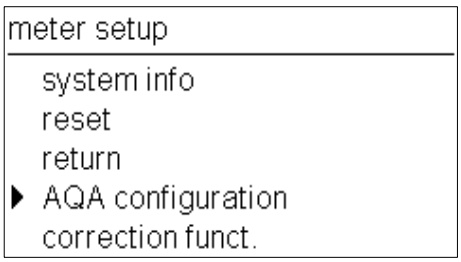
→ Select the menu item, *erase*

→ Confirm with .

The message *methods are erased...* appears

→ In the *setup* menu, call up the *meter setup* submenu.

The following display appears:



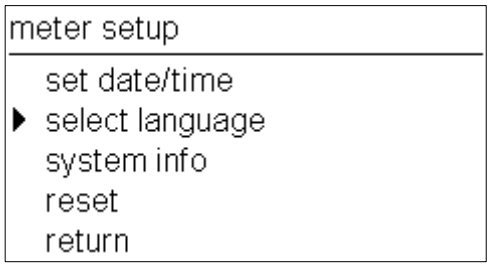
This chapter describes four functions of the *meter setup* menu:

- *select language*
- *set date/time*
- *reset*
- *system info*

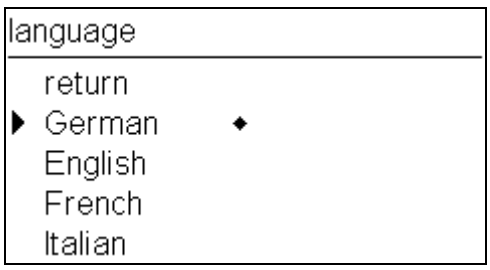
14.1 Selecting the language

The following languages are stored in the photometer:

- German
- English
- French
- Italian
- Portuguese
- Polish
- Danish
- Swedish
- Spanish
- Dutch
- Indonesian
- Czech
- Hungarian



→ Select the menu item, select language.



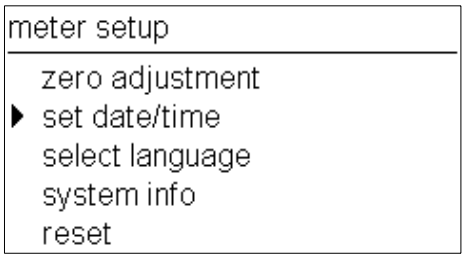
→ Select the language required, e. g. *German*

→ Confirm with .

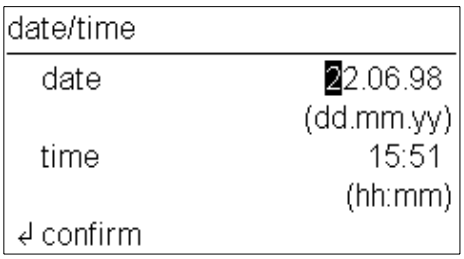
→ Press the key again:
Return to the *meter setup* submenu.

The displays appear in German.

14.2 Setting up the date and time



→ Call up the *set date/time* menu item.



→ Input the date via the numeric keypad

→ Confirm with .

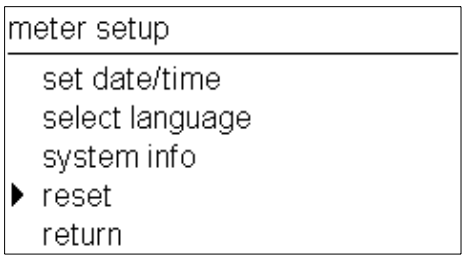
→ Input the time via the numeric keypad

→ Confirm with .

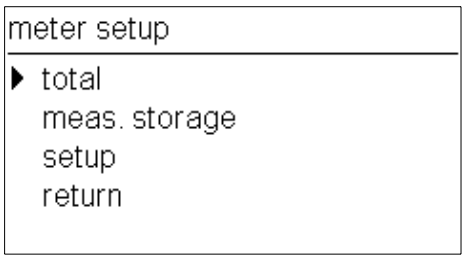
14.3 Performing a meter reset

It is possible to reset the photometer to its factory settings (delivery state) in single steps. The *reset total* resets all settings at once.

All AQA functions are retained when *meter setup* is used.
See section 9.1.6 *for AQA reset.*



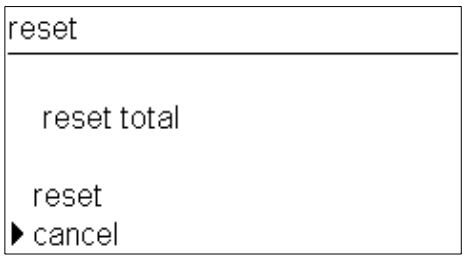
→ Call up the menu item, *reset*



Select between

- *total*
  Erase the measured value store and reset the settings to the delivery state
- *meas. storage*
  Erase the measured value storage
- *setup*
  Reset all the settings to the delivery state.

Example: Performing a total reset

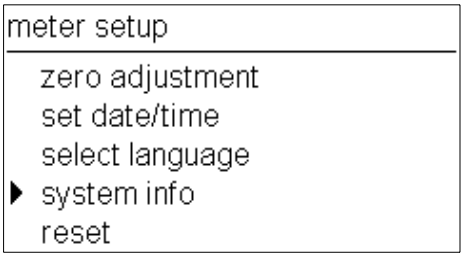


→ Select the *reset* menu item

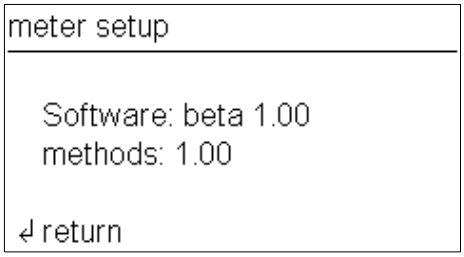
→ Confirm with .

A meter reset is performed (measured value store and setup).

14.4 System information



→ Call up the *system info* menu item.



Sample display

14 Photometer setup

15.1 Downloading and updating method data from the Internet

In the Internet, you will always find the latest method data for your photometer. A method update contains all new test sets and methods respectively. Additionally, minor modifications of already existing methods are transferred with it. With a method update, you receive all new methods and, at the same time, can easily and conveniently update all method data.

The software provided for downloading contains the program file and the method data. It can be downloaded from our homepage with a mouse click. The files are packed in a self-decompressing archive file (*.exe) or in a zip file (*.zip) and can be decompressed after the download.

To download and update the photometer method data via the built-in RS232 interface, you need the following:

- PC (Win 95 or higher) with Internet connection
- PC cable (available as an accessory)
- A *.exe or *.zip file from the Internet; contains the "UpdateMethodData.exe" program file and 6 method data files (pls6md.xxx, pls12md.xxx, plspekmd.xxx, nova30md.xxx, nova60md.xxx, nova400md.xxx; xxx = version).

Carry out the update as follows:

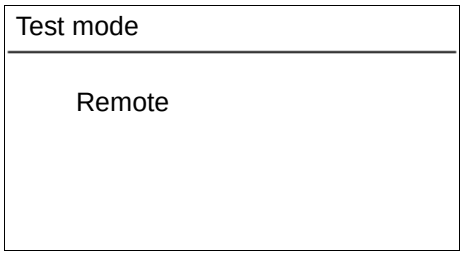
→ Switch on the photometer (open the cover).
→ Switch on the PC.
→ Download from the Internet the software including the method data (*.exe or *.zip) and copy it into a separate directory or on a floppy disk.
→ Decompress the *.exe file by a double-click or decompress the *.zip file with Winzip.
→ Connect the serial interfaces of the PC and photometer with the cable.
→ Start the "UpdateMethodData.exe" program file by double-clicking. The "Update Method Data" window appears. In the upper half of the window there is the name of your photometer (among other things), behind it there is the method version in brackets (e.g. 8.00).



All method data are reloaded into the photometer with the update. The old method data are overwritten by this.
Possibly existing user-defined methods are erased with this update and have to be entered again!

→ Click on the "Search meter" button. The program automatically recognizes the connected photometer. Another "Update Method Data" window appears.
→ Click on the "Start" button to start the method download. The process takes approx. 3 minutes. You can terminate it at any time by clicking on the "Cancel" button. In this case, however, the download has to be carried out once again completely so that the photometer can save the method data and is operative.

During the download, the following display appears on the photometer screen:

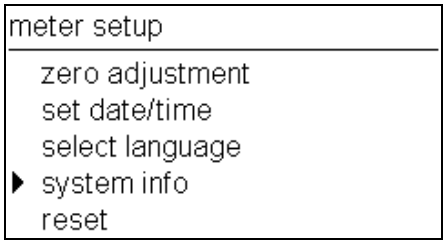


→ After the download, confirm the "Data successfully downloaded" message. The download is finished. The photometer returns to the *Concentration* measuring mode.

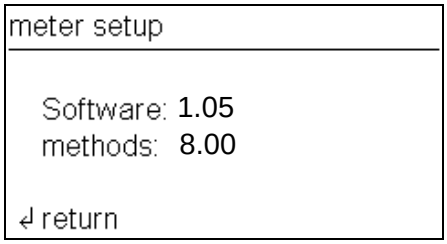
You can check whether the new method data are stored in the photometer.

To do so, proceed as follows:

→ In the setup menu, call up the *meter setup* sub-menu.



→ Call up the *system info* menu item.



Sample display (the software version is irrelevant here).

The method version (here: 8.00) has to agree with the method version for your photometer in the "Update Method Data" window during the download.

Possible error message

Message	Meaning	Remedy
No meter found	→ Connection PC - photometer out of order or not available	→ Tightly connect the cable to the serial interfaces of the PC and photometer. → Use the correct cable
	→ Photometer not recognized	→ Select the photometer manually

15.2 Update method data via the MemoChip

Modified or new data of individual methods can also be updated by means of a MemoChip.

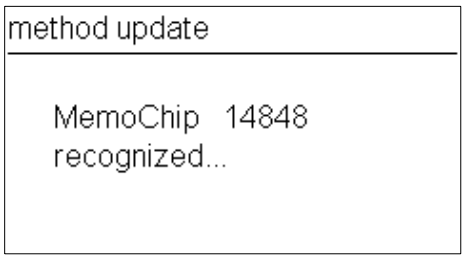
The method data is read in after initializing the photometer by switching it on (opening the cover) with the MemoChip in place (recess in the housing front, with the printing of the MemoChip facing upwards).

If several MemoChips are required for a method, ensure the correct sequence is followed.

In the printout of the method list, the version status (date) also appears for each method.

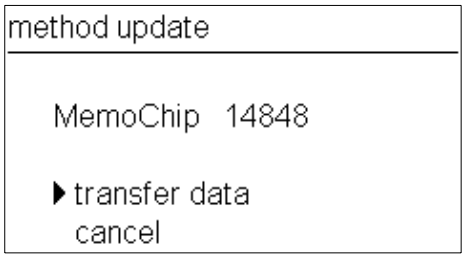
→ Switch off the photometer (close the cover)
→ Place the MemoChip in the recess (see also section 1.1)
→ Switch on the photometer (open the cover).

The following display appears (example):



The MemoChip has been recognized and the data is read.

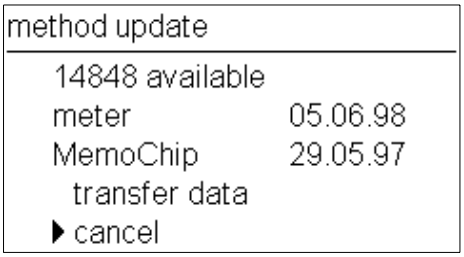
If the method is not yet stored, the following display appears after approx. 3s:



→ Press to take over the data
→ Press to select the menu item, *cancel*
→ Confirm with .

If several MemoChips are required for updating extensive method data, a request to insert the second MemoChip appears after the successful identification of the first MemoChip.

If a version of the method is already stored in the photometer, a message appears together with the dates of both versions:

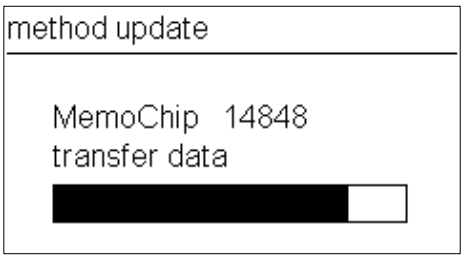


→ Press to stop the data transfer. The 15 minutes warm-up period of the photometer begins then.

→ Press to select the *transfer data* menu item

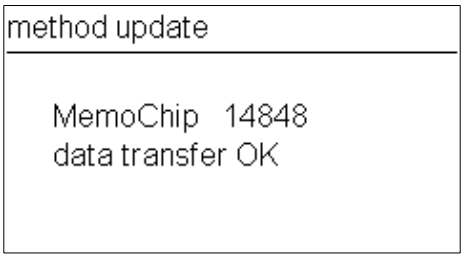
→ Confirm with .

The following display appears:



The data of the MemoChip is transferred (continuation display).

After the data transfer is complete, the following display appears:



The 15 minutes warm-up period of the photometer follows; the photometer then automatically performs a SelfCheck.

Possible error messages

Message	Meaning	Remedy
MemoChip unknown	MemoChip not designated for photometer	→ Place the correct MemoChip in the recess
MemoChip illegible	MemoChip defective or not programmed	→ Request a new MemoChip
Wrong MemoChip (sequence)	Sequence of the MemoChips incorrect	→ Ensure the correct sequence
Transmission error	Error in data transfer	→ Repeat the procedure

Via the interface, data can be

- output to a printer and
- exchanged with a personal computer (PC)

To transmit data quickly and conveniently, the following accessories are available (with operating manuals):

- Printer cable
- Printer
- Interface cable
- Communication software.

The following sections of this chapter are meant for specialists who want to establish the remote control via the PC themselves.

16.1 Principle operating sequence of a remote control

String to meter	**Reply from meter**	**Operating mode**
S <CR>	> <CR>	*Remote*
Command xx (see section 16.2)	Reply string command xx <CR>	*Remote*
.		
.		
.		
CLOC <CR>		Concentration measurement

The keyboard of the photometer is locked in the *Remote* operating mode.

16.2 Instruction set

Command	**Function**
S	Begin communication
CLOC	Switchover to normal operation (concentration measurement)
CDAT [anz]	Reads out stored measured values [anz] = number of the measured values to be output
CMES [MMM]	Measuring and transferring the concentration value with date/time [MMM] = method number (e. g. *086* for method 14729)
CEXT [LLL]	Measurement and transmission of the absorbance value for the wavelength [LLL] = wavelength
CBLA [MMM]	Measurement and transmission of the sample blank value [MMM] = method number
CCLB	Erase the stored sample blank value

Command	Function
CSPK [Lmin Lmax]	Measurement and transmission of all measured values of the spectrum [Lmin Lmax] = wavelength range
CEME	Input user-defined methods (see chapter 13 USER-DEFINED METHODS)
REME [MMM]	Output user-defined methods [MMM] = method number
CCLR [MMM]	Erase user-defined methods [MMM] = method number

The error message, *Invalid command* appears if commands are unknown or cannot be carried out (e. g. if optional parameters do not agree with the cell coding). Optional parameters [MMM] and [LLL] need only be input for uncoded cells.

16.3 Output format of measured values

Character	Meaning
3	consecutive number (not required for interface commands CMES, CEXT and CBLA)
5	method designation
6	ID number
17	date and time
4	special character
9	measured value
10	unit
12	citation form
4	AQA I. D. (AQA1/AQA2)
4	dilution factor

Data fields are separated by spaces.
Character set: IBM, code page 437

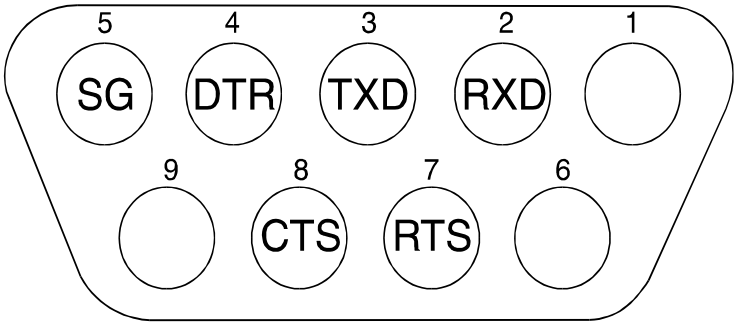
Meaning of the special characters:

Character	Meaning
!	Measuring with blank value (concentration) or reference absorbance (absorbance)
t/T	Measuring with turbidity correction / with high turbidity
*	Measured value outside the measuring range
Q	AQA measurement

16.4 Data transmission

Baud rate	4800
Data bits	8
Stop bits	1
Parity	none
Handshake	Hardware
Max. cable length	15 m

16.5 PIN allocation of the RS232 interface



Photometer	Computer		Printer	Allocation
9-pin socket	9-pin socket	25 pin plug	with RS 232 C interface	
1	4	20	4	–
2	3	2	3	TXD
3	2	3	2	RXD
4	1 and 6	6	1 and 6	-
5	5	7	5	SG
6	4	20	4	–
7	8	5	8	–
8	7	4	7	DTR (if not available:short-circuit CTS and RTS)
9	–	–		–

The photometer is almost maintenance-free. The only maintenance task is replacing the lamp if it is defective. A spare lamp is included in the scope of delivery of the photometer.

17.1 Changing the lamp

→ Switch off the photometer and disconnect it from the mains

Warning

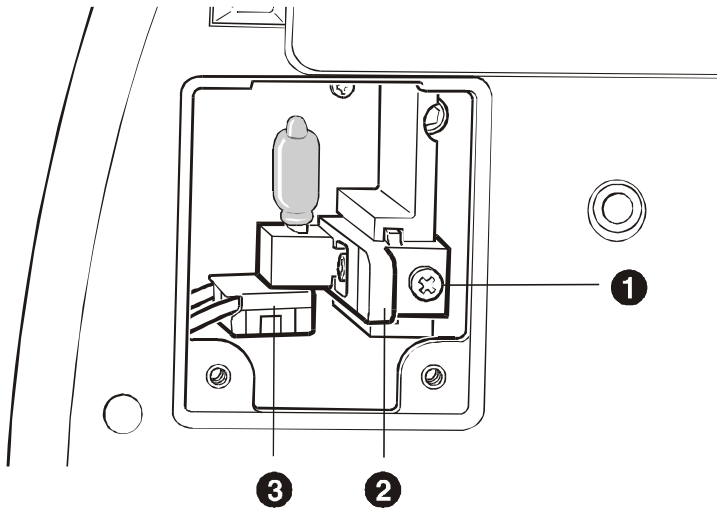
Before starting to change the lamp, wait for approx. 10 minutes to let the lamp of the photometer cool down. Otherwise, there is the danger of burning!

→ Carefully turn the photometer upside down and park it safely. While doing so, keep hold of the cover with the integrated on/off switch
→ Screw off the lamp cover on the underside of the photometer using a screwdriver
→ Unscrew the screw ❶, and make sure it does not fall into the housing
→ Remove the lamp with its holder ❷ by pulling it gently upwards
→ Pull out the plug ❸
→ Dispose of the lamp with the household refuse

Caution

Do not touch the new light bulb of the photometer to avoid fingerprints. Only touch the lamp on the holder.

→ Connect the plug ❸ of the new lamp
→ Insert the new lamp and screw it tight using the screw ❶
→ Screw the lamp cover on again



→ Set up the photometer again and connect it to the mains
→ Switch on the photometer (open the cover)
→ Perform a zero adjustment (see chapter 12 ZERO ADJUSTMENT).

17.2 Actions to take if a cell is broken

Caution

Do not rotate the photometer to pour out the liquid! The liquid shall not come into contact with electronic components. The photometer has a draining mechanism under the cell shaft that, when operated correctly, prevents this contact.

Warning

The safety instructions and instructions for protective measures when dealing with chemicals on the package of the coded cell tests and reagent test sets must be followed!

→ Switch off the photometer (close the cover) and disconnect it from the mains
→ Let the liquid drain off into a suitable vessel. Dispose of the liquid properly according to the instructions of the reagent package
→ Carefully remove glass rests, e. g. using tweezers, and dispose of them with the household refuse
→ Carefully clean the cell shaft with a damp, lint-free cloth
→ Let the cell shaft dry

After it is dry, check the photometer:

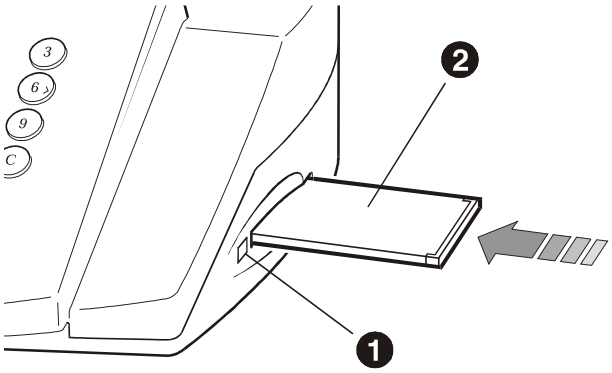
→ Perform a photometer monitoring (see section 9.2).

17.3 Cleaning the housing

→ Keep the photometer free of dust and dirt as possible
→ Clean the housing surfaces with a soft, damp cloth and aqueous soap solution
→ Do not use any cleaning detergents that contain solvents
→ Follow the safety instructions when performing cleaning activities!

The Memory Card contains all data relevant for the operation of the photometer.
The photometer software can be simply and easily updated by means of a Memory Card.

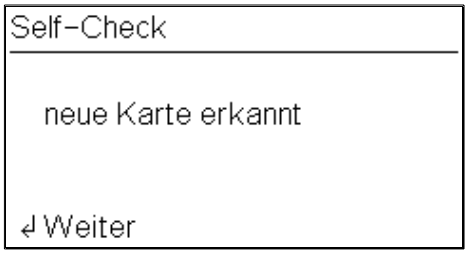
→ Switch off the photometer



→ Press the button ❶ at the right side of the photometer to throw out the old Memory Card

→ Insert the new Memory Card ❷ in the opening. The label with the type designation and software version must point upwards.
→ Switch on the photometer

The following display appears:



→ Confirm with ↲. After the 15 minutes warm-up period the photometer automatically performs a SelfCheck.

18 Exchanging the Memory Card

Optical measuring principle	Single beam spectrophotometer; Simultaneous recording of all wavelengths
Light source	Tungsten halogen lamp, premounted Operational lifetime: typical 500 operating hours
Dispersion element	Aberration-corrected concave lattice
Receiver	256 x photo diode array
Wavelength -range	330 nm to 850 nm
-accuracy	± 0.3 nm
-resolution	10 nm
-reproducibility	± 0.1 nm at an ambient temperature of ± 5 °C
Photometric -reproducibility	0.001 A at 1.000 A
-resolution	0.001 A
Warm-up time	Standard operation: 15 minutes Kinetic measuring: 120 minutes recommended
Types of measurement	Concentration (method dependent, selectable display form), absorbance, transmission, color according to EN ISO 7880
Cell filling height	minimum 20 mm
Measuring range of absorbance	-0.300 A to 3.200 A
Balancing	Permanently stored
Drift correction	Automatic on each SelfCheck
Rest drift without drift correction	typical 2 mA/h at 525 nm (without AutoCheck, constant ambient temperature, after 120 min warm-up time)
Retrofitting of new methods	Via Internet or MemoChip
User-defined methods	Max. 99
Calibration line	Determination in user-defined methods
Kinetics	Automatic measurement repetition with selectable interval
Spectrum	Scaling automatic or freely selectable
Barcode recognition	Automatic selection of the method Automatic recognition of the reagents lot
Cell recognition	automatic
SelfCheck	Test: Memory, optics, electronic measured value recording, barcode recognition, cell recognition Automatic calibration: Electronic measured value recording, barcode recognition, rectangular cell recognition
Time/Date	Real-time clock in the photometer
Dimensions	H: 150 mm, D: 275 mm, W: 375 mm
Weight	approx. 2.7 kg

Meter safety	EN 61010-1, IEC 1010
Safety class	EN 61010-1 / class III
Plug-in power supply unit	
Type	Friwo FW7362/08,11.9833, Friwo Part-No. 1811504 Input: 100 – 240 V~ ±10% / 50 – 60 Hz / 700 mA (installation category ll) Output: 7.5 VDC / 3.3 A alternatively: Friwo FW7301/07,11.9833, Friwo Part-No. 1811504 Input: 100 – 240 V~ ±10% / 47 – 63 Hz / 700 mA (installation category ll) Output: 7.5 VDC / 3.3 A
Safety of the plug-in power supply unit	EN 60950
Power supply	7.5 VDC / 3000 mA max.
EMC	
Interference emission	EN 50081-1 FCC class A
Interference immunity	EN 50082-1
Climatic class	2, VDI/VDE 3540
Ambient temperature	Storage: – 25 °C to + 65 °C Operation: + 5 °C to + 35 °C
Allowable relative humidity	Annual mean: ≤ 75%, 30 days / year: 95% other days: 85%
Test certificates	CE
Operating devices	On/Off switch actuated by opening/closing the cell shaft cover Silicon keyboard with 4 function keys and number field with 12 keys Round cell shaft ● for round cells (flat cell floor, external/internal diameter 16 mm / 13.8 mm) Rectangular cell shaft ● for 10 mm, 20 mm and 50 mm rectangular cells with a maximum width of 12.60 mm Recess for MemoChip
Display	Graphical display 240 x 128 Pixel, CFL background illumination
Connections	
Digital interface	RS 232 C 9-pin socket to connect to PC or printer
Measured value storage	Cyclical memory to record 1000 measured values
Power supply	2-pin socket to connect the plug-in power supply unit

Software settings when delivered	ID number input: Off Measured value number: 000 Blank value: Off Reference absorbance: Off Reference transmission: Off Turbidity correction: Off Language: English Kinetic interval: 60s Date of the last valid AQA1 check: invalid (not yet measured) AQA1 interval: 12 weeks AQA2 interval: 4 weeks AQA password: 0000 AQA mode: Off Lock measurement if AQA2 expired: Off AQA2 values: none Citation forms of the methods: respective reference citation Units of the methods: respective reference unit
Settings after reset - total	Measured value storage and setup reset
Settings after reset - meas. storage	Measured value number: 000 Measured values: none
Settings after reset - setup	ID number input: Off Measured value number: 000 Blank value: Off Reference absorbance: Off Reference transmission: Off Turbidity correction: Off Language: unchanged Kinetic interval: 60s Citation forms of the methods: respective reference citation Units of the methods: respective reference unit

Settings after reset - AQA

Date of the last valid AQA1 check: invalid (not yet measured)

AQA1 interval: 12 weeks

AQA2 interval: 4 weeks

AQA password: 0000

AQA mode: Off

Lock measurement if AQA2 expired: Off

AQA1 values:

PhotoCheck standard

445-1

445-2

445-3

445-4

525-1

525-2

525-3

525-4

690-1

690-2

690-3

690-4

AQA2 values: none

(theoretical values and tolerances of all methods are set to default values according to the Spectroquant® COMBI-CHECK AND STANDARD SOLUTIONS table in the first part **General information** of this operating manual)

FCC Class A Equipment Statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

	Cause	Remedy
The display remains blank when switched on	No power supply.	→ Connect the photometer to the mains supply via the plug-in power supply unit.
Date/time is lost when switched off	The support battery of the real time clock is empty.	→ Send the meter to the service department to have the battery replaced.
Password forgotten		→ Inform the service department.
Photometer does not react	The connected printer is off line.	→ Switch on the printer or pull out the interface cable.
Measured value is output in small numerals	The measured value is above or below the measuring range. The given value is an extrapolated value which is an approximate value for possible dilutions.	→ Use a method with a suitable measuring range or → If the measuring range is exceeded dilute the sample or → With a reagent test, use a different rectangular cell if necessary.
“OFL” is displayed instead of the measured value	The measured value is outside the measuring range.	→ Use a method with a suitable measuring range or → If the measuring range is exceeded dilute the sample or → With a reagent test, use a different rectangular cell if necessary.
“Memory Card?” is displayed	The Memory Card has not been inserted.	→ Insert the Memory Card (see chapter 3 COMMISSIONING). After approx. 10 s the warm-up time starts.
“Invalid command” is displayed on the PC	When entering user-defined methods via the PC a mistake was made.	→ see paragraph 13.2 ENTERING CHARACTERISTICS VIA THE PC.

Error messages on the display:	Cause	Remedy
Remove cell	The message *remove cell* appears on the display although no cell is inserted. The cell shaft is contaminated.	→ Clean the cell shaft with a damp, lint-free cloth. → If the error message still appears, return the photometer to the service department.
Lamp defective	The lamp is defective.	→ Replace the lamp (see chapter 17 MAINTENANCE AND CLEANING).
No zero adjustment	No zero adjustment is stored in the meter for the cell.	→ Perform a zero adjustment (see chapter 12 ZERO ADJUSTMENT).
Cell error	The rectangular cell is inserted incorrectly, or two cells are inserted.	→ Insert the cell correctly.
Cell invalid	A cell type that is not allowed for the selected method was selected, e. g. a round cell for the reagent test.	→ Select the correct cell type.
Method invalid	No data is stored in the photometer for the selected method.	→ Update method data (see chapter 15 UPDATING METHOD DATA).
Wrong method	During a difference measurement, the method was changed between the first and second measurement.	→ Perform the second measurement using the same method as for the first measurement. During a difference measurement, the method must remain identical.
MemoChip unknown	MemoChip not designated for photometer	→ Place the correct MemoChip in the recess
MemoChip illegible	MemoChips defective or not programmed	→ Request a new MemoChip
Wrong MemoChip (sequence)	Sequence of the MemoChips incorrect	→ Ensure the correct sequence
Transmission error	Error in data transfer	→ Repeat the procedure
E_0	Hardware error	→ Send the photometer to the service department.
E_1, E_2 or E_3	The beam path of the photometer is blocked or the lamp is defective.	→ Check the cell shafts and, if there are particles, remove them. Switch the photometer off and on again. → If the error message remains, replace the lamp (chapter 17 MAINTENANCE AND CLEANING). → If the error message still remains, send the meter to the service department.

This chapter offers additional information and orientation aids.

Menu structure

The menu structure shows the structure of the *setup* menu and the submenus in an overview.

Abbreviations

The list of abbreviations explains display indications and abbreviations that occur when dealing with the measuring instrument.

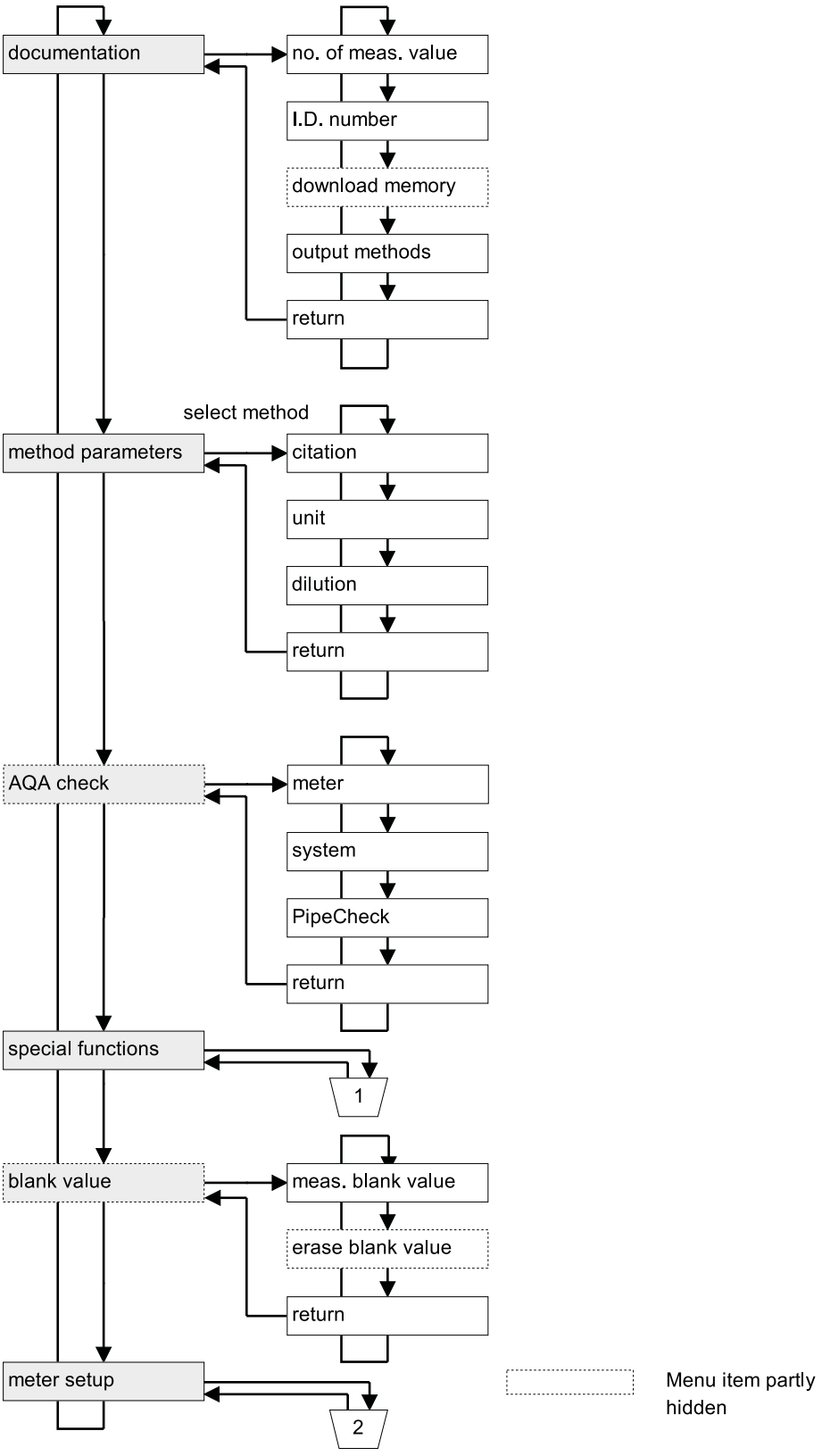
Glossary

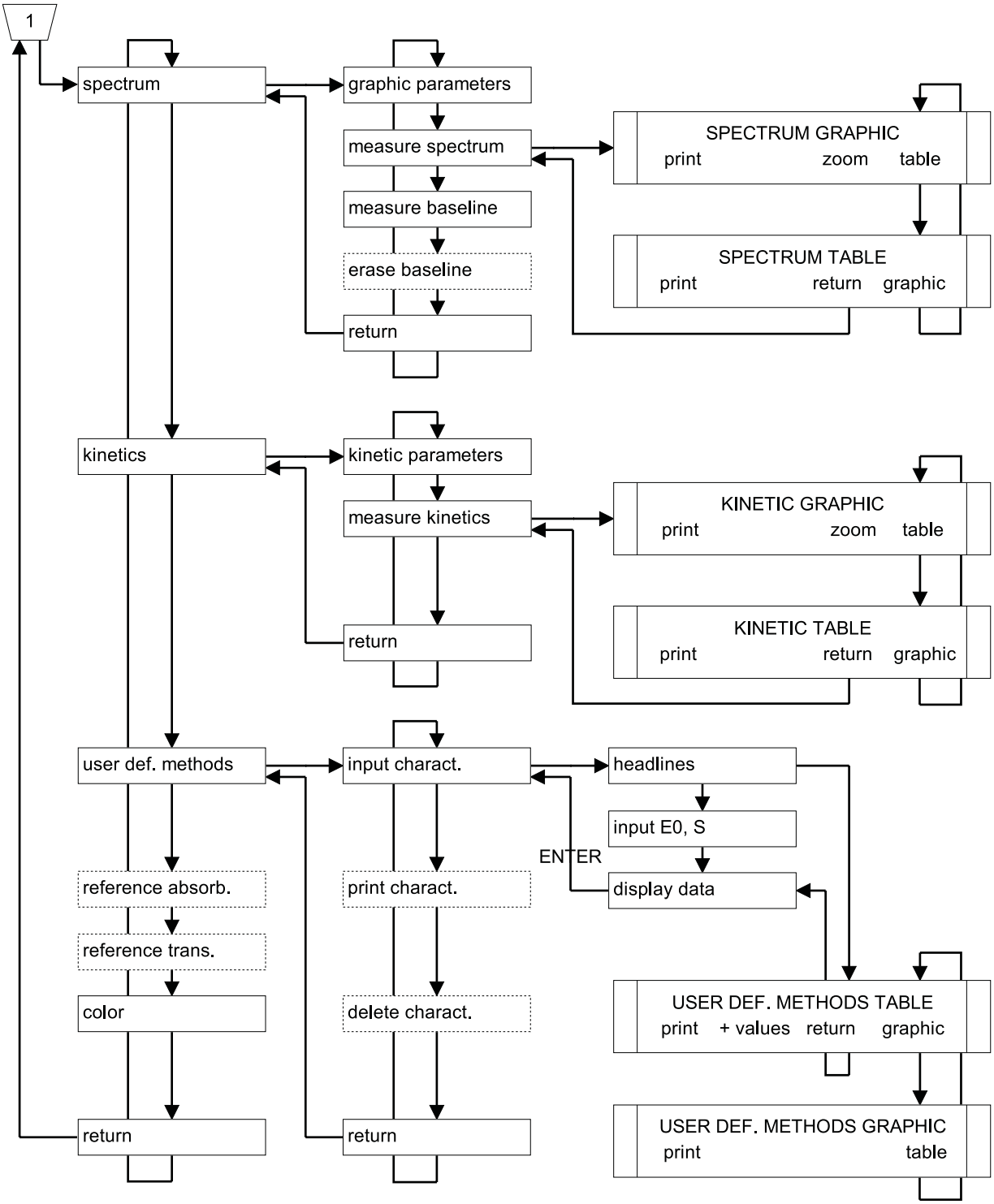
The glossary briefly explains the meaning of the specialist terms. However, terms that should already be familiar to the target group are not described here.

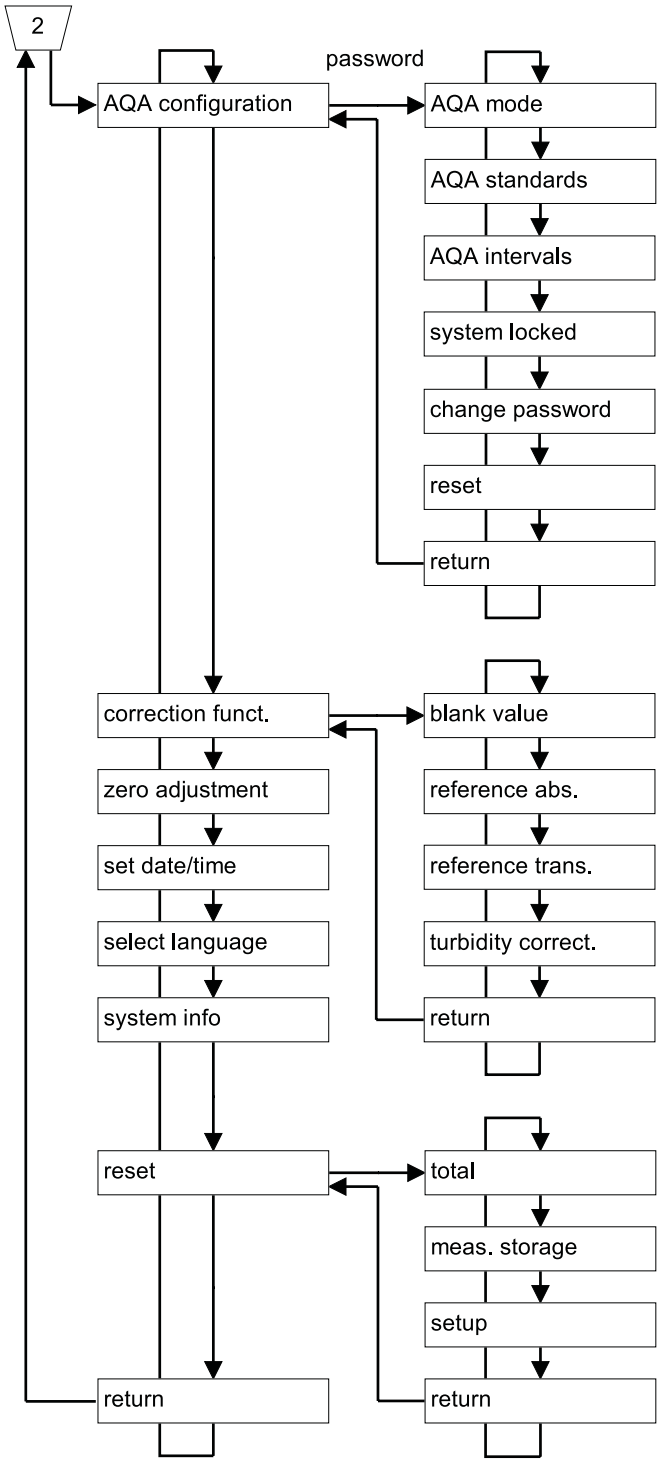
Index

The index helps you to find the topics that you are looking for.

21.1 Menu structure of the setup menu




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measure spectrum
measure baseline
erase baseline
return
SPECTRUM GRAPHIC
print zoom table
SPECTRUM TABLE
print return graphic
kinetics
kinetic parameters
measure kinetics
return
KINETIC GRAPHIC
print zoom table
KINETIC TABLE
print return graphic
user def. methods
input charact.
headlines
input E0, S
ENTER
display data
reference absorb.
reference trans.
color
return
print charact.
delete charact.
return
USER DEF. METHODS TABLE
print + values return graphic
USER DEF. METHODS GRAPHIC
print table


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AQA configuration
AQA mode
AQA standards
AQA intervals
system locked
change password
reset
return
correction funct.
blank value
zero adjustment
reference abs.
set date/time
reference trans.
select language
turbidity correct.
system info
return
reset
total
meas. storage
setup
return
return

21.2 List of abbreviations

AQA	Analytical Quality Assurance
AQA1	Level 1 of the Analytical Quality Assurance: Photometer monitoring
AQA2	Level 2 of the Analytical Quality Assurance: Total system monitoring
auto	automatic
A	Absorbance
abs.	Absorbance
L1 /L2	Cells to check the light barrier in the photometer
L check	Light barrier check in the photometer
mg/l	Milligrams per liter
mmol/l	Millimol per liter
nm	Nanometer
SEr	serial interface Memory download to the RS 232
T	Transmission
D	Dilution factor
w	Week(s)
w	Week(s)
%T	% Transmission

21.3 Glossary

Absorbance	Logarithmic dimension for the absorption of the sample; negative decadic logarithm of the transmission
AQA	Analytical Quality Assurance
AQA I. D.	Measured values are given an AQA I. D. (AQA1 or AQA2) in the documentation, depending on which AQA level was active when the measurement was performed
AQA1	Level 1 of the Analytical Quality Assurance: Photometer monitoring
AQA2	Level 2 of the Analytical Quality Assurance: Monitoring the total system
AutoSelector	Synthetic material cylinder with barcode. It is inserted into the round cell shaft and transmits the code for the reagent test to the photometer
Barcode	Optical code (black and white areas) of the method. It can be read by light barriers in the photometer
Baseline	Reference value for the spectrum of reference absorbances or reference transmissions
Blank value (= reagent blank value)	Absorbance value received when measuring with photometrical methods using distilled water as the test sample
Color	Defined in EN ISO 7887
CombiCheck	Multi-parameter standards to monitor the total system for a method
Concentration	Mass or quantity of a dissolved substance per volume, e. g. in g/l or mol/l
Correlation coefficient	Specifies the dimension of the linear relation of the value pairs when determining the zero point and slope for a user-defined method
Kinetics	Time-resolved measurement
MemoChip	*Transponder* (data carrier) with new method or AQA data
Memory Card	Exchangeable storage card (contains the measuring program, instrument data and measuring data)
Method	Procedure to determine the concentration of a substance contained in a sample using a photometrical test set and a photometer
PhotoCheck standard	Stable color solution with defined absorbance values to check the photometer
PipeCheck	Photometer function to find pipette errors

Recovery	The recovery rate is the measured value found divided by the specified value (in percent). Example: Specified value 20 mg/l; measured value 19.7 mg/l => recovery 0.985 or recovery rate 98.5%.
Reference absorbance	With this function, the basic absorbance stored in the photometer can be replaced by an own measurement
Reference transmission	With this function, the basic transmission stored in the photometer can be replaced by an own measurement
Spectrum	Distribution of the intensity, transmission or absorbance depending on the wavelength
Standard	Sample with a defined concentration of the substance measured
Transmission	The part of the light that goes through the sample
Transponder	Small data carrier made out of synthetic material to transmit data to the photometer contactless
Turbidity	Light damping caused by diffuse scattering at undissolved substances
Zero adjustment	Measuring and storing the absorbance of a cell filled with water (basic absorbance)

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