thermoscientific

AQUAfast AQ3170 Chlorine Colorimeter User Guide

Version 1

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ThermoFisher
SCIENTIFIC

Important Information

⚠ 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.

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.

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! Thermo Scientific 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 Thermo Scientific instruments for disposal freight prepaid to your supplier.

Contents

General Notes

Guidelines for photometric measurements

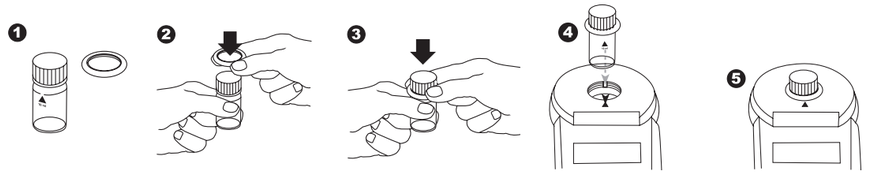
1. Vials, caps and stirring rods should be cleaned thoroughly after each analysis to prevent interference. Even minor reagent residues can cause errors in the test result.
2. The outside of the vial must be clean and dry before starting the analysis. Clean the outside of the vials with a towel to remove fingerprints or other marks.
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 zeroing and test with the Δ mark on the vial aligned with the Δ mark on the instrument.
5. Always perform zeroing and test with the vial cap tightly closed. Only use the cap with a sealing ring.
6. 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.
7. Avoid spillage of water into the sample chamber because this can lead to incorrect test results.
8. Contamination of the transparent cell chamber can result in wrong readings. Check at regular intervals and – if necessary – clean the transparent cell chamber using a moist cloth or cotton buds.
9. Large temperature differences between the instrument and the environment can lead to errors – e.g. due to the formation of condensation in the cell chamber or on the vial.
10. To avoid errors caused by stray light do not use the instrument in bright sunlight.
11. The reagents must be added in the correct sequence.

Method Notes

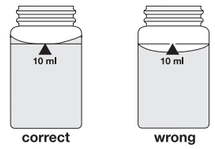
- Prior to measurement ensure that the sample is suitable for analysis (no major interferences) and does not require any preparation i.e. pH adjustment, filtration etc.
- Reagents are designed for use in chemical analysis only and should be kept well out of the reach of children.
- Ensure proper disposal of reagent solutions.
- Safety Data Sheets are available on request.

General Notes

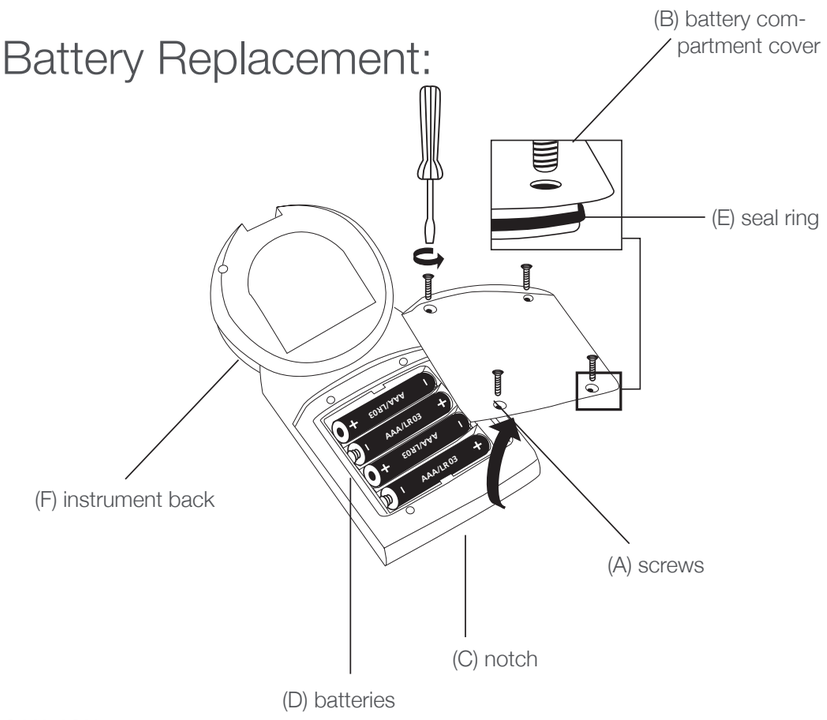
Correct position of the vial (Ø 24 mm):



Correct filling of the vial:



Battery Replacement:



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

If the batteries are removed for more than one minute the date and time menu starts automatically when the photometer is switched on the next time.

Functional Description

Operation

On Off

Switch the unit on using the [ON/OFF] key.

The display shows the following: "CL L" or "CL H"

Mode

Select the required test using the [MODE] key.

Scroll Memory (SM)
To avoid unnecessary scrolling for the required test method, the instrument memorizes the last method used before being switched off. When the instrument is switched on again, the scroll list comes up with the last used test method first.

The display shows the following: "CL L" or "CL H"

Fill a clean vial with the water sample up to the 10 ml mark, screw the cap on and place the vial in the sample chamber making sure that the ◬ marks are aligned.

Zero Test

Press the [ZERO/TEST] key.

The "CL L" or "CL H" symbol flashes for approx. 8 seconds.

0.0.0

The display shows the following: 0.0.0

After zero calibration is completed, remove the vial from the sample chamber. Add the reagent to the vial according to the specific reagent instructions. The characteristic coloration appears after the addition of the reagent.

Replace the cap on the vial and place in the sample chamber making sure that the ◬ marks are aligned.

Zero Test

Press the [ZERO/TEST] key.
(For Countdown/reaction period see page 7)

The "CL L" or "CL H" symbol flashes for approx. 3 seconds.

The result appears in the display.

The result is saved automatically.

Repeating the test:

Zero Test

Press the [ZERO/TEST] key again.

Repeating the zero:

Zero Test

Press the [ZERO/TEST] key for 2 seconds.

Functional Description

Display Backlight

Option

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

Recall of Stored Data

Option

If the instrument is switched on, press the [Option] key for more than 4 seconds to access the recall menu.

Timer / Reaction Period

If a reaction period is included in a method a countdown function can be used:

Option

Press the [Option] key and hold.

Zero Test

Press the [ZERO/TEST] key.

Release the [Option] key; the countdown starts.

After the countdown is finished the measurement starts automatically.

It is possible to interrupt the countdown by pressing the [ZERO/TEST] key. Measurement starts immediately.

Caution:
An incomplete reaction period can lead to incorrect test results.

CL L

Chlorine, Low Range, with Powder Pack Reagent
0.02 – 2.0 mg/l

If necessary, press the [MODE] key until the CL L mode is shown.

a) Free Chlorine

1. Fill a clean vial (24 mm Ø) with **10 ml of the water sample** and close the vial tightly with the cap. Wipe the exterior of the vial with a lint-free tissue. (See Notes 2 and 3)
2. Place the vial into the sample chamber making sure that the marks are aligned.
3. Press the [ZERO/TEST] key to perform a zero calibration.
4. Remove the vial from the sample chamber.
5. Add the contents of **one Chlorine Free-DPD Powder Pack Reagent** 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 seconds).
7. Place the vial in the sample chamber making sure that the marks are aligned.
8. Press the [ZERO/TEST] key. The **CL L** symbol will flash for approximately 3 seconds.
9. The result will be shown in the display in mg/l Free Chlorine.

b) Total Chlorine

1. Remove the vial from the sample chamber.
2. Rinse the vial and the cap several times and then fill the vial with **10 ml of water sample** (see Notes 2 and 3).
3. Add the contents of **one Chlorine Total-DPD Powder Pack Reagent** straight from the foil into the water sample.
4. Close the vial tightly with the cap and invert several times to mix the contents (20 seconds).
5. Place the vial in the sample chamber making sure that the marks are aligned.
6. **Wait for a reaction period of 3 minutes.**
   To activate the countdown:
   a. Press and hold the [Option] key.
   b. Press the [ZERO/TEST] key.
   c. Release the [Option] key and the countdown will start.
7. After the 3 minute countdown, the measurement will start automatically or press the [ZERO/ TEST] key. The **CL L** symbol will flash for approximately 3 seconds.
8. The result will be shown in the display in mg/l Total Chlorine.

c) Combined Chlorine

Combined Chlorine = Total Chlorine – Free Chlorine

Tolerances:

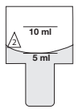
0 – 1 mg/l: ± 0.05 mg/l
> 1 – 2 mg/l: ± 0.10 mg/l

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. Do not use the same sample vial for free and total chlorine without thoroughly rinsing the vial between the two different tests.
4. Preparing the sample:
   The analysis must take place immediately after taking the sample.
5. The DPD color 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).
6. Exceeding the measuring range:
   Concentrations above 2 mg/l chlorine can lead to results showing 0 mg/l. In this case, the water sample must be diluted with water free of chlorine and the measurement repeated.
7. Oxidizing agents such as bromine, ozone etc. interfere as they react in the same way as chlorine.

Reagent	Quantity	Cat. No.
Clorine Free-DPD Powder Pack Reagent	100 CT	AC4P71
Chlorine Total-DPD Powder Pack Reagent	100 CT	AC4P72
Chlorine Bulk Powder Dispenser, Free	250 CT	AQ250F
AQ250F Refill Free Chlorine, 1 Vial	250 CT	AC71P1
AQ250F Refill Free Chlorine, 2 Vials	2 x 250 CT	AC71P2
Chlorine Bulk Powder Dispenser, Total	250 CT	AQ250T
AQ250T Refill Total Chlorine, 1 Vial	250 CT	AC72P1
AQ250T Refill Total Chlorine, 2 Vials	2 x 250 CT	AC72P2
Chlorine Primary Standard Kit	1.5 mg/l	CLSK100
Chlorine Secondary Standard Kit	0.0, 0.20 and 1.0 mg/l	CLSK200

CL H



Chlorine with Powder Pack Reagent (plastic vial type 2, ⊔ 10 mm) 0.1 – 8.0 mg/l

If necessary, press the [MODE] key until the CL H mode is shown.

a) Free Chlorine

0.0.0

Fill a clean vial (10 mm ⊔) with **5 ml of the water sample** and perform zero calibration (see “Operation”).

Add the contents of **two Chlorine Free-DPD Powder Pack Reagents** straight from the foil into the water sample.

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

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

Zero Test

CL H

Press the [ZERO/TEST] key.

The **CL H** symbol flashes for approx. 3 seconds.

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

b) Total Chlorine

0.0.0

Fill a clean vial (10 mm ⊔) with **5 ml of the water sample** and perform zero calibration (see “Operation”).

Add the contents of **two Chlorine Total-DPD Powder Pack Reagents** straight from the foil into the water sample.

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

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

Wait for a reaction period of 3 – 6 minutes.

Zero Test

CL H

Press the [ZERO/TEST] key.

The **CL H** symbol flashes for approx. 3 seconds.

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

c) Combined Chlorine

Combined Chlorine = Total Chlorine – Free Chlorine

Tolerances:

2 – 3 mg/l: ± 0.2 mg/l
> 3 – 4 mg/l: ± 0.3 mg/l
> 4 – 8 mg/l: ± 0.4 mg/l

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. Do not use the same sample vial for free and total chlorine without thoroughly rinsing the vial betweeen the two different tests.
4. 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.
5. The DPD color 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).
6. Concentrations above 8 mg/l chlorine can lead to results showing 0 mg/l. In this case, the water sample must be diluted with water free of chlorine and the measurement repeated.
7. If chlorine is at concentrations under 2 mg/l, the 0.02 - 2 mg/l measurement range should be used (CL L).
8. Oxidizing agents such as bromine, ozone etc. interfere as they react in the same way as chlorine.

Reagent	Quantity	Cat. No.
Clorine Free-DPD Powder Pack Reagent	100 CT	AC4P71
Chlorine Total-DPD Powder Pack Reagent	100 CT	AC4P72
Chlorine Bulk Powder Dispenser, Free	250 CT	AQ250F
AQ250F Refill Free Chlorine, 1 Vial	250 CT	AC71P1
AQ250F Refill Free Chlorine, 2 Vials	2 x 250 CT	AC71P2
Chlorine Bulk Powder Dispenser, Total	250 CT	AQ250T
AQ250T Refill Total Chlorine, 1 Vial	250 CT	AC72P1
AQ250T Refill Total Chlorine, 2 Vials	2 x 250 CT	AC72P2
Chlorine Primary Standard Kit	1.5 mg/l	CLSK100
10 mm Plastic Vials	12 Pack	AC2V10

Methods

Menu Selections

Mode / On Off / Option

Switch the unit off.

Press the [MODE] key and hold.

Switch the unit on using the [ON/OFF] key.
Allow the 3 decimal points to be displayed before releasing the [MODE] key.

The [Option] key allows for selection of the following menu points:

diS recall stored data

dAtE setting the date and time

CAL user calibration

diS

diS – Recall of Stored Data

Mode

After confirming the selection with the [MODE] key the photometer shows the last 16 data sets in the following format (automatically proceeds every 3 seconds until result is displayed):

Number	n xx (xx: 16...1)
Year	YYYY (e.g. 2014)
Date	mm.dd (monthmonth:dayday)
Time	hh:mm (hourhour:minuteminute)
Test	Method
Result	x,xx

Zero Test

The [ZERO/TEST] key repeats the current data set.

Mode

The [MODE] key scrolls through all stored data sets.

Option

Quit the menu by pressing [Option] key.

dAtE

Setting Date and Time (24-hour-format)

Mode

After confirming the selection with the [MODE] key the value to be edited will be shown for 2 sec.

SET
DATE
YYYY
(2 sec.)

The setting starts with the year (YYYY) followed by the actual value to be edited. The same applies for month (mm), day (dd), hour (hh) and minutes (mm). Set the minutes first in steps of 10, press the [Option] key to continue setting the minutes in steps of 1.

Mode

Increase the value by pressing the [MODE] key.

Zero Test

Decrease the value by pressing [ZERO/TEST] key.

Option

Proceed to the next value to be edited by pressing [Option] key.

After setting the minutes and pressing the [Option] key the display will show “IS SET” and the instrument returns to the measurement mode.

Menu options - Calibration Mode

Cal CAL

CAL – User Calibration

Note:

cAL user calibration (Display in calibration mode)

CAL factory calibration (Display in calibration mode)

CAL
METHOD

After confirming the selection with the [MODE] key the instrument will show CAL/"Method".

Scroll through methods using the [MODE] key.

Fill a clean vial with the standard up to the 10 ml mark, screw the cap on and place the vial in the sample chamber making sure that the ∆ marks are aligned.

Zero Test
METHOD
0.0.0
CAL

Press the [ZERO/TEST] key.

The method symbol flashes for approx. 8 seconds.

The display shows the following in alternating mode:

Perform calibration with a standard of known concentration (see "Operation").

Zero Test
METHOD

Press the [ZERO/TEST] key.

The method symbol flashes for approx. 3 seconds.

RESULT
CAL

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

If the reading corresponds with the value of the calibration standard (within the specified tolerance), exit calibration mode by pressing the [ON/OFF] key.

Mode
Zero Test
CAL
RESULT + x
On Off
: :

Changing the displayed value:

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.

Press the corresponding key until the reading equals the value of the calibration standard.

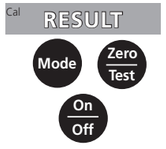
By pressing the [ON/OFF] key, the new correction factor is calculated and stored in the user calibration software.

Confirmation of calibration (3 seconds).

Calibration Mode

Factory Calibration Reset

Resetting the user calibration to the original factory calibration will reset all methods and ranges.



A user calibrated method is indicated by a "Cal" symbol while the test result is displayed.

To reset the calibration press both the [MODE] and [ZERO/TEST] key and **hold**.

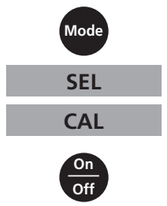
Switch the unit on using the [ON/OFF] key.
Release the [MODE] and [ZERO/TEST] keys after approx. 1 second.

The following messages will appear in turn on the display:

The factory setting is active.
(SEL stands for Select)

or:

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



Calibration is reset to the factory setting by pressing the [MODE] key.

The following messages will appear in turn on the display:

Switch the unit off using the [ON/OFF] key.

Technical Data

Technical Data

Instrument	single wavelength, direct reading colorimeter
Light source:	LED, interference filter (IF) and photosensor in transparent cell chamber. Wavelength specifications of the IF: 530 nm $\Delta\lambda$ = 5 nm
Wavelength accuracy	± 1 nm
Photometric accuracy*	3% FS (T = 20° C – 25° C)
Photometric resolution	0.01 A
Power supply	4 batteries (AAA/LR 03)
Operating time	17hr operating time or 5000 test measurements in continuous mode when display backlight is off
Auto-OFF	automatic switch off 10 minutes after last keypress
Display	backlit LCD (on keypress)
Storage	internal ring memory for 16 data sets
Time	real time clock and date
Calibration	user and factory calibration resetting to factory calibration possible
Dimensions	155 x 75 x 35 mm (LxWxH)
Weight	approx. 260 g (incl. batteries)
Ambient conditions	temperature: 5– 40 °C rel. humidity: 30–90 % (non-condensing)
Waterproof	as defined in IP 67
CE	Certificate for Declaration of CE-Conformity

*measured with standard solutions

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

Operating Messages - Error Codes

Operating Messages

Hı	Measuring range exceeded or excessive turbidity.
Lo	Result below the lowest limit of the measuring range.
	Replace batteries, no further tests possible.
btLo	Battery capacity is too low for the display backlight; measurement is still possible.
Cal **RESULT**	A user calibrated method is indicated by a "Cal" symbol while the test result is displayed. (see "Factory calibration reset").

Error Codes

E27 / E28 / E29	Light absorption too great. Reasons: e.g. dirty optics.
E 10 / E 11	Calibration factor "out of range"
E 20 / E 21	Too much light reaching the detector.
E23 / E24 / E25	
E 22	Battery capacity was too low during measurement. Change battery.

E 70	CL L: Factory calibration incorrect / erased
E 71	CL L: User calibration incorrect / erased
E 72	CL H: Factory calibration incorrect / erased
E 73	CL H: User calibration incorrect / erased

Technical Support

For any questions or if you require assistance, contact our Technical Support Specialists:

- Email wai.techservbev@thermofisher.com
- Within the United States, call 1-800-225-1480
- Outside the United States, call +1-978-232-6000 or fax +1-978-232-6031

For additional product information, contact your local authorized dealer, Thermo Scientific Orion technical sales representative or contact us using the Water and Laboratory Products (WLP) information on the back page of this user manual.

Ordering Information

AQ3170	Orion AQUAfast chlorine colorimeter with 100 free chlorine DPD powder packs, 100 total chlorine DPD powder packs, sample vials, field case, batteries and literature
AC4P71	Orion AQUAfast free chlorine DPD powder packs, 100 tests
AC4P72	Orion AQUAfast total chlorine DPD powder packs, 100 tests
AQ250F	Orion AQUAfast free chlorine DPD bulk powder dispenser with one vial x 250 count
AQ250T	Orion AQUAfast total chlorine DPD bulk powder dispenser with one vial x 250 count
CLSK100	Orion AQUAfast chlorine primary standard kit to prepare 1.5 mg/L NIST-traceable chlorine standard
CLSK200	Orion AQUAfast chlorine secondary standards kit (0.0, 0.20 and 1.0 mg/l chlorine)
AC2V24	Orion AQUAfast replacement 24mm vials, 12 pack
AC3SR24	Orion AQUAfast replacement sealing rings for 24mm vials, 12 pack
AC2V10	Orion AQUAfast replacement 10mm vials, 12 pack

Find out more at **thermofisher.com/water**

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