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Chapter 1 Introduction

General Information

This user guide contains information on the preparation, operation and maintenance of the Thermo Scientific Orion AQ3070 colorimetry meter. This user guide provides both a step by step guide to help you operate the waterproof AQ3070 meter and serves as a handy reference guide.

Follow the basic instructions contained in this user guide during the operation, care and maintenance of the meter. The safety protections provided by this equipment may be impaired if it is used in a manner not described in this user guide. It is recommended that all operators should read this user guide prior to working with this meter.

The manufacturer will not accept any responsibility for damage or malfunction to the meter caused by improper use of the meter.

The information presented in this user guide is subject to change without notice as improvements are made, and does not represent a commitment on the part of the manufacturer.

Note: The manufacturer reserves the right to make improvements in design, construction and appearance of products without notice.

AQ3070 Meter Overview

Thank you for selecting the waterproof portable AQ3070 colorimetry meter. The AQ3070 meter allows you to measure colorimetry of an aqueous sample in the field. The AQ3070 meter allows you to measure up to five parameters – free chlorine, total chlorine, cyanuric acid, pH and chlorine dioxide – of an aqueous sample.

The free and total chlorine parameters use our EPA approved methods AC4P71 for free chlorine and AC4P72 for total chlorine.
The table below indicates the items that you should find in your colorimetry meter shipment. Remove the AQ3070 colorimetry meter from the packing carton. Carefully inspect all items to ensure that no visible damage has occurred during shipment. If the items you received do not match your order, please contact Technical Support or your local dealer immediately.

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AQ3070 colorimeter with 4 AAA batteries</td>
</tr>
<tr>
<td>1</td>
<td>User guide</td>
</tr>
<tr>
<td>1</td>
<td>Meter carrying case</td>
</tr>
<tr>
<td>6</td>
<td>Sample vials</td>
</tr>
<tr>
<td>1</td>
<td>Vial cleaning brush</td>
</tr>
<tr>
<td>1</td>
<td>Tablet tamping stir rod</td>
</tr>
<tr>
<td>1 pack of 100 tests</td>
<td>Free chlorine reagent powder packs (AC4P71)</td>
</tr>
<tr>
<td>1 pack of 100 tests</td>
<td>Total chlorine reagent powder packs (AC4P72)</td>
</tr>
</tbody>
</table>

The following items can be purchased separately in addition to the AQ3070 colorimeter.

<table>
<thead>
<tr>
<th>Cat. No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC4P71</td>
<td>Free chlorine reagent powder packs (100 tests)</td>
</tr>
<tr>
<td>AC4P72</td>
<td>Total chlorine reagent powder packs (100 tests)</td>
</tr>
<tr>
<td>AC2098</td>
<td>Cyanuric acid reagent tablets (100 tests)</td>
</tr>
<tr>
<td>AC2099</td>
<td>Chlorine dioxide reagent tablets (100 tests)</td>
</tr>
<tr>
<td>AC3001</td>
<td>pH indicator, 2 x 15 mL dropper bottles (60 tests)</td>
</tr>
<tr>
<td>AC3V25</td>
<td>Replacement 25 mm vials, pack of 3</td>
</tr>
<tr>
<td>AC3ROD</td>
<td>Replacement tablet tamping stir rod, pack of 10</td>
</tr>
<tr>
<td>AC3CBR</td>
<td>Replacement vial cleaning brush, pack of 10</td>
</tr>
</tbody>
</table>
**Warning:** Extra care should be taken when unpacking, opening and handling the sample vials. Surface scratches or finger smudges on the sample vial surface may cause measurement errors. Handle the vials by their caps only.

The batteries provided with the meter package are to be installed prior to use. Refer to the **Battery Installation** section.

**Figure 1** depicts the meter. The three main components of the meter are the sample well, the display and the keypad. The following sections describe the functionality of the display and the keypad. The proper use of the meter and the sample well are discussed in later sections.
Display

All the LCD segments and annunciators that can appear on the display are shown in Figure 2. The display is used for reporting the test results and to provide guidance for the operation of the meter. In addition, the display has several other annunciators that are used to communicate error messages and provide user information.

Figure 2
Customized LCD with Annunciators

14-segment Liquid Crystal Display

CAL 13 CAL 24 TAvg

mg/l

pH

Battery Indicator

Units of Measurement

Calibration Standards
### Keys and Functions

The keypad has four keys: **ON/OFF**, **MODE**, **READ/ENTER** and **ZERO**.

<table>
<thead>
<tr>
<th>Key</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="ON/OFF" /></td>
<td>Powers on and off the meter. The meter automatically shuts off 10 minutes after last key press to conserve the battery life.</td>
</tr>
<tr>
<td><img src="image" alt="mode" /></td>
<td>Selects the test to be performed. Selects the calibration point by scrolling during calibration.</td>
</tr>
<tr>
<td><img src="image" alt="read enter" /></td>
<td>Initiates the measurement of the sample after the chemical reagent has been added. Confirms the test selection.</td>
</tr>
<tr>
<td><img src="image" alt="zero" /></td>
<td>Zeros the meter (sets the meter zero point) before chemical reagent is added to the sample. Initiates the calibration mode when used with the ON/OFF key. aborts the calibration process without saving. Exits the calibration mode.</td>
</tr>
</tbody>
</table>

![Figure 3 Keypad](image)
Battery Installation

Four AAA batteries are included in the carrying case.

**Note:** Use caution when loosening the screws, as some of the screws may be tightly seated.

1. Use a Phillips screwdriver to loosen the four screws holding the battery cover. See **Figure 4**. These captive screws will remain attached to the battery cover.

2. Remove the battery cover.

3. Insert the batteries. Follow the diagram inside the cover for the correct polarity.

4. Replace the battery cover in its original position and tighten the four screws removed earlier to secure the battery cover to the meter.

5. The meter is now ready for use.

**Note:** Dispose of used batteries in accordance with your local regulations.
Chapter 2  Colorimetry Measurement

General Information

The AQ3070 waterproof colorimetry meter allows you to measure up to five parameters – free chlorine, total chlorine, cyanuric acid, pH and chlorine dioxide – of a sample and reports the results in appropriate units (mg/L or pH). Each specific measurement has its own range, as listed in the Specifications section. The meter has been calibrated at the factory and is ready to take measurements out of the box.

The meter will go through a power sequence as shown below.

![Figure 5 Power Up Sequence]

An accurate colorimetry measurement depends on good measurement techniques. Factors such as clean sample vials, positioning of vial in the sample well, using a vial with a light shield cap, meter calibration, handling of meter and others have to be taken into consideration.

Notes

- Do not pour liquid directly into the sample well of the meter. Always use a vial. The meter will only accurately measure the sample when vials sealed with the black caps are used. The black cap serves as both seal and a light shield.

- Do not attempt to clean the sample well. The optics may be damaged.

- This meter is designed to measure solutions contained in the custom made glass vials and therefore the use of other type of sample vials or sample cells may result in inaccurate measurements.

- Reagent MSDS files can be obtained from www.thermo.com/water by reagent part number.
1. Obtain a clean and dry sample vial. See Figure 6.

2. Handle the sample vial by the top.

3. Rinse the vial with approximately 10 mL of the sample solution, capping the vial with the black cap and gently inverting it several times. Discard the used sample and repeat the rinsing procedure two times.

4. Fill the rinsed vial with approximately 10 mL of the sample solution, up to the mark indicated on the vial. See Figure 7. Cap the vial with the supplied black cap.

5. Wipe the vial with a soft, lint-free cloth. Ensure that the outside of the vial is dry, clean and free from smudges.

6. Place the vial into the meter for measurement.
Measurement Procedure

1. Place the AQ3070 colorimetry meter on a flat and level surface.

2. Zero the meter using a sample vial filled with deionized water.

3. Place the sample vial inside the sample well and align the vial alignment mark with the meter alignment mark. See Figure 8.

4. Push the vial down until it slides fully into the meter.

5. Turn on the meter by pressing the ON/OFF key.

6. The display will indicate the last test that was performed. Press the MODE key to select the desired test to be performed.

7. Press the READ/ENTER key to confirm your selection. The meter will display [STbY], indicating that it is ready to accept a blank sample of deionized water to perform a zero calibration.

8. Press the ZERO key to zero the meter.

9. Remove the sample vial used for zeroing the meter and add the appropriate reagent to it. Cap the vial and follow the appropriate instructions for proper mixing and the time required to develop the color for each reagent.

10. Place the vial with the developed color into the sample well and align the alignment mark on the vial with the alignment mark on the meter. Press the vial down until it slides fully into the optical holder.

11. Press the READ/ENTER key. The meter will display the reading in the appropriate units within three seconds.

12. To perform a measurement of the same sample, repeat steps 8 through 11.

Note: For greater accuracy, perform a zero on each sample vial to remove or “zero out” sample and vial effects.
The AQUAfast AC4P71 method for free chlorine and the AQUAfast AC4P72 method for total chlorine are approved for reporting chlorine levels in drinking water and wastewater to the US EPA. These tests may also be used for measuring the chlorine levels in water, treated water, natural waters and seawater, as well as other aqueous environmental samples. The EPA methods are available at www.thermo.com/waterapps.

**Note:** The EPA testing range is 0 to 2 mg/L Cl₂.

### Chlorine, Free and Total Test Procedure

1. Switch the meter on by pressing the **ON/OFF** key.

2. Press the **MODE** key until [CL-F] is displayed for free chlorine determination or [CL-T] is displayed for total chlorine determination.

3. Press the **READ/ENTER** key to confirm the desired test parameter. The meter will display [STbY], indicating that it is in the standby mode and waiting for measurement or a blank sample of deionized water to perform a zero calibration.

4. Select a clean and dry vial, unscrew the cap and fill the vial with the sample to the line on the vial. Replace the cap, ensuring that it is screwed on finger-tight to the vial.

5. Ensure that the outside of the vial is clean, dry and absent of any marks or fingerprints. Gently push the vial into the sample well of the meter, while aligning the alignment mark on the vial with the alignment mark on the meter. Press the vial down until it slides fully into the optical holder.

6. Press the **ZERO** key to initiate the zeroing of the meter. The display will show [ZERo] while zeroing is taking place.

**Note:** The meter will store the last zero value, even if the meter is turned off or if the batteries are removed.
7. Remove the vial from the meter and add the contents of one AC4P71 free chlorine powder pack for free chlorine determination or the contents of one AC4P72 total chlorine powder pack for total chlorine determination.

8. Replace the cap, ensuring that it is screwed on finger-tight to the vial. Gently swirl the vial repeatedly for approximately twenty seconds, until the powder has dissolved.

**Note:** A small amount of the powder may remain undissolved in the vial, but this will not affect the measurement.

![Image of adding powder to vial and swirling](image)

9. Gently push the vial back into the sample well of the meter, while aligning the alignment mark on the vial with the alignment mark on the meter. Press the vial down until it slides fully into the optical holder.

10. For free chlorine determination, press the **READ/ENTER** key within a few seconds after the free chlorine powder was added to the vial.

11. For total chlorine determination, wait two minutes and then press the **READ/ENTER** key within four minutes after the total chlorine powder was added to the vial.

12. The meter will flash either [CL-F] or [CL-T], depending on which test is performed, while the measurement is taken. The meter will then display the chlorine concentration in milligrams per liter (mg/L) Cl₂.

![Image of meter displaying CL-F and concentration](image)
Sample Collection

- Chlorine determination must take place as soon as possible after the sample is taken or low results may be obtained.

- Plastic containers should not be used to collect the sample because these may have a high chlorine demand that will lead to low reading results. It is recommended to wash the container with sample water before the sample is collected.

- Avoid agitating the sample excessively, as this may lead to low results. Swirling the vial is the best way to dissolve and mix the reagent.

Sample Measurement

- If the pink color forms and then rapidly fades, it is an indication that the chlorine concentration may be very high. If this is the case, dilute the sample with deionized water and retest it. Multiply the result by the dilution factor. Results obtained by this method will not be as accurate as stated in this user guide because some chlorine will be lost in the dilution process.

Example: If the sample was diluted 1:1 with deionized water (i.e. 1 part sample water to 1 part deionized water), the result is multiplied by 2 to give the true concentration of the original sample.

- After use, the vial should be cleaned thoroughly to avoid contaminating the next sample. Do not use household cleaners, as these may have a chlorine demand that will lead to low results on subsequent tests.

- After testing total chlorine, give extra attention to cleaning the vial as any residual reagent will affect any subsequent free chlorine tests. It is recommended to use separate vials for free and total chlorine.

Interferences

- Acidity – Greater than 250 mg/L CaCO₃ may cause an interference. To remove this interference, neutralize a separate sample to pH 6 - 7 using 1 N sodium hydroxide. Record the volume used and add the same volume of 1 N sodium hydroxide to the sample before carrying out the test procedure. Use a multiplication factor to correct for the dilution of the sample.
• Alkalinity – Greater than 250 mg/L CaCO_3 may cause an interference. To remove this interference, neutralize a separate sample to a pH of 6 to 7 using 1 N sulfuric acid. Note the volumes used and add the same volume of 1 N sulfuric acid to the sample before performing the test procedure. Use a multiplication factor to correct for the dilution of the sample.

• Hardness – No effect at less than 2000 mg/L CaCO_3.

• Monochloramine – Monochloramine will cause a gradual increase in the free chlorine results over time. Take the test result within one minute of adding the reagent pack to avoid these errors.

• Oxidants, including bromine, chlorine dioxide, iodine and ozone – These will interfere with the test method at all levels. It is recommended that an alternative test method be used if more than two of these species are present.

• Oxidized manganese or oxidized chromium – All levels will cause an interference. To remove this interference:
  1. Test a 10 mL sample as described in the measurement procedure.
  2. Adjust the pH of a separate 10 mL sample to a pH of 6 to 7 using 1 N sodium hydroxide or 1 N sulfuric acid.
  3. Add one drop of 20% potassium iodide solution, swirl to mix and then wait sixty seconds.
  4. Add three drops of 5 g/L sodium arsenite solution and swirl to mix.
  5. Use this as the sample in the test procedure and make a note of the result. Use a multiplication factor to correct for the dilution of the sample with reagents.
  6. Subtract the result obtained in step 5 from the result obtained in step 1 to give the true result.
  7. To correct for any reagent added to the sample to neutralize it, a dilution correction factor must be used:

\[
\text{Final Volume} / \text{Initial Sample Volume} = \text{Correction Factor}
\]

The final volume can be calculated by adding together the initial sample volume and the volume of neutralizing reagent used:

\[
\text{Final Volume} = \text{Initial Sample Vol.} + \text{Neutralizing Reagent Vol.}
\]

The result from a test can then be multiplied by the correction factor to give the true result.

If reagents are added from the supplied dropper bottles, then twenty five drops is equal to 1 mL.
Example: A 50 mL sample is neutralized using 50 drops of 1 N sulfuric acid and each drop is 0.04 mL.

Initial Sample Volume = 50 mL

Volume of Neutralizing Reagent = 50 drops • 0.04 mL = 2 mL

Final Volume = 50 mL + 2 mL = 52 mL

Correction Factor = 52/50 = 1.04

A result of 1.00 mg/L would then be 1.00 mg/L • 1.04 = 1.04 mg/L

Producing chlorine standards is a difficult procedure that should only be attempted by trained laboratory staff. Details of preparation techniques are not provided in this document. The prepared chlorine standard may be used to check the accuracy of the meter or to recalibrate the meter. In almost all cases it is recommended to use the default factory calibration.

To check the accuracy of the meter, prepare a standard solution of known concentration within the range of the meter. It is recommended to prepare a standard near to the concentration value usually tested with the meter. Use this standard in place of the sample solution in the test method. Repeat the measurement five to seven times with different reagent packs and average the results. The result obtained should be approximately the value of the standard used. Refer to the Specifications section for data on the meter accuracy and precision.

All meters are factory calibrated and user calibration is not recommended. However, if a chlorine standard can be prepared, measured accurately and qualified by a different method (i.e. titration) or another meter of higher accuracy and precision, then a chlorine standard in the 1.6 to 2.5 mg/L Cl₂ range can be used. Refer to the Free Chlorine, Total Chlorine and Chlorine Dioxide Calibration section for details.

Chlorine exists in water as uncombined (free) chlorine and combined chlorine. The concentration of free chlorine can be determined directly and the concentration of combined chlorine may be calculated by subtracting the concentration of free chlorine from that of total chlorine.

In the free chlorine test method uncombined chlorine reacts directly with DPD (N,N-diethyl-p-phenylenediamine) in a conditioned sample to give a pink color. In the total chlorine test method, combined chlorine reacts with potassium iodide to form tri-iodide ions. The tri-iodide and free chlorine react with DPD in a conditioned sample to give a pink color.

The depth of the pink color produced is proportional to the concentration of chlorine. The amount of 525 nm light absorbed by the pink color is accurately measured by the meter and then converted into the chlorine concentration.
Cyanuric Acid (5 to 90 mg/L)

Cyanuric Acid Test Procedure

This method for cyanuric acid is applicable to water and treated water.

1. Switch the meter on by pressing the ON/OFF key.

2. The AQ3070 colorimeter will display the last test that was performed. Press the MODE key until [CYNA] is displayed.

3. Press the READ/ENTER key to confirm the test parameter. The meter will read [STbY], indicating it is in the standby mode, waiting a measurement or a blank sample of deionized water to perform a zero calibration.

4. Select a clean and dry vial, unscrew the cap and fill the vial with sample solution to the line on the vial. Replace the cap, ensuring that it is screwed on finger-tight on the vial.

5. Ensure that the outside of the vial is clean, dry and absent of any marks or fingerprints. Gently push the vial into the meter, while aligning the alignment mark on the vial with the alignment mark on the meter. Press the vial down until it slides fully into the optical holder.

6. Press the ZERO key to zero the meter to that vial; the meter will read [ZERo] while this is taking place.

   **Note:** The meter will store the last zero value, even if the meter is turned off or if the batteries are removed.

7. Remove the vial from the meter and unscrew the cap. Select a cyanuric acid reagent tablet, Cat. No. AC2098. Open the pack and drop the tablet into the vial, without touching the tablet. Use the stir rod to crush the tablet and mix the solution.

8. Replace the cap, ensuring that it is screwed on finger-tight to the vial. Gently swirl the vial for one minute to mix.

   **Note:** A small amount of the powder may remain undissolved in the vial, but this will not affect the reading.
9. Gently push the vial into the sample well of the meter, while aligning the alignment mark on the vial with the alignment mark on the meter. Press the vial down until it slides fully into the optical holder.

10. Wait for two minutes and press the READ/ENTER key within five minutes from the time the cyanuric acid reagent was added to the vial.

11. The meter will flash [CYNA] while the measurement is taken. It will then display the cyanuric acid concentration in milligrams per liter (mg/L).

Cyanuric Acid Measuring Hints and Tips

Sample Collection

- Samples may be collected in either plastic or glass bottles. It is recommended to wash the container with the sample solution before collecting the sample.

- Do not store the sample for more than twenty four hours before conducting the analysis.

Sample Measurement

- Due to the nature of the test method, concentrations less than 5 mg/L cyanuric acid are not detectable.

- Clean the vial immediately after taking and recording a reading. Do not leave the sample with added reagent into the vial for more than few minutes after measurement. The test will cause the build up of a cloudy layer on the inside wall of the vial. It is important to thoroughly clean the vial after use to remove this layer because subsequent test results may be affected.
Interferences

- Sample turbidity – Turbid samples should be filtered prior to analysis.

Cyanuric Acid Accuracy Check and User Calibration

A stock solution of 1000 mg/L cyanuric acid may be produced by dissolving exactly 1 gram of cyanuric acid in 1 liter of deionized water. Check the purity of the cyanuric acid being used and if it is less than 100%, adjust the amount used accordingly.

The stock solution may then be diluted to give a cyanuric acid standard. Take a portion of the stock solution and make up to 1 liter using deionized water. For example, 50 mL of stock solution will produce a 50 mg/L standard.

To check the accuracy of the meter, prepare a standard in the range 20 to 80 mg/L. It is recommended to check a standard at near the concentration usually tested for using the meter. Use this standard in place of the sample solution in the test method. The result obtained should be approximately the value of the standard used. Refer to the Specifications section for data on the meter accuracy and precision.

All meters are factory calibrated and user calibration is not recommended. However, if a cyanuric acid standard can be accurately prepared, or measured by a different method or meter of higher accuracy and precision, then a cyanuric acid standard in the 66 to 75 mg/L range can be used. Refer to the Cyanuric Acid Calibration section for details.

Cyanuric Acid Chemistry

Cyanuric acid is commonly used to stabilize the chlorine present in swimming pool water. With correct pool maintenance, cyanuric acid buildup is uncommon; however, if correct maintenance is not carried out, the levels may build up until potentially harmful.

In the test method, the cyanuric acid reacts with the tablet reagent, in a conditioned sample, to produce a suspended turbidity.

The amount of turbidity produced is proportional to the concentration of cyanuric acid. The amount of 525 nm light absorbed/scattered by the turbidity is accurately measured by the meter and then converted into the cyanuric acid concentration.
pH Test Procedure

This phenol red method for pH is applicable to water and wastewater.

1. Switch the meter on by pressing the **ON/OFF** key.

2. The AQ3070 colorimeter will display the last test that was performed. Press the **MODE** key until [PH] is displayed.

3. Press the **READ/ENTER** key to confirm the test parameter. The meter will read [STby], indicating it is in the standby mode, waiting for either a measurement or a blank sample of deionized water to perform a zero calibration.

4. Select a clean and dry vial, unscrew the cap and fill the vial with sample solution to the line on the vial. Replace the cap, ensuring that it is screwed on finger-tight on the vial.

5. Ensure that the outside of the vial is clean, dry and absent of any marks or fingerprints. Gently place the vial into the sample well of the meter, while aligning the alignment mark on the vial with the alignment mark on the meter. Press the vial down until it slides fully into the optical holder.

6. Press the **ZERO** key to zero the meter to that vial; the meter will read [ZERo] while this is taking place.

   **Note:** The meter will store the last zero value, even if the meter is turned off or if the batteries are removed.

7. Remove the vial from the meter and unscrew the cap. Select a bottle of pH indicator (phenol red), Cat. No. AC3001. Unscrew the cap, hold the bottle vertically and gently squeeze eleven drops of the phenol red into the contents of the vial. Replace the cap on the phenol red bottle. Take extra care not to overtighten the cap.
8. Replace the cap onto the vial, ensuring that it is screwed on finger-tight. Gently swirl the vial several times, using a circular motion and making sure not to create bubbles, to mix the solution.

9. Gently push the vial into the sample well of the meter, while aligning the alignment mark on the vial with the alignment mark on the meter. Press the vial down until it slides fully into the optical holder.

10. Wait for one minute and then press the READ/ENTER key within three minutes from the time the phenol red was added to the vial.

11. The meter will flash [PH] while the measurement is taken. It will then display the pH of the solution in pH units.

**pH Measuring Hints and Tips**

**Sample Collection**

- Samples may be collected in either plastic or glass bottles. It is recommended to wash the container with sample water before the sample is collected.

- For accurate results, analysis should be conducted as soon as possible after sample collection.
Sample Measurement

- The amount of sample used and the amount of reagent added is critical to obtaining correct test results. Ensure that the reagent is added in a consistent manner, with the dropper bottle being held vertically and squeezed slowly. To increase the test accuracy, measure the 10 mL sample and reagent using calibrated pipettes.

**Note:** Six drops of reagent is equal to 0.18 mL.

- It is important to recalibrate the meter to each new batch of reagent used, or if the reagent has not been used for more than a month. It is also important to occasionally check the results obtained with a colorless pH 7.0 buffer solution. If the result is outside the pH range of 6.9 to 7.1, recalibrate the meter. Refer to the **pH Calibration** section.

- Due to the nature of the test method, a sample pH of less than 5.9 or greater than 8.2 may result in false readings. Do not use this test method to analyze samples with a pH outside of the specified range.

Interferences

- Chlorine – Chlorine concentrations of greater than 6 mg/L may interfere. To remove this interference, add a crystal of sodium thiosulphate to the sample and mix before adding the reagent. A colorless pH 7.0 buffer can be used to check the test accuracy and strength of reagent.

**pH Accuracy Check and User Calibration**

To check the accuracy of the meter, use the colorless pH 7.0 buffer in place of the sample solution in the test method. The result obtained should be in the pH range of 6.9 to 7.1. Refer to the **Specifications** section for data on the meter accuracy and precision.

To recalibrate the meter, refer to the **pH Calibration** section for details.

**pH Chemistry**

The monitoring and control of the pH of water is important in many different applications. This test method provides a quick and accurate method for measuring pH in the range of 5.9 to 8.2.

A precise amount of phenol red indicator is added to a sample of water. The phenol red changes color from yellow at pH 5.9 to dark red at pH 8.2. The amount of red color is related to its pH. The amount of 525 nm light absorbed by the red color is accurately measured by the meter and then converted into the pH of the sample.
Chlorine Dioxide (0 to 9.0 mg/L ClO₂)

The DPD method¹ for chlorine dioxide is applicable to water, treated water and wastewater.

¹ Adapted from “Standard Methods for the Examination of Water and Wastewater.”

Chlorine Dioxide Test Procedure

1. Switch the meter on by pressing the ON/OFF key. The display will show [CLO₂] momentarily before displaying [STbY], indicating that it is in standby mode, waiting for either a measurement or a blank sample of deionized water to perform a zero calibration.

2. Select a clean and dry vial, unscrew the cap and fill the vial with sample solution to the line on the vial. Replace the cap, ensuring that it is screwed on finger-tight on the vial.

3. Ensure that the outside of the vial is clean, dry and absent of any marks or fingerprints. Gently place the vial into the sample well of the meter, while aligning the alignment mark on the vial with the alignment mark on the meter. Press the vial down until it slides fully into the optical holder.

4. Press the ZERO key to zero the meter to that vial; the meter will read [ZERo] while this is taking place.

Note: The meter will store the last zero value, even if the meter is turned off or if the batteries are removed.

5. Remove the vial from the meter and unscrew the cap. Select a chlorine dioxide tablet, Cat. No. AC2099. Open the pack and drop the tablet into the vial, without touching the tablet. Use the stir rod to crush the tablet and mix the solution.

6. Replace the cap, ensuring that it is screwed on finger-tight to the vial. Gently swirl the vial for twenty seconds to mix.

Note: A small amount of the powder may remain undissolved in the vial, but this will not affect the measurement. Do not shake or invert the vial, as this may result in the loss of chlorine dioxide.
7. Gently push the vial into the sample well of the meter, while aligning the alignment mark on the vial with the alignment mark on the meter. Press the vial down until it slides fully into the optical holder.

8. Press the READ/ENTER key within one minute from the time the chlorine dioxide tablet was added to the vial.

9. The meter will flash [CLO2] while the measurement is taken. It will display the chlorine dioxide concentration in milligrams per liter (mg/L).

![Image of chlorine dioxide measurement on meter]
Chlorine Dioxide Measuring Hints and Tips

Sample Collection

- Chlorine dioxide determination must take place as soon as possible after the sample is taken or else low results may be obtained.

- Plastic containers should not be used to collect the sample because these may have a high chlorine dioxide demand which will lead to low reading results. It is recommended to wash the container with the sample solution before the sample is collected.

- Do not agitate the sample, as this will lead to low results. Swirling the vial is the best way to dissolve and mix the reagent.

Sample Measurement

- If the pink color forms and then rapidly fades, it is an indication that the chlorine dioxide concentration may be very high. If this occurs, dilute the sample with deionized water and retest it. Multiply the result by the dilution factor used. Results obtained by this method will not be as accurate as stated in this user guide because some chlorine dioxide will be lost in the dilution process.

Example: If the sample was diluted 1:1 with deionized water (i.e. 1 part sample water to 1 part deionized water), the result is multiplied by 2 to give the true concentration of the original sample.

- After use, the vial should be cleaned thoroughly to avoid contaminating the next sample. Do not use household cleaners as these may have a chlorine dioxide demand which will lead to low results on subsequent tests.

Interferences

- Acidity – Greater than 250 mg/L CaCO₃ may cause an interference. To remove this interference, neutralize a separate sample to a pH of 6 to 7 using 1 N sodium hydroxide. Record the volume used and add the same volume of 1 N sodium hydroxide to the sample before carrying out the test procedure. Use a multiplication factor to correct for the dilution of the sample.

- Alkalinity – Greater than 250 mg/L CaCO₃ may cause an interference. To remove this interference, neutralize a separate sample to a pH of 6 to 7 using 1 N sulfuric acid. Note the volumes used and add the same volume of 1 N sulfuric acid to the sample before performing the test procedure. Use a multiplication factor to correct for the dilution of the sample.
• Chlorine – Chlorine levels greater than 6 mg/L may interfere. Use two packs of chlorine dioxide reagent in step 5 to remove the interference.

• Hardness – No effect at less than 2000 mg/L CaCO₃.

• Metals and chlorine in combination – If chlorine is present, some metals may interfere with the test. Use two packs of chlorine dioxide reagent in step 5 to remove the interference.

• Monochloramine – Monochloramine will cause a gradual increase in the chlorine dioxide result over time. Take the test result within one minute of adding the reagent pack to avoid these errors.

• Oxidants, including bromine and iodine – These will interfere with the test method at all levels. It is recommended that an alternative test method be used if more than two of these species are present.

• Ozone – May cause interference at levels above 1.5 mg/L.

• Oxidized manganese or oxidized chromium – All levels will cause an interference. To remove this interference:
  1. Test a 10 mL sample as described in the test procedure.
  2. Adjust the pH of a separate 10 mL sample to a pH of 6 to 7 using 1 N sodium hydroxide or 1 N sulfuric acid.
  3. Add one drop of 20% potassium iodide solution, swirl to mix and then wait sixty seconds.
  4. Add three drops of 5 g/L sodium arsenite solution and swirl to mix.
  5. Use this as the sample in the test procedure and make a note of the result. Use a multiplication factor to correct for the dilution of the sample with reagents.
  6. Subtract the result obtained in step 5 from the result obtained in step 1 to give the true result.
  7. To correct for any reagent added to the sample to neutralize it, a dilution correction factor must be used:

\[
\frac{\text{Final Volume}}{\text{Initial Sample Volume}} = \text{Correction Factor}
\]

The final volume can be calculated by adding together the initial sample volume and the volume of neutralizing reagent used:

\[
\text{Final Volume} = \text{Initial Sample Vol.} + \text{Neutralizing Reagent Vol.}
\]

The result from a test can then be multiplied by the correction factor to give the true result. If reagents are added from the supplied dropper bottles, then twenty five drops is equal to 1 mL.
Example: A 50 mL sample is neutralized using 50 drops of 1 N sulfuric acid and each drop is 0.04 mL.
Initial Sample Volume = 50 mL
Volume of Neutralizing Reagent = 50 drops • 0.04 mL = 2 mL
Final Volume = 50 mL + 2 mL = 52 mL
Correction Factor = 52/50 = 1.04
A result of 1.00 mg/L would then be 1.00 mg/L • 1.04 = 1.04 mg/L

**Chlorine Dioxide Accuracy Check and User Calibration**

Producing chlorine standards is a difficult procedure that should only be attempted by trained laboratory staff. Details of preparation techniques are not provided in this document.

The prepared chlorine standard may be used to check the accuracy of the meter or to recalibrate the meter. In almost all cases, it is recommended to use the default factory calibration.

To check the accuracy of the meter, prepare a standard solution of known concentration within the range of the meter. It is recommended to prepare a standard near to the concentration value usually tested with the meter. Use this standard in place of the sample water in the test method. Repeat the measurement five to seven times with different packs and average the results. The result obtained should be approximately the value of the standard used. Refer to the *Specifications* section for data on the meter accuracy and precision.

All meters are factory calibrated and user calibration is not recommended. However, if a chlorine standard can be prepared, measured accurately and qualified by a different method (i.e. titration) or another meter of higher accuracy and precision, then a chlorine standard in the 1.6 to 2.5 mg/L Cl₂ range can be used. Refer to the *Free Chlorine, Total Chlorine and Chlorine Dioxide Calibration* section for details.
Chapter 3  Colorimetry Calibration

The AQ3070 colorimetry meter was calibrated and tested prior to leaving the factory. Therefore, it is possible for you to use the meter directly out of the box. Re-calibration of the meter is not recommended, particularly in the case of chemical tests of very unstable and/or difficult to prepare calibration solutions. However, the meter allows you to calibrate one point for each test’s calibration curve in the meter. It is recommended to calibrate the pH at 7.0 pH units using a quality brand of colorless pH 7.0 buffer.

For each of the chemical tests in the AQ3070 meter, the colorimetry meter requires only one standard solution for a complete calibration. During calibration, the meter performs several system self-diagnostics. As such, several warning messages will be displayed. If the meter detects an irregularity with either the detector or the lamp, a warning message will be displayed during or upon exiting the calibration mode. If this occurs, attempt to rectify the situation as indicated in the Troubleshooting Guide section. In any event, the meter will continue to read the concentration or pH, but with a decreased accuracy until the error is rectified.

The meter has an auto exit feature whereby it will exit the calibration mode if no key is pressed within 10 minutes or if there is an error during calibration.

Calibration Procedure

The standard calibration solutions are to be prepared in the ranges indicated in the Specifications section. Standard solutions should be measured accurately and qualified by a different method or another meter of higher accuracy and precision.

Note: Do not pour liquid directly into the sample well of the meter. Always use a vial. The meter will only accurately measure the sample when vials sealed with the black caps are used. The black cap serves as both seal and a light shield.

Note: Do not attempt to clean the sample well, the optics may be damaged.

Note: This meter is designed to measure solutions contained in the custom made glass vials and therefore the use of other type of sample vials or sample cells may result in inaccurate measurements.
The following procedure describes the calibration for free chlorine, total chlorine and chlorine dioxide.

**Note:** Only chlorine standards should be used for these calibrations. Do not attempt to calibrate the chlorine dioxide parameter with chlorine dioxide standard solutions. Do not use chlorine dioxide reagent during the calibration of the chlorine dioxide parameter.

1. Prepare a chlorine standard in the 1.6 to 2.5 mg/L Cl₂ range. Measure and record the concentration value using either a non-colorimetric method, such as a titration with an ion selective electrode (ISE), or another meter of similar or higher accuracy.

2. Ensure that the meter is switched off. Press and hold the **ZERO** key while switching the meter on by pressing the **ON/OFF** key. The meter will momentarily flash the model number and then display the CAL annunciator at the top left corner of the screen indicating the meter is in calibration mode.

3. The AQ3070 colorimeter will display either [CL-F] for calibrating free chlorine and chlorine dioxide or [CL-T] for calibrating total chlorine. Press the **MODE** key to select the desired calibration mode.

4. Press the **READ/ENTER** key to confirm the selected test. The meter will display [bLNK], indicating it is waiting for a blank sample of deionized water to perform a zero calibration.

   **Note:** Zeroing is required during calibration or the meter will not continue with the calibration procedure.

5. Select a clean and dry vial, unscrew the cap and fill the vial with deionized water to the line on the vial. Replace the cap, ensuring that it is screwed on finger-tight on the vial.

6. Ensure that the outside of the vial is clean, dry and absent of any marks or fingerprints. Gently place the vial into the sample well of the meter, while aligning the alignment mark on the vial with the alignment mark on the meter. Press the vial down until it slides fully into the optical holder.

7. Press the **ZERO** key to zero the meter for that vial; the meter will read [ZERo] while this is taking place.
8. Remove the zero vial from the meter. The meter will display 4.1 mg/L, with the CAL annunciator on the top left corner.

9. Press the **MODE** key repeatedly to scroll to the concentration of the prepared calibration standard in the 1.6 to 2.5 mg/L range.

10. Select another clean vial, unscrew the cap and fill it with 10 mL of the prepared chlorine standard (fill up to the line on the vial).

11. For free chlorine or chlorine dioxide calibration, select the AC4P71 free chlorine powder pack. For total chlorine calibration, select the AC4P72 total chlorine powder pack. Open the powder pack and pour the contents into a vial containing the calibration standard.

12. Replace the cap, ensuring that it is screwed on finger-tight on the vial. Gently swirl the vial repeatedly for approximately twenty seconds, until the powder has dissolved.

   ![Zeroing Unreacted Sample](image)

   ![CAL ZERO](image)

   ![CAL MODE](image)

   ![Press Mode to select calibration point from 1.6 ppm to 2.5 ppm in an incremental circular manner.](image)

   **Note:** A small amount of the powder may remain undissolved in the vial, but this will not affect the measurement.

13. Ensure that the outside of the vial is clean, dry and absent of any marks or fingerprints. Gently place the vial into the sample well of the meter, while aligning the alignment mark on the vial with the alignment mark on the meter. Press the vial down until it slides fully into the optical holder.

14. For a free chlorine or chlorine dioxide calibration, press the **READ/ENTER** key immediately. The test must take place within two minutes from the time the pack was added to the vial. For a total chlorine calibration, wait two minutes before pressing the **READ/ENTER** key. The **READ/ENTER** key must be pressed within five minutes from the time the pack was added to the vial.
15. The meter will display [– Rd –] while the calibration standard is being measured and then display [SAVE] to prompt for calibration acceptance and saving of calibration data.

16. Press the READ/ENTER key. The meter will accept the calibration value and momentarily display [HoLD] and the CAL annunciator before returning to the beginning of the calibration as in step 3.

17. To continue with another calibration, press the MODE key to select the desired calibration mode.

18. To exit the calibration mode, press the ZERO key to return to the measurement mode.

**Note:** If you wish to abort the calibration process, do not press the READ/ENTER key as in step 16. Press the ZERO key instead. The meter will display [AbRT] and CAL annunciator to signify that the calibration has been aborted without saving the calibration value. The meter will then return to the beginning of the calibration as in step 3.

**Note:** If an error occurs during calibration, the display will present an error message. Refer to the Troubleshooting Guide section for details.
Cyanuric Acid Calibration

1. Prepare a cyanuric acid standard solution in the 66 to 75 mg/L range and record the concentration value.

2. Ensure that the meter is switched off. Press and hold the ZERO key while switching the meter on by pressing the ON/OFF key. The meter will momentarily flash the model number and then display the CAL annunciator at the top left corner of the screen indicating the meter is in calibration mode.

3. The AQ3070 colorimeter will display the last test performed. Press the MODE key until [CYNA] is displayed.

4. Press the READ/ENTER key to confirm the selected test. The meter will display [bLNK], indicating it is waiting for a blank sample of deionized water to perform a zero calibration.

   Note: Zeroing is required during calibration or the meter will not continue with the calibration procedure.

5. Select a clean and dry vial, unscrew the cap and fill the vial with deionized water to the line on the vial. Replace the cap, ensuring that it is screwed on finger-tight on the vial.

6. Ensure that the outside of the vial is clean, dry and absent of any marks or fingerprints. Gently place the vial into the sample well of the meter, while aligning the alignment mark on the vial with the alignment mark on the meter. Press the vial down until it slides fully into the optical holder.

7. Press the ZERO key to zero the meter for that vial; the meter will read [ZERo] while this is taking place.

8. Remove the zero vial from the meter. The meter will display 66 mg/L, with the CAL annunciator on top left corner.

9. Press the MODE key repeatedly to scroll to the concentration of the prepared calibration standard in the 66 to 75 mg/L range.
10. Select another clean vial, unscrew the cap and fill it with 10 mL of the prepared cyanuric acid standard (fill up to the line on the vial).

11. Select a cyanuric acid reagent tablet, Cat. No. AC2098. Open the pack and drop the tablet into the vial containing the calibration standard, without touching the tablet. Use the stir rod to crush the tablet and mix the solution.

12. Replace the cap, ensuring that it is screwed on finger-tight on the vial. Gently swirl the vial repeatedly for approximately one minute, until the powder has dissolved.

![Image showing mixing process]

**Note:** A small amount of the powder may remain undissolved in the vial, but this will not affect the measurement.

13. Ensure that the outside of the vial is clean, dry and absent of any marks or fingerprints. Gently place the vial into the sample well of the meter, while aligning the alignment mark on the vial with the alignment mark on the meter. Press the vial down until it slides fully into the optical holder.

14. Wait for two minutes, then press the **READ/ENTER** key within five minutes from the time the cyanuric acid reagent was added to the vial.

15. The meter will display [- Rd -] while the calibration standard is being measured and then display [SAVE] to prompt for calibration acceptance and saving of calibration data.

![Image showing calibration display]

16. Press the **READ/ENTER** key. The meter will accept the calibration value and momentarily display [HoLD] and the CAL annunciator before returning to the beginning of the calibration as in step 3.
17. To continue with another calibration, press the **MODE** key to select the desired calibration mode.

18. To exit the calibration mode, press the **ZERO** key to return to the measurement mode.

**Note:** If you wish to abort the calibration process, do not press the **READ/ENTER** key as in step 16. Press the **ZERO** key instead. The meter will display [AbRT] and CAL annunciator to signify that the calibration has been aborted without saving the calibration value. The meter will then return to the beginning of the calibration as in step 3.

**Note:** If an error occurs during calibration, the display will present an error message. Refer to the **Troubleshooting Guide** section for details.
pH Calibration

1. Ensure that at least 10 mL of clear pH 7.0 buffer is available.

2. Ensure that the meter is switched off. Press and hold the ZERO key while switching the meter on by pressing the ON/OFF key. The meter will momentarily flash the model number and then display the CAL annunciator at the top left corner of the screen indicating the meter is in calibration mode.

3. The AQ3070 colorimeter will display the last test performed. Press the MODE key until [PH] is displayed.

4. Press the READ/ENTER key to confirm the selected test. The meter will display [bLNK], indicating it is waiting for a blank sample of deionized water to perform a zero calibration.

   **Note:** Zeroing is required during calibration or the meter will not continue with the calibration procedure.

5. Select a clean and dry vial, unscrew the cap and fill the vial with deionized water to the line on the vial. Replace the cap, ensuring that it is screwed on finger-tight on the vial.

6. Ensure that the outside of the vial is clean, dry and absent of any marks or fingerprints. Gently place the vial into the sample well of the meter, while aligning the alignment mark on the vial with the alignment mark on the meter. Press the vial down until it slides fully into the optical holder.

7. Press the ZERO key to zero the meter for that vial; the meter will read [ZERo] while this is taking place.

8. Remove the zero vial from the meter. The meter will display 7.0 pH with the CAL annunciator on top left corner.

   ![CAL ZERO pH](image)

9. Select another clean vial, unscrew the cap and fill it with 10 mL of the pH 7.0 colorless buffer (fill up to the line on the vial).

   **Note:** A proper calibration requires exactly 10 mL of pH 7.0 buffer.
10. Select a bottle of AC3001 pH indicator (phenol red). Unscrew the cap and, holding the bottle vertically, gently squeeze 11 drops of phenol red into the contents of the vial. Replace the cap on the phenol red bottle. Be careful not to over-tighten the cap.

![Phenol Red](image)

11. Replace the cap, ensuring that it is screwed on finger-tight on the vial. Gently swirl the vial repeatedly to mix the solution.

![Swirling Vial](image)

12. Ensure that the outside of the vial is clean, dry and absent of any marks or fingerprints. Gently place the vial into the sample well of the meter, while aligning the alignment mark on the vial with the alignment mark on the meter. Press the vial down until it slides fully into the optical holder.

13. Wait for one minute and then press the READ/ENTER key within three minutes from the time the phenol red was added to the vial.

14. The meter will display [– Rd –] while the calibration standard is being measured and then display [SAVE] to prompt for calibration acceptance and saving of calibration data.

![Calibration Screen](image)

15. Press the READ/ENTER key. The meter will accept the calibration value and momentarily display [HoLD] and the CAL annunciator before returning to the beginning of the calibration as in step 3.

16. To continue with another calibration, press the MODE key to select the desired calibration mode.
17. To exit the calibration mode, press the **ZERO** key to return to the measurement mode.

Note: If you wish to abort the calibration process, do not press the **READ/ENTER** key as in step 15. Press the **ZERO** key instead. The meter will display [AbRT] and CAL annunciator to signify that the calibration has been aborted without saving the calibration value. The meter will then return to the beginning of the calibration as in step 3.

Note: If an error occurs during calibration, the display will present an error message. Refer to the **Troubleshooting Guide** section for details.
The AQ3070 colorimetry meter allows you to reset the meter back to the factory default calibration values. This feature is extremely useful when there are errors in calibration or when you have new calibration standards. Figure 10 shows the sequence for restoring factory calibration values.

1. With the meter switched off, press and hold the MODE key. Turn on the meter by pressing the ON/OFF key. Release the MODE key after about 2 seconds.

2. The meter will momentarily flash the model number and [URST] (user reset) and then display [No].

3. Press the MODE key to scroll between [YES] or [No].
   - [YES] = To restore meter back to factory calibration values
   - [No] = To retain last calibrated values

4. After selecting [YES] or [No], press the READ/ENTER key.

5. The meter will now flash the model number, the meter’s revision number and enter the measurement selection mode.
Figure 10
Restoring Factory Calibration

Press MODE and ON/OFF keys simultaneously and hold for 2 seconds before releasing.

The meter is now ready for measurement.

To restore factory calibration

To retain last calibration values without retrieving factory calibration.

The meter is now ready for measurement.
Chapter 4 Customer Services

Routine Maintenance

The supplied carrying case is optimal for protecting the meter. If you do not plan on leaving the meter in the supplied carrying case, when not in use ensure that the meter has been turned off and that a clean sample vial fitted with a black cap has been placed in the sample well. This will ensure that a minimal amount of dust and/or debris will be able to settle on the optics of the meter.

Vials – Handling, Cleaning and Care

Proper colorimetric measurement of a sample requires the use of a vial that is free of marks, smudges, scratches and any bacterial growth. Therefore, sample vials must be handled with absolute care to avoid contamination or damage, which might change the optical characteristics of the glass. Scratches, fingerprints, and water droplets on the sample vial or inside the sample well can cause stray light interference leading to inaccurate readings.

Cleaning the vial is accomplished by washing the interior and exterior of the vial in a detergent solution. Once cleaned, the vial should be rinsed thoroughly 8 to 10 times with clean distilled water to eliminate the possibility of detergent buildup and streaking.

Sample vials should always be handled from the top or by the cap to avoid fingerprints or smudges. After a vial has been filled with a sample and capped, the outside surface should be wiped with a clean, lint-free absorbent cloth until it is dry. Cleaned and dried vials should be stored with the black caps on. The vial can be stored in the carrying case. During normal operation you may use any typical glass cleaner along with a lint-free cloth or tissue, to clean the outside of the vials.
The AQ3070 colorimetry meter routinely performs self-diagnostics and will automatically generate messages to provide you with specific diagnostic information. These messages are for your use and do not indicate a reduction in the performance of the instrument or a failure of any component in the instrument, unless otherwise stated in this list.

<table>
<thead>
<tr>
<th>LCD Message</th>
<th>Description</th>
<th>Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR</td>
<td>Over range – the measured concentration (or pH value) is above the measurement range (chemistry test specific).</td>
<td>Ensure that the sample value is within the measurement range as listed in the Specification section.</td>
</tr>
<tr>
<td>UR</td>
<td>Under range – the measured concentration (or pH value) is below the measurement range (chemistry test specific).</td>
<td>Ensure that the sample value is within the measurement range as listed in the Specification section.</td>
</tr>
<tr>
<td>ERR0</td>
<td>Inappropriate signal to recognize the zero sample. Sample absorbance is less than zeroing or zeroing too low to achieve specified resolution.</td>
<td>Ensure that zeroing is done before the chemical reagent is added. Repeat the zeroing procedure.</td>
</tr>
<tr>
<td>ERR1</td>
<td>Calibration Failure. The absorbance of the calibration standard is outside the range allowed for the selected calibration point.</td>
<td>Ensure that the calibration standard is accurately prepared. Replace calibration standard with a known accurate value and recalibrate.</td>
</tr>
<tr>
<td>ERR2</td>
<td>Excessive stray light detected.</td>
<td>Ensure that the vial slides fully into the sample well.</td>
</tr>
<tr>
<td>ERR3</td>
<td>Lamp Failure. LED is faulty.</td>
<td>Return the unit for repair.</td>
</tr>
<tr>
<td>- -</td>
<td>Low battery indication. The batteries need to be replaced.</td>
<td>Replace the batteries.</td>
</tr>
</tbody>
</table>

**Note:** If an error message appears, take the appropriate corrective action and re-do the desired procedure. If the problem persists, contact Technical Support or your dealer.
After troubleshooting all components of your measurement system, contact Technical Support. Within the United States call 1.800.225.1480 and outside the United States call 978.232.6000 or fax 978.232.6031. In Europe, the Middle East and Africa, contact your local authorized dealer. For the most current contact information, visit www.thermo.com/contactwater.

**Warranty**

For the most current warranty information, visit www.thermo.com/water.

The AQ3070 meter is supplied with a 2 year warranty from manufacturing defects. If repair or adjustment is necessary and has not been the result of abuse or misuse within the designated period, please contact Technical Support or your dealer for an RMT number. A repair technician will determine if the product problem is due to deviations or customer misuse. Out of warranty products will be repaired on a charged basis.

**Exclusions**

The instrument warranty shall not apply to defects resulting from:

- Improper or inadequate maintenance by customer
- Unauthorized modification or misuse
- Operation outside of the environment specifications of the products

**Waterproof Seal:** Opening the instrument enclosure (excluding the battery compartment) may void the warranty.
**Warning:** This meter may radiate radio frequency energy and if not installed and used properly, that is in strict accordance with the manufacturer’s instructions, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a commercial environment. Operation of the meter in a residential area may cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

The Thermo Scientific Orion AQ3070 colorimetry meter is CE and cTUVus certified, which includes TUV 3-in-1 testing to EMC and US and Canadian standards.

**WEEE Compliance**

This product is required to comply with the European Union’s Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the following symbol:

![WEEE symbol]

We have contracted with one or more recycling/disposal companies in each EU Member State and this product should be disposed of or recycled through them. Further information on compliance with these Directives, the recyclers in your country, and information on Thermo Scientific Orion products which may assist the detection of substances subject to the RoHS Directive are available at www.thermo.com/WEEERoHS.
Declaration of Conformity

Manufacturer: Thermo Fisher Scientific Inc.
166 Cummings Center
Beverly, MA 01915 USA

The manufacturer hereby declares that the AQ3070 colorimetry meter conforms with the following standards and documents:

**Safety**
EN/IEC 61010-1:2001

**EMC**
EC 89/336/EEC Electromagnetic Compatibility
EN 61326-1:2006

**Emissions**
EN 61326-1:2006 Emissions
CISPR 11:2003 Radiated Emissions
FCC Part 15B Class A

**Immunity**
EN 61326-1:2006 Immunity
IEC 61000-4-2:2001 Electrostatic Discharge Immunity
IEC 61000-4-3:2002 RF Radiated Immunity

This Thermo Scientific Orion product has been manufactured in compliance with the provisions of the relevant manufacturing and test documents and processes. These documents and processes are recognized as complying with ISO 9001:2008 by QMI, listed as File # 001911.

Patrick Chiu
Senior Quality Engineer, Regulatory Compliance
September 4, 2009
Beverly, MA
<table>
<thead>
<tr>
<th>Cat. No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AQ3070</td>
<td>AQUAfast III AQ3070 colorimeter kit, includes meter, 6 sample vials, AC4P71 free chlorine reagent, AC4P72 total chlorine reagent, batteries, vial cleaning brush, tablet tamping stir rod, carrying case, user guide and MSDSs</td>
</tr>
<tr>
<td>AC4P71</td>
<td>Free chlorine reagent powder packs (100 tests)</td>
</tr>
<tr>
<td>AC4P72</td>
<td>Total chlorine reagent powder packs (100 tests)</td>
</tr>
<tr>
<td>AC2098</td>
<td>Cyanuric acid reagent tablets (100 tests)</td>
</tr>
<tr>
<td>AC2099</td>
<td>Chlorine dioxide reagent tablets (100 tests)</td>
</tr>
<tr>
<td>AC3001</td>
<td>pH indicator, 2 x 15 mL dropper bottles (60 tests)</td>
</tr>
<tr>
<td>AC3V25</td>
<td>Replacement 25 mm sample vials, pack of 3</td>
</tr>
<tr>
<td>AC3Rod</td>
<td>Replacement tablet tamping stir rod, pack of 10</td>
</tr>
<tr>
<td>AC3CBR</td>
<td>Replacement sample vial cleaning brush, pack of 10</td>
</tr>
</tbody>
</table>
## Chlorine, Free and Total

<table>
<thead>
<tr>
<th>Measurement Parameter</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic Range Selection</td>
<td>0.02 to 4.0 mg/L</td>
</tr>
<tr>
<td>US EPA range</td>
<td>0.03 to 2.0 mg/L</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.01 mg/L (0.02 to 1.99 mg/L)</td>
</tr>
<tr>
<td></td>
<td>0.1 mg/L (2.0 to 4.0 mg/L)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>± 0.02 mg/L (0.02 to 0.5 mg/L)</td>
</tr>
<tr>
<td></td>
<td>± 0.2 mg/L (0.6 to 4.0 mg/L)</td>
</tr>
</tbody>
</table>

## Cyanuric Acid

<table>
<thead>
<tr>
<th>Measurement Parameter</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic Range Selection</td>
<td>5 to 90 mg/L</td>
</tr>
<tr>
<td>Resolution</td>
<td>1 mg/L</td>
</tr>
<tr>
<td>Accuracy</td>
<td>± 4 mg/L</td>
</tr>
</tbody>
</table>

## pH

<table>
<thead>
<tr>
<th>Measurement Parameter</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic Range Selection</td>
<td>5.9 to 8.2 pH</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.1 pH</td>
</tr>
<tr>
<td>Accuracy</td>
<td>± 0.1 pH</td>
</tr>
</tbody>
</table>

## Chlorine Dioxide

<table>
<thead>
<tr>
<th>Measurement Parameter</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic Range Selection</td>
<td>0 to 9.0 mg/L</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.01 mg/L (0 to 4.6 mg/L)</td>
</tr>
<tr>
<td></td>
<td>0.1 mg/L (4.7 to 9.0 mg/L)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>± 0.10 mg/L (0 to 4.0 mg/L)</td>
</tr>
<tr>
<td></td>
<td>± 0.3 mg/L (4.1 to 9.0 mg/L)</td>
</tr>
</tbody>
</table>
### Meter Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement Method</td>
<td>Photometric</td>
</tr>
<tr>
<td>Light Source</td>
<td>Light Emitting Diode (LED)</td>
</tr>
<tr>
<td>Wavelength</td>
<td>525 nm</td>
</tr>
<tr>
<td>Detector</td>
<td>Silicon photodiode</td>
</tr>
<tr>
<td>Absorbance Range</td>
<td>0 to 2.5 Abs</td>
</tr>
<tr>
<td>Photometric Precision</td>
<td>± 0.0015 Abs</td>
</tr>
<tr>
<td>Calibration Points</td>
<td>User selectable; 1 point per colorimetric test</td>
</tr>
<tr>
<td>Display</td>
<td>4 digit, 14 segments customized liquid crystal display (LCD) with annunciators</td>
</tr>
<tr>
<td>Sample Cells</td>
<td>Borosilicate glass with screw caps, fill line and indexing mark</td>
</tr>
<tr>
<td></td>
<td>51 mm (height) x 25 mm (diameter), (2 in x 1 in)</td>
</tr>
<tr>
<td>Sample Required</td>
<td>10 mL (0.33 oz)</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>0 to 50 °C (32 to 122 °F)</td>
</tr>
<tr>
<td>Sample Temperature Range</td>
<td>0 to 50 °C (32 to 122 °F)</td>
</tr>
<tr>
<td>Operating Humidity Range</td>
<td>0 to 90% relative humidity, non-condensing at 30 °C (86 °F)</td>
</tr>
<tr>
<td>Power Supply</td>
<td>4 AAA alkaline batteries</td>
</tr>
<tr>
<td>Battery Life</td>
<td>&gt; 3000 tests</td>
</tr>
<tr>
<td>Electromagnetic Compliance (EMC)</td>
<td>Emitted Interference – EN 61326</td>
</tr>
<tr>
<td></td>
<td>Immunity to Interference – EN 61326</td>
</tr>
<tr>
<td>Regulatory Certification</td>
<td>CE, cTUVus, TUV 3-in-1, FCC part 15</td>
</tr>
<tr>
<td>Enclosure Rating</td>
<td>IP67</td>
</tr>
<tr>
<td>Insulation Rating</td>
<td>Pollution degree 2</td>
</tr>
<tr>
<td>Weight</td>
<td>Meter: 200 g (7 oz)</td>
</tr>
<tr>
<td></td>
<td>Meter in carrying case: 1.25 kg (2.75 lb)</td>
</tr>
<tr>
<td>Dimensions</td>
<td>Meter: 6.8 cm (width) x 15.5 cm (length) x 4.6 cm (height), (2.7 in x 6.1 in x 1.8 in)</td>
</tr>
<tr>
<td></td>
<td>Carrying case: 16 cm (width) x 35 cm (length) x 12 cm (height), (6.3 in x 13.8 in x 4.7 in)</td>
</tr>
</tbody>
</table>
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