evoqua
WATER TECHNOLOGIES

WALLACE & TIERNAN® PHOTOMETER P34 PROFESSIONAL

INSTRUCTION MANUAL

Important steps before using the photometer

Please carry out the following steps as described in the Instruction manual. Become familiar with your new photometer before starting with the first tests:

- Unpacking and inspection of delivery contents, see page 164.
- Install the batteries, see page 112, 113.

Perform the following settings in the Mode-Menu; Instruction manual from page 125 and following:

- MODE 10: select language
- MODE 12: set date and time
- **MODE 34: perform "Delete data"**
- **MODE 69: perform "User m. init" to initialise the user polynomial system**

If required set other functions.

DE

Wichtige Information
Um die Qualität unserer Umwelt zu erhalten, beschützen und zu verbessern
Entsorgung von elektronischen Geräten in der Europäischen Union

Aufgrund der Europäischen Verordnung 2012/19/EU darf Ihr elektronisches Gerät nicht mit dem normalen Hausmüll entsorgt werden!
Evoqua entsorgt ihr elektrisches Gerät auf eine professionelle und für die Umwelt verantwortungsvolle Weise. Dieser Service ist, **die Transportkosten nicht inbegriffen**, kostenlos. Dieser Service gilt ausschließlich für elektrische Geräte die nach dem 13.08.2005 erworben wurden. Senden Sie Ihre zu entsorgenden evoqua Geräte frei Haus an Ihren Lieferanten.

GB

Important Information
To Preserve, Protect and Improve the Quality of the Environment
Disposal of Electrical Equipment in the European Union

Because of the European Directive 2012/19/EU your electrical instrument must not be disposed of with normal household waste!
Evoqua will dispose of your electrical instrument in a professional and environmentally responsible manner. This service, **excluding the cost of transportation** is free of charge. This service only applies to electrical instruments purchased after 13th August 2005. Send your electrical evoqua instruments for disposal freight prepaid to your supplier.

FR

Notice importante
Conserver, protéger et optimiser la qualité de l'environnement
Élimination du matériel électrique dans l'Union Européenne

Conformément à la directive européenne n° 2012/19/UE, vous ne devez plus jeter vos instruments électriques dans les ordures ménagères ordinaires !
La société evoqua se charge d'éliminer vos instruments électriques de façon professionnelle et dans le respect de l'environnement. Ce service, **qui ne comprend pas les frais de transport**, est gratuit. Ce service n'est valable que pour des instruments électriques achetés après le 13 août 2005. Nous vous prions d'envoyer vos instruments électriques evoqua usés à vos frais à votre fournisseur.

NL

Belangrijke informatie
Om de kwaliteit van ons leefmilieu te behouden, te verbeteren en te beschermen is voor landen binnen de Europese Unie de Europese richtlijn 2012/19/EU voor het verwijderen van elektronische apparatuur opgesteld.

Volgens deze richtlijn mag elektronische apparatuur niet met het huishoudelijk afval worden afgevoerd.
Evoqua verwijdert uw elektronisch apparaat op een professionele en milieubewuste wijze. Deze service is, **exclusief de verzendkosten**, gratis en alleen geldig voor elektrische apparatuur die na 13 augustus 2005 is gekocht. Stuur uw te verwijderen evoqua apparatuur franco aan uw leverancier.

ES

Información Importante
Para preservar, proteger y mejorar la calidad del medio ambiente
Eliminación de equipos eléctricos en la Unión Europea

Con motivo de la Directiva Europea 2012/19/UE, ¡ningún instrumento eléctrico deberá eliminarse junto con los residuos domésticos diarios!
Evoqua se encargará de dichos instrumentos eléctricos de una manera profesional y sin dañar el medio ambiente. Este servicio, **el cual escluye los gastos de transporte**, es gratis y se aplicará únicamente a aquellos instrumentos eléctricos adquiridos después del 13 de agosto de 2005. Se ruega enviar aquellos instrumentos eléctricos inservibles de evoqua a carga pagada a su distribuidor.

IT

Informazioni importanti
Conservare, proteggere e migliorare la qualità dell'ambiente
Smaltimento di apparecchiature elettriche nell'Unione Europea

In base alla Direttiva europea 2012/19/UE, gli apparecchi elettrici non devono essere smaltiti insieme ai normali rifiuti domestici!
Evoqua provvederà a smaltire i vostri apparecchi elettrici in maniera professionale e responsabile verso l'ambiente. Questo servizio, **escluso il trasporto**, è completamente gratuito. Il servizio si applica agli apparecchi elettrici acquistati successivamente al 13 agosto 2005. Siete pregati di inviare gli apparecchi elettrici evoqua divenuti inutilizzabili a trasporto pagato al vostro rivenditore.

PT

Informação Importante
Para Preservar, Proteger e Melhorar a Qualidade do Ambiente
Remoção de Equipamento Eléctrico na União Europeia

Devido à Directiva Europeia 2012/19/UE, o seu equipamento eléctrico naõ deve ser removido com o lixo doméstico habitual!
A evoqua tratará da remoção do seu equipamento eléctrico de forma profissional e responsável em termos ambientais. Este serviço, **não incluindo os custos de transporte**, é gratuito. Este serviço só é aplicável no caso de equipamentos eléctricos comprados depois de 13 de Agosto de 2005. Por favor, envie os seus equipamentos eléctricos evoqua que devem ser removidos ao seu fornecedor (transporte pago).

PL

Istotna informacja
Dla zachowania, ochrony oraz poprawy naszego środowiska
Usuwanie urządzeń elektronicznych w Unii Europejskiej
Na podstawie Dyrektywy Parlamentu Europejskiego 2012/19/UE nie jest dozwolone usuwanie zakupionych przez Państwo urządzeń elektronicznych wraz z normalnymi odpadami z gospodarstwa domowego!
Evoqua usunie urządzenia elektrycznego Państwa w sposób profesjonalny i odpowiedzialny z punktu widzenia środowiska. Serwis ten jest, za wyjątkiem kosztów transportu, bezpłatny. Serwis ten odnosi się wyłącznie do urządzeń elektrycznych zakupionych po 13.08.2005r. Przeznaczone do usunięcia urządzenia firmy evoqua mogą Państwo przesyłać na koszt własny do swojego dostawcy.

DE

Wichtiger Entsorgungshinweis zu Batterien und Akkus

Jeder Verbraucher ist aufgrund der Batterieverordnung (Richtlinie 2006/66/EG) gesetzlich zur Rückgabe aller ge- und verbrauchten Batterien bzw. Akkus verpflichtet. Die Entsorgung über den Hausmüll ist verboten. Da auch bei Produkten aus unserem Sortiment Batterien und Akkus im Lieferumgang enthalten sind, weisen wir Sie auf folgendes hin:

Verbrauchte Batterien und Akkus gehören nicht in den Hausmüll, sondern können unentgeltlich bei den öffentlichen Sammelstellen Ihrer Gemeinde und überall dort abgegeben werden, wo Batterien und Akkus der betreffenden Art verkauft werden. Weiterhin besteht für den Endverbraucher die Möglichkeit, Batterien und Akkus an den Händler, bei dem sie erworben wurden, zurückzugeben (gesetzliche Rücknahmepflicht).

GB

Important disposal instructions for batteries and accumulators

EC Guideline 2006/66/EC requires users to return all used and worn-out batteries and accumulators. They must not be disposed of in normal domestic waste. Because our products include batteries and accumulators in the delivery package our advice is as follows :

Used batteries and accumulators are not items of domestic waste. They must be disposed of in a proper manner. Your local authority may have a disposal facility; alternatively you can hand them in at any shop selling batteries and accumulators. You can also return them to the company which supplied them to you; the company is obliged to accept them.

FR

Information importante pour l'élimination des piles et des accumulateurs

En vertu de la Directive européenne 2006/66/CE relative aux piles et accumulateurs, chaque utilisateur est tenu de restituer toutes les piles et tous les accumulateurs utilisés et épuisés. L'élimination avec les déchets ménagers est interdite. Etant donné que l'étendue de livraison des produits de notre gamme contient également des piles et des accumulateurs, nous vous signalons ce qui suit :

les piles et les accumulateurs utilisés ne sont pas des ordures ménagères, ils peuvent être remis sans frais aux points de collecte publics de votre municipalité et partout où sont vendus des piles et accumulateurs du type concerné. Par ailleurs, l'utilisateur final a la possibilité de remettre les piles et les accumulateurs au commerçant auprès duquel ils ont été achetés (obligation de reprise légale).

NL

Belangrijke mededeling omtrent afvoer van batterijen en accu's

Ledere verbruiker is op basis van de richtlijn 2006/66/EG verplicht om alle gebruikte batterijen en accu's in te leveren. Het is verboden deze af te voeren via het huisvuil. Aangezien ook onze producten geleverd worden met batterijen en accu's wijzen wij u op het volgende; Lege batterijen en accu's horen niet in het huisvuil thuis. Men kan deze inleveren bij inzamelpunten van uw gemeente of overal daar waar deze verkocht worden. Tevens bestaat de mogelijkheid batterijen en accu's daar in te leveren waar u ze gekocht heeft. (wettelijke terugnameplicht)

ES

Indicación importante acerca de la eliminación de pilas y acumuladores

Basado en la norma relativa a pilas/ baterías (directiva 2006/66/CE), cada consumidor, está obligado por ley, a la devolución de todas las pilas/ baterías y acumuladores usados y consumidos. Está prohibida la eliminación en la basura doméstica. Ya que en productos de nuestra gama, también se incluyen en el suministro pilas y acumuladores, le sugerimos lo siguiente:

Las pilas y acumuladores usados no pertenecen a la basura doméstica, sino que pueden ser entregados en forma gratuita en cada uno de los puntos de recolección públicos de su comunidad en los cuales se vendan pilas y acumuladores del tipo respectivo. Además, para el consumidor final existe la posibilidad de devolver las pilas y baterías recargables a los distribuidores donde se hayan adquirido (obligación legal de devolución).

IT

Indicazioni importanti sullo smaltimento di pile e accumulatori

In base alla normativa concernente le batterie (Direttiva 2006/66/CE) ogni consumatore è tenuto per legge alla restituzione di tutte le batterie o accumulatori usati ed esauriti. È vietato lo smaltimento con i rifiuti domestici. Dato che anche alcuni prodotti del nostro assortimento sono provvisti di pile e accumulatori, vi diamo di seguito delle indicazioni: Pile e accumulatori esauriti non vanno smaltiti insieme ai rifiuti domestici, ma depositati gratuitamente nei punti di raccolta del proprio comune o nei punti vendita di pile e accumulatori dello stesso tipo. Inoltre il consumatore finale può portare batterie e accumulatori al rivenditore presso il quale li ha acquistati (obbligo di raccolta previsto per legge).

PT

Instruções importantes para a eliminação residual de pilhas e acumuladores

Os utilizadores finais são legalmente responsáveis, nos termos do Regulamento relativo a pilhas e acumuladores (Directiva 2006/66/CE), pela entrega de todas as pilhas e acumuladores usados e gastos. É proibida a sua eliminação juntamente com o lixo doméstico. Uma vez que determinados produtos da nossa gama contêm pilhas e/ou acumuladores, alertamos para os seguintes aspectos:

As pilhas e acumuladores usados não podem ser eliminados com o lixo doméstico, devendo sim ser entregues, sem encargos, junto dos pontos de recolha públicos do seu município, ou em qualquer ponto de venda de pilhas e acumuladores. O utilizador final dispõe ainda da possibilidade de entregar as pilhas e/ou acumuladores no estabelecimento comerciante onde os adquiriu (dever legal de aceitar a devolução).

PL

Istotna wskazówka dotycząca utylizacji baterii i akumulatorów

Każdy użytkownik na mocy rozporządzenia w sprawie baterii (wytyczna 2006/66/WE) jest ustawowo zobowiązany do oddawania wszystkich rozładowanych i zużytych baterii lub akumulatorów. Utylizacja wraz z odpadkami domowymi jest zabroniona. Ponieważ także w produktach z naszego asortymentu zawarte są w zakresie dostawy baterie i akumulatory, zwracamy uwagę na poniższe zasady:

zużyte baterie i akumulatory nie mogą być wyrzucane wraz z odpadkami domowymi, lecz powinny być bezpłatnie przekazywane w publicznych miejscach zbiórki wyznaczonych przez gminę lub oddawane w punktach, gdzie sprzedawane są baterie i akumulatory danego rodzaju. Poza tym użytkownik końcowy ma możliwość zwrócenia baterii i akumulatorów do przedstawiciela handlowego, u którego je nabył (ustawowy obowiązek przyjęcia).

Safety precautions

⚠ CAUTION ⚠

Reagents are formulated exclusively for chemical analysis and must not be used for any other purpose. Reagents must not get into the hands of children. Some of the reagents contain substances which are not entirely harmless environmentally. Be aware of the ingredients and take proper care when disposing of the test solution.

⚠ CAUTION ⚠

Please read this instruction manual before unpacking, setting up or using the photometer. Please read the method description completely before performing the test. Be aware of the risks of using the required reagents by reading the MSDS (Material Safety Data Sheets). Failure could result in serious injury to the operator or damage to the instrument.

MSDS are available on request.

⚠ CAUTION ⚠

The accuracy of the instrument is only valid if the instrument is used in an environment with controlled electromagnetic disturbances according to DIN 61326. Wireless devices, e.g. wireless phones, must not be used near the instrument.

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Part 1

Methods

1.1 Table of Methods

No.	Analysis	Reagent	Range	Displayed as	Method	λ [nm]	OTZ	Page
20	**Acid demand to pH 4.3 T**	tablet	0.1-4	mmol/l	Acid/Indicator [1,2,5]	610	✓	12
30	**Alkalinity, total T**	tablet	5-200	mg/l $CaCO_3$	Acid/Indicator [1,2,5]	610	✓	14
31	**Alkalinity HR, total T**	tablet	5-500	mg/l $CaCO_3$	Acid/Indicator [1,2,5]	610	✓	16
40	**Aluminium T**	tablet	0.01-0.3	mg/l Al	Eriochrome Cyanine R [2]	530	✓	18
50	**Aluminium PP**	PP + liquid	0.01-0.25	mg/l Al	Eriochrome Cyanine R [2]	530	–	20
60	**Ammonia T**	tablet	0.02-1	mg/l N	Indophenol blue [2,3]	610	✓	22
80	**Bromine T**	tablet	0.05-13	mg/l Br_2	DPD [5]	530	✓	24
100	**Chlorine T ***	tablet	0.01-6	mg/l Cl_2	DPD [1,2,3]	530	✓	26, 28
103	**Chlorine HR T ***	tablet	0.1-10	mg/l Cl_2	DPD [1,2,3]	530	✓	26, 32
101	**Chlorine L ***	liquid	0.02-4	mg/l Cl_2	DPD [1,2,3]	530	✓	26, 36
110	**Chlorine PP ***	PP	0.02-2	mg/l Cl_2	DPD [1,2]	530	✓	26, 40
111	**Chlorine HR PP ***	PP	0.1-8	mg/l Cl_2	DPD [1,2]	530	–	26, 44
120	**Chlorine dioxide T**	tablet	0.02-11	mg/l ClO_2	DPD, Glycine [1,2]	530	✓	48
150	**Copper T ***	tablet	0.05-5	mg/l Cu	Biquinoline [4]	560	✓	58
153	**Copper PP**	PP	0.05-5	mg/l Cu	Bicinchoninate	560	✓	62
160	**CyA-TEST T**	tablet	0-160	mg/l CyA	Melamine	530	✓	64
214	**H_2O_2 HR L**	liquid	40-500	mg/l H_2O_2	Titanium tetrachloride/acid	530	–	66
191	**Hardness, Calcium 2T**	tablet	0-500	mg/l $CaCO_3$	Murexide [4]	560	✓	68
200	**Hardness, total T**	tablet	2-50	mg/l $CaCO_3$	Metallphthalein [3]	560	✓	70
201	**Hardness, total HR T**	tablet	20-500	mg/l $CaCO_3$	Metallphthalein [3]	560	✓	72
215	**Iodine T**	tablet	0.05-3.6	mg/l I	DPD [5]	530	✓	74
220	**Iron T**	tablet	0.02-1	mg/l Fe	PPST [3]	560	✓	76

* = free, combined, total; PP = powder pack; T = tablet; L = liquid; TT = tube test; LR = low range; MR = middle range; HR = high range;

1.1 Table of Methods

No.	Analysis	Reagent	Range	Displayed as	Method	λ [nm]	OTZ	Page
290	**Oxygen, active T**	tablet	0.1-10	mg/l O_2	DPD	530	✓	78
300	**Ozone (DPD) T**	tablet	0.02-2	mg/l O_3	DPD/Glycine [5]	530	✓	80
70	**PHMB T**	tablet	2-60	mg/l PHMB	Buffer/Indicator	560	✓	86
319	**Phosphate, T ortho LR**	tablet	0.05-4	mg/l PO_4	Ammonium-molybdate [2,3]	660	✓	88
329	**pH-Value LR T**	tablet	5.2-6.8	—	Bromocresolpurple[5]	560	✓	90
330	**pH-Value T**	tablet	6.5-8.4	—	Phenolred[5]	560	✓	92
331	**pH-Value L**	liquid	6.5-8.4	—	Phenolred[5]	560	✓	94
332	**pH-Value HR T**	tablet	8.0-9.6	—	Thymolblue [5]	560	✓	96
212	**Sodium hypochlorite T**	tablet	0.2-16	% NaOCl	Potassium iodide[5]	530	✓	98
355	**Sulfate T**	tablet	5-100	mg/l SO_4	Bariumsulfate-Turbidity	610	✓	100
360	**Sulfate PP**	PP	5-100	mg/l SO_4	Bariumsulfate-Turbidity[2]	530	✓	102
390	**Urea T**	tablet + liquid	0.1-2.5	mg/l Urea	Indophenol/ Urease	610	✓	104

* = free, combined, total; PP = powder pack; T = tablet; L = liquid; TT = tube test; LR = low range; MR = middle range; HR = high range;

1.1 Methods

The precision of Reagent Systems (tablets, powder packs and tube tests) is identical to the precision specified in standards literature such as American Standards (AWWA), ISO etc.

Most of the data referred to in these standard methods relates to Standard Solutions. Therefore they are not readily applicable to drinking-, boiler- or waste-water, since various interferences can have a major influence on the accuracy of the method.
For this reason we don't state such potentially misleading data.

Due to the fact that each sample is different, the only way to check the tolerances ('precision') is the Standard Additions Method.

According to this method, first the original sample is tested. Then further samples (2 to 4) are taken and small amounts of a Standard Solution are added, and further results are obtained. The amounts added range from approximately half, up to double the amount present in the sample itself.

These supplementary results make it possible to estimate the actual concentration of the original sample by comparison.

Literature

The reagent formulations are based on internationally recognised test methods. Some are described in national and/or international guidelines.

1. Deutsche Einheitsverfahren zur Wasser-, Abwasser- und Schlammuntersuchung
2. Standard Methods for the Examination of Water and Wastewater; 18th Edition, 1992
3. Photometrische Analysenverfahren, Schwedt,
   Wissenschaftliche Verlagsgesellschaft mbH, Stuttgart 1989
4. Photometrische Analyse, Lange / Vejdelek, Verlag Chemie 1980
5. Colorimetric Chemical Analytical Methods, 9th Edition, London

Notes for searching:

OTZ (OneTimeZero) switching on and off, see Mode 55, page 147

Active Oxygen	->	Oxygen, activ
Alkalinity-m	->	Alkalinity, total
Biguanide	->	PHMB
Calcium Hardness	->	Hardness, Calcium
Cyanuric acid	->	CyA-TEST
H_2O_2	->	Hydrogen peroxide
Total Hardness	->	Hardness, total
m-Value	->	Alkalinity, total
total Alkalinity	->	Alkalinity, total
total Hardness	->	Hardness, total

Langelier Saturation Index (Water Balance)	->	**Mode function 70**

1.1 Methods

2 0 Acid demand to pH 4.3 with Tablet

0.1 – 4 mmol/l

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber.
5. Add **one ALKA-M-PHOTOMETER tablet** straight from the foil to the water sample and crush the tablet using a clean stirring rod.
6. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.
7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

8. Press **TEST** key.

The result is shown in the display as Acid demand to pH 4.3 in mmol/l.

1.1 Methods

Notes:

1. The terms total Alkalinity, Alkalinity-m, m-Value and Acid demand to pH 4.3 are identical.
2. For accurate results exactly 10 ml of water sample must be taken for the test.

1.1 Methods

3 0 Alkalinity, total = Alkalinity-m = m-Value with Tablet

5 – 200 mg/l $CaCO_3$

Ø 24 mm

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber.
5. Add **one ALKA-M-PHOTOMETER tablet** straight from the foil to the water sample and crush the tablet using a clean stirring rod.
6. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.
7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

8. Press **TEST** key.

The result is shown in the display as total Alkalinity.

1.1 Methods

Notes:

1. The terms total Alkalinity, Alkalinity-m, m-Value and Alkalinity to pH 4.3 are identical.
2. For accurate results exactly 10 ml of water sample must be taken for the test.
3. Conversion table:

	Acid demand to pH 4.3 DIN 38 409 ($K_{S4.3}$)	German °dH*	English °eH*	French °fH*
1 mg/l $CaCO_3$	0.02	0.056	0.07	0.1

*Carbonate hardness (reference = Hydrogencarbonate-anions)
Example:
10 mg/l $CaCO_3$ = 10 mg/l x 0.056 = 0.56 °dH
10 mg/l $CaCO_3$ = 10 mg/l x 0.02 = 0.2 mmol/l

4. ▲ $CaCO_3$
   °dH
   °eH
   °fH
   ▼ °aH

1.1 Methods

3 1 Alkalinity HR, total = Alkalinity-m HR = m-Value HR with Tablet

5 – 500 mg/l $CaCO_3$

Ø 24 mm

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber.
5. Add **one ALKA-M-HR PHOTOMETER tablet** straight from the foil to the water sample and crush the tablet using a clean stirring rod.
6. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.

Countdown
1:00
start: ↵

7. Press [↵] key.
   Wait for a **reaction period of 1 minute.**
8. **Remix the solution.**
9. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

10. Press **TEST** key.

    The result is shown in the display as total Alkalinity.

1.1 Methods

Notes:

1. For verification of the result look carefully at the bottom of the vial. If a thin yellow layer forms, then mix the vial again. This ensures that reaction is complete. Reread the result.

2. Conversion table:

	Acid demand to pH 4.3 DIN 38 409 ($K_{S4.3}$)	German °dH*	English °eH*	French °fH*
1 mg/l $CaCO_3$	0.02	0.056	0.07	0.1

*Carbonate hardness (reference = Hydrogencarbonate-anions)
Example:
10 mg/l $CaCO_3$ = 10 mg/l x 0.056 = 0.56 °dH
10 mg/l $CaCO_3$ = 10 mg/l x 0.02 = 0.2 mmol/l

3. ▲ $CaCO_3$
   °dH
   °eH
   °fH
   ▼ °aH

1.1 Methods

4 0 Aluminium with Tablet

0.01 – 0.3 mg/l Al

Ø 24 mm

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.

2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.

4. Remove the vial from the sample chamber.

5. Add **one ALUMINIUM No. 1 tablet** straight from the foil to the water sample and crush the tablet using a clean stirring rod (dissolve the tablet).

6. Add **one ALUMINIUM No. 2 tablet** straight from the foil to the same water sample and crush the tablet using a clean stirring rod.

7. Close the vial tightly with the cap and swirl gently several times until the tablets are dissolved.

8. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

9. Press **TEST** key.
Wait for a **reaction period of 5 minutes.**

Countdown
5:00

After the reaction period is finished the measurement starts automatically.

The result is shown in the display in mg/l Aluminium.

1.1 Methods

Notes:

1. Before use, clean the vials and the accessories with Hydrochloric acid (approx. 20%). Rinse them thoroughly with deionised water.
2. To get accurate results the sample temperature must be between 20°C and 25°C.
3. A low test result may be given in the presence of Fluorides and Polyphosphates. The effect of this is generally insignificant unless the water has fluoride added artificially. In this case, the following table should be used:

Fluoride [mg/l F]	Displayed value: Aluminium [mg/l Al]					
	0.05	0.10	0.15	0.20	0.25	0.30
0.2	0.05	0.11	0.16	0.21	0.27	0.32
0.4	0.06	0.11	0.17	0.23	0.28	0.34
0.6	0.06	0.12	0.18	0.24	0.30	0.37
0.8	0.06	0.13	0.20	0.26	0.32	0.40
1.0	0.07	0.13	0.21	0.28	0.36	0.45
1.5	0.09	0.20	0.29	0.37	0.48	---

   Example: If the result of Aluminium determination is 0.15 mg/l Al and the Fluoride concentration is known to be 0.4 mg/l F, the true concentration of Aluminium is 0.17 mg/l Al.

4. A special tablet ingredient prevents effects on the measurement due to iron and manganese.
5. ▲ Al
   ▼ Al_2O_3

1.1 Methods

5 0 Aluminium with Vario Powder Pack

0.01 – 0.25 mg/l Al

Ø 24 mm

Use two clean vials (24 mm Ø) and mark one as blank for zeroing.

1. Fill **20 ml of the water sample** in a 100 ml beaker.

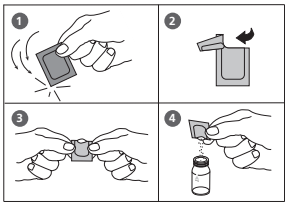
2. Add the contents of **one Vario Aluminum ECR F20 Powder Pack** straight from the foil to the water sample.

3. Dissolve the powder using a clean stirring rod.

Countdown 1
0:30
start: ↵

4. Press **[↵]** key.
   Wait for a **reaction period of 30 seconds.**

After the reaction period is finished proceed as follows:



5. Add the contents of **one Vario Hexamine F20 Powder Pack** straight from the foil to the same water sample.

6. Dissolve the powder using a clean stirring rod.

7. Add **1 drop of Vario Aluminum ECR Masking Reagent** in the vial marked as blank.

8. Add 10 ml of the prepared water sample to the vial (this is the blank).

9. Add the remaining 10 ml of the prepared water sample in the second clean vial (this is the sample).

10. Close the vials tightly with the caps and swirl several times to mix the contents.

Countdown 2
5:00
start: ↵

11. Press **[↵]** key.

    Wait for **a reaction period of 5 minutes**.

1.1 Methods

After the reaction period is finished proceed as follows:

12. Place the vial (the blank) in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

13. Press **ZERO** key.

14. Remove the vial from the sample chamber.

15. Place the vial (the sample) in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

16. Press **TEST** key.

The result is shown in the display in mg/l Aluminium.

Notes:

1. Before use, clean the vials and the accessories with Hydrochloric acid (approx. 20%). Rinse them thoroughly with deionised water.
2. To get accurate results the sample temperature must be between 20°C and 25°C.
3. A low test result may be given in the presence of Fluorides and Polyphosphates. The effect of this is generally insignificant unless the water has fluoride added artificially. In this case, the following table should be used:

Fluoride [mg/l F]	Displayed value: Aluminium [mg/l Al]					
	0.05	0.10	0.15	0.20	0.25	0.30
0.2	0.05	0.11	0.16	0.21	0.27	0.32
0.4	0.06	0.11	0.17	0.23	0.28	0.34
0.6	0.06	0.12	0.18	0.24	0.30	0.37
0.8	0.06	0.13	0.20	0.26	0.32	0.40
1.0	0.07	0.13	0.21	0.28	0.36	0.45
1.5	0.09	0.20	0.29	0.37	0.48	---

Example: If the result of Aluminium determination is 0.15 mg/l Al and the Fluoride concentration is known to be 0.4 mg/l F, the true concentration of Aluminium is 0.17 mg/l Al.

4. ▲ Al
   ▼ Al_2O_3

1.1 Methods

6 0 Ammonia with Tablet

0.02 – 1 mg/l N

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample,** close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber.
5. Add **one AMMONIA No. 1 tablet** straight from the foil to the water sample and crush the tablet using a clean stirring rod.
6. Add **one AMMONIA No. 2 tablet** straight from the foil to the same water sample and crush the tablet using a clean stirring rod.
7. Close the vial tightly with the cap and swirl several times until the tablets are dissolved.
8. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

9. Press **TEST** key.
   Wait for a **reaction period of 10 minutes.**

Countdown
10:00

After the reaction period is finished the measurement starts automatically.

The result is shown in the display in mg/l Ammonia as N.

1.1 Methods

Notes:

1. The tablets must be added in the correct sequence.
2. The AMMONIA No. 1 tablet will only dissolve completely after the AMMONIA No. 2 tablet has been added.
3. The temperature of the sample is important for full colour development.
   At a temperature below 20°C the reaction period is 15 minutes.
4. Sea water samples:
   Ammonia conditioning reagent is required when testing sea water or brackish water samples to prevent precipitation of salts.
   Fill the test tube with the sample to the 10 ml mark and add one level spoonful of Conditioning Powder. Mix to dissolve, then continue as described in the test instructions.
5. Conversion:
   mg/l NH_4 = mg/l N x 1.29
   mg/l NH_3 = mg/l N x 1.22
6. ▲ N
   NH_4
   ▼ NH_3

1.1 Methods

8 0 Bromine with Tablet

0.05 – 13 mg/l Br_2

Ø 24 mm

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber and **empty it, leaving a few drops remaining in the vial**.
5. Add **one DPD No. 1 tablet** straight from the foil and crush the tablet using a clean stirring rod.
6. Add water sample to the 10 ml mark.
7. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.
8. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

9. Press **TEST** key.

The result is shown in the display in mg/l Bromine.

1.1 Methods

Notes:

1. Vial cleaning:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances,the subsequent determination of Bromine may show lower results. To avoid any measurement errors, only use glassware free of Chlorine demand.
   Preparation: Put all applicable glassware into Sodium hypochlorite solution (0.1 g/l) forone hour, then rinse all glassware thoroughly with deionised water.
2. Preparing the sample:
   When preparing the sample, the lost of Bromine, e.g. by pipetting or shaking, must be avoided. The analysis must take place immediately after taking the sample.
3. The DPD colour development is carried out at a pH value of 6.2 to 6.5. The reagent tablet therefore contains a buffer for the pH adjustment. Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the reagent is added (use 0.5 mol/l Sulfuric acid resp. 1 mol/l Sodium hydroxide).
4. Exceeding the measuring range:
   Concentrations above 22 mg/l Bromine can lead to results showing 0 mg/l.
   In this case, the water sample must be diluted with water free of Bromine.
   10 ml of the diluted sample should be mixed with the reagent and the measurement repeated.
5. Oxidising agents such as Chlorine, Ozone etc. interfere as they react in the same way as Bromine.

1.1 Methods

1 0 0 **Chlorine with Tablet**

0.01 – 6 mg/l Cl_2

1 0 3 **Chlorine HR with Tablet**

0.1 – 10 mg/l Cl_2

1 0 1 **Chlorine with Liquid Reagent**

0.02 - 4 mg/l Cl_2

1 1 0 **Chlorine with Vario Powder Pack**

0.02 - 2 mg/l Cl_2

1 1 1 **Chlorine HR with Vario Powder Pack**

0.1 - 8 mg/l Cl_2

Chlorine **>> diff** **free** **total**	The following selection is shown in the display:
>> diff	for the differentiated determination of free, combined and total Chlorine.
>> free	for the determination of free Chlorine.
>> total	for the determination of total Chlorine.

Select the desired determination with the arrow keys [▲] and [▼]. Confirm with [↵] key.

1.1 Methods

Notes:

1. Vial cleaning:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of Chlorine may show lower results. To avoid any measurement errors, only use glassware free of Chlorine demand.
   Preparation: Put all applicable glassware into Sodium hypochlorite solution (0.1 g/l) for one hour, then rinse all glassware thoroughly with deionised water.
2. For individual testing of free and total Chlorine, the use of different sets of glassware is recommended (EN ISO 7393-2, 5.3)
3. Preparing the sample:
   When preparing the sample, the lost of Chlorine, e.g. by pipetting or shaking, must be avoided. The analysis must take place immediately after taking the sample.
4. The DPD colour development is carried out at a pH value of 6.2 to 6.5. The reagents therefore contain a buffer for the pH adjustment.
   Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the reagent is added (use 0.5 mol/l Sulfuric acid resp. 1 mol/l Sodium hydroxide).
5. Exceeding the measuring range:
   Concentrations above:
   10 mg/l Chlorine using tablets (method 100)
   4 mg/l Chlorine using liquid reagents (method 101)
   2 mg/l using powder packs (method 110)
   8 mg/l using powder packs (method 111)
   can lead to results showing 0 mg/l. In this case, the water sample must be diluted with water free of Chlorine. 10 ml of the diluted sample should be mixed with the reagent and the measurement repeated.
6. Turbidity (can lead to errors):
   The use of the DPD No. 1 tablet (method 100) in samples with high Calcium ion contents* and/or high conductivity* can lead to turbidity of the sample and therefore incorrect measurements. In this case, the reagent tablet DPD No. 1 High Calcium should be used as an alternative. If turbidity does occur after the DPD No. 3 tablet has been added, this can be prevented by using the DPD No. 1 High Calcium tablet and the DPD No. 3 High Calcium tablet.
   The DPD No. 1 High Calcium should only be used in combination with the DPD No.3 High Calcium.
   ** it is not possible to give exact values, because the development of turbidity depends on the nature of the sample.*
7. If ??? is displayed at a differentiated test result see page 170.
8. Oxidizing agents such as Bromine, Ozone etc. interfere as they react in the same way as Chlorine.

1.1 Methods

(1) (0) (0) Chlorine, differentiated determination with Tablet

0.01 – 6 mg/l Cl_2

Ø 24 mm

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample,** close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber and **empty it, leaving a few drops remaining in the vial**.
5. Add **one DPD No. 1 tablet** straight from the foil and crush the tablet using a clean stirring rod.
6. Add water sample to the 10 ml mark.
7. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.
8. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare T1
press TEST

9. Press **TEST** key.
10. Remove the vial from the sample chamber.
11. Add **one DPD No. 3 tablet** straight from the foil to the same water sample and crush the tablet using a clean stirring rod.
12. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.

1.1 Methods

13. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

T1 accepted
prepare T2
press TEST

14. Press **TEST** key.
Wait for a **reaction period of 2 minutes**.

Countdown
2:00

After the reaction period is finished the measurement starts automatically.

The result is shown in the display in:

***,** mg/l free Cl**
***,** mg/l comb Cl**
***,** mg/l total Cl**

mg/l free Chlorine
mg/l combined Chlorine
mg/l total Chlorine

Notes:

See page 27

1.1 Methods

1 0 0 Chlorine, free with Tablet

0.01 – 6 mg/l Cl_2

Ø 24 mm

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber and **empty it, leaving a few drops remaining in the vial**.
5. Add **one DPD No. 1 tablet** straight from the foil and crush the tablet using a clean stirring rod.
6. Add water sample to the 10 ml mark.
7. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.
8. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

9. Press **TEST** key.

The result is shown in the display in mg/l free Chlorine.

Notes:

See page 27

1.1 Methods

1 0 0 Chlorine, total with Tablet

0.01 – 6 mg/l Cl_2

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.

2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.

4. Remove the vial from the sample chamber and **empty it, leaving a few drops remaining in the vial**.

5. Add **one DPD No. 1 tablet** and **one DPD No. 3 tablet** straight from the foil and crush the tablets using a clean stirring rod.

6. Add water sample to the 10 ml mark.

7. Close the vial tightly with the cap and swirl several times until the tablets are dissolved.

8. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

9. Press **TEST** key.
Wait for a **reaction period of 2 minutes**.

Countdown
2:00

After the reaction period is finished the measurement starts automatically.

The result is shown in the display in mg/l total Chlorine.

Notes:

See page 27

1.1 Methods

1 0 3 Chlorine HR, differentiated determination with Tablet

0.1 – 10 mg/l Cl_2

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample,** close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber and **empty it, leaving a few drops remaining in the vial**.
5. Add **one DPD No. 1 HR tablet** straight from the foil and crush the tablet using a clean stirring rod.
6. Add water sample to the 10 ml mark.
7. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.
8. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare T1
press TEST

9. Press **TEST** key.
10. Remove the vial from the sample chamber.
11. Add **one DPD No. 3 HR tablet** straight from the foil to the same water sample and crush the tablet using a clean stirring rod.

1.1 Methods

12. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.

13. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

T1 accepted
prepare T2
press TEST

14. Press **TEST** key.
Wait for a **reaction period of 2 minutes**.

Countdown
2:00

After the reaction period is finished the measurement starts automatically.

The result is shown in the display in:

***,** mg/l free Cl**
***,** mg/l comb Cl**
***,** mg/l total Cl**

mg/l free Chlorine
mg/l combined Chlorine
mg/l total Chlorine

Notes:

See page 27

1.1 Methods

1 0 3 Chlorine HR, free with Tablet

0.1 – 10 mg/l Cl_2

Ø 24 mm

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber and **empty it, leaving a few drops remaining in the vial**.
5. Add **one DPD No. 1 HR tablet** straight from the foil and crush the tablet using a clean stirring rod.
6. Add water sample to the 10 ml mark.
7. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.
8. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

9. Press **TEST** key.

The result is shown in the display in mg/l free Chlorine.

Notes:

See page 27

1.1 Methods

1 0 3 Chlorine HR, total with Tablet

0.1 – 10 mg/l Cl_2

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.

2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.

4. Remove the vial from the sample chamber and **empty it, leaving a few drops remaining in the vial**.

5. Add **one DPD No. 1 tablet** and **one DPD No. 3 tablet** straight from the foil and crush the tablets using a clean stirring rod.

6. Add water sample to the 10 ml mark.

7. Close the vial tightly with the cap and swirl several times until the tablets are dissolved.

8. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

9. Press **TEST** key.
Wait for a **reaction period of 2 minutes**.

Countdown
2:00

After the reaction period is finished the measurement starts automatically.

The result is shown in the display in mg/l total Chlorine.

Notes:

See page 27

1.1 Methods

1 0 1 Chlorine, differentiated determination with Liquid Reagent

0.02 – 4 mg/l Cl_2

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber and **empty the vial**.
5. Fill the vial with drops of the same size by holding the bottle vertically and squeeze slowly:

   6 drops of DPD 1 buffer solution

   2 drops of DPD 1 reagent solution

6. Add water sample to the 10 ml mark.
7. Close the vial tightly with the cap and swirl several times to mix the contents.
8. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare T1
press TEST

9. Press **TEST** key.
10. Remove the vial from the sample chamber.
11. **Add 3 drops of DPD 3 solution** to the same water sample.
12. Close the vial tightly with the cap and swirl several times to mix the contents.

1.1 Methods

13. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

T1 accepted
prepare T2
press TEST

14. Press **TEST** key.
Wait for a **reaction period of 2 minutes**.

Countdown
2:00

After the reaction period is finished the measurement starts automatically.

The result is shown in the display in:

***,** mg/l free Cl**
***,** mg/l comb. Cl**
***,** mg/l total Cl**

mg/l free Chlorine
mg/l combined Chlorine
mg/l total Chlorine

Notes:

1. After use replace the bottle caps securely noting the colour coding.
2. **Store the reagent bottles in a cool, dry place ideally between 6°C and 10°C**.
3. Also see page 27

1.1 Methods

1 0 1 Chlorine, free with Liquid Reagent

0.02 – 4 mg/l Cl_2

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber and **empty the vial**.
5. Fill the vial with drops of the same size by holding the bottle vertically and squeeze slowly:

   6 drops of DPD 1 buffer solution

   2 drops of DPD 1 reagent solution

6. Add water sample to the 10 ml mark.
7. Close the vial tightly with the cap and swirl several times to mix the contents.
8. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

9. Press **TEST** key.

   The result is shown in the display in mg/l free Chlorine.

Notes (free and total Chlorine):

1. After use replace the bottle caps securely noting the colour coding.
2. **Store the reagent bottles in a cool, dry place ideally between 6°C and 10°C.**
3. Also see page 27

1.1 Methods

1 0 1 Chlorine, total with Liquid Reagent

0.02 – 4 mg/l Cl_2

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber and **empty the vial**.
5. Fill the vial with drops of the same size by holding the bottle vertically and squeeze slowly:

   6 drops of DPD 1 buffer solution

   2 drops of DPD 1 reagent solution

   3 drops of DPD 3 solution
6. Add water sample to the 10 ml mark.
7. Close the vial tightly with the cap and swirl several times to mix the contents.
8. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

9. Press **TEST** key.
   Wait for a **reaction period of 2 minutes**.

Countdown
2:00

After the reaction period is finished the measurement starts automatically.

The result is shown in the display in mg/l total Chlorine.

1.1 Methods

(1) (1) (0) Chlorine, differentiated determination with Vario Powder Pack

0.02 – 2 mg/l Cl_2

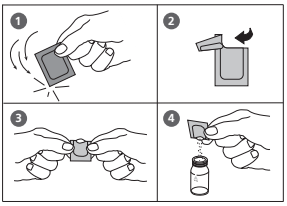
1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.

2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.

4. Remove the vial from the sample chamber.



5. Add the contents of **one VARIO Chlorine FREE-DPD/ F10 Powder Pack** straight from the foil to the water sample.

6. Close the vial tightly with the cap and swirl several times to mix the contents (approx. 20 seconds).

7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare T1
press TEST

8. Press **TEST** key.

9. Remove the vial from the sample chamber, empty the vial, rinse vial and cap several times and then fill the vial with **10 ml of the water sample**.

10. Add the contents of **one VARIO Chlorine TOTAL-DPD / F10 Powder Pack** straight from the foil to the water sample.

11. Close the vial tightly with the cap and swirl several times to mix the contents (approx. 20 seconds).

1.1 Methods

12. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

T1 accepted
prepare T2
press TEST

13. Press **TEST** key.
Wait for a **reaction period of 3 minutes.**

Countdown
3:00

After the reaction period is finished the measurement starts automatically.

The result is shown in the display in:

***,** mg/l free Cl**
***,** mg/l comb. Cl**
***,** mg/l total Cl**

mg/l free Chlorine
mg/l combined Chlorine
mg/l total Chlorine

Notes:

See page 27

1.1 Methods

1 1 0 Chlorine, free with Vario Powder Pack

0.02 – 2 mg/l Cl_2

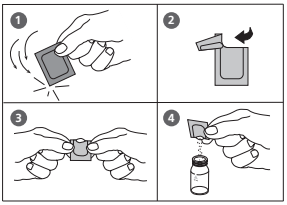
1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.

2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.

4. Remove the vial from the sample chamber.



5. Add the contents of **one VARIO Chlorine FREE-DPD / F10 Powder Pack** straight from the foil to the water sample.

6. Close the vial tightly with the cap and swirl several times to mix the contents (approx. 20 seconds).

7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

8. Press **TEST** key.

The result is shown in the display in mg/l free Chlorine.

Notes:

See page 27

1.1 Methods

1 1 0 Chlorine, total with Vario Powder Pack

0.02 – 2 mg/l Cl_2

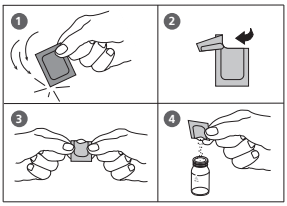
1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.

2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.

4. Remove the vial from the sample chamber.



5. Add the contents of **one VARIO Chlorine TOTAL-DPD / F10 Powder Pack** straight from the foil to the water sample.

6. Close the vial tightly with the cap and swirl several times to mix the contents (approx. 20 seconds).

7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

8. Press **TEST** key.
Wait for a **reaction period of 3 minutes**.

Countdown
3:00

After the reaction period is finished the measurement starts automatically.

The result is shown in the display in mg/l total Chlorine.

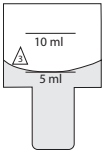
Notes:

See page 27

1.1 Methods

1 1 1

Chlorine HR, differentiated determination with Vario Powder Pack plastic vial (type 3) ⊔ 10 mm



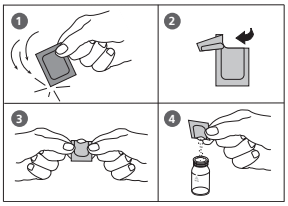
0.1 – 8 mg/l Cl_2

1. Fill a clean vial (10 mm Ø) with **5 ml of the water sample**, close tightly with the cap.

2. Place the vial in the sample chamber making sure that the ⨯ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.



4. Remove the vial from the sample chamber.

5. Add the contents of **two Vario Chlorine Free-DPD/ F10 Powder Pack** straight from the foil into the water sample.

6. Close the vial tightly with the cap and invert several times to mix the contents (20 sec.).

7. Place the vial in the sample chamber making sure that the ⨯ marks are aligned.

Zero accepted
prepare T1
press TEST

8. Press the **TEST** key.

9. Remove the vial from the sample chamber, empty the vial, rinse vial and cap several times and then fill the vial with 5 ml of the water sample.

10. Add the contents of **two Vario Chlorine TOTAL-DPD/ F10 Powder Pack** straight from the foil into the water sample.

1.1 Methods

11. Close the vial tightly with the cap and invert several times to mix the contents (20 sec.).

12. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

T1 accepted
prepare T2
press TEST

13. Press **TEST** key.

Wait for a reaction period of 3 minutes.

Countdown
3:00

After the reaction period is finished the measurement starts automatically.

The result is shown in the display in:

***,** mg/l free Cl**
***,** mg/l comb. Cl**
***,** mg/l total Cl**

mg/l free Chlorine
mg/l combined Chlorine
mg/l total Chlorine

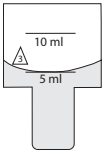
Notes:

See page 27

1.1 Methods

1 1 1

Chlorine HR, free with Vario Powder Pack plastic vial (type 3) ⊔ 10 mm



0.1 – 8 mg/l Cl_2

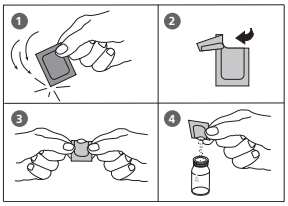
1. Fill a clean vial (10 mm Ø) with **5 ml of the water sample**, close tightly with the cap.

2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.

4. Remove the vial from the sample chamber.



5. Add the contents of **two Vario Chlorine Free-DPD/ F10 Powder Pack** straight from the foil into the water sample.

6. Close the vial tightly with the cap and invert several times to mix the contents (20 sec.).

7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

8. Press the **TEST** key.

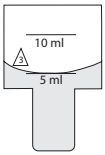
The result is shown in the display in mg/l free Chlorine.

Notes:
See page 27

1.1 Methods

1 1 1

Chlorine HR, total with Vario Powder Pack plastic vial (type 3) ⊔ 10 mm



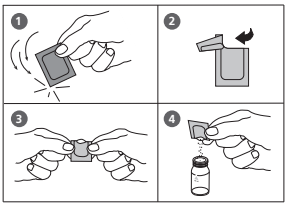
0.1 – 8 mg/l Cl_2

1. Fill a clean vial (10 mm Ø) with **5 ml of the water sample**, close tightly with the cap.

2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.



4. Remove the vial from the sample chamber.

5. Add the contents of **two Vario Chlorine Free-DPD/ F10 Powder Pack** straight from the foil into the water sample.

6. Close the vial tightly with the cap and swirl several times to mix the contents (approx. 20 seconds).

7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

8. Press **TEST** key.
Wait for a **reaction period of 3-6 minutes**.

Countdown
3:00

After the reaction period is finished the measurement starts automatically.

The result is shown in the display in mg/l total Chlorine.

Notes:
See page 27

1.1 Methods

120 Chlorine dioxide with Tablet

0.02 – 11 mg/l ClO_2

Chlorine dioxide >> with Cl without Cl

The following selection is shown in the display:

>> with Cl

for the determination of Chlorine dioxide in the presence of Chlorine.

>> without Cl

for the determination of Chlorine dioxide in the absence of Chlorine.

Select the desired determination with the arrow keys [▲] and [▼]. Confirm with [↵] key.

1.1 Methods

Notes:

1. Vial cleaning:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of Chlorine dioxide may show lower results. To avoid any measurement errors, only use glassware free of Chlorine demand.
   Preparation: Put all applicable glassware into Sodium hypochlorite solution (0.1 g/l) for one hour, then rinse all glassware thoroughly with deionised water.
2. Preparing the sample: When preparing the sample, the lost of Chlorine dioxide, e.g. by pipetting or shaking, must be avoided. The analysis must take place immediately after taking the sample.
3. The DPD colour development is carried out at a pH value of 6.2 to 6.5. The reagent tablet therefore contains a buffer for the pH adjustment.
   Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the tablet is added (use 0.5 mol/l Sulfuric acid resp. 1 mol/l Sodium hydroxide).
4. Exceeding the measuring range:
   Concentrations above 19 mg/l Chlorine dioxide can lead to results showing 0 mg/l. In this case, the water sample must be diluted with water free of Chlorine dioxide. 10 ml of the diluted sample should be mixed with the reagent and the measurement repeated.
5. If ??? is displayed at a differentiated test result see page 170.
6. Oxidising agents such as Chlorine, Ozone etc. interfere as they react in the same way as Chlorine dioxide.

1.1 Methods

(1) (2) (0) Chlorine dioxide in the presence of Chlorine with Tablet

0.02 – 11 mg/l ClO_2

Ø 24 mm

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**.
2. Add **one GLYCINE tablet** straight from the foil and crush the tablet using a clean stirring rod.
3. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.
4. **Fill a second clean vial with 10 ml of water sample** and close tightly with the cap.
5. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

6. Press **ZERO** key.
7. Remove the vial from the sample chamber and **empty the vial**.
8. Add **one DPD No. 1 tablet** straight from the foil and crush the tablet using a clean stirring rod.
9. **Transfer the contents of the first vial (Glycine solution) into the prepared vial (point 8).**
10. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.
11. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare T1
press TEST

12. Press **TEST** key.

1.1 Methods

13. Remove the vial from the sample chamber, empty the vial, rinse vial and cap several times. Fill with **a few drops of water sample**.

14. Add **one DPD No. 1 tablet** straight from the foil and crush the tablet using a clean stirring rod.

15. Add water sample to the 10 ml mark.

16. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.

17. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

T1 accepted
prepare T2
press TEST

18. Press **TEST** key.

19. Remove the vial from the sample chamber.

20. Add **one DPD No. 3 tablet** straight from the foil to the same water sample and crush the tablet using a clean stirring rod.

21. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.

22. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

T2 accepted
prepare T3
press TEST

23. Press **TEST** key.
Wait for a **reaction period of 2 minutes**.

Countdown
2:00

After the reaction period is finished the measurement starts automatically.

The result is shown in the display in:

***,** mg/l ClO_2**

as Chlorine dioxide in mg/l ClO_2.

***,** mg/l free Cl**
***,** mg/l comb. Cl**
***,** mg/l total Cl**

mg/l free Chlorine
mg/l combined Chlorine
mg/l total Chlorine

Notes:

See next page.

1.1 Methods

Notes: (Chlorine dioxide in the presence of Chlorine)

1. The conversion factor to convert Chlorine dioxide (display) to Chlorine dioxide as Chlorine units is 2.6315.
   mg/l ClO_2 [Cl] = mg/l ClO_2 · 2.6315
   Chlorine dioxide displayed as Chlorine units ClO_2 [Cl] has its origin in swimming poolwater treatment according to DIN 19643.
2. The total Chlorine result given includes the contribution of the chlorine dioxide as Chlorine units reading. For true Chlorine value add the free and combined Chlorine values.
3. See also page 49.

1.1 Methods

1 2 0 Chlorine dioxide in absence of Chlorine with Tablet

0.02 – 11 mg/l ClO_2

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber and **empty it, leaving a few drops remaining in the vial**.
5. Add **one DPD No. 1 tablet** straight from the foil and crush the tablet using a clean stirring rod.
6. Add water sample to the 10 ml mark.
7. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.
8. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

9. Press **TEST** key.

The result is shown in the display

***,** mg/l ClO_2**

as Chlorine dioxide in mg/l ClO_2.

Notes:

See page 49

1.1 Methods

(1) (0) (0) Chlorite in presence of Chlorine and Chlorine dioxide

0,01 – 6 mg/l Cl_2

Firstly, the glycine method is used to measure the concentration of Chlorine Dioxide. This is then followed by the determination of the free and total chlorine, from which the Combined Chlorine can be calculated. A third test is performed which measures the Total Chlorine concentration plus any Chlorite present. Finally, the Chlorite concentration can be calculated from the three recorded results.

Chlorine
>> diff
free
total

The following selection is shown in the display:

>> free

select for the determination of free Chlorine.

Ø 24 mm

1. Fill a clean vial with **10 ml of water sample**.
2. Add **one GLYCINE tablet** straight from the foil to the water sample and crush the tablet using a clean stirring rod.
3. Close the vial tightly with the cap and swirl gently several times until the tablet is dissolved.
4. **Fill a second clean vial with 10 ml of water sample**, close tightly with the cap.
5. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

6. Press **ZERO** key.
7. **Remove the vial from the sample chamber and empty the vial.**
8. Add **one DPD No. 1 tablet** straight from the foil and crush the tablet using a clean stirring rod.

1.1 Methods

9. **Transfer the contents of the first vial (Glycine solution) into the prepared vial (point 8).**

10. Close the vial tightly with the cap and swirl several times until the tablets are dissolved.

11. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

12. Press **TEST** key.

    Record the displayed test result (G).

13. Remove the vial from the sample chamber, empty the vial, rinse vial and cap several times. Fill with **a few drops of water sample**.

14. Add **one DPD No. 1 tablet** straight from the foil and crush the tablet using a clean stirring rod.

15. Add water sample to the 10 ml mark.

16. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.

17. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

18. Press **TEST** key.

    Record the displayed test result (A).

19. Remove the vial from the sample chamber.

20. Add **one DPD No. 3 tablet** straight from the foil to the same water sample and crush the tablet using a clean stirring rod.

1.1 Methods

21. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.

22. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

23. Wait for a **reaction period of 2 minutes**.

Zero accepted
prepare Test
press TEST

24. Press **TEST** key.

    Record the displayed test result (C).

25. Remove the vial from the sample chamber.

26. Add **one DPD ACIDIFYING tablet** straight from the foil to the same water sample and crush the tablet using a clean stirring rod.

27. Wait for a **reaction period of 2 minutes**.

28. Add **one DPD NEUTRALISING tablet** straight from the foil to the same water sample and crush the tablet using a clean stirring rod.

29. Close the vial tightly with the cap and swirl several times until the tablets are dissolved.

30. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

31. Press **TEST** key.

    Record the displayed test result (D).

1.1 Methods

Calculations:

mg/l Chlorine dioxide	= result G x 1,9
mg/l free Chlorine	= result A – result G
mg/l combined Chlorine	= result C – result A
mg/l Chlorite	= result D – (result C + 4 x result G)

Tolerances:

1. By calculation of non direct analysable parameters it is necessary to consider the error propagation besed on the possible tolerances of the single test tesults.
2. see Notes Chlorine

1.1 Methods

1 5 0 Copper with Tablet

0.05 – 5 mg/l Cu

Copper
>> diff
free
total

The following selection is shown in the display:

>> diff

for the differentiated determination of free, combined and total Copper.

>> free

for the determination of free Copper.

>> total

for the determination of total Copper.

Select the desired determination with the arrow keys [▲] and [▼]. Confirm with [↵] key.

Note:

1. If ??? is displayed at the diffentiated test result see page 170.

1.1 Methods

1 5 0 Copper, differentiated determination with Tablet

0.05 – 5 mg/l Cu

prepare Zero
press ZERO

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.
3. Press **ZERO** key.
4. Remove the vial from the sample chamber.
5. Add **one COPPER No. 1 tablet** straight from the foil to the water sample and crush the tablet using a clean stirring rod.
6. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.
7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare T1
press TEST

8. Press **TEST** key.
9. Remove the vial from the sample chamber.
10. Add **one COPPER No. 2 tablet** straight from the foil to the same water sample and crush the tablet using a clean stirring rod.
11. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.
12. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

T1 accepted
prepare T2
press TEST

13. Press **TEST** key.

***,** mg/l free Cu**
***,** mg/l comb Cu**
***,** mg/l total Cu**

The result is shown in the display in:
mg/l free Copper
mg/l combined Copper
mg/l total Copper

1.1 Methods

1 5 0 Copper, free with Tablet

0.05 – 5 mg/l Cu

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber.
5. Add **one COPPER No. 1 tablet** straight from the foil to the water sample and crush the tablet using a clean stirring rod.
6. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.
7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

8. Press **TEST** key.

The result is shown in the display in mg/l free Copper.

1.1 Methods

1 5 0 Copper, total with Tablet

0.05 – 5 mg/l Cu

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber.
5. Add **one COPPER No. 1 tablet and one COPPER No. 2 tablet** straight from the foil to the water sample and crush the tablets using a clean stirring rod.
6. Close the vial tightly with the cap and swirl several times until the tablets are dissolved.
7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

8. Press **TEST** key.

The result is shown in the display in mg/l total Copper.

1.1 Methods

1 5 3 Copper, free (Note 1) with Vario Powder Pack

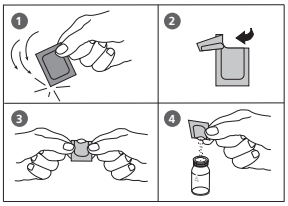
0.05 – 5 mg/l Cu

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.

2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.



4. Remove the vial from the sample chamber.

5. Add the contents of **one VARIO Cu 1 F10 Powder Pack** straight from the foil to the water sample.

6. Close the vial tightly with the cap and swirl several times to mix the contents (Note 3).

7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

8. Press **TEST** key.

   Wait for a **reaction period of 2 minutes**.

Countdown
2:00

After the reaction period is finished the measurement starts automatically.

The result is shown in the display in mg/l Copper

1.1 Methods

Notes:

1. For determination of total Copper digestion is required.
2. Extremely acid water samples (pH 2 or less) must be adjusted between pH 4 and pH 6 before the reagent is added (with 8 mol/l Potassium hydroxide solution KOH). Caution: pH values above 6 can lead to Copper precipitation.
3. Accuracy is not affected by undissolved powder.
4. Interferences:

Cyanide, CN^-	Cyanide prevents full colour development. Add 0.2 ml Formaldehyde to 10 ml water sample and wait for a reaction time of 4 minutes (Cyanide is masked). After this perform test as described. Multiply the result by 1.02 to correct the sample dilution by Formaldehyde.
Silver, Ag^+	If a turbidity remains and turns black, silver interference is likely. Add 10 drops of saturated Potassium chloride solution to 75 ml of water sample. Filtrate through a fine filter. Use 10 ml of the filtered water sample to perform test.

1.1 Methods

1 6 0 CyA-TEST (Cyanuric acid) with Tablet

0 – 160 mg/l CyA

1. Fill a clean vial (24 mm Ø) with **5 ml of the water sample** and **5 ml deionised water (Note 1)**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber.
5. Add **one CyA-TEST tablet** straight from the foil to the prepared water sample and crush the tablet using a clean stirring rod.
6. Close the vial tightly with the cap and swirl several times until the tablet is dissolved (Note 2, 3).
7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

8. Press **TEST** key.

The result is shown in the display in mg/l Cyanuric acid.

1.1 Methods

Notes:

1. Use deionised water or tap water free of Cyanuric acid.
2. If Cyanuric acid is present a cloudy solution will occur.
   Small single particles are not necessarily caused by Cyanuric acid.
3. Dissolve the tablet completely (therefore swirl the vial approx. 1 minute).
   Un-dissolved particles of the tablet can cause results that are too high.

1.1 Methods

2 1 4

H_2O_2 (Hydrogen peroxide) HR with Liquid Reagent

40 – 500 mg/l H_2O_2

Insert the adapter for 16 mm Ø vials.

1. Fill a clean vial (16 mm Ø) with **10 ml of the water sample**, close tightly with the cap. (Note 1, 2)

2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press the **ZERO** key.

4. Remove the vial from the sample chamber.

5. Fill the prepared vial with drops of the same size by holding the bottle vertically and squeeze slowly:

   6 drops of H_2O_2-Reagent

6. Close the vial tightly with the cap and invert several times to mix the contents.

7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

8. Press the **TEST** key.

   The result is shown in the display in mg/l H_2O_2.

1.1 Methods

Notes:

1. The hydrogen peroxide is determined in the form of yellow/orange coloured peroxotitanic acids in strongly acidic media. In connection with neutral to weakly alkaline (~pH 10) samples, the acid in the reagent is sufficient in order to produce a medium suitable for measurement. In the case of strongly alkaline samples (pH > 10), the samples must be acidified before measurement otherwise the results may be deficient. This is achieved by diluting the sample with a 5% sulphuric acid solution, for example, at a ratio of 1:1.

   In contrast to many other colour reactions, in connection with the presence of hydrogen peroxide, discoloration with long-term stability is achieved that can still be measured after 24 h. Particles in the sample solution or turbidity distort the analysis and must be eliminated by centrifuging or simply filtering the sample solution prior to performing the measurement. Falsification of the measurement results should also be expected in connection with coloured solutions.

2. Oxidising agents such as chlorine, bromine, chlorine dioxide and ozone do not distort the analysis. On the other hand, however, water discoloration does distort the analysis. In this case, proceed as described in the following:
   - Fill a clean vial (16 mm Ø) with 10 ml of the water sample and perform zero calibration (see "Operation").
   - Measure the sample solution without the addition of drops of reagent (result B).
   - Then the same sample solution, measured with the addition of the reagent drops (result A).
   - Calculations: mg/l H_2O_2 = result A – result B

3. Attention: The reference reagent contains a 25% sulphuric acid solution. It is recommended to wear appropriate protective clothing (protective goggles/gloves).

1.1 Methods

(1) (9) (1) Hardness, Calcium 2T with Tablet

0 – 500 mg/l $CaCO_3$

Ø 24 mm

1. Fill a clean vial (24 mm Ø) with **10 ml of water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber.
5. Add **one CALCIO H No. 1 tablet** straight from the foil to the 10 ml water sample, crush the tablet using a clean stirring rod and dissolve the tablet completely.
6. Add **one CALCIO H No. 2 tablet** straight from the foil to the same water sample and crush the tablet using a clean stirring rod.
7. Close the vial tightly with the cap and swirl gently several times until the tablet is completely dissolved.
8. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

9. Press **TEST** key.

   Wait for a **reaction period of 2 minutes**.

Countdown
2:00

After the reaction period is finished the measurement starts automatically.

The result is shown in the display as Calcium Hardness.

1.1 Methods

Notes:

1. To optimise the readings an optional batch related calibration can be performed using Mode 40, see page 140.
2. Strong alkaline or acidic water samples must be adjusted to a pH-value between pH 4 and 10 before the tablets are added (use 1 mol/l Hydrochloride acid resp. 1 mol/l Sodium hydroxide).
3. For accurate test results exactly 10 ml of water sample must be taken for the test.
4. This method was developed from a volumetric procedure for the determination of Calcium Hardness. Due to undefined conditions, the deviations from the standardised method may be greater.
5. The tolerance of the method is increasing with higher concentrations. When diluting samples, this should be taken in account, always measuring in the first third of the range.
6. Interferences:
   - Magnesium hardness up to 200 mg/l $CaCO_3$ does not interfere.
   - Iron concentration above 10 mg/l may cause low results.
   - Zinc concentration above 5 mg/l may cause high results.
7. ▲ $CaCO_3$
   °dH
   °eH
   °fH
   ▼ °aH

1.1 Methods

2 0 0 Hardness, total with Tablet

2 – 50 mg/l $CaCO_3$

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.

2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.

4. Remove the vial from the sample chamber.

5. Add **one HARDCHECK P tablet** straight from the foil to the water sample and crush the tablet using a clean stirring rod.

6. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.

7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

8. Press **TEST** key.

   Wait for a **reaction period of 5 minutes**.

Countdown
5:00

After the reaction period is finished the measurement starts automatically.

The result is shown in the display as total Hardness.

1.1 Methods

Notes:

1. Strong alkaline or acidic water samples must be adjusted between pH 4 and pH 10 before the tablet is added (use 1 mol/l Hydrochloric acid resp. 1mol/l Sodium hydroxide).
2. Conversion table:

	mg/l $CaCO_3$	°dH	°fH	°eH
1 mg/l $CaCO_3$	----	0.056	0.10	0.07
1 °dH	17.8	----	1.78	1.25
1 °fH	10.0	0.56	----	0.70
1 °eH	14.3	0.80	1.43	----

3. ▲ $CaCO_3$
   °dH
   °eH
   °fH
   ▼ °aH

1.1 Methods

2 0 1 Hardness, total HR with Tablet

20 – 500 mg/l $CaCO_3$


Ø 24 mm

1. Fill a clean vial (24 mm Ø) with **1 ml of the water sample** and **9 ml of deionised water**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber.
5. Add **one HARDCHECK P tablet** straight from the foil to the water sample and crush the tablet using a clean stirring rod.
6. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.
7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

8. Press **TEST** key.

   Wait for a **reaction period of 5 minutes**.

Countdown
5:00

After the reaction period is finished the measurement starts automatically.

The result is shown in the display as total Hardness.

1.1 Methods

Notes:

1. Strong alkaline or acidic water samples must be adjusted between pH 4 and pH 10 before the tablet is added (use 1 mol/l Hydrochloric acid resp. 1mol/l Sodium hydroxide).
2. Conversion table:

	mg/l $CaCO_3$	°dH	°fH	°eH
1 mg/l $CaCO_3$	----	0.056	0.10	0.07
1 °dH	17.8	----	1.78	1.25
1 °fH	10.0	0.56	----	0.70
1 °eH	14.3	0.80	1.43	----

3. ▲ $CaCO_3$
   °dH
   °eH
   °fH
   ▼ °aH

1.1 Methods

2 1 5 Iodine with Tablet

0.05 – 3.6 mg/l I

Ø 24 mm

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber, **empty the vial leaving a view drops in.**
5. Add **one DPD No. 1 tablet** straight from the foil to the water sample and crush the tablet using a clean stirring rod.
6. Add water sample to the 10 ml mark.
7. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.
8. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

9. Press **TEST** key.

The result is shown in the display in mg/l Iodine.

1.1 Methods

Notes:

1. Oxidizing reagents, such as Chlorine, Bromine, etc. interfere as they react in the same way as Iodine.

1.1 Methods

220 Iron (Note 1) with Tablet

0.02 – 1 mg/l Fe

Determination of total dissolved Iron Fe^{2+} and Fe^{3+} *

Ø 24 mm

*This information refers to analysis of the water sample without digestion.

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber.
5. Add **one IRON LR tablet** straight from the foil to the water sample and crush the tablet using a clean stirring rod.
6. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.
7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

8. Press **TEST** key.
   Wait for a **reaction period of 5 minutes**.

Countdown
5:00

After the reaction period is finished the measurement starts automatically.

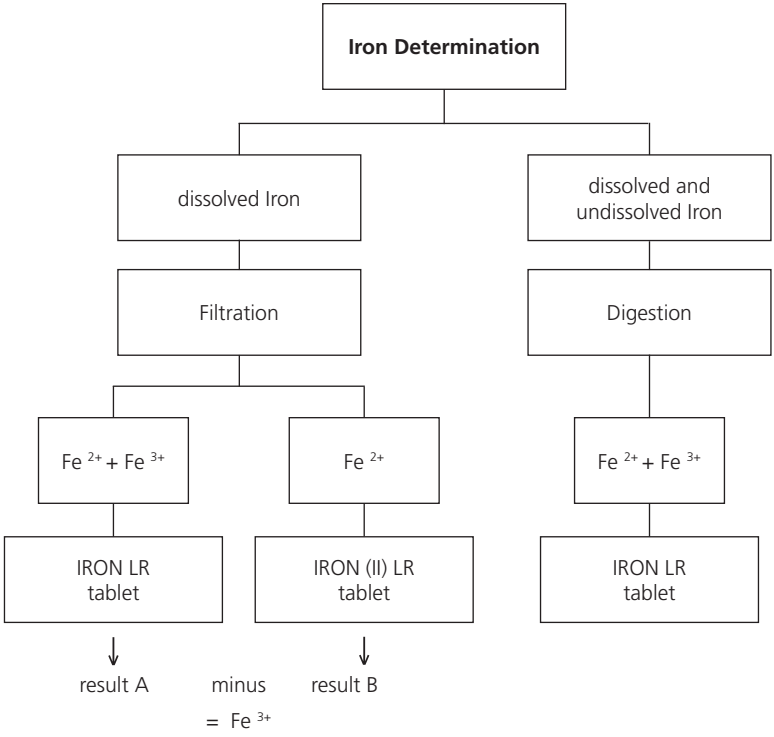
The result is shown in the display in mg/l Iron ($Fe^{2+/3+}$).

Notes:

1. This method determines the total dissolved Iron as Fe^{2+} and Fe^{3+}.
2. The IRON (II) LR tablet is used for differentiation – as described above – instead of the IRON LR tablet.
   $Fe^{3+} = Fe^{2+/3+} - Fe^{2+}$
3. For the determination of total dissolved and undissolved iron digestion is required.
   An example is described on page 77.

1.1 Methods

Notes:



Digestion procedure for the determination of total dissolved and undissolved iron.

1. Add 1 ml of concentrated sulfuric acid to 100 ml water sample. Heat and boil for 10 minutes or until all particles are dissolved. After cooling down, the sample is set to a pH-value of 3 to 6 by using ammonia solution. Refill with deionised water to the previous volume of 100 ml and mix well. 10 ml of this pre-treated solution is used for the following analysis. Perform as described by the selected test method.
2. Water which has been treated with organic compounds like corrosion inhibitors must be oxidised where necessary to break down the iron. Therefore add 1 ml concentrated sulfuric acid and 1 ml concentrated nitric acid to 100 ml water sample and boil to approx. half volume. After cooling down, proceed as described above.

1.1 Methods

(2) (9) (0) Oxygen, active * with Tablet

0.1 – 10 mg/l O_2

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.

2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.

4. Remove the vial from the sample chamber.

5. Add **one DPD No. 4 tablet** straight from the foil to the water sample and crush the tablet using a clean stirring rod.

6. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.

7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

8. Press **TEST** key.

   Wait for a **reaction period of 2 minutes**.

Countdown
2:00

After the reaction period is finished the measurement starts automatically.

The result is shown in the display in mg/l active Oxygen.

1.1 Methods

Notes:

*** Active Oxygen is a synonym for a common disinfectant (based on "Oxygen") in Swimming Pool Treatment.**

1. When preparing the sample, the lost of Oxygen, e.g. by pipetting or shaking, must be avoided.
2. The analysis must take place immediately after taking the sample.

1.1 Methods

3 0 0 Ozone with Tablet

0.02 – 2 mg/l O_3

Ozon
>> with Cl
without Cl

The following selection is shown in the display:

>>	**with Cl**

for the determination of Ozone in the presence of Chlorine.

>>	**without Cl**

for the determination of Ozone in the absence of Chlorine.

Select the desired method with the arrow keys [▲] and [▼]. Confirm with [↵] key.

1.1 Methods

Notes:

1. Vial cleaning:
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of Ozone may show lower results. To avoid any measurement errors, only use glassware free of Chlorine demand.
   Preparation: Put all applicable glassware into Sodium hypochlorite solution (0.1 g/l) for one hour, then rinse all glassware thoroughly with deionised water.
2. Preparing the sample:
   When preparing the sample, the lost of Ozone, e.g. by pipetting or shaking, must be avoided. The analysis must take place immediately after taking the sample.
3. The DPD colour development is carried out at a pH value of 6.2 to 6.5. The reagent tablet therefore contains a buffer for the pH adjustment.
   Strong alkaline or acidic water samples must be adjusted between pH 6 and pH 7 before the tablet is added (use 0.5 mol/l Sulfuric acid resp. 1 mol/l Sodium hydroxide).
4. Exceeding the measuring range:
   Concentrations above 6 mg/l Ozone can lead to results showing 0 mg/l. In this case, the water sample must be diluted with water free of Ozone. 10 ml of the diluted sample should be mixed with the reagent and the measurement repeated.
5. If ??? is displayed at the diffentiated test result see page 170.
6. Oxidising agents such as Bromine, Chlorine etc. interfere as they react in the same way as Ozone.

1.1 Methods

3 0 0 Ozone, in the presence of Chlorine with Tablet

0.02 – 2 mg/l O_3

prepare Zero
press ZERO

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.
3. Press **ZERO** key.
4. Remove the vial from the sample chamber and **empty it, leaving a few drops remaining in the vial**.
5. Add **one DPD No. 1 tablet** and **one DPD No. 3 tablet** straight from the foil and crush the tablets using a clean stirring rod.
6. Add water sample to the 10 ml mark.
7. Close the vial tightly with the cap and swirl several times until the tablets are dissolved.
8. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare T1
press TEST

9. Press **TEST** key.

   Wait for a **reaction period of 2 minutes**.

Countdown
2:00

   After the reaction period is finished the measurement starts automatically.

10. Remove the vial from the sample chamber, empty the vial, rinse vial and cap several times.
11. **Fill a second clean vial with 10 ml of water sample.**
12. Add **one GLYCINE tablet** straight from the foil and crush the tablet using a clean stirring rod.

1.1 Methods

13. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.

14. Add **one DPD No. 1 tablet** and **one DPD No. 3 tablet** straight from the foil into the first cleaned vial and crush the tablets using a clean stirring rod.

15. **Transfer the contents of the second vial (Glycine solution) into the prepared vial (point 14).**

16. Close the vial tightly with the cap and swirl several times until the tablets are dissolved.

17. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

T1 accepted
prepare T2
press TEST

18. Press **TEST** key.

Wait for a **reaction period of 2 minutes**.

Countdown
2:00

After the reaction period is finished the measurement starts automatically.

The result is shown in the display in:

***,** mg/l O_3**
***,** mg/l total Cl**

mg/l Ozone
mg/l total Chlorine

Notes:

See page 81

1.1 Methods

3 0 0 Ozone, in absence of Chlorine with Tablet

0.02 – 2 mg/l O_3

1. Fill a clean vial (24 mm Ø) **with 10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber and **empty it, leaving a few drops remaining in the vial**.
5. Add **one DPD No. 1 tablet** and **one DPD No. 3 tablet** straight from the foil and crush the tablets using a clean stirring rod.
6. Add water sample to the 10 ml mark.
7. Close the vial tightly with the cap and swirl several times until the tablets are dissolved.
8. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

9. Press **TEST** key.
   Wait for a **reaction period of 2 minutes**.

Countdown
2:00

After the reaction period is finished the measurement starts automatically.

The result is shown in the display in

mg/l Ozone.

Notes:
See page 81.

1.1 Methods

7 0 PHMB (Biguanide) with Tablet

2 – 60 mg/l PHMB

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.

2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.

4. Remove the vial from the sample chamber.

5. Add **one PHMB PHOTOMETER tablet** straight from the foil to the water sample and crush the tablet using a clean stirring rod.

6. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.

7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

8. Press **TEST** key.

   The result is shown in the display in mg/l PHMB.

1.1 Methods

Notes:

1. Clean vials with the brush immediately after analysis.
2. Vials and stirring rods may turn blue after prolonged use. In this case clean vials and stirring rods with a laboratory detergent (see chapter 1.2.2 Cleaning of vials and accessories for analysis). Rinse vials and caps thoroughly with tap water and then with deionised water.
3. The test result is influenced by Hardness and Total Alkalinity.
   The calibration of this method was done using water with the following concentration:
   Ca-Hardness: 200 mg/l $CaCO_3$
   Total Alkalinity: 120 mg/l $CaCO_3$

1.1 Methods

3 1 9 Phosphate, ortho LR with Tablet

0.05 – 4 mg/l PO_4


Ø 24 mm

1. Fill a clean vial (24 mm ø) with **10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the marks ⧖ aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber.
5. Add **one PHOSPHATE No. 1 LR tablet** straight from the foil to the water sample and crush the tablet using a clean stirring rod.
6. Add **one PHOSPHATE No. 2 LR tablet** straight from the foil to the same water sample and crush the tablet using a clean stirring rod.
7. Close the vial tightly with the cap and swirl gently several times until the tablet is dissolved.
8. Place the vial in the sample chamber making sure that the marks ⧖ aligned.

Zero accepted
prepare Test
press TEST

9. Press **TEST** key.

Countdown
10:00

Wait for a **reaction period of 10 minutes**.

After the reaction period is finished the measurement starts automatically.

The result is shown in the display as ortho-Phosphate.

1.1 Methods

Notes

1. Only ortho-Phosphate ions PO_4^{3-} react.
2. The tablets must be added in the correct sequence.
3. The test sample should have a pH-value between 6 and 7.
4. Interferences:
   Higher concentrations of Cu, Ni, Cr (III), V (V) and W (VI) interfere due to their colour.
   Silicates do not interfere (masked by Citric acid in the tablets).
5. Conversion:
   mg/l P = mg/l PO_4 x 0.33
   mg/l P_2O_5= mg/l PO_4 x 0.75
6. ▲ PO_4
   P
   ▼ P_2O_5

1.1 Methods

3 2 9 pH value LR 5.2 – 6.8 with Tablet

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber.
5. Add **one BROMOCRESOLPURPLE PHOTOMETER tablet** straight from the foil to the water sample and crush the tablet using a clean stirring rod.
6. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.
7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

8. Press **TEST** key.

   The result is shown in the display as pH-value.

1.1 Methods

Notes:

1. For photometric determination of pH values only use BROMOCRESOLPURPLE tablets in black printed foil pack and marked with PHOTOMETER.
2. pH values below 5.2 and above 6.8 can produce results inside the measuring range. A plausibility test (pH-meter) is recommended.
3. The accuracy of the colorimetric determination of pH-values depends on various boundary conditions (buffer capacity of the sample, salt contents etc.).
4. Salt error
   Correction of test results (average values) for samples with salt contents of:

Indicator	Salt content		
Bromcresolpurple	1 molar – 0.26	2 molar – 0.33	3 molar – 0.31

The values of Parson and Douglas (1926) are based on the use of Clark and Lubs buffers.
1 Mol NaCl = 58.4 g/l = 5.8 %

1.1 Methods

3 3 0 pH value 6.5 – 8.4 with Tablet

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber.
5. Add **one PHENOL RED PHOTOMETER tablet** straight from the foil to the water sample and crush the tablet using a clean stirring rod.
6. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.
7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

8. Press **TEST** key.

The result is shown in the display as pH-value.

1.1 Methods

Notes:

1. For photometric determination of pH values only use PHENOL RED tablets in black printed foil pack and marked with PHOTOMETER.
2. Water samples with low values of Alkalinity-m (below 35 mg/l $CaCO_3$) may give wrong pH readings.
3. pH values below 6.5 and above 8.4 can produce results inside the measuring range. A plausibility test (pH-meter) is recommended.
4. The accuracy of the colorimetric determination of pH values depends on various boundary conditions (buffer capacity of the sample, salt contents etc.).
5. Salt error
   Correction of test results (average values) for samples with salt contents of:

Indicator	Salt content		
Phenol red	1 molar – 0.21	2 molar – 0.26	3 molar – 0.29

The values of Parson and Douglas (1926) are based on the use of Clark and Lubs buffers.
1 Mol NaCl = 58.4 g/l = 5.8 %

1.1 Methods

3 3 1 pH value 6.5 – 8.4 with Liquid Reagent

Ø 24 mm

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber.
5. Fill the vial with drops of the same size by holding the bottle vertically and squeeze slowly:

   6 drops of PHENOL RED solution

6. Close the vial tightly with the cap and swirl several times to mix the contents.
7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare TEST
press Test

8. Press **TEST** key.

   The result is shown in the display as pH-value.

1.1 Methods

Notes:

1. When testing chlorinated water the residual chlorine contents can influence the colour reaction of the liquid reagent. This can be avoided (without interfering with the pH measurement) by adding a small crystal of Sodiumthiosulfate ($Na_2S_2O_3 \cdot 5\ H_2O$) to the sample before adding the PHENOL RED solution. PHENOL RED tablets already contain Thiosulfate.
2. Due to differing drop sizes results can show a discrepancy in accuracy by comparison with tablets. This can be minimised by using a pipette (0.18 ml PHENOLRED solution is equivalent to 6 drops).
3. After use replace the bottle cap securely.
4. **Store the reagent in a cool, dry place ideally at between 6°C and 10°C.**

1.1 Methods

3 3 2 pH value HR 8.0 – 9.6 with Tablet

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber.
5. Add **one THYMOLBLUE PHOTOMETER tablet** straight from the foil to the water sample and crush the tablet using a clean stirring rod.
6. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.
7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare TEST
press Test

8. Press **TEST** key.

The result is shown in the display as pH-value.

1.1 Methods

Notes:

1. For photometric determination of pH values only use THYMOLBLUE tablets in black printed foil pack and marked with PHOTOMETER.
2. pH values below 8.0 and above 9.6 can produce results inside the measuring range. A plausibility test (pH-meter) is recommended.
3. The accuracy of the colorimetric determination of pH values depends on various boundary conditions (buffer capacity of the sample, salt contents etc.).
4. Salt error
   Correction of test results (average values) for samples with salt contents of:

Indicator	Salt content		
Thymolblue	1 molar – 0.22	2 molar – 0.29	3 molar – 0.34

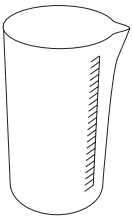
The values of Parson and Douglas (1926) are based on the use of Clark and Lubs buffers.
1 Mol NaCl = 58.4 g/l = 5.8 %

1.1 Methods

(2) (1) (2)

Sodium hypochlorite (Soda bleaching lye) with Tablet

0.2 – 16 % w/w NaOCl



Preparation:

1. Fill a 5 ml plastic syringe with the test solution, ensuring that all air bubbles are expelled. Transfer the 5 ml test solution slowly into a 100 ml beaker and dilute to the 100 ml mark with chlorine-free water. Mix thoroughly.
2. Fill a 5 ml plastic syringe with the diluted test solution (step 1) to the 1 ml mark, ensuring that all air bubbles are expelled. Transfer the 1 ml test solution slowly into a 100 ml beaker and dilute to the 100 ml mark with chlorine-free water. Mix thoroughly.

Performing test procedure:

Ø 24 mm

1. Fill a clean vial (24 mm Ø) with **10 ml of the prepared water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber.
5. Add **one CHLORINE HR (KI) tablet** straight from the foil to the water sample and crush the tablet using a clean stirring rod.
6. Add **one ACIDIFYING GP tablet** straight from the foil to the same water sample and crush the tablet using a clean stirring rod.
7. Close the vial tightly with the cap and swirl several times until the tablets are dissolved.

1.1 Methods

8. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

9. Press **TEST** key.

The result is shown in the display in % w/w as available chlorine present in the original sample of Sodium hypochlorite.

Notes:

1. Please pay attention when handling sodium hypochlorite. The material has a very strong alkalinity and can cause corrosion. Contact with eyes, skin and clothes etc.has to be avoided. Refer to the detailed information the producer supplied with the product.
2. The tablets must be added in the correct sequence.
3. This method provides a fast and simple test. The test can be performed on site but the result will not be as precise as a laboratory method.
4. By strictly following the test procedure, an accuracy of +/- 1 weight % can be achieved.

1.1 Methods

3 5 5 Sulfate with Tablet

5 – 100 mg/l SO_4

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample,** close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.
4. Remove the vial from the sample chamber.
5. Add **one SULFATE T tablet** straight from the foil to the water sample and crush the tablet using a clean stirring rod.
6. Close the vial tightly with the cap and swirl several times until the tablet is dissolved.
7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

8. Press **TEST** key.

The result is shown in the display in mg/l Sulfate.

1.1 Methods

Notes:

1. If Sulfate is present a cloudy solution will appear.

1.1 Methods

3 6 0 Sulfate with Vario Powder Pack

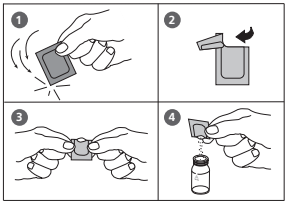
5 – 100 mg/l SO_4

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.

2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

prepare Zero
press ZERO

3. Press **ZERO** key.



4. Remove the vial from the sample chamber.

5. Add the contents of **one VARIO Sulpha 4 / F10 Powder Pack** straight from the foil to the water sample.

6. Close the vial tightly with the cap and swirl several times to mix the contents.

7. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

8. Press **TEST** key.
Wait for a **reaction period of 5 minutes.**

Countdown
5:00

After the reaction period is finished the measurement starts automatically.

The result is shown in the display in mg/l Sulfate.

1.1 Methods

Note:

1. If Sulfate ions are present a cloudy solution will appear.

1.1 Methods

3 9 0 Urea with Tablet and Liquid Reagent

0.1 – 2.5 mg/l $(NH_2)_2CO$ / mg/l Urea

Ø 24 mm

prepare Zero
press ZERO

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample**, close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.
3. Press **ZERO** key.
4. Remove the vial from the sample chamber.
5. In the presence of free Chlorine (HOCl), add **one UREA PRETREAT tablet** straight from the foil and crush the tablet using a clean stirring rod (Note 10).
6. Close the vial tightly with the cap and swirl several times to mix the contents.
7. Add **2 drops of Urea reagent 1** to the water sample (Note 9).
8. Close the vial tightly with the cap and swirl several times to mix the contents.
9. Add **1 drop of Urea Reagent 2** (Urease) to the same water sample (Note 9).
10. Close the vial tightly with the cap and swirl several times to mix the contents.

Countdown
5:00
start: ↵

11. Press **[↵]** key.

    Wait for a **reaction period of 5 minutes**.

    After the reaction period is finished proceed as follows:

12. Add **one AMMONIA No. 1 tablet** straight from the foil to the prepared water sample and mix to dissolve with a clean stirring rod.
13. Add **one AMMONIA No. 2 tablet** straight from the foil to the same water sample and mix to dissolve with a clean stirring rod.

1.1 Methods

14. Close the vial tightly with the cap and swirl several times until the tablets are dissolved.

15. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Zero accepted
prepare Test
press TEST

16. Press **TEST** key.
Wait for a **reaction period of 10 minutes**.

Countdown
10:00

After the reaction period is finished the measurement starts automatically.

The result is shown in the display in mg/l Urea.

Notes:

1. The sample temperature should be between 20°C and 30°C.
2. Carry out the test at the latest one hour after sample taking.
3. Concentrations above 2 mg/l Urea can produce results inside the measuring range. In this case, the water sample should be diluted with Urea free water and remeasured.
4. The tablets must be added in the correct sequence.
5. The AMMONIA No. 1 tablet will only dissolve completely after the AMMONIA No. 2 tablet has been added.
6. **Do not store reagent 1 (Urease) below 10°C; granulation is possible. Store reagent 2 (Urease) in the refrigerator at a temperature of 4°C to 8°C.**
7. Ammonia and chloramines are also measured during urea measurement.
8. Before analysing seawater samples, a measuring spoon of Ammonia Conditioning Powder must be added to the sample and swirled to dissolve before AMMONIA No. 1 tablet is added.
9. Fill the vial with drops of the same size by holding the bottle vertically and squeeze slowly.
10. One UREA PRETREAT tablet compensates for the interference of free Chlorine up to 2 mg/l (two tablets up to 4 mg/l, three tablets up to 6 mg/l).

1.2 Important notes

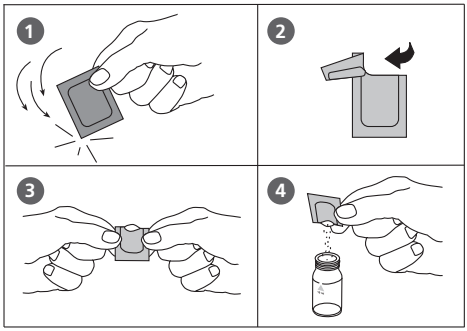
1.2.1 Correct use of reagents

The reagents must be added in the correct sequence.

Tablet reagents:
The tablet reagents should be added to the water sample straight from the foil without touching them with the fingers.

Liquid reagents:
Add drops of the same size to the water sample by holding the bottle vertically and squeezing slowly.
After use replace the bottle caps securely noting the colour coding.
Note recommendation for storage (e.g. cool and dry).

Powder Packs:



1.2.2 Cleaning of vials and accessories for analysis

Vials, caps and stirring rods should be cleaned thoroughly **after each analysis** to prevent interferences.

Procedure:

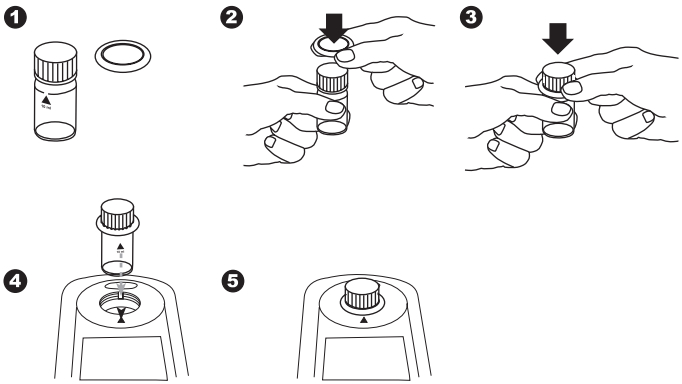
Clean vials and accessories after each analysis as soon as possible.

a. Clean vials and accessories with laboratory detergent
(e.g. Extran® MA 02 (neutral, phosphatic), Extran® MA 03 (alkaline, phosphate-free) from Merck KGaA).
b. Rinse thoroughly with tap water.
c. On demand (see Notes) perform special cleaning as required, e.g.: rinse with diluted Hydrochloric acid solution.
d. Rinse thoroughly with deionised water.

1.2.3 Guidelines for photometric measurements

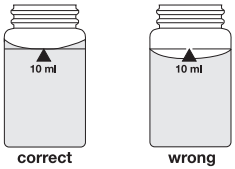
1. Vials, caps and stirring rods should be cleaned thoroughly after each analysis to prevent interferences. Even minor reagent residues can cause errors in the test result.
2. The outside of the vial must be clean and dry before starting the analysis. Clean the outside of the vials with a towel. Fingerprints or other marks will be removed.
3. If there is no defined vial for the blank, the zeroing and the test must be carried out with the same vial as there may be slight differences in optical performance between vials.
4. The vials must be positioned in the sample chamber for zeroing and test with the Δ mark on the vial aligned with the ∇ mark on the instrument.

Correct position of the vial (Ø 24 mm):



1. Always perform zeroing and test with closed vial cap. Only use cap with sealing ring.
2. Bubbles on the inside wall of the vial lead to incorrect measurements. To prevent this, remove the bubbles by swirling the vial before performing the test.
3. Avoid spillage of water in the sample chamber. If water should leak into the instrument housing, it can destroy electronic components and cause corrosion.
4. Contamination of the lens in the sample chamber can result in errors. Check at regular intervals and – if necessary – clean the light entry surfaces of the sample chamber using a moist cloth or cotton buds.
5. Large temperature differences between the instrument and the environment can lead to errors – e.g. due to the formation of condensation in the area of the lens or on the vial.
6. To avoid errors caused by stray light do not use the instrument in bright sunlight.

Correct filling of the vial:



1.2.4 Sample dilution techniques

Proceed as follows for accurate dilutions:

Pipette the water sample (see table) into a 100 ml volumetric flask and fill up to 100 ml mark with deionised water. Swirl to mix the contents.

Water sample [ml]	Multiplication factor
1	100
2	50
5	20
10	10
25	4
50	2

Pipette the required volume of the diluted sample into the vial and proceed as described in the test methods.

Caution:

1. Dilution decreases accuracy.
2. Do not dilute water samples for measurement of pH-values. This will lead to incorrect test results. If "Overrange" is displayed use another instrument (e.g. pH-meter).

1.2.5 Correcting for volume additions

If a larger volume of acid or base is used to pre-adjust the pH-value, a volume correction of the displayed result is necessary.

Example:

For adjusting the pH-value of a 100 ml water sample 5 ml of acid had to be added. The corresponding displayed result is 10 mg/l.

Total volume = 100 ml + 5 ml = 105 ml

Correction factor = 105 ml / 100 ml = 1.05

Corrected result = 10 mg/l x 1.05 = 10.5 mg/l

Part 2

Instrument Manual

2.1 Operation

2.1.1 Set up

Before working with the photometer insert the batteries (delivery contents). See chapter 2.1.2 Saving data – Important Notes, 2.1.3 Replacement of batteries.

Before using the photometer perform the following settings in the Mode-Menu:

- MODE 10: select language
- MODE 12: set date and time
- MODE 34: perform „Delete data"
- MODE 69: perform "User m. init" to initialise the userpolynomial system

See chapter 2.4 Photometer settings.

2.1.2 Saving data – Important Notes

The batteries save data (stored results and photometer setting).
During battery change the data in the photometer is saved for 2 minutes. If the change time exceeds 2 minutes all stored data and settings are lost.
Recommendation: for replacement a screwdriver and new batteries must be available.

2.1.3 Replacement of batteries

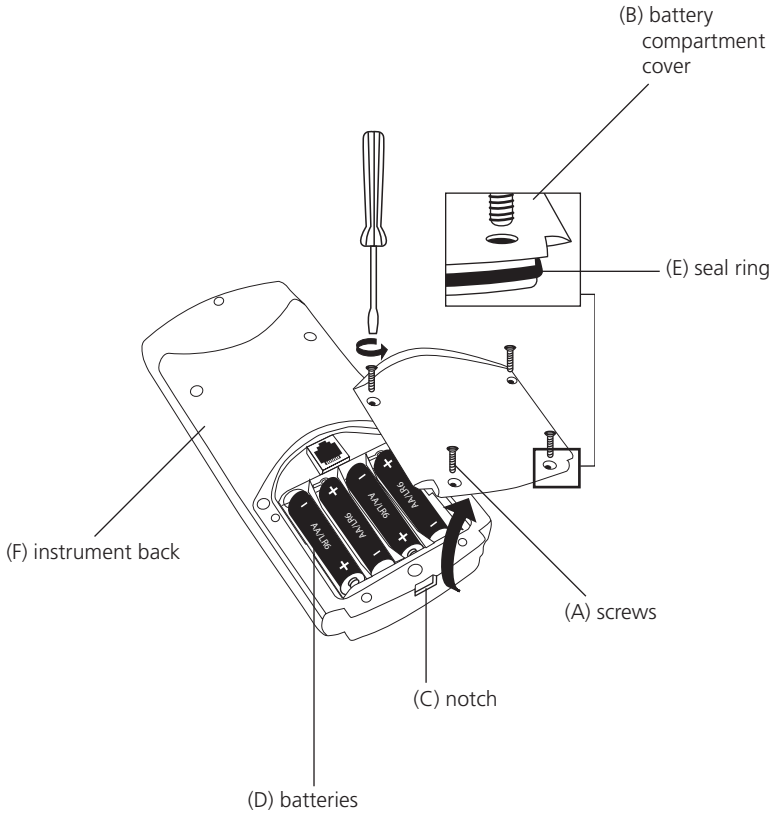
See chapter 2.1.2 "Saving data - important notes" before replacing batteries.

1. Switch the instrument off.
2. If necessary remove vial from the sample chamber.
3. Place the instrument upside down on a clean and even surface.
4. Unscrew the four screws (A) of the battery compartment cover (B).
5. Lift off battery compartment cover at the notch (C).
6. Remove old batteries (D).
7. Place 4 new batteries.
   Ensuring the correct polarity!
8. Replace the battery compartment cover.
   Check the seal ring (E) of the notch to make sure if is tight-fitting
9. Tighten the screws carefully.

CAUTION
Dispose of used batteries in accordance with all federal, state and local regulations.

2.1.4 Instrument (explosion drawing):

(A) screws
(B) battery compartment cover
(C) notch
(D) batteries: 4 batteries (AA/LR6)
(E) seal ring
(F) instrument back



CAUTION:
To ensure that the instrument is water proof:

- **seal ring (E) must be in position**
- **battery compartment cover (B) must be fixed with the four screws**

2.2 Overview of function keys

2.2.1 Overview

Switching the photometer on or off

Press shift key to achieve figures key 0-9.
Keep the shift key depressed and press desired figures key.
e.g.: [Shift] + [1][1]

Returning to selection of methods or previous menu

Function key: description in the text if key available

Function key: description in the text if key available

Function key: description in the text if key available

Confirming

Menu of photometer settings and further functions

Moving the cursor up or down

Storing of displayed test result

Performing Zero

Performing Test

Displaying date and time / user countdown

Decimal point

2.2.2 Displaying time and date:

Press [“clock”] key.

19:30:22 2013-06-15

The display shows:

After 15 seconds the photometer reverts to the previous display automatically

or press [↲] key or [ESC].

2.2.3 User countdown

With this function the operator is able to define his own countdown.

Press [“clock”] key.

19.30.20 2013-06-15

The display shows time and date:

Press [“clock”] key.

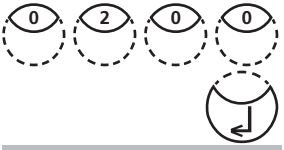
Countdown
mm : ss
99 : 99

The display shows:

Either press [↲] key to accept the last used user countdown.

or

press any number key to start entering a new value



The entry comprises two digits each.
Enter minutes and seconds,
e.g.: 2 minutes, 0 seconds = [Shift] + [0][2][0][0].
Confirm with [↲] key.

Countdown
02:00
start: ↲

The display shows:

Start countdown with [↲] key.

After countdown has finished the photometer reverts to the previous display automatically.

2.2.4 Display backlight

Press the [Shift] + [F1] key to turn the display backlight on or off. The backlight is switched off automatically during the measurement.

2.3 Operation mode

Switch the photometer on by pressing the [ON/OFF] key.

selftest ...

The photometer performs an electronic self-test.

2.3.1 Automatic switch off

The instrument switches off automatically after 20 minutes. This is indicated 30 seconds before by a beeper. Press any key to avoid the instrument switching off.
As long as the instrument is working (for example countdown or printing) the automatic switch off is inactive.

2.3.2 Selecting a method

```
>>  20 Acid demand T
    30 Alkalinity-tot T
    31 Alkal.-tot HR T
```

The display shows a selection:

There are two possibilities to select the required method:

a) enter method-number directly
e.g.: [Shift] + [8] [0] to select Bromine

b) press arrow key [▼] or [▲] to select the required method from the displayed list.

Confirm with [↵] key.

2.3.2.1 Method Information (F1)

Use [F1] key to switch between the compact and the detailed list for method selection.

```
100 Chlorine
0.02-6 mg/l Cl2
Tablet
24 mm
DPD No 1
DPD No 3
```

Example:

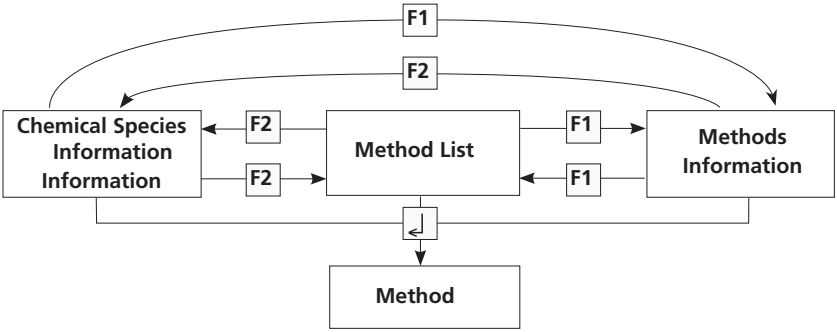
Line 1: Method number, Method name
Line 2: Range
Line 3: Kind of reagent
Line 4: Vial
Line 5-7: Used reagent

2.3.2.2 Chemical Species Information

Pressing the [F2] key the display shows a list with available chemical species and corresponding ranges. Changing chemical species see chapter 2.3.7 page 120.

319 Phosphate LR T
0.05-4 mg/l PO_4
0.02-1.3 mg/l P
0.04-3 mg/l P_2O_5

Line 1: Method number, Method name
Line 2: Range with chemical species 1
Line 3: Range with chemical species 2
Line 4: Range with chemical species 3



2.3.3 Differentiation

Chlorine
>> diff
free
total

Differentiation is possible in some methods (e.g. Chlorine). The photometer then requires the type of determination.

Press arrow key [▼] or [▲] to select the required determination.

Confirm with [↵] key.

2.3.4 Performing Zero

prepare Zero
press ZERO

The display shows:

Prepare a clean vial as described in "Method" and place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Press [ZERO] key.

Zero accepted
prepare Test
press TEST

The display shows:

2.3.5 Performing Tests

When zero calibration is complete, remove the vial from the sample chamber and perform the tests as described under "Method".

When the results have been displayed:

- with some methods you can change between different chemical species
- you can store and/or print out the results
- perform further analysis with the same zero
- select a new method

2.3.6 Ensuring reaction periods (countdown)

To ensure compliance with reaction periods a time delay is incorporated: the countdown. There are two kinds of countdowns:

Countdown
2:00

start: ↵

- Press [↵] key.
  Prepare water sample, start countdown with [↵] key and proceed as described in the mode description.
  The vial must not be placed in the sample chamber.

Countdown
1:59

- Press [TEST] key.
  Prepare the water sample as described in the method description and place the vial in the sample chamber. The display shows the countdown by pressing the [TEST] key and the countdown is started automatically. After the reaction period is finished the measurement starts automatically.

Notes:

1. It is possible to finish the working countdown by pressing the [↵] key. Reading starts immediately. In this case the operator is responsible for ensuring the necessary reaction period.
   Non-compliance with reaction periods leads to incorrect test results.
2. The time remaining is displayed continuously.
   The beeper indicates the last 10 seconds.

2.3.7 Changing chemical species

For some methods there is a possibility to change the chemical species of the test result. If the test result is displayed press arrow key [▲] or [▼].

Example:

319 Phosphate LR T -----[▼]---->	319 Phosphate LR T <---- [▼] -----	319 Phosphate LR T
0.05-4 mg/l PO_4	0.02-1.3 mg/l P	0.04-3 mg/l P_2O_5
<---- [▲] -----	------ [▲] ---->	
1.00 mg/l PO_4	0.33 mg/l P	0.75 mg/l P_2O_5

If the species of a test result is changed the displayed range is adjusted automatically. For an already stored result it is not possible to change the chemical species. The last displayed chemical species is kept by the instrument and will be displayed if this method is used the next time. If there is the possibility to change the chemical species for a method it is described in the manual. The arrows indicate the possible chemical species and are printed below the notes of the method:

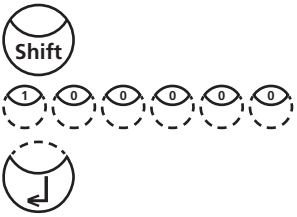
▲ PO_4
P
▼ P_2O_5

2.3.8 Storing results

Press [STORE] key while the test result is displayed.

Code-No.:
_ _ _ _ _ _

The display shows:



- We advise you to enter a numeric code (up to 6 places). (A Code No. can contain references to the operator or the sampling location.)

  After entering confirm with [↵] key.

- If a code number is not necessary confirm by pressing [↵] directly. (The assignment for the Code No. is then 0 automatically.)

The entire data set is stored with date, time, Code No., method and test result.

Stored!

The display shows:

The test result is then shown again.

Note:

Storage: 900
free records left

The display shows the number of free data sets.

Storage: only 29
free records left

If there are less than 30 data sets free the display shows:

Clear the memory as soon as possible (see "Deleting stored results"). If memory capacity is used up it is impossible to save additional test results.

2.3.9 Printing results (Infra-Red Interface Module) (optional)

If the IRiM (see chapter 2.5) is switched on and the printer is connected, it is possible to print out the test results (without saving it beforehand).

Press [F3] key.

The entire data set is printed with date, time, Code No., method and test result. Printing example:

100 Chlorine T
0.02-6 mg/l Cl_2
Profi-Mode: no
2013-07-01 14:53:09
Test No.: 1
Code-Nr.: 007
4.80 mg/l Cl_2

The test No. is an internal number that is set automatically if a test result is stored. It appears only on the print out.

2.3.10 Perform additional measurements

To perform additional tests using the same method:

Zero accepted
prepare Test
press TEST

- Press [TEST] key

The display shows:

Confirm with [TEST] key

or

- Press [ZERO] key to perform a new zero calibration.

prepare Zero
press ZERO

The display shows:

2.3.11 Selecting a new method

Press [ESC] key to return to method selection.

Or enter the required method number directly,
e.g. [Shift] + [1][6][0] for CyA-TEST (Cyanuric acid).

Confirm with [↵] key.

2.3.12 Measure absorbance

Range: –2600 mAbs to +2600 mAbs

Method-No.	Title
910	mAbs 530 nm
920	mAbs 560 nm
940	mAbs 610 nm

Select the desired wavelength from the method list or by entering the corresponding method number directly.

910 mAbs 530 nm
-2600 mAbs - + 2600 mAbs
prepare Zero
press ZERO

The display shows e.g.:

Always carry out zeroing using a filled (e.g. deionised water) vial.

Zero accepted
prepare Test
press TEST

The display shows:

Carry out measurement of the sample.

500 mAbs

The display shows e.g.:

TIP: To ensure complete reaction times the user countdown may be helpful (chapter 2.2.3, page 116).

2.3.13 Examination of the Photometer

The verification standard kit for the P7 Professional is designed to assure the user of the accuracy and the reliability of the results related to the integrated wave lengths.

Order code Verifikation-Standard-Kit: W3T330121

The kit contains one zero standard, 3 different vials for checking 3 different wave lengths.

To check the device with a Verifikation Standard Kit, proceed as follows:

Select the desired wavelength from the method list or by entering the corresponding method number directly.

Method-No.	Title
910	mAbs 530 nm
920	mAbs 560 nm
940	mAbs 610 nm

910 mAbs 530 nm
-2600 mAbs - + 2600 mAbs
Zero vorbereiten
ZERO drücken

The display shows e.g.:

Place the supplied blank ("Zero" Verifikation Standard) in the sample chamber making sure that the marks are aligned ⧖.

Place the supplied Verifikation Kit cover on the adapter.

Press **ZERO** key.

Zero accepted
prepare Test
press TEST

The display shows:

Use the Verifikation Standard for the required wavelenth. Invert the vial and place the vial in the sample chamber making sure that the ⧖ marks are aligned.

Place the supplied Verifikation Kit cover on the adapter.

Press **TEST** key.

500 mAbs The display shows e.g.:

The reading should correspond to the stated calibration value within the given tolerances.

Notes:

1. If an instrument and the Verifikation Standards show Non_Compliance:
   - the cell chamber should be checked for dirtiness, if so, cleaned and the measurement should be repeated
   - the instrument and the Verifikation Standards should be returned to evoqua or an authorized distributor for servicing
2. Place standards in the case after use.
   Store in the dark at room temperature (15-25°C).
   Do not use the standards after the stated expiry date.
3. Verifikation Standards should be used under laboratory conditions.
   Avoid working in direct sunlight and carry out calibrations at a temperature of 17-23°C.

2.4 Photometer settings: Table of Mode Functions

MODE-Function	No.	Description	Page
Calibration	40	Special method calibration	140
Clear calibration	46	Deleting user calibration	145
Clock	12	Setting date and time	127
Countdown	13	Switching the countdown on/off to ensure reaction times	128
Delete data	34	Deleting all stored results	139
Key beep	11	Switching the acoustic signal on/off to indicate key-pressing	127
Langelier	70	Calculation of Langelier saturation Index (Water Balance)	158
Language	10	Selecting language	126
LCD contrast	80	Setting the display contrast	160
LCD brightness	81	Setting the display brightness	160
Method list	60	User method list, adaption	148
M list all on	61	User method list, switching on all methods	149
M list all off	62	User method list, switching off all methods	149
OTZ	55	One Time Zero (OTZ)	147
Print	20	Printing all stored results	130
Print, code no.	22	Print only results of a selected Code No. range	132
Print, date	21	Print only results of a selected time period	131
Print, method	23	Print only results of one selected method	133
Printing parameters	29	Setting of printing options	134
Profi-Mode	50	Switching the detailed operator instructions on/off	146
Signal beep	14	Switching the acoustic signal on/off to indicate end of reading	129
Storage	30	Displaying all stored results	135
Stor., code	32	Displaying only results of a selected Code No. range	137
Stor., date	31	Displaying only results of a selected time period	136
Stor., method	33	Displaying only results of one selected method	138
System info	91	Information about the instrument e.g. current software version	161
Temperature	71	Selection of °C or °F for Langelier Mode 70	159

MODE-Function	No.	Description	Page
User calibration	45	Storage of user calibration	144
User concentration	64	Entering the data necessary to run a user concentration method	150
User polynoms	65	Entering the data necessary to run a user polynomial	152
User methods clear	66	Delete all data of a user polynomial or of a concentration method	155
User methods print	67	Print out all data stored with mode 64 (concentration) or mode 65 (polynomial)	156
User methods init	69	Initialise the user method system (polynomial and concentration)	157

The selected settings are kept by the photometer even when switched off. To change photometer settings a new setting is required.

2.4.1 blank because of technical requirements

2.4.2 Instrument basic settings 1

Selecting a language

Press [MODE], [Shift] + [1][0] keys.

Confirm with [↲] key.

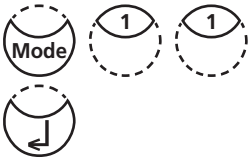
```
<Language>
        Deutsch
   >>   English
        Francais
```

The display shows:

Press arrow key [▼] or [▲] to select the required language from the displayed list.

Confirm with [↲] key.

Key beep



Press [MODE], [Shift] + [1][1] keys.

Confirm with [↵] key.

<Key-Beep>
ON: 1 OFF: 0

The display shows:

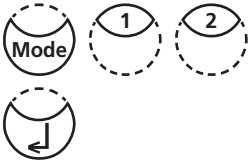
- Press [Shift] + [0] keys to switch the key beep off.
- Press [Shift] + [1] keys to switch the key beep on.

Confirm with [↵] key.

Note:

1. In the case of methods with reaction periods, an acoustic signal still sounds during the last 10 seconds of the countdown even if the key beep is switched off.

Setting date and time



Press [MODE], [Shift] + [1][2] keys.

Confirm with [↵] key.

<clock>	
yy-mm-dd	**hh:mm**
_ _-_ _-_ _	_ _:_ _

The display shows:

The entry comprises two digits each.

yy-mm-dd	**hh:mm**
13-05-14	_ _:_ _

Enter year, month and day,
e.g.: 14. May 2013 = [Shift] + [1][3][0][5][1][4]

yy-mm-dd	**hh:mm**
13-05-14	**15:07**

Enter hours and minutes
e.g.: 3.07 p.m. = [Shift] + [1][5][0][7]

Confirm with [↵] key.

Note:

1. While confirming date and time with [↵] key the seconds are adjusted to zero automatically.

Countdown (Ensuring reaction periods)

Some methods require a reaction period. This reaction period is incorporated in the method as standard with the countdown function.
It is possible to switch the countdown off for all methods:

Press [MODE], [Shift] + [1][3] keys.

Confirm with [↵] key.

<Countdown>
ON: 1 OFF: 0

The display shows:

- Press [Shift] + [0] keys to switch the countdown off.

- Press [Shift] + [1] keys to switch the countdown on.

Confirm with [↵] key.

Notes:

1. It is possible to interrupt the working countdown by pressing the [↵] key (application e.g. serial analysis).
   The "user countdown" is also available if the countdown is switched off.
2. If the countdown function is switched off, the operator is responsible for ensuring the necessary reaction period.
   Non-compliance with reaction periods leads to incorrect test results.

Signal beep

Performing a zero or a measurement takes 8 seconds. The photometer indicates the end of zeroing or measuring by a short beep.

Press [MODE], [Shift] + [1][4] keys.

Confirm with [↵] key.

<Signal-Beep>
ON: 1 OFF: 0

The display shows:

- Press [Shift] +[0] keys to switch the signal beep off.

- Press [Shift] + [1] keys to switch the signal beep on.

Confirm with [↵] key.

Note:

1. In the case of methods with reaction periods, an acoustic signal still sounds during the last 10 seconds of the countdown even if the key beep is switched off.

2.4.3 Printing of stored results

Printing all results

Press [MODE], [Shift] + [2][0] keys.

Confirm with [↲] key.

<Print>
Print all Data
Start: ↲
cancel: ESC

The display shows:

Press [↲] key for printing out all stored test results.

Test No.:

The display shows e.g.:

After printing the photometer goes back to <Mode-Menu> automatically.

Note:

1. It is possible to cancel the entry by [ESC].
2. All stored data are printed out.
   See chapter 2.5.1 Data Printing.

Printing results of a selected time period

Press [MODE], [Shift] + [2][1] keys.

Confirm with [↲] key.

<Print>
sorted: date
from yy-mm-dd
__-__-__

The display shows:

Enter year, month and day for the first day of the required period, e.g.: 14 May 2013 = [Shift] + [1][3][0][5][1][4]

Confirm with [↲] key.

to yy-mm-dd
__-__-__

The display shows:

Enter year, month and day for the last day of the required period, e.g.: 19 May 2013 = [Shift] + [1][3][0][5][1][9]

Confirm with [↲] key.

from 2013-05-14
to 2013-05-19
Start: ↲
cancel: ESC

The display shows:

Press [↲] key and all stored results in the selected date range are printed.

After printing the photometer goes back to mode menu automatically.

Note:

1. It is possible to cancel the entry by [ESC].
2. If you want to print only results of one day enter the same date twice to determine the period.

Printing results of a selected Code No. range

Press [MODE], [Shift] + [2][2] keys.

Confirm with [↲] key.

<Print>
sorted: Code-No.
from _ _ _ _ _ _

The display shows:

Enter numeric code number (up to 6 places) for the first required Code No., e.g.: [Shift] + [1].

Confirm with [↲] key.

to _ _ _ _ _ _

The display shows:

Enter numeric code number (up to 6 places) for the last required Code No., e.g.: [Shift] + [1][0].

Confirm with [↲] key.

from 000001
to 000010
Start: ↲
cancel: ESC

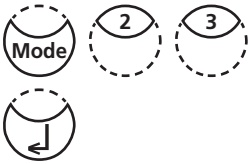
The display shows:

Press [↲] key and all stored results in the selected code number range are printed.

After printing the photometer goes back to mode menu automatically.

Note:
1. It is possible to cancel the entry by [ESC].
2. If you want to print only results of one code number enter the same code number twice.
3. If you want to print all results without code no. (code no. is 0) enter Zero [0] twice.

Printing results of one selected method



Press [MODE], [Shift] + [2][3] keys.

Confirm with [↵] key.

```
<Print>
>>20 Acid demand
   30 Alkalinity-tot
   40 Aluminium T
```

The display shows:

Select the required method from the displayed list or enter the method-number directly.

Confirm with [↵] key.

In case of differentiated methods select the required kind of determination and confirm with [↵] key.

```
<Print>
method
30 Alkalinity-tot
Start:  ↵
cancel: ESC
```

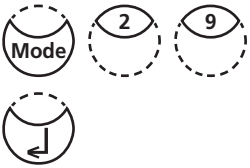
The display shows:

Press [↵] key and all stored results of the selected method are printed.

After printing the photometer goes back to mode menu automatically.

Note:
1. It is possible to cancel the entry by [ESC].

Printing Parameter



Press [MODE], [Shift] + [2][9] keys.

Confirm with [↲] key.

<printing parameter>
2: Baud rate

cancel: ESC

The display shows:

Press [Shift] + [2] keys to select "Baud rate".

<Baud rate>
is: 19200
select: [▲] [▼]
save: ↲
cancel: ESC

The display shows:

Press arrow key [▼] or [▲] to select the required baud rate.
(1200, 2400, 4800, 9600, 14400, 19200)

Confirm with [↲] key.

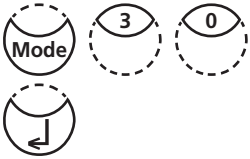
End with [ESC] key.

Back to Mode Menu with [ESC] key.

Back to method selection with [ESC] key.

2.4.4 Recall / delete stored results

Recall all stored results



Press [MODE], [Shift] + [3][0] keys.

Confirm with [↵] key.

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

The display shows:

The stored data sets are displayed in chronological order, starting with the latest stored test result. Press **[↵]** key and all stored results are displayed.

- Press [F3] key to print the displayed result.
- Press [F2] key to print all results.
- End with [ESC].

- Press arrow key [▼] to display the following test result.
- Press arrow key [▲] to display the previous test result.

no data

If there are no test results in memory the display shows:

Recall results of a selected time period

Press [MODE], [Shift] + [3][1] keys.

Confirm with [↲] key.

<Storage>
sorted: date
from yy-mm-dd
__-__-__

The display shows:

Enter year, month and day for the first day of the required period, e.g.: 14 May 2013 = [Shift] + [1][3][0][5][1][4]

Confirm with [↲] key.

to yy-mm-dd
__-__-__

The display shows:

Enter year, month and day for the last day of the required period, e.g.: 19 May 2013 = [Shift] +[1][3][0][5][1][9]

Confirm with [↲] key.

from 2013-05-14
to 2013-05-19
Start: ↲ cancel: ESC
print: F3
print all: F2

The display shows:

- Press [↲] key and all stored results in the selected date range are displayed.
- Press [F3] key to print the displayed result.
- Press [F2] key to print all selected results.
- End with [ESC].

Note:

1. It is possible to cancel the entry by [ESC].
2. If you want to recall only results of one day enter the same date twice to determine the time period.

Recall results of a selected Code No. range

Press [MODE], [Shift] + [3][2] keys.

Confirm with [↵] key.

<Storage>
sorted: Code-No.
from _ _ _ _ _ _

The display shows:

Enter numeric code number (up to 6 places) for the first required Code No., e.g.: [Shift] + [1].

Confirm with [↵] key.

to _ _ _ _ _ _

The display shows:

Enter numeric code number (up to 6 places) for the last required Code No., e.g.: [Shift] + [1][0].

Confirm with [↵] key.

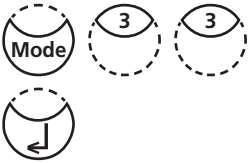
from 000001
to 000010
Start: ↵ cancel: ESC
print: F3
print all: F2

The display shows:

- Press [↵] key and all stored results in the selected Code No. range are displayed.
- Press [F3] key to print the displayed result.
- Press [F2] key to print all selected results.
- End with [ESC].

Note:
1. It is possible to cancel the entry by [ESC].
2. If you want to recall only results of one code number enter the same code number twice.
3. If you want to recall all results without code no. (code no. is 0) enter Zero [0] twice.

Recall results of one selected method



Press [MODE], [Shift] + [3][3] keys.

Confirm with [↲] key.

<Storage>
>>20 Acid demand
30 Alkalinity-tot
40 Aluminium T

The display shows:

Select the required method from the displayed list or enter the method number directly.

Confirm with [↲] key.

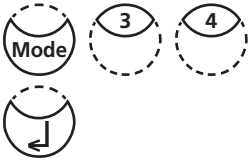
In case of differentiated methods select the required kind of determination and confirm with [↲] key.

<Storage>
method
30 Alkalinity-tot
Start: ↲ cancel: ESC
print: F3
print all: F2

The display shows:

- Press [↲] key and all stored results of the selected method are displayed.
- Press [F3] key to print the displayed result.
- Press [F2] key to print all selected results.
- End with [ESC].

Delete stored results



Press [MODE], [Shift] + [3][4] keys.

Confirm with [↲] key.

<Delete data>
Delete all data?
YES : 1 NO : 0

The display shows:

- Press [Shift] + [0] keys to retain the data sets in memory.
- After pressing keys [Shift] + [1] the following acknowledgment is displayed:

<Delete data>
Delete data ↲
Do not delete: ESC

Press [↲] key to delete.

ATTENTION:
All stored test results are deleted

or cancel without deleting data by pressing [ESC] key.

Note:

1. All stored test results are deleted.

2.4.5 Calibration

Calcium Hardness Method 191 – Calibration of a method blank

Press [MODE], [Shift] + [4] [0] keys.

Confirm with [↲] key.

<Calibration>
1: M191 Ca-Hardness 2
2: M191 0 Jus. Reset
3: M170 Fluoride L

The display shows:

Press [Shift] + [1] keys.

<Calibration>
M191 Calcium Hardness 2T
prepare ZERO
press ZERO

The display shows:

1. Fill a clean vial (24 mm Ø) with exactly **10 ml of deionised water,** close tightly with the cap.
2. Place the vial in the sample chamber making sure that the ⧖ marks are aligned.

3. Press **ZERO** key.
4. Remove the vial from the sample chamber.
5. Pipette 100 ml of water free of calcium to an appropriate beaker (note 2, 3).
6. Add **10 CALCIO H No. 1 tablets** straight from the foil to the 100 ml of water, crush the tablets using a clean stirring rod and dissolve the tablets completely.
7. Add **10 CALCIO H No. 2 tablets** straight from the foil to the same water, crush the tablets using a clean stirring rod and dissolve the tablets completely.

8. Press [↲] key.

   Wait for a **reaction period of 2 minutes**.

Zero accepted
Countdown
2:00
start: ↲

After the reaction period is finished proceed as follows:

9. Rinse the vial (24 mm Ø) with the coloured sample from the beaker and fill with 10 ml of the sample.

prepare TEST
press TEST

10. Press **TEST** key.

stored

The batch related method blank is saved.

Press [↵] key,
to go back to mode menu.

Notes:

1. If a new batch of CALCIO tablets is used a calibration of the method blank has to be performed to optimise the results.
2. Deionised or tap water.
3. If no water free of Calcium is available these ions can be masked by using EDTA. Preparation: Add 50 mg (a spatula-tipful) EDTA to 100 ml water and dissolve.
4. To achieve the most accurate method blank it is important to adhere exactly to the sample volume of 100 ml.

Calcium Hardness Method 191 – Reset method blank to factory calibration

Press [MODE], [Shift] + [4] [0] keys.

Confirm with [↵] key.

<Calibration>
1: M191 Ca-Hardness 2
2: M191 0 Jus. Reset
3: M170 Fluoride L

The display shows:

Press [Shift] + [2] keys.

<Calibration>
M191 Calcium Hardness 2T
Reset ?
YES: 1, NO: 0

The display shows:

Press [Shift] + [0] keys to keep the method blank.

Press [Shift] + [1] keys to erase the method blank and set the value back to factory calibration.

The instrument goes back to mode menu automatically.

User Calibration

If a test method is user calibrated the method name is displayed inverse.

Procedure:

- Prepare a standard of known concentration and use this standard instead of the sample according to the test procedure.
- It is recommend to use well known standards which are formulated according to DIN EN, ASTM or other international norms or to use certified standards which are commercially available.
- After measuring this standard solution it is possible to change the displayed results to the required value.
- If a method uses a mathematic equation for the calculation of the result, it is only possible to calibrate the basic tests since all the other tests use the same polynomial.
- The same applies for some test procedures which use a polynomial from another test procedure.

Return to factory calibration:

If the user calibration is deleted the factory calibration is automatically activated.

Table

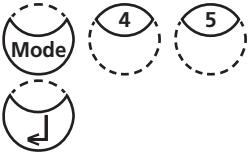
No.	Method	Recommended range for user calibration
20	Acid demand	1–3 mmol/l
30	Alkalinity-total	50–150 mg/l $CaCO_3$
31	Alkalinity-total HR T	50–300 mg/l $CaCO_3$
40	Aluminium T	0.1–0.2 mg/l Al
50	Aluminium PP	0.1–0.2 mg/l Al
60	Ammonia T	0.3–0.5 mg/l N
80	Bromine	Calibration with basic test 100 Chlorine free
100	Chlorine T	0.5–1.5 mg/l Cl
103	Chlorine HR T	0.5–6 mg/l Cl
101	Chlorine L	Calibration with basic test 100 Chlorine free
110	Chlorine PP	0.5–1 mg/l Cl_2
111	Chlorine HR PP	4–5 mg/l Cl_2
120	Chlorine dioxide	Calibration with basic test 100 Chlorine free
150	Copper T	0.5–1.5 mg/l Cu
153	Copper PP	0.5–1.5 mg/l Cu
160	CyA-TEST	30–60 mg/l CyA
214	H_2O_2 HR L	200-300 mg/l H_2O_2
191	Hardness, Calcium	100–200 mg/l $CaCO_3$
200	Hardness, total T	15–25 mg/l $CaCO_3$

No.	Method	Recommended range for user calibration
201	Hardness, total HR T	Calibration with basic test 200 Hardness, total
215	Iodine	Calibration with basic test 100 Chlorine free
220	Iron T	0.3–0.7 mg/l Fe
300	Ozone (DPD)	Calibration with basic test 100 Chlorine free
290	Oxygen, active	Calibration with basic test 100 Chlorine free
329	pH-Value LR	6.0–6.6
330	pH-Value T	7.6–8.0
331	pH-Value L	7.6–8.0
332	pH-Value HR	8.6–9.0
70	PHMB	15–30 mg/l
319	Phosphate LR T	1–3 mg/l PO_4
212	Sodium hypochlorite	8 %
360	Sulfate PP	50 mg/l SO_4
355	Sulfate T	50 mg/l SO_4
390	Urea	1–2 mg/l CH_4N_2O

Store user calibration

100 Chlorine T
0.02-6 mg/l Cl2
0.90 mg/l free Cl2

Perform the required method as described in the manual using a standard of known concentration instead of the water sample.



If the test result is displayed press [MODE], [Shift] + [4] [5] keys and confirm with [↲] key.

<user calibration>
100 Chlorine T
0.02-6 mg/l Cl2
0.90 mg/l free Cl2
up: ↑, down: ↓
save: ↲

The display shows:

Pressing the arrow key [▲] once increases the displayed result.

Pressing the arrow key [▼] once decreases the displayed result.

Press keys till the displayed result corresponds to the value of the standard.

Confirm with [↲] key to store the new calibration factor.

Cancel user calibration by pressing [ESC] key.

Jus Factor
saved

The display shows:

100 Chlorine T
0.02-6 mg/l Cl2
1.00 mg/l free Cl2

Now the method name is displayed inverse and the test result is calculated with the new calibration factor.

Delete user calibration

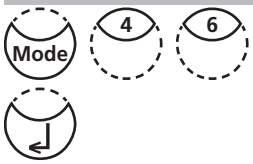
This chapter only applies for methods which can be user calibrated.

100 Chlorine T
0.02-6 mg/l Cl2

Select the required method.

prepare ZERO
press ZERO

Instead of zeroing the instrument press [MODE], [Shift] + [4][6] keys and confirm with [↵] key.



<user calibration>
100 Chlorine T
0.02-6 mg/l Cl2
clear user
calibration?
YES: 1, NO: 0

The display shows:

Press [Shift] + [1] keys to delete user calibration.

Press [Shift] + [0] keys to keep the valid user calibration.

The instrument goes back to Zero-query automatically.

2.4.6 Lab function

Reduced operator guidance => “Profi-Mode“

This function may be used for routine analyses with many samples of one method.
The following information is always stored in the methods:

a) Method
b) Range
c) Date and time
d) Differentiation of results
e) Detailed operator instruction
f) Compliance with reaction periods

If the Profi-Mode is active, the photometer provides only a minimum of operator instructions.
The criteria specified above in d, e, f are no longer included.

Press [MODE], [Shift] + [5][0] keys in succession.

Confirm with [↲] key.

<Profi-Mode>
ON : 1 OFF : 0

The display shows:

- Press [Shift] + [0] keys to switch the Profi-Mode off.

- Press [Shift] + [1] keys to switch the Profi-Mode on.

switched off

The display shows:

or

switched on

Confirm with [↲] key.

Note:

1. Storage of test results is possible. When results are stored the display also shows “Profi-Mode”.
2. The selected settings are kept by the photometer even whein it is switched off. To change photometer setting a new setting is required.

One Time Zero (OTZ)

OneTimeZero is available for all methods where Zero is performed in a 24 mm Ø round vial with sample water (see chapter 1.1 Table of Methods).

OneTimeZero can be used for different tests providing the tests are performed with the same sample water and under the same test conditions. When changing the method, it is not necessary to perform a new Zero. The test can be carried out straight away.

When the instrument is first being used for an OTZ compatible method and OneTimeZero is activated, the instrument will request a new Zero with "prepare OT-Zero". Perform Zero as described in the method. This Zero will be stored and used for all methods with OTZ function until the instrument is switched off.

If necessary, a new Zero can be performed by pressing [Zero] key at any time.

Switching the "OTZ-Function" on and off:

Press [MODE], [Shift] + [5][5] keys.

Confirm with [↵] key.

<OneTimeZero>	
ON : 1	**OFF : 0**

The display shows:

- Press [Shift] + [0] keys to switch the OTZ off.

- Press [Shift] + [1] keys to switch the OTZ on.

switched off

The display shows:

or

switched on

Confirm with [↵] key.

The instrument goes back to mode menu automatically.

Note:

1. The specified accuracy is valid for all test results when Zero is performed for each test (OneTimeZero function is switched off).

2.4.7 User operations

User method list

After switching on the instrument a scroll list of all available methods is automatically shown in the display. To shorten this list according to the requirements of the user it is possible to create a user defined scroll list.

The program structure requires that this list must have at least one active (switched on) method. For this reason it is necessary to activate first all required methods and then to switch off the automatically activated one if this method is not required.

User-method list, adaptation

Press [MODE], [Shift] + [6][0] keys.

Confirm with [↲] key.

```
<Method list>
selected: •
toggle: F2
save: ↲
cancel: ESC
```

The display shows:

Start with [↲] key.

```
<Method list>
>> 30•Alkalinity-tot
   40•Aluminium
   50•Ammonium
....
```

The complete method list is displayed.

Methods with a point [•] behind the method number will be displayed in the method selection list. Methods without a point will not be displayed in the method selection list.

```
>> 30•Alkalinity-tot
```

Press key [▲] or [▼] to select the required method from the displayed list.

```
>> 30 Alkalinity-tot
```

Switch with [F2] key between "active" [•] and "inactive" [ ].

```
>> 30•Alkalinity-tot
```

Select next method, activate or inactivate it and continue.

Confirm with [↲] key.

Cancel without storing by pressing [ESC] key.

Recommendation:

1. If only a few methods are required it is recommended to perform Mode 62 first, followed by Mode 60.
2. All user Polynomials (1-25) and Concentrations (1-10) are displayed in the method list, although they are not programmed by the user. Non-programmed user methods can't be activated!

User method list, switch all methods on

This mode function activates all methods. After switching on the instrument a scroll list of all available methods is automatically shown in the display.

Press [MODE], [Shift] + [6][1] keys.

Confirm with [↵] key.

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

The display shows:

- Press [Shift] + [1] keys to display all methods in the method selection list.

- Press [Shift] + [0] keys to keep the valid method selection list.

The instrument goes back to mode menu automatically.

User method list, switch all methods off

The program structure requires that the method list must have at least one active (switched on) method. For this reason the instrument activates one method automatically.

Press [MODE], [Shift] + [6][2] keys.

Confirm with [↵] key.

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

The display shows:

- Press [Shift] + [1] keys to display only one method in the method selection list.

- Press [Shift] + [0] keys to keep the valid method selection list.

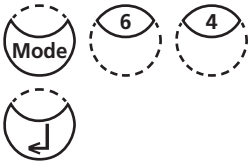
The instrument goes back to mode menu automatically.

User Concentration Methods

It is possible to enter and store up to 10 User Concentration Methods.
Therefor you need 2 to 14 standards of known concentration and one blank (deionised water or reagent blank value). The Standards should be measured with increasing concentrations and from the brightest to the darkest colouration.
The measuring range for „Underrange“ and „Overrange“ is defined with –2600 mAbs* and +2600 mAbs*. After selection of a method the concentration of the lowest and highest used standard is displayed as measuring range. The operation range should be within this range to achieve best results.

*1000 mAbs = 1 Abs = 1 E (displayed)

Entering a User Concentration:



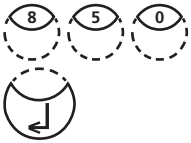
Press [MODE], [Shift] + [6][4] keys.

Confirm with [↲] key.

Entry Procedure:

< User concentr.>
choose no.: ____
(850-859)

The display shows:



Enter a method number in the range from 850 to 859, e.g.: [Shift] + [8][5][0]

Confirm with [↲] key.

Overwrite conc. meth.?
YES: 1, NO: 0

Note:
if the entered number has already been used to save a concentration the display shows the query:

- Press [Shift] + [0] or [ESC] keys to go back to method no. query.
- Press [Shift] + [1] keys to start entry mode.

wavelength:
1: 530 nm
2: 560 nm
3: 610 nm

Enter the required wavelength, e.g.: [Shift] + [2] for 560 nm.

choose unit:
>>
mg/l
g/l
mmol/l
mAbs
µg/l
E
A
%

Press [▲] or [▼] keys to select the required unit.

Confirm with [↲] key.

choose resolution
1: 1
2: 0.1
3: 0.01
4: 0.001

Press the appropriate numerical key to select the required resolution, e.g.: [Shift] + [3] for 0.01.

Note:
Please enter the required resolution according to the instrument pre-sets:

range	max. resolutions
0.000 ...9.999	0.001
10.00 ...99.99	0.01
100.0... 999.9	0.1
1000 ...9999	1

Measurement procedure with standards of known concentration:

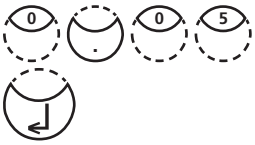
< User concentr.>
prepare Zero
press ZERO

The display shows:

Prepare Zero and press [Zero] key.

Note:
Use deionised water or reagent blank value.

< User concentr.>
Zero accepted
S1: +_____
↲ | ESC | F1



The display shows:

Enter the concentration of the first standard;
e.g.: [Shift] + [0][.][0][5]

- One step back with [ESC].
- Press [F1] key to reset numerical input.

Confirm with [↲] key.

< User concentr.>
S1: 0.05 mg/l
prepare
press TEST

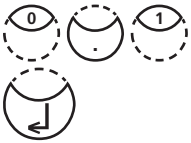
The display shows:

Prepare the first standard and press [Test] key.

S1: 0.05 mg/l
mAbs: 12 ↲

The display shows the input value and the measured absorption value. Confirm with [↲] key.

S1 accepted
S2: +_____
↲ | ESC | F1



Enter the concentration of the second standard;
e.g.: [Shift] + [0][.][1]

- One step back with [ESC].
- Press [F1] key to reset numerical input.

Confirm with [↲] key.

S2: 0.10 mg/l
prepare
press TEST

Prepare the second standard and press [Test] key.

S2: 0.10 mg/l
mAbs: 150 ↲

The display shows the input value and the measured absorption value. Confirm with [↲] key.

Note:
- Perform as described above to measure further standards.
- The minimum of measured standards is 2.
- The maximum of measured standards is 14 (S1 to S14).

S2 accepted
S3: +_____
↲ | ESC | F1 | Store

If all required standards or the maximum value of 14 standards are measured press [Store] key.

stored!

The display shows:

The instrument goes back to the mode menu automatically.

Now the concentration is stored in the instrument and can be recalled by entering its method number or selecting it from the displayed method list.

TIP:

Save all your concentration data in a written form because in case of power outage (e.g. changing the battery) all concentration data will be lost and must be entered again.

You might want to use Mode 67 to transfer all concentration data to a PC.

User Polynomials

It is possible to enter and store up to 25 User Polynomials.

The program allows the user to apply a Polynomial up to the 5th degree:

$$y = A + Bx + Cx^2 + Dx^3 + Ex^4 + Fx^5$$

If only a Polynomial of a lower degree is necessary the other coefficients are specified as zero (0), e.g.: for the 2nd degree is D, E, F = 0.

The values of the coefficients A, B, C, D, E, F must be entered in an academic notation with maximal 6 decimal places, e.g.: 121,35673 = 1,213567E+02

Entering a User Polynomial:

Press [MODE], [Shift] + [6][5] keys.

Confirm with [↲] key.

<User polynoms>
choose no.: ____
(800-824)

The display shows:

Enter a method number in the range from 800 to 824, e.g.: [Shift] + [8][0][0]

Confirm with [↵] key.

Overwrite polynom?
YES: 1, NO: 0

Note:
if the entered number has already been used to save a polynomial the display shows the query:

- Press [Shift] + [0] or [ESC] keys to go back to method no. query.

wavelength:
1: 530 nm
2: 560 nm
3: 610 nm

- Press [Shift] + [1] keys to start entry mode.

Enter the required wavelength, e.g.: [2] for 560 nm.

< User polynoms>
y = A+Bx+Cx²+Dx³+
Ex⁴+Fx⁵
A: +_____

- Press [▲] or [▼] key to change between plus and minus sign
- Enter data of the coefficient A including decimal point, e.g.: [Shift] + [1][.][3][2]
- Press [F1] key to reset numerical input.

Confirm with [↵] key.

A: 1.32____ E+____

- Press [▲] or [▼] key to change between plus and minus sign
- Enter the exponent of the coefficient A, e.g.: [Shift] + [3]

Confirm with [↵] key.

B: +_____

Successively the instrument queries the data for the other coefficients (B, C, D, E and F).

Note:
If zero [0] is entered for the value of the coefficient, the input of the exponent is omitted automatically.

Confirm every input with [↵] key.

measurement range
Min mAbs: +_____
Max mAbs: +_____

Enter measurement ranges from – 2600 to + 2600 mAbs.

- Press [▲] or [▼] key to change between plus and minus sign.
- Enter the values in Absorbance (mAbs) for the upper limit (Max) and the lower limit (Min).

Confirm every input with [↵] key.

choose unit:
>>
mg/l
g/l
mmol/l
mAbs
µg/l
E
A
%

Press [▲] or [▼] keys to select the required unit.

Confirm with [↵] key.

choose resolution
1: 1
2: 0.1
3: 0.01
4: 0.001

Press the appropriate numerical key to select the required resolution, e.g.: [Shift] + [3] for 0.01.

Note:
Please enter the required resolution according to the instrument pre-sets:

range	max. resolutions
0.000 ...9.999	0.001
10.00 ...99.99	0.01
100.0... 999.9	0.1
1000 ...9999	1

stored!

The display shows:

The instrument goes back to the mode menu automatically.

Now the polynomial is stored in the instrument and can be recalled by entering its method number or selecting it from the displayed method list.

1. TIP:
Save all your polynomial data in a written form because in case of power outage (e.g. changing the battery) all polynomial data will be lost and must be entered again.

2. You might want to use Mode 67 to transfer all polynomial data to a PC.

Delete User Methods (Polynomial or Concentration)

In principle a valid user method can be overwritten.

An existing user method (Polynomial or Concentration) can be totally deleted as well and is removed out of the method selection list:

Press [MODE], [Shift] + [6][6] keys.

Confirm with [↵] key.

<User m. clear>
choose no.: _____
(800-824), (850-859)

The display shows:

Enter the number of the User Method you want to delete (in the range from 800 to 824 or 850 to 859), e.g.: [Shift] + [8][0][0]

Confirm with [↵] key.

M800
delete?
YES: 1, NO: 0

The query is displayed:

- Press [Shift] + [1] keys to delete the selected User Method.

- Press [Shift] + [0] keys to keep the valid User Method.

The instrument goes back to mode menu automatically.

Print Data of User Methods (Polynomials & Concentration)

With this Mode function all data (e.g. wavelength, unit ...) of stored user polynomials and concentration methods can be printed out or transferred with HyperTerminal to a PC.
HyperTerminal is a Windows communications program. The Data Acquisition Software is designed to receive data from the instrument and store it either in an Excel-Spreadsheet or as a .txt-file. Depending on the instrument being used for transmission, an IRiM (InfraRed interface Module) or an RS232 computer interface is required. If the latter is not available, an RS232 to USB adapter can also be used.

Press [MODE], [Shift] + [6][7] keys.

Confirm with [↲] key.

<User m. print>
Start: ↲

The display shows:

Press [↲] key to print out the data (e.g. wavelength, unit, ...) of all stored User Methods.

M800
M803
...

The display shows e.g.:

After data transfer the photometer goes back to mode menu automatically.

Initialise User Method System (Polynomials & Concentration)

Power loss will cause incoherent data. The user method system must be initialised with this mode function to set it to a predefined state.

ATTENTION:
All stored user methods (polynomial & concentration) are deleted with initialisation.

Press [MODE], [Shift] + [6][9] keys.

Confirm with [↲] key.

<User m. init>
Start: ↲

The display shows:

Confirm with [↲] key.

Initialising?
YES: 1, NO: 0

The query is displayed:

- Press [Shift] + [1] keys to start initialisation.

- Press [Shift] + [0] keys to to cancel without initialisation.

The instrument goes back to mode menu automatically.

2.4.8 Special functions

Langelier Saturation Index (Water Balance)

For calculation the following tests are required:

- pH-value
- Temperature
- Calcium hardness
- Total Alkalinity
- TDS (Total Dissolved Solids)

Run each test separately and note the results.
Calculate the Langelier Saturation Index as described:

Calculation of Langelier Saturation Index

With Mode 71 (see below) it is possible to select between degree Celsius or degree Fahrenheit.

Press [MODE], [Shift] + [7][0] keys.

Confirm with [↲] key.

<Langelier>
temperature °C:
3°C <=T<=53°C
+_ _ _ _

The display shows:

Enter the temperature value (T) in the range between 3 and 53°C and confirm with [↲] key. If °F was selected, enter the temperature value in the range between 37 and 128°F.

calcium hardness
50<=CH<=1000
+_ _ _ _

The display shows:

Enter the value for Calcium hardness (CH) in the range between 50 and 1000 mg/l $CaCO_3$ and confirm with [↲] key.

tot. alkalinity
5<=TA<=800
+_ _ _ _

The display shows:

Enter the value for Total Alkalinity (TA) in the range between 5 and 800 mg/l $CaCO_3$ and confirm with [↲] key.

total dissol. solids
0<=TDS<=6000
+_ _ _ _

The display shows:

Enter the value for TDS (Total Dissolved Solids) in the range between 0 and 6000 mg/l and confirm with [↲] key.

pH value
0<=pH<=12
+_ _ _ _

The display shows:

Enter the pH-value in the range between 0 and 12 and confirm with [↲] key.

<Langelier>
Langelier
saturation index
0.00
Esc ↲

The display shows the Langelier Saturation Index.

Press [↲] key to start new calculation.

Return to mode menu by pressing [ESC] key.

Operating error:

Examples:

Values out of defined range:

CH<=1000 mg/l CaCO3!

The entered value is too high.

CH>=50 mg/l CaCO3!

The entered value is too low.

Confirm display message with [↲] key and enter a value in the defined range.

Selection of temperature unit

Entering the temperature value is possible in degree Celsius or degree Fahrenheit.
Therefore the following preselection is (once) required.

Press [MODE], [Shift] + [7][1] keys.

Confirm with [↲] key.

<temperature>
1: °C 2: °F

The display shows:

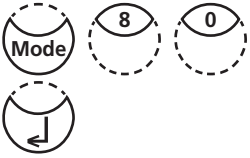
Press [Shift] + [1] keys to select degree Celsius.

Press [Shift] + [2] keys to select degree Fahrenheit.

The instrument goes back to mode menu automatically.

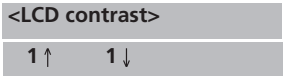
2.4.9 Instrument basic settings 2

Adjusting display contrast



Press [MODE], [Shift] + [8][0] keys.

Confirm with [↵] key.



The display shows:

- Press arrow key [▲] to increase contrast of the LCD display about one unit.

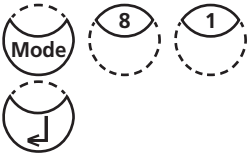
- Press arrow key [▼] to decrease contrast of the LCD display about one unit.

- Press [Store] key to increase contrast of the LCD display about ten units.

- Press [Test] key to decrease contrast of the LCD display about ten units.

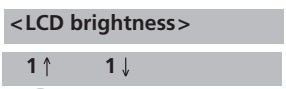
Confirm with **[↵]** key.

Adjusting display brightness



Press [MODE] [8] [1] keys.

Confirm with **[↵]** key.



The display shows:

Press [▲] key to increase brightness of the display about one unit.

Press [▼] key to decrease brightness of the display about one unit.

10 ↑ 10 ↓	
	Press [Store] key to increase brightness of the display about ten units.
	Press [Test] key to decrease brightness of the display about ten units.
0...254 : 200	The display shows: The brightness can be selected between 0 and 254 units, e.g.: 200.
	Confirm with **[↲]** key.

2.4.10 Instrument special functions /service

Photometer-Information

	Press [MODE], [Shift] + [9][1] keys.
	Confirm with [↲] key.
<System-Info> Software: V201.001.1.001.002 more: ↓, cancel: Esc	This method informs you about the current software version, about the number of performed tests and free memory capacity.
	Press arrow key [▼] to display the number of performed tests and free memory capacity.
<System-Info> Number of Tests: 139 free records left 999 cancel: Esc	Finish with [ESC] key.

2.5 Data transfer

To print data or to transmit to a PC the optional IRiM (Infra-Red Interface Module) is required.
Order-No.: W3T330498

The IRiM (infra-red interface module) uses modern infra-red technology to transmit measurement data from the photometer to one of 3 optional interfaces. These interfaces can be used to connect to a PC, a USB printer[1)] or alternatively a serial printer[2)]. The interface which is selected is displayed by an LED function indicator. The user can switch between the interfaces using the „Select" button. The unit is supplied complete with data logging software providing easy and rapid transfer of data to the PC. As an option, the data can be saved as an Excel sheet or a .txt file. Necessary accessories is included.

[1)] USB-printer: HP Deskjet 6940

[2)] each ASCII- printer

2.5.1 Data Printing

Besides the IRiM module the following printer is required to print data directly using the USB Interface of the module: HP Deskjet 6940.

2.5.2 Data transfer to a personal computer

Besides the IRiM a transfer program, is required to transmit test results.
Please find detailed information in the IRiM manual.

Part 3

Enclosure

3.1 Unpacking

Carefully inspect all items to ensure that every part of the list below is present and no visible damage has occurred during shipment. If there is any damage or something is missing, please contact your local distributor immediately.

3.2 Delivery contents

Standard contents for P34 Professional:

☑

- ❑ 1 Photometer in plastic case
- ❑ 1 Instruction manual
- ❑ 1 Guarantee declaration
- ❑ 1 Certificate of compliance
- ❑ 4 batteries (1,5V, Type AA/LR 6)
- ❑ 1 battery compartment cover, 4 screws and scewdriver
- ❑ 3 Round vials with cap and sealing ring, height 48 mm, Ø 24 mm
- ❑ 1 Cleaning brush
- ❑ 1 Stirring rod, plastic
- ❑ 1 beaker 100 ml
- ❑ 1 syringe 5 ml

Tablet reagents for each 100 tests:

- ❑ DPD No. 1
- ❑ DPD No. 3
- ❑ PHENOL RED PHOTOMETER
- ❑ GLYCINE
- ❑ ALKA-M

Further reagent sets are not part of the standard scope of delivery.
Different Refill Packs available on request.

3.3 Spare parts

3 Round vials with cap (Ø 24 mm)	W3T171790
Sealing ring	W3T168322
Cleaning brush	W3T161264
Stirring rod, plastic	W3T168970
Beaker 100 ml	W3T172849
Syringe, plastic, 5 ml	W3T168321
Adapter, 16 mm	W3T330551
Instructional Manual german	W3T329159
Instructional Manual englisch	W3T329160
Instructional Manual frensh	W3T329201
10 Round vials with cap (Ø 16x75 mm)	W3T330500

Test	Range	Reagent	λ/nm	Method	Display	Form of reagent/ Quantity	Order-No.:
Acid demand pH 4.3	0.1-4 mmol/l	ALKA-M-PHOTOMETER	610	Acid / Indicator	---	Tablet / 100 Tablet / 250	W3T172638 W3T172645
Alkalinity-m (total)	5-200 mg/l	ALKA-M-PHOTOMETER	610	Acid / Indicator	$CaCO_3$	Tablet / 100 Tablet / 250	W3T172638 W3T172645
Alkalinity-m HR (total)	5-500 mg/l	ALKA-M-HR-PHOTOMETER	610	Acid / Indicator	$CaCO_3$	Tablet / 100	W3T330122
Aluminium	0.01-0.30 mg/l	Aluminium No. 1 Aluminium No. 2	530	Eriochrome cyanine R	Al	Tablet / 100 Tablet / 250 Tablet / 100 Tablet / 250	W3T172627 W3T165085 W3T165078 W3T165086
Aluminium	0.01-0.25 mg/l	VARIO Aluminum ECR/F20 VARIO Aluminum Hexamine/F20 VARIO Aluminum Masking Reagt.	530	Eriochrome cyanine R	Al	Powder Pack / 100 Powder Pack / 100 Liquid reagent / 25 ml Set	W3T168325 W3T168326 W3T168327 W3T168328
Ammonium	0.02-1 mg/l	AMMONIA No. 1 AMMONIA No. 2	610	Indophenol blue	N	Tablet / 100 Tablet / 100	W3T168329 W3T168330
Bromine	0.05-13 mg/l	DPD No. 1	530	DPD	Br	Tablet / 100 Tablet / 500	W3T172628 W3T172647
Chlorine	0.01-6 mg/l	DPD No. 1 DPD No. 3 DPD No. 1 HIGH CALCIUM DPD No. 3 HIGH CALCIUM	530	DPD	Cl_2	Tablet / 100 Tablet / 500 Tablet / 100 Tablet / 500 Tablet / 100 Tablet / 100	W3T172628 W3T172647 W3T172629 W3T172648 W3T168351 W3T196741
Chlorine	0.1-10 mg/l	DPD No. 1 HR DPD No. 3 HR	530	DPD	Cl_2	Tablet / 100 Tablet / 100	W3T330123 W3T330124
Chlorine	0.02-4 mg/l	DPD 1 Buffer solution DPD 1 Reagent solution DPD 3 Solution **Set**	530	DPD	Cl_2	Liquid reagent / 15 ml Liquid reagent / 100 ml Liquid reagent / 15 ml Liquid reagent / 100 ml Liquid reagent / 15 ml Liquid reagent / 100 ml Set	W3T168331 W3T164710 W3T168332 W3T164711 W3T168333 W3T16471 W3T168334
Chlorine	0.02-2 mg/l	VARIO Chlorine FREE-DPD/F10 VARIO Chlorine TOTAL-DPD/F10	530	DPD	Cl_2	Powder Pack / 100 Powder Pack / 100	W3T168335 W3T168336
Chlorine dioxide	0.02-11 mg/l	DPD No. 1 DPD No. 3 GLYCINE	530	DPD	ClO_2	Tablet / 100 Tablet / 500 Tablet / 100 Tablet / 500 Tablet / 100 Tablet / 250	W3T172628 W3T172647 W3T172629 W3T172648 W3T168337 W3T172642
Copper	0.05-5 mg/l	COPPER No. 1 COPPER No. 2	560	Biquinoline	Cu	Tablet / 100 Tablet / 100	W3T168344 W3T168345
Copper, free	0.05-5 mg/l	VARIO Cu 1 F10	560	Bicinchoninate	Cu	Powder Pack / 100	W3T172295
Cyanuric acid	0-160 mg/l	CYA-TEST	530	Melamine	CyA	Tablet / 100	W3T172636
H_2O_2	40-500 mg/l	H_2O_2 Reagent	530	DPD/Catalyst	H_2O_2	Liquid reagent / 15 ml	W3T330125
Hardness, Calcium	0-500 mg/l	CALCIO-H No. 1 + CALCIO-H No. 2	560	Murexide	$CaCO_3$	Tablet / 2 x 100	W3T203772

Test	Range	Reagent	λ/nm	Method	Display	Form of reagent/ Quantity	Order-No.:
Hardness, total	2-50 mg/l	HARDCHECK P	560	Metallphthalein	$CaCO_3$	Tablet / 100	W3T168343
Hardness, total HR	20-500 mg/l	HARDCHECK P	560	Metallphthalein	$CaCO_3$	Tablet / 100	W3T168343
Iodine	0.05-3.6 mg/L	DPD No. 1	530	DPD	I	Tablet / 100	W3T172628
Iron (II, III) soluble	0.02-1 mg/l	IRON LR IRON (II) LR	560	PPST	Fe	Tablet / 100 Tablet / 100	W3T168338 W3T168339
Oxygen, activ	0.1-10 mg/l	DPD No. 4	530	DPD	O_2	Tablet / 100 Tablet / 500	W3T172630 W3T172649
Ozone	0.02-2 mg/l	DPD No. 1 DPD No. 3 GLYCINE	530	DPD/Glycine	O_3	Tablet / 100 Tablet / 500 Tablet / 100 Tablet / 500 Tablet / 100 Tablet / 250	W3T172628 W3T172647 W3T172629 W3T172648 W3T168337 W3T172642
PHMB (Biguanide)	2-60 mg/l	PHMB PHOTOMETER	560	Buffer/Indicator	PHMB	Tablet / 100	W3T168346
Phosphate, ortho	0.05-4 mg/l	PHOSPHATE LR No.1 PHOSPHATE LR No.2	610	Ammonium molybdate	PO_4	Tablet / 100 Tablet / 100	W3T172296 W3T172297
pH-Value LR	5.2-6.8	BROMOCRESOLPURPLE / PHOTOMETER	560	Bromcresolpurple	pH	Tablet / 100	W3T330129
pH-Value	6.5-8.4	PHENOLRED / PHOTOMETER	560	Phenolred	pH	Tablet / 100 Tablet / 500	W3T172635 W3T172651
pH-Value	6.5-8.4	PHENOLRED-Solution	560	Phenolred	pH	Liquid reagent / 15 ml Liquid reagent / 100 ml	W3T168347 W3T164713
pH Value HR	8.0-9.6	THYMOLBLUE / PHOTOMETER	560	Thymolblue	pH	Tablet / 100	W3T330130
Sodium hypochlorite T	0.2-18 %	Chlorine HR (KI) Acidifying GP	530	Potassium iodide	NaOCl	Tablet / 100 Tablet / 100	W3T330126 W3T330127
		Dilution-set: 2 x 100 ml container with stopper, 1 ml + 5 ml syringe					W3T330128
Sulfate	5-100 mg/l	SULFATE T	610	BariumsulfateTurbidity	SO_4	Tablet / 100	W3T172298
Sulfate	5-100 mg/l	VARIO Sulpha 4 / F10	530	BariumsulfateTurbidity	SO_4	Powder Pack / 100	W3T168348
Urea	0.1-2.5 mg/l	UREA-Reagent 1 UREA-Reagent 2 AMMONIA No. 1 AMMONIA No. 2	610	Indophenol / Urease	Urea	Liquid reagent / 15 ml Liquid reagent / 10 ml Tablet / 100 Tablet / 100	W3T168340 W3T168341 W3T168329 W3T168330

3.4 Technical data

Display	Graphic Display
Serial Interface	IR interface for data transfer RJ45 connector for internet updates (see chapter 2.5.3)
Light source	light-emitting diode – photosensor – pair arrangement in a transparent measurement chamber Wavelength ranges: λ1 = 530 nm IF Δ λ = 5 nm λ2 = 560 nm IF Δ λ = 5 nm λ3 = 610 nm IF Δ λ = 6 nm IF = Interference filter
Wavelength accuracy	± 1 nm
Photometric accuracy*	2% FS (T = 20°C – 25°C)
Photometric resolution	0.005 A
Protection	conforming to IP 68 (1 h, 0.1 m)
Operation	Acid and solvent resistant touch-sensitive keyboard with integral beeper as acoustic indicator.
Power supply	4 batteries (Type AA/LR 6); lifetime: approx. 26 hours continuous use or 3500 tests
Auto off	20 minutes after last function, 30 seconds acoustical signal before switch off
Dimensions	approx. 210 x 95 x 45 mm (unit) approx. 395 x 295 x 106 mm (case)
Weight (unit)	approx. 450 g
Working condition	5 – 40°C at max. 30–90% relative humidity (without condensation)
Language options	English, German, French, Spanish, Italian, Portuguese, Polish; further languages via Internet Update
Storage capacity	ca. 1000 data sets

** measured with standard solutions*

Subject to technical modification!

To ensure maximum accuracy of test results, always use the reagent systems supplied by the instrument manufacturer.

3.5 Abbreviations

Abbreviation	Definition
°C	degree Celsius (Centigrade)
°F	degree Fahrenheit °F = (°C x 1.8) + 32
°dH	degree German Hardness
°fH	degree French hardness
°eH	degree English Hardness
°aH	degree American Hardness
Abs	Absorption unit (≙ Extinction E) 1000 mAbs = 1 Abs ≙ 1 A ≙ 1 E
µg/l	(= ppb) Microgram per litre
mg/l	(= ppm) Milligram per litre
g/l	(= ppth) gram per litre
K S 4.3	Acid demand to pH 4.3 – this method is similar to Total Alkalinity but converted into the unit "mmol/l", as the German DIN 38409 demand.
LR	Low Range
MR	Medium Range
HR	High Range
L	Liquid reagent
P	Powder (reagent)
PP	Powder Pack
T	Tablet
DPD	Diethyl-p-phenylendiamine
PPST	3-(2-Pyridyl)-5,6-bis(4-phenylsulfonic acid)1,2,4-triazine

3.6 Troubleshooting

3.6.1 Operating messages in the display / error display

Display	Possible Causes	Elimination
Overrange	reading is exceeding the range	if possible dilute sample or use other measuring range
	water sample is too cloudy	filtrate water sample
	too much light on the photo cell	seal on the cap? Repeat measurement with seal on the cap of the vial.
Underrange	result is under the detection limit	indicate result with lower x mg/l x = low end of measuring range; if necessary use other analytical method
Storagesystem error use Mode 34	mains power fails or is not connected	insert or change battery. Delete data with Mode 34
Battery warning 	warning signal every 3 minutes warning signal every 12 seconds	capacity of the battery is too low; change the batteries
	warning signal, the instrument switches itself off	change the batteries
Jus Overrange E4	The user calibration is out of the accepted range	Please check the standard, reaction time and other possible faults. Repeat the user calibration.
Jus Underrange E4		
Overrange E1	The concentration of the standard is too high/too low, so that during user calibration the limit of the range was exceeded	Perform the test with a standard of higher/lower concentration
Underrange E1		
E40 user calibration not possible	If the display shows Overrange/ Underrange for a test result a user calibration is not possible	Perform the test with a standard of higher/lower concentration
Zero not accepted	Light absorption is too great or too low	Refer to chapter 2.3.4 Performing Zero. Clean sample chamber. Repeat zeroing.

Display	Possible Causes	Elimination
???	The calculation of a value (e.g. combined Chlorine) is not possible	Test procedure correct? If not – repeat test
Example 1 0,60 mg/l free Cl ??? comb Cl 0,59 mg/l total Cl		Example 1: The readings for free and total Chlorine are different, but considering the tolerances of each reading they are the same. For this reason the combined Chlorine is most likely zero.
Example 2 Underrange ??? comb Cl 1,59 mg/l total Cl		Example 2: The reading for free Chlorine is under the detection limit. The instrument is not able to calculate the combined Chlorine. In this case the combined Chlorine is most likely the same as the total Chlorine.
Example 3 0,60 mg/l free Cl ??? comb Cl Overrange		Example 3: The reading for total Chlorine is exceeding the range. The instrument is not able to calculate the combined Chlorine. The test should be repeated with a diluted sample.

3.6.2 General

Finding	Possible Causes	Elimination
Test result deviates from the expected.	Chemical species not as required.	Press arrow keys to select the required chemical species.
No differentiation: e.g. for the Chlorine test there is no selection between differentiated, free or total.	Profi-Mode is switched on.	Switch Profi-Mode off with Mode 50.
The pre-programmed countdown is not displayed.	Countdown is not activated and/or the Profi-Mode is activated.	Switch the countdown on with Mode 13 and/or switch the Profi-Mode off with Mode 50.
It seems that a method is not available.	Method is not activated in the user method list.	Activate the required method in the user method list with Mode 60.

3.7 Declaration of CE-Conformity

EVOQUA WATER TECHNOLOGIES

EG-Konformitätserklärung
EC Declaration of Conformity
Déclaration CE de conformité

No. MAE1634

Ausgabe/*issue*/**édition** 02

Hersteller/*Manufacturer*/**Constructeur:**	Evoqua Water Technologies GmbH
Anschrift/*Address*/**Adresse:**	Auf der Weide 10, D-89312 Günzburg
Produktbezeichnung: *Product description:* **Description du produit:**	Photometer P34 Professional *Photometer P34 Professional* **Photomètre P34 Professional**

Das bezeichnete Produkt stimmt in der von uns in Verkehr gebrachten Ausführung mit den Vorschriften folgender europäischer Richtlinien überein:
The product described above in the form as delivered is in conformity with the provisions of the following European Directives:
Le produit désigné est conforme, dans la version que nous avons mise en circulation, avec les prescriptions des directives européennes suivantes :

2014/30/EU — Richtlinie des Europäischen Parlaments und des Rates vom 26. Februar 2014 zur Harmonisierung der Rechtsvorschriften der Mitgliedstaaten über die elektromagnetische Verträglichkeit.
Directive of the European Parliament and of the Council of 26 February 2014 on the approximation of the laws of the Member States relating to electromagnetic compatibility.
Directive du Parlement européen et du Conseil du 26 février 2014 relative au rapprochement des législations des Etats membres concernant la compatibilité électromagnétique.

Ersteller : SR
Ausgabe : 13.05.2014
Dokument: VD130-1_CE_Konformitätserklärung.doc

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Seite 1 von 2

Die Konformität mit den Richtlinien wird nachgewiesen durch die Einhaltung der in der Nachweisdokumentation aufgelisteten Normen.
Evidence of conformity to the Directives is assured through the application of the standards listed in the relevant documentation.
La conformité avec les directives est assurée par le respect des normes listés dans la documentation téchnique correspondante.

Benannte Person für technische Unterlagen:
Authorized person for the technical file:
Personne désignée pour la documentation technique:

Name / *name* / **nom:** Evoqua Water Technologies GmbH

Adresse / *address* / **adresse:** Auf der Weide 10, D-89312 Günzburg

Günzburg, den / *the* 2016-10-18

Evoqua Water Technologies GmbH

i.V. .....

Klaus Andre
Technischer Leiter / *Director Engineering*

Unterschrift
signature / **signature**

i.V. .....

Helmut Fischer
Leiter QM / *Quality Manager*

Unterschrift
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Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, ist jedoch keine Beschaffenheits- oder Haltbarkeitsgarantie nach §443 BGB. Die Sicherheitshinweise der mitgelieferten Produktdokumentation sind zu beachten.
This declaration certifies the conformity to the specified directives but does not imply any warranty for properties. The safety documentation accompanying the product shall be considered in detail..
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