(GB) Photometer DT 2 B

● Operation

For the determination of chlorine and chlorine dioxide use the graduated vials with 10 ml mark. For the determination of fluoride use the special vials without graduation, as the test result is highly dependent on exact sample and reagent volumes. The sample and reagent volumes should always be metered using a 10 or 2 ml full pipette.

ON/OFF — Switch the unit on using the ON/OFF switch.

CL — The display shows the following:

Mode — Select the test required using the MODE key:
CL → CdO → F → ..... (Scroll)

METHOD — The display shows the following:

Fill a clean vial with the water sample up to the 10 ml mark, replace the cap tightly and place the vial in the sample chamber with the Δ-mark on the vial aligned with the ∇–mark on the instrument.

Zero/Test — Press the ZERO/TEST key.

METHOD — The method symbol flashes for approx. 3 seconds.

0.0.0 — The display shows the following:

After zero calibration is completed, remove the vial from the sample chamber.
Add the appropriate reagent tablet; a colour will develop in the sample.
Replace the cap tightly and place the vial in the sample chamber with the Δ and ∇ marks aligned.

Zero/Test — Press the ZERO/TEST key.

METHOD — The method symbol flashes for approx. 3 seconds.

RESULT — The result appears in the display.

Repeating the analysis:
Press the ZERO/TEST key again.
New zero calibration:
Press the MODE key until the desired method symbol appears in the display again.

● User messages

EOI — Light absorption too great. Reasons: zero calibration not carried out or, possibly, dirty optics.

÷Err — Measuring range exceeded or excessive turbidity.

- Err — Result below the lowest limit of the measuring range.

LO BAT — Replace 9 V battery, no further analysis possible.

● Technical data

Light source:	LED, λ_1 = 528 nm, λ_2 = 580 nm
Battery:	9 V-block battery (Life 600 tests).
Auto-OFF:	Automatic switch off 5 minutes after last keypress
Ambient conditions:	5-40°C rel. humidity (non-condensing).
CE:	DIN EN 55 022, 61 000-4-2, 61 000-4-8, 50 082-2, 50 081-1, DIN V ENV 50 140, 50 204

● Chlorine 0,05 - 6,0 mg/l

(a) Free Chlorine

0.0.0 — Perform zero calibration (see "Operation").
Empty the vial. Hold the drip bottle vertically and add evenly sized drops to the vial by pressing slowly (6 drops of DPD 1 buffer solution, 2 drops of DPD 1 reagent solution). Add the water sample to the 10 ml mark. Screw the cap on, swirl to mix, and replace the vial in the compartment making sure the ∇ and Δ marks are aligned.

Zero/Test — Press the ZERO/TEST key.

CL — The method symbol flashes for approx. 3 seconds.

RESULT — The result is shown in the display in mg/l free chlorine.

(b) Total Chlorine

Immediately after measurement, add 3 drops of DPD 3 solution to the coloured test solution. Replace the cap, swirl to mix, and put the vial back into the sample chamber, repositioning the ∇ and Δ marks.

Wait for a colour reaction time of two minutes.

Zero/Test — Press the ZERO/TEST key.

CL — The method symbol flashes for approx. 3 seconds.

RESULT — The result is shown in the display in mg/l total chlorine.

Rinse the vial and cap thoroughly after each test.

(c) Combined Chlorine

Combined Chlorine = Total Chlorine - Free Chlorine

Tolerance: 0-1 mg/l: ± 0.05 mg/l > 3-4 mg/l: ± 0.30 mg/l
> 1-2 mg/l: ± 0.10 mg/l > 4-6 mg/l: ± 0.40 mg/l
> 2-3 mg/l: ± 0.20 mg/l

● Chlorine dioxide 0,1 - 11 mg/l

0.0.0 — Perform zero calibration (see "Operation").
Empty the vial. Hold the drip bottle vertically and add evenly sized drops to the vial by pressing slowly (6 drops of DPD 1 buffer solution, 2 drops of DPD 1 reagent solution). Add the water sample to the 10 ml mark. Screw the cap on, swirl to mix, and replace the vial in the compartment making sure the ∇ and Δ marks are aligned.

Zero/Test — Press the ZERO/TEST key.

CdO — The method symbol flashes for approx. 3 seconds.

RESULT — The result is shown in the display in mg/l chlorine dioxide.

Tolerance:

0,1	-	1,9 mg/l:	± 0,1 mg/l
> 1,9	-	3,8 mg/l:	± 0,2 mg/l
> 3,8	-	5,7 mg/l:	± 0,4 mg/l
> 5,7	-	7,6 mg/l:	± 0,6 mg/l
> 7,6	-	11,0 mg/l	

● Chemical method notes

1. Reagents
   Chlorine concentration above 4 mg/l can lead to low results due to bleaching of the colour. In these cases the sample should first be diluted with chlorine-free water and the test repeated - remember to multiply the result by the dilution factor.
   In principle, it is also possible to use reagent tablets (e.g. DPD 1, 3 or 4) for analysis in these cases if such tablets are available and treated accordingly. Undissolved tablet residues or turbidity in the beam passage of the photometer lead to measuring errors and should therefore be avoided.
   The specified tolerances only apply if LOVIBOND® / DULCOTEST reagents are used.
2. Selectivity
   The DPD method used responds to a wide range of oxidation agents, and you should therefore ensure that **only** the selected oxidation agent is present. **Mixtures**, such as a combination of chlorine and chlorine dioxide, merely supply cumulative values.
   In water containing bromide and iodide, the free - and possibly combined - halogens formed by the chlorination process are listed as chlorine.
   A steady increase in the measuring result for a sample indicates that a further oxidation agent is present in addition to the selected one, and that this agent is affecting the measurement process for some reason (far higher concentration, equilibria, high temperature). These interferences are known in the systems [combined chlorine ⇒ free chlorine} and {chlorite ⇒ chlorine dioxide]. The resulting errors can be minimised by fast working and immediate read-off.
3. Vial cleaning
   As many household cleaners (e.g. dishwasher detergent) contain reducing substances, the subsequent determination of oxidation agents (e.g. chlorine) may show lower results.
   In order to rule out this measurements error, we refer users to DIN 38 408, part 4, No. 6.2: "The glass appliances should be free of chlorine consumption and used exclusively for this process (determination of free chlorine and total chlorine). Chlorine consumption-free glass appliances are obtained by placing them in a sodium hypochlorite solution (0.1 g/l) for 1 hour and then rinsing thoroughly with water."
   N.B. As an alternative to the sodium hypochlorite solution, the vial may also be placed in chlorinated swimming pool water and then thoroughly rinsed with water before use.
4. Preparing the sample
   When preparing the sample, the escape of gases, e.g. by pipetting or shaking, must be avoided. This applies above all to the dissolved gases *chlorine dioxide* and *ozone*, particularly at temperatures > 30°C. The analysis must take place immediately after taking the sample.
   The DPD colour development is carried out with a pH value of 6.3-6.5. The reagents therefore contain a buffer for the pH value adjustment. Strongly alkaline or acidic water must, however, be neutralised before the analysis.
5. Exceeding of the measuring range
   Concentrations above *10 mg/l of chlorine, 19 mg/l of ClO_2 and 7 mg/l of O_3* can produce results within the measuring range up to 0 mg/l. In this event, the water sample must be diluted using chlorine-free water and the measurement repeated (plausibility test).

Notes

Observe application options, analysis regulations and matrix effects of methods. Reagent tablets are designed for use in chemical analysis only and should be kept well out of the reach of children. Ensure proper disposal of reagent solutions.

● Calibration Mode for Chlorine and Chlorine Dioxide

Mode — Press MODE key and **keep it depressed**.

On / Off — Switch unit on using ON/OFF key.
Release MODE key after approx. 1 second.

CAL
CL — Select the test required using the MODE key:
CAL CL → CAL F →..... (Scroll)

Zero / Test — Perform zero calibration (see "Operation").
Press the ZERO/TEST key.

METHOD — The method symbol flashes for approx. 3 seconds.

0.0.0
CAL — The display shows the following in alternating mode:

Zero / Test — Place the calibration standard to be used in the sample chamber with the Δ and ∇ marks aligned.
Press the ZERO/TEST key.

METHOD — The method symbol flashes for approx. 3 seconds.

RESULT
CAL — The result is shown in the display, alternating with CAL.

If the result displayed corresponds with the value of the calibration standard (within the tolerance quoted), exit calibration mode by pressing the ON/OFF key.

Mode / Zero / Test — Otherwise, pressing the MODE key once increases the displayed value by 1 digit.
Pressing the ZERO/TEST key once decreases the displayed value by 1 digit.

CAL
RESULT ÷ x — Pressing the relevant key until the displayed value equals the value of the calibration standard.

On / Off — By pressing the ON/OFF key, the new correction factor is calculated and stored in the user calibration software.

: : — Confirmation of calibration (3 seconds).

● Note

Separate calibration of the measuring range for chlorine dioxide is not possible. The unit uses the calibration for the chlorine measuring range. Factor of 1.9 is used to calculate chlorine dioxide respectively, from the chlorine polynomial.

CAL — Factory calibration active.

cAL — Calibration has been set by the user.

● Recommended calibration values

Chlorine LR: between 0,5 and 1,5 mg/l Cl

● User calibration : cAL
Manufacturing calibration : CAL

To reset the calibration to the factory setting:

Mode / Zero / Test — Press both the MODE and ZERO/TEST and **keep them depressed**.

On / Off — Switch the unit on using the ON/OFF key. Release the MODE and ZERO/TEST keys after approx. 1 second.

The following messages will appear in turn on the display:

SEL
CAL — The calibration is reset to the factory setting.
(SEL stands for Select)

or:

SEL
cAL — Calibration has been set by the user. (If the user calibration is to be retained, switch the unit off using the ON/OFF key.)

Mode — Calibration is reset to the factory setting by pressing the MODE key. The following messages will appear in turn on the display:

SEL
CAL

On / Off — Switch the unit off using the ON/OFF key.

● User notes

E 10 — Calibration factor "out of range"

E 70 — Cl: Manufacturing calibration incorrect / erase

E 71 — Cl: Manufacturing calibration incorrect / erase

● Fluoride 0.05 - 2.0 mg/l F^-

Adjust sample temperature to that used for the calibration (±1°C).

Use special vial.

0.0.0 Perform zero calibration (see "Operation")

After zeroing remove the vial from the sample chamber. Pipet 2 ml of SPADNS-reagent[4]. The SPADNS-reagent must be measured accurately. Replace the cap tightly. Invert the vial gently several times to mix the contents. Place the vial back in the sample chamber making sure the Δ and ∇ marks are aligned. Place the cover on the sample chamber.

Zero / Test Press the ZERO/TEST key.

F The method symbol flashes for approx. 3 seconds.

RESULT The result is shown in the display in mg/l F^-.

Tolerance[2]: 5 % Full Scale[3]

● Notes

1) The special vials are not graduated, as the test result is highly dependent on exact sample and reagent volumes. The sample and reagent volumes should always be metered using a 10 or 2 ml full pipette.

2) For proof of accuracy use a 1 mg/l Fluorid Standard in place of the sample for each batch of SPADNS-reagent (as recommended by Standard Methods 20th, 1998, APHA, AWWA, WEF 4500-F^- D. S.4.82). Refer to Calibration Mode.

3) The accuracy of the method decreases above 1.4 mg/l. Better accuracy may be obtained by diluting a fresh sample 1:1 with deionized water and retesting. Multiply the result by 2.

4) SPADNS-reagent is toxic and corrosive ; use care while measuring.

5) SPADNS-reagent contains arsenite to eliminate interference up to 5 mg/l chlorine.

● Calibration Mode for Fluoride (for supplied standards with defined values)

The sample and reagent volumes should always be metered using a 10 or 2 ml full pipette. The calibration solution and the water samples to be tested should have the same temperature (± 1°C).

Mode Press MODE key and **keep it depressed**.

On / Off Switch unit on using ON/OFF key.
Release MODE key after approx. 1 second.

CAL
F Select the test required using the MODE key:
CAL CL → CAL F →..... (Scroll)

Perform zero calibration (see "Operation"). Instead of the sample use 10 ml of destilled water in a clean vial. Use a graduated pipet. Place the cover on the sample chamber.

Zero / Test Press the ZERO/TEST key.

F The method symbol flashes for approx. 3 seconds.

0.0.0 The display shows:

After zeroing remove the vial from the sample chamber. Pipet 2 ml of SPADNS-reagent[4]. The SPADNS-reagent must be measured accurately. Replace the cap tightly. Invert the vial gently several times to mix the contents. Place the vial back in the sample chamber making sure the Δ and ∇ marks are aligned. Place the cover on the sample chamber.

Zero / Test Press the ZERO/TEST key.

METHODE The method symbol flashes for approx. 3 seconds.

FO The display shows the following.

Empty the vial, rinse vial and cap several times with destilled water and dry. Measure 10 ml standard solution of 1 mg/l Fuoride accurately into the dry vial. Pipet 2 ml of SPADNS-reagent[4]. The SPADNS-reagent must be measured accurately. Replace the cap tightly. Invert the vial gently several times to mix the contents. Place the vial back in the sample chamber making sure the Δ and ∇ marks are aligned. Place the cover on the sample chamber.

Zero / Test Press the ZERO/TEST key.

F The method symbol flashes for approx. 3 seconds.

F1 The display shows the following:
(confirmation of calibration (adjustment))

On / Off Switch the unit off using the ON/OFF key. The new calibration is stored.

● Note

Calibration solutions and samples should be used at the same temperature (±1°C).

● Method notes

Observe application options, analysis regulations and matrix effects of methods. Reagent tablets are designed for use in chemical analysis only and should be kept well out of the reach of children.

If necessary, request safety data sheets.

Ensure proper disposal of reagent solutions.

● Troubleshooting: Guidelines for photometric measurements

1. Vials, caps and stirring rods should be cleaned thoroughly **after each analysis** to prevent errors being carried over. Even minor reagent residues can cause errors in the test results. Use the brush provided for cleaning.
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. Zero calibration and 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 zero calibration and test with the Δ-mark on the vial aligned with the ∇–mark on the instrument.
5. Place the cover on the sample chamber for zero calibration and test.
6. Bubbles on the inside of the vial may also lead to errors. In this case, fit the vial with a clean stopper and remove bubbles by swirling the contents before starting test.
7. Avoid spillage of water in the sample chamber. If water should leak into the photometer housing, it can damage electronic components and cause corrosion.
8. Contamination of the windows over the light source and photo sensor in the sample chamber can result in errors. If this is suspected check the condition of the windows.
9. Large temperature differentials between the photometer and the operating environment can lead to incorrect measurement due to, for example, the formation of condensate in the area of the lens or on the vial.

Technical changes without notice
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