



## APPLICATION NOTE

Exaqua  
method procedure  
**Z231L Ammonia NH<sub>4</sub>**  
Ultra low range  
Marine water

**exaqua**

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### INTRODUCTION

Ammonia is a metabolic byproduct of the decomposition of organic nitrogen. Although its occurrence is a natural phenomenon, ammonia is a toxic compound for fish and levels should be kept as close to 0 ppm as possible. At trace levels, even the air surrounding the sample can be a source of ammonia. When taking a measurement in a room crowded area, higher concentrations may be observed.

Exaqua offers the **Z231 Total ammonia NH<sub>4</sub>, marine water** method with a range of 0.1 - 3 ppm and with a resolution of 0,05 ppm. To allow advanced users to measure ammonia at the lower detection limit the **Z231L Total ammonia NH<sub>4</sub>, Trace level range, marine water** method was developed, using the Z231 reagent kit and an alternative procedure. The lower detection limit allows the determination of as low as 25 ppb of ammonia with a resolution of 10 ppb.

The Z231L NH<sub>4</sub> Low Range Marine water method was verified on various marine waters. The method was calibrated using standard ammonia solutions and ammonia-free synthetic marine water.

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photometer reinvented

## 1. SPECIFICATION

Description:	Test for determining the content of total ammonia in marine water at trace levels
Range:	25 – 300 ppb
Measurement error:	±10 ppb ± 10% For results below 100 ppb, displayed resolution is 0.1 ppb. For results above 100 ppb, displayed resolution is 1 ppb.
Wavelength:	610 nm
Reagent set:	<b>Product code: 8231</b>

## 2. PERFORMING THE MEASUREMENT OF TRACE LEVELS OF AMMONIA CONCENTRATION IN MARINE WATER

### 2.1 REQUIRED REAGENTS AND ACCESSORIES

- » A properly calibrated user method

Instructions on preparing the user method, see. [Chapter 3](#).

- » Exaqua reagent kit Z231 Total ammonia NH<sub>4</sub> Marine water
- » Short or tall vial Exaqua

Short vial – cat. no 8000.000  
Tall vial – cat. no 8000.001

- » Timing Instrument

#### NOTE:

Although the test for measuring trace levels of ammonia according to the method Z231L uses the same reagents as the standard Exaqua method Z230, the procedure and amounts of reagents added are slightly different for both methods.

### 2.2 METHOD PROCEDURE

1. Prepare Exaqua set of reagents **Z231 Total ammonia NH<sub>4</sub>, marine water**, any vial and a timer.
2. Rinse vial with water sample and shake out remaining water.
3. Fill the vial with 5 ml of water sample.
4. Insert the vial in the vial holder and press the **ZERO** key.
5. Add 10 drops of **Reagent NH<sub>4</sub>-1** and mix.
6. Add 5 drops of **Reagent NH<sub>4</sub>-2** and mix.
7. Add 13 drops of **Reagent NH<sub>4</sub>-3**.
8. Close the vial, mix the solution and place it in a dark environment. It is recommended to simply place it inside the Exaqua reagent box and close the lid.
9. Leave the tested sample in dark environment for **30 minutes**. After the time has passed, the sample is ready for measurements.
10. Insert the vial in the vial holder and press the **MEAS** to measure the ammonia concentration.

#### NOTE:

In some cases, after a prolonged idle time, photometer may require to refresh zero. It is recommended to have an additional clean vial containing only 5 ml of water sample at hand to quickly measure new zero and resume tests.

### 2.3 REMARKS

- » At trace levels, even the air surrounding the sample can be a source of ammonia. When taking a measurement in a room crowded area, higher concentrations may be observed.
- » Water salinity affects the concentration reading. For aquariums that differ in salinity level from typical marine aquariums, use the salinity correction described in this application note.

### 2.4 POTENTIAL INTERFERENCES

too high or too low temperature	- may interfere with the measurement - take care to maintain the temperature of solutions and reagents close to or equal to 25°C
phosphate content	may cause falsely low readings
high content of magnesium (Mg)	above <b>2000 ppm</b> may cause precipitation
high content of calcium (Ca)	above <b>600 ppm</b> may cause precipitation
exposure to external light during the measurement	may have effect on the colour change of a solution thus deteriorating the repeatability and accuracy of the measurement

### 2.5. QUICK METHOD GUIDE

<b>STEP 1</b>	Take <b>5 ml</b> of water sample
<b>STEP 2</b>	Zero measurement ( <b>ZERO</b> key)
<b>STEP 3</b>	Reagent NH <sub>4</sub> -1 <b>10 drops</b> mix
<b>STEP 4</b>	Reagent NH <sub>4</sub> -2 <b>5 drops</b> mix
<b>STEP 5</b>	Reagent NH <sub>4</sub> -3 <b>13 drops</b> mix
<b>STEP 6</b>	Place in darkness
<b>STEP 7</b>	Wait <b>30 minutes</b>
<b>STEP 8</b>	Final measurement ( <b>MEAS</b> key)

### 3. PREPARATION OF THE CUSTOM Z231L USER METHOD

#### 3.1 REQUIRED REAGENTS AND ACCESSORIES

- » Exaqua reagent kit Z231 Total ammonia NH<sub>4</sub> Marine water
- » Method calibration kit for the Z231L method (art. no. 8232)

##### Inside the set (art. no 8232):

- ✓ Reagent cal-1 - 10 ml for one calibration
- ✓ Reagent cal-2 - 0,25 ml for one calibration
- ✓ 1 ml syringe
- ✓ vial (3 pcs.)

#### 3.2 CREATING A NEW USER METHOD OR EDITING EXISTING METHODS

1. Press the **Home**  button on the photometer keyboard to enter the **MAIN MENU** section.
2. Choose **Methods** from the displayed list, then **User methods**.
3. Enter the following parameters in the user method edit menu for the selected method:

<b>name:</b>	any name, suggested name: Z31L NH <sub>4</sub> LR sxx.xx Marine (where xx.xx is a reagent batch number)
<b>unit:</b>	ppb
<b>wavelength:</b>	610 nm
<b>abs0:</b>	first vial (#1) absorbance measurement result
<b>conc0:</b>	0
<b>abs1:</b>	second vial (#2) absorbance measurement result
<b>concl:</b>	500

#### 3.3 ABSORBANCE MEASUREMENTS FOR USER METHOD

To obtain absorbance values required to make Z231L user method follow the instructions below.

1. Prepare 3 vials.
2. Add 5 ml of **Reagent cal-1** to the **first** vial.
3. Add 5 ml of **Reagent cal-1** to the **second** vial.
4. Add 0,25 ml of **Reagent cal-2** to the **second** vial and mix.
5. Add 5 ml of **demineralized water** to the **third** vial.
6. Pass the first and second vial through the procedure described in **steps 5-9** in **section 2.2** of **chapter 2**.
7. After the **30-minutes** reaction time remove the vials from the box.
8. Enter the user method edit menu, go to **abs0** and press the **MEAS** key to open the absorbance measurement window.

9. Place the **third** vial (containing demineralized water) in the vial holder of the photometer and press the **ZERO** key.
10. Place the **first** vial in the vial holder of the photometer and press the **MEAS** key.
11. Press **SEL** to transfer the obtained result to the user's method. If something went wrong, press the **EXIT** key to exit, or the **MEAS** key to measure the absorbance of the solution again. After the measurement is completed, remove the vial from the vial holder.
12. Leave the value in the **conc0** position equal to **0.000**.
13. Move to the **abs1** position and press the **MEAS** key to open the absorbance measurement window.
14. Place the **second** vial in the vial holder of the photometer and press **MEAS** key.
15. After transferring the obtained result to the **abs1** position, go to the **concl** position, select **EDIT** and set the concentration value to **500**. Press the **ENTER** key to confirm.
16. Finally, exit the edit menu by pressing the **Home**  button on the photometer keyboard to save the user method. The method can be freely edited at any time.

### 4. EFFECT OF SALINITY ON READINGS

The Z231L Total ammonia NH<sub>4</sub> Ultra Low Range, Marine water method was optimized for testing marine water samples with the salinity of about 28-33 ppt. Measurements of water with lower values of salinity can result in falsely low readings. For that reason a salinity correction is recommended when testing ammonia concentration in water samples with low salinity, using the Exaqua NH<sub>4</sub> Low Range Marine test.

#### 4.1 SALINITY CORRECTION

Salinity correction is prepared using previously created user method. To obtain salinity correction, one additional measurement is required. It is obtained through the following procedure.

1. Set the photometer to the previously prepared user method Z231L for measuring trace levels of ammonia in marine water (see [Section 3.2](#)).
2. Prepare 1 vial.
3. Add 5 ml of demineralized water to the vial.
5. Perform the measurement by following steps **4-10** of the procedure described in **section 2.2** of the **chapter 2**. The photometer will display negative ammonia content, this indicates the most extreme case of salinity effect. Make a note of the obtained value – later in the document this value will be referred to as "**zero reading**" and will be the key element for obtaining salinity correction.

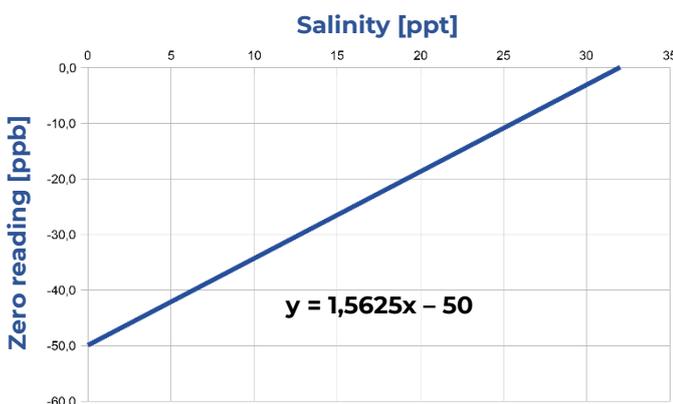
If the method will be carried out using water with salinity that deviates from typical marine water, a salinity correction should be made and a correction should be used, as shown in the equations below:

$$\text{ammonia concentration [ppb]} = \text{photometer reading [ppb]} + \text{correction [ppb]}$$

$$\text{correction [ppb]} = \text{zero reading [ppb]} * \left( \frac{\text{salinity (ppt)}}{32 \text{ [ppt]}} - 1 \right)$$

## 4.2 EXAMPLE OF OBTAINING AND USAGE OF SALINITY CORRECTION

Additional measurement made for obtaining the salinity correction resulted in reading '-50' (zero reading = -50), the observed salinity effect is visually presented in the graph below:



For water sample with salinity of 11 ppt, the correction is:

$$(-50) \cdot (11/32 - 1) = \mathbf{32,81 \text{ ppb}}$$

Then, if the test indicates 31 ppb of ammonia in such a sample, the corrected measurement value will be:

$$31 + 32,81 = 63,81 \approx \mathbf{64 \text{ ppb}}$$

## 5. SHARING USER METHODS

Prepared custom user method can be shared and transferred to other Exaqua photometers.

### 5.1 EXPORTING USER METHOD TO EXAQUA PHOTOMETER

To export user method you will need an Exaqua photometer with the user method, a micro-USB cable (included with photometer) and a computer with USB port. Follow the below procedure:

1. Connect Exaqua photometer to a computer using USB cable.
2. To enable USB mode press the **Home**  button and go to **MAIN MENU**, then select **USB**. The photometer's internal memory should be opened on the computer screen.
3. Open the folder **User Methods** on the computer and copy text file **umX\_cfg** containing desired user method.

#### NOTE

In the **umX\_cfg** name of text file, the 'X' represents a user method number from 1 to 4, e.g. **um3\_cfg**.

#### NOTE

Do not change the file name or remember to restore its original name **umX\_cfg** before uploading the method to another photometer.

4. Press the **EXIT** button on photometer to leave USB mode and disconnect photometer from the computer.
5. The method has been correctly exported and can be shared with other users or imported to any Exaqua photometer.

### 5.2 IMPORTING USER METHOD INTO EXAQUA PHOTOMETER

To import user method you will need an Exaqua photometer on which the method will be imported, a micro-USB cable (included with photometer), a computer with USB port and the user method in the form of a .txt file. Follow the below procedure:

1. Connect the Exaqua photometer to a PC via USB cable.
2. To enable FW Update mode press the **Home**  button and go to **MAIN MENU**, then select **FW Update**. The photometer's internal memory should be opened on the computer screen.
4. Open **User Methods** folder and replace **um1\_cfg** text file with the provided custom method with the same file name.

#### NOTE

In the **umX\_cfg** name of text file, the 'X' represents a user method number from 1 to 4, e.g. **um3\_cfg**.

#### NOTE

Do not change the uploaded **umX\_cfg** file name.

3. Press the **EXIT** button to leave update mode. The screen will display 'FW update cancelled' message.
4. The method has been correctly imported and can be used now.

### 5.3 SELECTING AND USING IMPORTED METHODS

1. Press the **Home**  button on the photometer keyboard to enter the **MAIN MENU** section.
2. Choose **Methods** from the displayed list, then **User methods**.
3. Select imported method from the displayed list and press the **SEL** key to confirm.

#### NOTE

Pressing the middle button on the alphanumeric keyboard (digit **5**) activates edit section of a method as in the case of pressing the **EDIT** key.

4. Now, it is possible to return to the section with the list of user methods by pressing the **EXIT** key or the **Home**  button on the photometer keyboard.