



# Contents

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**45 Applications**  
 Salt Meter Applications

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## Bringing Out the Best in Foods

To measure thick sauces, dilution is the key.

In cooking, there are many types of condiments. They can be thin and soupy or thick and pasty. In Japan, there is also a dipping sauce called “tare”.

### Seasoning **Sauce, Tare (dipping sauce), Ketchup, Tomato Paste, & Curry**

Ketchup, gyu-don (beef bowl) sauce, demi-glace sauce, white sauce, oyster sauce—there are many varieties of sauce from around the world.

It is said that the origin of the word comes from the Latin “Salsus,” which means, “salty.” Various ingredients make up a sauce but typically they include meat, broth, vegetables, and seafood. The optimal balance of viscosity, thickness, and salinity is the most important aspect of a sauce. When intertwined with the main dish, the sauce adds a depth of flavor that would be missed if absent. Sauce is not something that can be made simply by stewing together ingredients for a couple of minutes. The amount of moisture in the natural ingredients will be different every time. It is important to find the right time to remove the sauce from the heat once it has been reduced. This is the key to making delicious sauce!

There are set standards for Worcester sauce, Chuunou sauce (thicker Worcester sauce), and Tonkatsu sauce (pork cutlet sauce) established by The Japanese Agricultural Standards (JAS).

We recommend the **PAL-SALT** and **ES-421** for measuring the salt content of sauce.

Since sauce is dense, we recommend diluting with water by a factor of 10 for the most precise and accurate salt concentration measurements.

If you wish to measure the viscosity or concentration of sauce, we can recommend viscometers or refractometers.

Please contact us for more details.



Ketchup for your eggs and omelets.



Guacamole, salsa, and sour cream.



Curry

Recommended Products

Salt Concentration  
**PAL-SALT**  
 Cat.No.4250



Salt Concentration  
**ES-421**  
 Cat.No.4211



For further product details [P.B12](#)

For further product details [P.B17](#)

The Salt Content of Sauce, Tare (dipping sauce), Ketchup, Tomato Paste, & Curry (Rough guide)

Worcester sauce.....	3.7%
Chuunou sauce (thicker Worcester sauce).....	2.0%
Tonkatsu sauce (pork cutlet sauce).....	1.9%
Okonomiyaki (Japanese pancake) sauce.....	4.5%
Oyster sauce.....	9.4%
Yakiniku (Korean-style grilled meat) sauce.....	4.8%
Grilled chicken sauce.....	6.5%
Ketchup.....	3.0%
Curry.....	1.6%

## When you eat salad, what do you pour over it?



Oil does not conduct electricity. The trick is to bypass the oil in order to measure the salt concentration!

Salad dressing is a liquid sauce that is made from a mixture of vinegar, oil, salt, herbs, and spices.

Seasoning

## Dressings & Mayonnaise

We have a variety of choices when it comes to dressings. For example, soy sauce based dressings are very popular in Japan. Since mayonnaise is made with vinegar and oil, it is also one type of dressing. Dressing isn't just for salad, though; it is a very useful addition to many different types of dishes. However, if you use too much, your oil and salt intake could be inadvertently high.

Recently, there are an abundance of low-sodium, and non-oil type dressings. But remember to check the label on those products. Non-oil dressings may have a high calorie count and the salt content may be more than you might expect!

Dressing brings out the natural flavor of vegetables and when used in moderation, it can provide a different flavor profile to your recipes. When used sparingly, dressing allows us to adjust healthy foods to our taste, and makes keeping a balanced diet a delightful and healthy experience.

There are set quality standards for "dressings" and "dressing-type seasonings" according to The Japanese Agricultural Standards (JAS). According to JAS, "mayonnaise," is strictly described as, "Any semi-solid dressing that is made with egg yolk, or both egg yolks and egg whites, as well as the necessary raw ingredients (hydrolyzed proteins, salt, sugars, spices, seasonings, amino acids) and not using any other raw ingredients (aside from acidifiers)."

We recommend the **PAL-SALT** and **ES-421** for measuring the salt content of dressings and mayonnaise.

### Measurement method

Some dressings separate when not constantly stirred. To measure these types of dressings, let the sample sit until the oil has separated from the other ingredients. Avoiding the oil, extract 10g of the other ingredients and mix with 90g of water.

Another method is to take 10g of the dressing with the oil included, then dilute it with 90g of water. Vigorously shake the sample. The oil will separate from the other substances. Take a sample from below the oil layer and measure.

For measuring mayonnaise, first, dilute 10g of mayonnaise with 90g of water (you can use boiling water), and mix well. Let the mixture settle for approximately 10 minutes. Once the mixture has separated, take a sample from below the oil layer and measure.



The popular classic: mayonnaise



Homemade dressing



Fresh vegetables with a generous amount of dip

The Salt Content of Dressings & Mayonnaise (Rough guide)

Soy sauce dressing .....	6.1%
French dressing .....	1.7%
Mayonnaise .....	1.6%
Tartar sauce .....	2.0%

Recommended Products

Salt Concentration  
**PAL-SALT**  
Cat.No.4250



Salt Concentration  
**ES-421**  
Cat.No.4211



For further product details [P.B12](#)

For further product details [P.B17](#)

## Traditional Japanese Seasonings: Soy Sauce & Miso



Depending on the type of soy sauce or miso, the salt concentration will vary.

Soy sauce and miso are seasonings which play an important role in bringing out the flavor of a dish. Soy sauce and miso are the two most popular seasonings in Japan.

Seasoning

## Soy Sauce & Miso

### [Soy sauce]

By adding a little soy sauce during preliminary food prep, during cooking, or when applying the final garnishing touches, the taste of a dish can be elevated to a whole new level of delicious.

Soy sauce's appealing, characteristic color, taste, and fragrance is derived from the blending of its main ingredient, soy beans, with wheat and salt. Soy sauce's flavor comes from the protein in soy beans, and its fragrance comes from the starch in wheat. These traits are produced by the microorganisms in each component. Delicious soy sauce is made from thoroughly fermenting and aging these raw ingredients for a long time. Depending on the soy sauce, there are differences in the degree of flavor intensity, extract (unsalted soluble solid contents), and color. The Japanese Agricultural Standards (JAS) classifies soy sauce based on these differences. The distinctive qualities (color, flavor, fragrance) of the soy sauce can vary. Flavor assessment is divided into nitrogen and extract content.

ATAGO recommends the **PAL-SALT** and **ES-421** for measuring the salt content of soy sauce.

For measuring the salt content of soy sauce, we recommend diluting by 10 times. On average the salt content of Koikuchi (strongly colored) soy sauce is 14 to 15%, and Usukuchi (lightly colored) soy sauce is 16 to 18%. Salt content of reduced sodium soy sauce is typically reduced by half, to between 7 to 8%. The extract content of soy sauce (unsalted soluble solid contents) can be found by subtracting the salt content from the soluble solid contents (Brix). Refractometers are used for measuring soluble solid content (please contact ATAGO for more details).

### [Miso]

Mention "miso," and for many Japanese people, "miso soup" comes to mind. In addition to its raw ingredients, which contain many nutrients, miso also has an abundance of beneficial compounds created from fermentation. Characteristics of miso vary by region, and it is classified by the raw ingredients: rice miso, barley miso, soybean miso, and mixed miso. The ratio of raw ingredients (soybeans, rice, or barley) to salt content is different for each type of miso. Other main components include water (40 to 46%), carbohydrates, protein, fat, and ash. Miso contains various other components like vitamins and minerals. The salt content in miso is all found dissolved in the water. For this reason, the concentration of salt changes depending on the amount of water. The salt content used during fermentation is normally about 12%; for soybean miso and sweet miso it is somewhat less, and for white miso and edoama miso (the traditional type of miso from the Tokyo region in Japan), it is even less: 5 to 7%.

Unlike soy sauce, miso does not have any Japanese Agricultural Standards. The main reason is that there are so many varieties; it would be difficult to classify all of them. Miso is "alive" with beneficial bacteria and cannot be classified, since it is constantly changing.

Also, there are many miso products which do not undergo heat sterilization, and among those, the living yeast and lactobacilli in the miso consume the nutrients. For this reason, physicochemical analytical values cannot be set or maintained in the same manner as with soy sauce's nitrogen and extract contents.

For a detailed and accurate measurement of miso's salt content, we recommend diluting by 10 times.

We recommend the **PAL-SALT** and **ES-421** for measuring the salt content of miso.

Recommended Products

Salt Concentration  
**PAL-SALT**  
Cat.No.4250



Salt Concentration  
**ES-421**  
Cat.No.4211



For further product details [P.B12](#)

For further product details [P.B17](#)

### The Salt Content of Soy Sauce & Miso (Rough guide)

Soy sauce (Koikuchi) .....	14.0 to 15.0%
Soy sauce (Usukuchi) .....	16.0 to 18.0%
Rice miso (Red) .....	13.0%
Rice miso (White) .....	12.4%
Soybean miso .....	10.9%
Barley miso .....	10.7%

## Why are pickles so beloved?

Depending on the type of pickles, the salt content can be high. Dilution is important for taking accurate measurements.

Pickles are low in calories, contain fiber, and contain lactobacillus; this means pickles promote health and improve skin complexion.

Pickles

## Pickles & Pickling Solutions

There are countless types of pickles; pickled cucumber, pickled eggplant, ume-boshi (pickled plums), pickled yellow daikon radish, Matsumae pickles (pickled dried squid, herring roe, and seaweed), Nara pickles (gourds pickled in sake lees), Senmai pickles (thin slices of turnip pickled in vinegar and other ingredients), pickled wasabi, kimchi (Korean style spicy pickled vegetables), pickled olives—just to name a few.

"Why are pickles so beloved?" The history of pickles in Japan is extremely ancient. In the Nara period, eggplant and uri (a type of Japanese gourd) pickled in brine were popular, and in the Heian period, pickles prepared with miso and soy sauce were consumed regularly.

Pickles are eaten all over the world, not just in Japan. There is kimchi in Korea, Szechuan pickles in China, Sauerkraut in Germany, and various other pickles in Europe and North America. Although they come in different forms, pickles are beloved by the world. This is because pickles have many appealing qualities.

**Pickles are low in calories, contain fiber, and contain lactobacillus; this means pickles promote health and improve skin complexion.**

The vitamin C in pickled vegetables has a unique characteristic. Normally, vitamin C is sensitive to heat and will break down. In pickles, the vitamin C is more resilient and does not break down as easily. Pickled vegetables are a precious source of vitamins. Additionally, vegetables lose bulk once their water content is

removed, so it becomes easier to consume a large amount of vegetables in one sitting. Not only are pickles high in fiber, but since oil is not used in their production, they are also low in calories.

Pickles contain plant-based lactobacillus. Compared to lactobacillus derived from protein sources, plant-based lactobacillus is resistant to changes in temperature. Even after heat is applied, a comparatively significant number of living lactobacillus easily reaches the intestines. When you ingest lactobacillus, not only does the amount of probiotic, "friendly" bacteria in your intestines increase and regulate your digestive system, but the probiotic bacteria works toward strengthening your body's immune system. It plays an important role in promoting overall health.

Although the salt content varies depending on the type of pickle, a general standard is about 2g of salt per 100g of pickles. Recently, people are insisting on reduced sodium, and it appears pickles are heading in this direction as well.

We recommend the **PAL-SALT** for measuring the salt content of brines and pickling solutions.

If the pickling solution consists of only salt and water, and if it is over 10%, we recommend the **PAL-03S**.

If you would like to measure the salt content of the pickle product itself in its solid form, or if you wish to measure how much salt has permeated throughout a sample, we recommend the **PAL-SALT PROBE**.

The Salt Content of Pickles		
Type of pickles	Forty years ago	Recent years
Ume-boshi	approx 20%	approx 8%
Fukujin pickles	approx 10 to 10.5%	approx 5 to 5.2%
Kimuchi	approx 4%	approx 2%
Pickled yellow daikon radish	approx 12 to 14%	approx 4 to 5%

The Salt Content of Pickles (Rough guide)	
Ume-boshi (Pickled Plum).....	20.0%
Pickled yellow daikon radish.....	4.5%
Honeyed Pickled Plum.....	8.0%
Kimuchi.....	2.0%
Fukujin pickles (a medley of vegetables pickled in a soy sauce base, often served with curry).....	5.0%

**Recommended Products**

Salt Concentration  
**PAL-SALT**  
Cat.No.4250



For further product details [P.B12](#)

Salt Concentration  
**PAL-SALT PROBE**  
Cat.No.4222



For further product details [P.B16](#)

Salt / Snow-melting agent (g/100g)  
**PAL-03S**  
Cat.No.4403



For further product details [P.B18](#)

## The Salt Concentration & Deliciousness of Soup Stock

Cut down your daily intake of salt by using soup stock wisely!

Maintaining the perfect balance of salt in a soup stock plays an important role in preserving an appetizing flavor. If we understand the concept of this "golden ratio," we will always be able to preserve the taste of delicious soup stock.

Soup

## Soup Stock, Soup & Ramen Soup

**[Bonito, Kelp, Small Dried Sardines, Shiitake Mushrooms]**

Soup stock is made from boiling bones, meat, seafood, or vegetables and serves as the basis for broths, soups, and many other dishes. Using a refractometer, you can measure the total dissolved solids in the stock and adjust the flavoring/seasoning accordingly. You can also use a salt meter to monitor the salt concentration.

Maintaining the perfect balance of salt in a soup stock plays an important role in preserving an appetizing flavor. If we understand the concept of this "golden ratio," we will always be able to preserve the taste of delicious soup stock. For those that do not yet have confidence in their palette, a refractometer and a salt meter will surely help in developing a recipe that produces consistent and delicious soup stock.

We recommend the **PAL-1** refractometer, and the **PAL-SALT** for measuring soup stock.

For solid samples such as dashimaki tamago (a rolled Japanese style omelet), or dishes made with a soup stock base, we recommend the **PAL-SALT PROBE**.

**[Soup]**

Miso soup is a dish on its own, but many other soups are used as a "dipping broth" for other foods, like pasta or meat. If you compare these two types of soup, miso is more reliant on subtle differences in taste and flavor based on the salt concentration. Not only is flavor affected, but even a small change in salt concentration can have a large effect on daily salt intake.

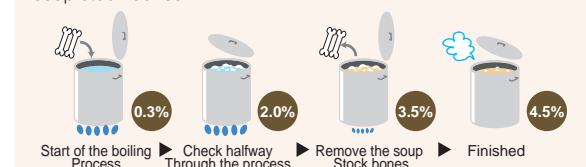
We recommend the **PAL-SALT** for measuring the salt content of miso soup and other soups.

**[Ramen soup]**

Our refractometers and salt meters are already being used at many famous ramen shops.

Taishoken Ramen Shop's owner in Toshima, Tokyo had this to say about our product: "ATAGO's Ramen Soup refractometer is easy to use and immensely useful. I can easily measure the standard for flavor, and in order for me to be able to continue to maintain and create the same original flavor that was first created in the past, it's absolutely indispensable."

Checking the concentration when boiling dashi (soup stock) and soup stock bones



We recommend the **PAL-96S** and **PAL-SALT** Ramen Soup refractometer and Kansui (a solution of water and lye used for making Chinese noodles) Baume refractometer for Ramen Soup.

Our products are especially useful for monitoring sauce preparation, assessing if a reduction is at the proper concentration, confirming a stock delivered from a factory is the correct concentration, or for formulating and maintaining the same flavor standard of a new recipe.

There is a specific method for measuring Ramen soup. Please contact us for more details.

The Salt Content of Soup Stock & Soup & Ramen Soup (Rough guide)	
Kelp soup stock.....	0.25%
Bonito soup stock.....	0.3%
Dashimaki tamago.....	0.9%
Miso soup (robust flavor).....	1.2%
Miso soup (mild flavor).....	0.7%
Ramen Soup.....	1.3 to 1.4%

**Recommended Products**

Salt Concentration  
**PAL-SALT**  
Cat.No.4250



For further product details [P.B12](#)

Salt Concentration  
**PAL-SALT PROBE**  
Cat.No.4222



For further product details [P.B16](#)

Brix  
**PAL-1**  
Cat.No.3810



Please contact us for more details

Chinese noodle soup (Ramen soup) Boume kansui  
**PAL-96S**  
Cat.No.4496



Please contact us for more details

# What is the biggest difficulty when cooking stewed dishes?

As the temperature changes, so too does the perception of flavor and salt concentration.

Do you determine the flavor of stewed dishes by monitoring the concentration of the cooking liquid or the salt content? If you precisely monitor these numerical values, you will always be able to create the same flavor. However, there are a few other factors to consider.

Cooked Food

## Stewed dish & Oden

(Japanese stewed dish consisting of fish cakes, daikon, taro, hard boiled eggs, etc.)

What is the biggest difficulty when cooking stewed dishes?

- The concentration of liquid seasoning and salt.
- The right time to turn off the heat.
- How deeply the flavor has penetrated the food.

Varying amounts of water in natural products (vegetables and meats) affect the flavor in stewed dishes. Simply monitoring the concentration of liquid seasonings and salt is often not enough to ensure a good batch is produced.

Even after stewed dishes are removed from the heat, changes still happen. The flavors continue to merge and a deeper flavor is achieved. While some stewed dishes are served piping hot, others are allowed to cool before serving. The flavor profiles and salt content change with the temperature.

Cooled stewed dishes generally have a stronger flavor and hot stewed dishes generally have a lighter flavor. So when is the best time to turn off the heat once a dish is simmering? You can monitor the cooking liquid for salt concentration or the total concentration of the liquid.

Additionally you can test how deep the salt/seasonings have penetrated into the food by using the **PAL-SALT PROBE** directly on a solid piece of the stew. We have a variety of products in our line-up that utilize different methods for measuring liquid or solid type samples. Contact us today for more information on the different measurement methods available.

We recommend the **PAL-1** and **PAL-SALT** for measuring the liquid seasoning of stewed dishes. If you would like to measure solid samples, we recommend the **PAL-SALT PROBE**.



Nikujaga (Japanese dish of stewed meat and potatoes)



Chikuzenni (Japanese dish of braised chicken and vegetables)



Stewed seasoned kabocha (Japanese winter squash)

### The Salt Content of Stewed dish & Oden (Rough guide)

Nikujaga	1.6%
Chikuzenni	1.0%
Oden	3.2%
Stewed seasoned kabocha	0.8%



Salt Concentration  
**PAL-SALT**  
Cat.No.4250

For further product details [P.B12](#)



Salt Concentration  
**PAL-SALT PROBE**  
Cat.No.4222

For further product details [P.B16](#)



Brix  
**PAL-1**  
Cat.No.3810

Please contact us for more details

# Rice : A Deeply Important Staple in Japanese Cuisine

Should the salt concentration be measured by directly pressing a probe onto the sample? Or should the sample be diluted?

“The addition or reduction of salt,” is the main factor that determines flavor. Particularly in simple dishes, adjusting the amount of salt changes the deliciousness of the dish.

Rice

## Rice, Onigiri (Rice balls), Takikomi Gohan (Japanese dish of rice cooked with meat or seafood, & other savory vegetables), & Fried Rice

### [Onigiri: A Familiar Food to the Japanese People]

These days, onigiri is a staple in convenience stores and supermarkets for meals-on-the-go. They have become beloved as an extremely convenient meal because they can be made in advance, have an excellent shelf-life, and can be eaten with your hands. As with other foods, the correct seasoning is the main factor in determining the flavor of onigiri.

Why bother measuring the salt concentration in onigiri? The optimal level of salt in onigiri ensures a delicious taste. If the rice for onigiri is cooked in salted water, you can measure the water directly to find the approximate salt concentration. Some customers even measure the onigiri directly (with the **PAL-SALT PROBE**) to ensure they remembered to add salt during the cooking process. We recommend the **PAL-SALT PROBE** for measuring the salted water or directly pressing the probe onto the onigiri.

### [Takikomi Gohan : A Dish Intermingled with the Essence of the Seasons]

Kamameshi (a type of Japanese pilaf cooked with various types of meat, seafood, and vegetables, and flavored with soy sauce, sake, or mirin), Kuri Gohan (chestnut rice), Matsutake Gohan (Matsutake mushroom rice), Taimeshi (rice cooked with sea bream)—there are various kinds of Takikomi Gohan. The Japanese people put great importance on “the essence of the seasons.” Takikomi Gohan, made with seasonal ingredients used at their peak, is a dish that truly captures the nuance of a season with its appearance, fragrance, and taste. There is a tendency to inadvertently eat a lot of these types of dishes.

In contrast to plain white rice, Takikomi Gohan’s seasonings and salt have percolated throughout the entire dish. Unfortunately if

you eat a considerable amount, you are consuming a larger amount of salt. This is why adjusting the salt concentration in food is important—it ensures a dish is properly seasoned and not lacking in flavor while preventing the over-consumption of salt.

We recommend the **PAL-SALT** for measuring the salt concentration of the liquid seasoning used for Takikomi Gohan.

Have you ever found that a stock-based dish tasted much too salty after it cooled down? This is due to the amount of salt in the stock and liquid seasoning being adjusted under the assumption that the final dish will be eaten while it’s hot. As the temperature cools, the flavor becomes stronger and easier to detect. If you use the **PAL-SALT**, regardless of the temperature at which you measure, the built-in Automatic Temperature Compensation (ATC) function will display a value that you would get at 20°C. You do not have to rely on taste testing because temperature will affect how you experience the flavor.

### [Is it possible to measure the salt concentration of fried rice?]

A Chinese restaurant owner had this request: “I want to measure the salt concentration of fried rice.” In this circumstance, each grain of rice is independent of each other, so rather than directly pressing a probe onto the sample, diluting with water and measuring with the **PAL-SALT** is the best procedure. In this case, add 90g of water to 10g of fried rice and stir well. Once the salt begins to seep out (approximately 15 minutes), measure the liquid part of the solution. Since the sample is diluted by 10, multiplying the value that is displayed by 10 will result in the salt concentration of the original fried rice.

We recommend the **PAL-SALT** for measuring the salt content of fried rice.



Salt Concentration  
**PAL-SALT**  
Cat.No.4250

For further product details [P.B12](#)



Salt Concentration  
**PAL-SALT PROBE**  
Cat.No.4222

For further product details [P.B16](#)

### The Salt Content of Rice (Rough guide)

Rice	0.0%
Onigiri	0.5%
Takikomi Gohan	0.9%
Fried Rice	1.0%

# Salt is the secret to delicious bread?!



salt is a necessary element to enhance the flavor of bread.

Salt is the secret to delicious bread?!  
Salt plays an important role when baking bread.

Bread

## Bread

The word "bread" conjures images, textures, and tastes that almost everyone can recognize. Around the world there are many varieties of bread and most share a common trait: They have salt added to the recipe.

The basic ingredients used to make bread are flour (bread flour or a high-gluten flour), yeast, salt, and water. Adding water and kneading the flour causes the protein contained in the flour to become sticky and elastic. The yeast is indispensable for making the bread dough rise.

Just what sort of role does salt play when it comes to bread?

Most bread is not particularly salty, but there is a huge difference in taste if no salt is added to the recipe. Bread made without salt is bland and tasteless. Salt helps to enhance the "bread" flavor. Additionally, salt helps to stabilize the two types of protein in the flour. This allows the bread dough to firm up. Salt also helps prevent unwelcome bacteria from invading the dough. Of course, if an excessive amount of salt is added to bread dough, it can kill the yeast before it has a chance to make the dough rise.

Balance is important and many experts say that 2% salt is ideal for most bread recipes.

- How useful is a salt meter when it comes to bread making?
- #1. It allows you to confirm whether or not the salt is uniformly distributed throughout the dough, and
  - #2. It allows you to confirm whether or not you may have forgotten to add salt.

We recommend the **PAL-SALT PROBE**. It is extremely useful, because you can press the probe directly onto the bread dough to measure the salt concentration.

In addition to baking home-made bread, if you like to make your own jam, you can monitor the sugar content with a Brix refractometer.

If you wish to measure the pH of yeast or dough, we recommend using a pH meter.

The units we can recommend depend on the type of sample you are measuring. Please contact us if you have any questions.



Bread is eaten all over the world



The raw ingredient : flour



A piece of toast, lightly-browned to perfection

### The Salt Content of Bread (Rough guide)

Bread	1.2%
French bread (baguette)	1.5%
Croissant	1.2%
Danish	0.5%

Recommended Products

Salt Concentration  
**PAL-SALT PROBE**  
Cat.No.4222



For further product details [P.B16](#)

Brix  
**PAL-1**  
Cat.No.3810



Please contact us for more details

Digital pH Meter  
**DPH-2**  
Cat.No.4320



Please contact us for more details

# The Salt Content in Boiling Water is Immensely Important for Pasta



Sensory tests vs. Salt meter results

Food scientists say that, "In order to boil pasta to delicious al-dente, the ideal salt concentration of the water when it is finished, is 1%."

Pasta

## Boiling Water for Pasta

"The salt content in boiling water is immensely important for pasta"

Mr. Sawada is using ATAGO's salt meter in his cooking lessons. There are many people who do not closely monitor salt concentration when cooking, but rely on their sense of taste. This could cause varying flavors in the final dish depending on the chef.

The reason for this discrepancy comes down to how the taste is perceived by different people. In Mr. Sawada's cooking class, he demonstrates the difference between his students' sense of taste and the reading on a salt meter.

We recommend the **PAL-SALT** to measure the salt concentration in boiling water for pasta.



Food researcher uses science to teach—Mr. Kenji Sawada's cooking class



In order to boil pasta to delicious al-dente, the ideal salt concentration of the water when it is finished, is 1%.



Salted pasta water used to help season this dish



Salt is the deciding factor in flavor.



### The Salt Content of Pasta (Rough guide)

Freshly cooked pasta	0.4%
Peperoncino	1.1%
Genovese	1.0%
Pescatore	0.8%
Carbonara	1.1%
Meat sauce	1.3%
Spaghetti alle vongole (Spaghetti with clams)	1.2%

Recommended Products

Salt Concentration  
**PAL-SALT**  
Cat.No.4250



For further product details [P.B12](#)

# Mmm...the Savory Aroma of Butter!



The key to dilution is to break the butter into smaller pieces.

**Q:** How much salt is in salted butter?  
**A:** About 3.2g of salt per 200g of butter.

## Dairy products

### Butter

Butter is made by first separating the cream from the milk. The cream is then skimmed from the top and agitated until butter solids separates from the buttermilk. After this hardens it is butter.

**[Characteristics of butter]**

- Soft and spreadable
- Makes baked goods flaky
- Adds creaminess

**[Measuring salinity of butte]**

Salt meter **PAL-SALT**

#### The rich flavor of butter

Toast thick sliced bread on a frying pan. The crisp smell of toast fills the room. Put a slice of butter on top and watch as it softens and melts. It looks and smells delicious, the aroma lifting your spirits and putting a smile on your face.

#### The magic of butter

Cooking with butter can add a rich, creamy, and delicious flavor to any food. For example, stir-fried bacon and spinach is even better when you add a little bit of butter.

#### Measurement method

1. Dice 10g of butter into small pieces.
2. Add 90g of warm water and stir.
3. Wait until the salt begins to dissolve into the warm water (about 1 minutes).
4. Measure the liquid.



Salted butter



Stir fried spinach and bacon : a classic recipe



Melted butter

The Salt Content of Butter (Rough guide)

Salted butter	1.9%
Unsalted butter	0.0%
Processed butter	1.3%
Soft margarine	1.2%

Recommended Products

Salt Concentration  
**PAL-SALT**  
 Cat.No.4250



For further product details **P.B12**

# Cheese, a good source of calcium.



In moderation, cheese can be part of a healthy diet.

Cheese is a good source of calcium with essential vitamins and minerals for health and beauty. Bone density is lost as people age leading to conditions like osteoporosis. It is important to have enough calcium in your diet.

## Dairy products

### Cheese

Cheese is high in calcium with a fast absorption rate. The vitamin content of cheese is high as well. Vitamin A is known to help protect skin while vitamin B2 promotes cell growth. Eating cheese is vital for maintaining beauty and a healthy body.

The sodium content of cheese varies between different varieties. For example, a single slice of processed cheese (20 g) contains about 0.6 g of salt.

Salt is added to natural cheese during the manufacturing process in order to preserve it, to bring out the flavor, to suppress the growth of harmful bacteria, and to promote aging. A decrease in salt results in improper aging and reduces the shelf-life of the cheese. Due to this aging process, blue cheese and parmesan cheese contain higher amounts of salt, but a single serving does not contain an inordinate amount of salt. Natural cheese generally contains less salt. The salt content of processed cheese mainly comes from the original ingredient of the cheese it is made of. Some low sodium cheeses are cream cheese, cottage cheese, mozzarella cheese and fresh cheese.

**[Recommended salt meter for measuring salinity of cheese]**

Dilute sample for more accurate measurement. This is because salt meter uses the conductivity method which measures the amount of electricity that passes through the sample. When measuring samples with atoms that are tightly packed together, it is harder for the electricity to pass through. By diluting, atoms are further apart and this allows for easier salt detection. **PAL-SALT** is recommended for measuring sample that require dilution.

**PAL-SALT PROBE** can be directly inserted into cheese and is recommended for testing salt consistency between batches, ensuring consistent salt levels, or for checking how deeply the salt has penetrated the cheese.

Please choose a unit based on your specific needs.

#### Measuring method

1. Take 10g of cheese and mince it.
2. Add 90g of water and mix it well.
3. After letting the sample soak for 30 minutes (in order for the salt to dissolve into the water), measure the liquid. The soaking time may vary based on the type of cheese, but 30 minutes is generally enough time.



Blue cheese



Gouda cheese



Cottage cheese

The Salt Content of Cheese (Rough guide)

Cottage cheese	1.0%
Camembert cheese	2.0%
Cream cheese	0.7%
Gouda cheese	2.0%
Parmesan cheese	3.8%
Blue cheese	3.8%

Recommended Products

Salt Concentration  
**PAL-SALT**  
 Cat.No.4250



For further product details **P.B12**

Salt Concentration  
**PAL-SALT PROBE**  
 Cat.No.4222



For further product details **P.B16**

The right amount of salt is the crucial factor when it comes to taste!

Insert directly into the sample or mince and dilute.

Processed meat products are quite popular. Each meat is processed and flavored depending on the type of meat. This process increases shelf life.

Meat

## Smoked Meats, Ham, & Sausage

### [Smoking (Cooking)]

Smoking is a technique used to preserve and flavor food. Liquid smoke and pickling liquid are used to enhance flavor, while also increasing preservation. Generally, there are three ways of smoking foods: smoke roasting, hot smoking, and cold smoking. Smoke roasting requires smoking in high temperature, usually above 80°C. This process is used for spare ribs and such. Hot smoking is done at approximately 60°C and is used for products such as ham. Cold smoking is used for products like prosciutto or unprocessed fresh ham, and the smoking is done below 30°C. The unique flavors of smoked products are determined by the salt concentration of the pickling and smoke liquid used. Depending on the salt concentration of the liquid, the condition of the meat (tenderness, color) changes.

### [Ham]

Commonly pork or boar meat is brined and processed. The English word "ham" refers to products made from pork thigh meat, however, in Japan, it does not necessarily mean the ham was made from pork or from thigh meat. Although most ham is smoked, there are types of ham which are not smoked. The process of smoking a ham involves shaping the meat, salting, seasoning, submerging in brine solution, smoking, and then boiling. The amount of salt used during brining determines the final flavor and texture of the ham.

### [Sausage]

Sausage is generally made from salted and seasoned ground pork. The prepared sausage is either boiled or smoked as the final preservation process. Sausage is generally stuffed into casings, such as sheep intestines. However, some sausages, like American breakfast sausage, are prepared without being stuffed into casings. The right amount of salt in the ground pork is an important factor for determining the flavor.

Recommended salt meter to measure jerky, ham, and sausage is **PAL-SALT**. For measuring salt content of solids, we recommend **PAL-SALT PROBE**. **PAL-03S**, **PAL-106S**, **PAL-04S**, **PAL-05S** are recommended for measuring salt water.



Bacon



Ham



Sausage

### The Salt Content of Smoked Meats, Ham, & Sausage (Rough guide)

Roasted ham	2.5%
Prosciutto ham	2.8%
Aged Prosciutto	5.6%
Bacon	2.0%
Wiener	1.9%
Frankfurter	1.9%



Salt Concentration  
**PAL-SALT**  
Cat.No.4250

For further product details [P.B12](#)



Salt Concentration  
**PAL-SALT PROBE**  
Cat.No.4222

For further product details [P.B16](#)



Salinity / Snow-melting agent Salinit  
Salinity specific gravity  
**PAL-03S** Cat.No.4403  
**PAL-106S** Cat.No.4506  
**PAL-04S** Cat.No.4404  
**PAL-05S** Cat.No.4405

For further product details [P.B18](#)

Marinated fish is commonly consumed in Japan

To measure marinated fish, it is easier to measure with a probe that can be directly inserted into the fish.

Examples of fish marinades used in Japan are saikyo-zuke (sweet miso marinade), miso-zuke (miso marinated), and kasu-zuke (sake lees marinade).

Fish Processing products

## Pickled Fish

Examples of fish marinades used in Japan are saikyo-zuke (sweet miso marinade), miso-zuke (miso marinated), and kasu-zuke (sake lees marinade).

### [Miso-zuke]

The natural sweet taste in saikyo miso comes from sucrose in the malt rice. Compared to other types of miso, saikyo miso contains the least amount of salt. The soy beans used for saikyo miso contain saponin and lecithin which can lower cholesterol and help protect against cardiovascular diseases.

### [Kasu-zuke]

Sake lees is a fermented food full of nutrients, just like miso. There are a variety of lees in which food can be marinated, such as sake lees and mirin lees. Normally, fishes are salted first regardless of what marinade is used (miso, sweet miso, or lees). To manage the salt brine concentration, **PAL-03S** or **PEN-SW** is recommended. These instruments can measure up to 28% pure salt water. For this reason, they are most suitable for customers that are measuring pure salt water.

Please contact ATAGO for further details.

We have instruments that measure in specific gravity or the Baume scale, which is the scale commonly used by hydrometers.

For fish marinated in miso or sake lees, **PAL-SALT PROBE** is recommended. The probe can be directly inserted into the fish, making it easier to measure. This instrument can measure both liquid and solid samples. Testing brine liquid and brined fish is easily accomplished with the **PAL-SALT PROBE**.

To measure salt content, use the **PAL-SALT**. For concentration measurements, use the **PAL-1**.

\* Please consult ATAGO about using **PAL-1**.

**PAL-SALT** can determine salt concentrations of miso and lees while **PAL-1** measures total dissolved solids of these marinades. To measure salt content, the **PAL-SALT** uses electrical conductivity. When measuring with the conductivity method, dilution is required. Dilution thins out the sample, allowing for a more accurate measurement. A recommended dilution is 10g of sample to 90g of distilled water.



Saikyo-zuke



Miso-zuke



Kasu-zuke

### The Salt Content of Pickled Fish (Rough guide)

Mackerel braised in miso sauce	1.1%
Miso marinated Spanish mackerel	0.8%
Sea-bass marinated in sake lees	1.6%



Salt Concentration  
**PAL-SALT**  
Cat.No.4250

For further product details [P.B12](#)



Salt Concentration  
**PAL-SALT PROBE**  
Cat.No.4222

For further product details [P.B16](#)



Salinity / Snow-melting agent  
**PAL-03S**  
Cat.No.4403

For further product details [P.B18](#)



Salinity  
**PEN-SW(W)** Cat.No.3756  
**PEN-SW(WV)** Cat.No.3757

For further product details [P.B20](#)



Brix  
**PAL-1**  
Cat.No.3810

Please contact us for more details



# Salt enhances the flavor of fish by denaturing proteins



First brined, and then dried.

“Himono” is an old method used to preserve fish in Japan.

Fish Processing products

## Dried Fish

There are many ways to prepare dried fish. The most common method is to salt the fish before drying. When fishes are seasoned with salt, proteins contained in the food denature (unfold). When the fish is then dried, the proteins trap seasonings inside the fish, resulting in a unique, savory, “umami” flavor. The practice of drying fish in the sun began in early history. People of Nara period (710) used himono as a tribute. By the Edo period, it became widely available and was enjoyed by everyone. Due to its long shelf life, it gained popularity as a souvenir to take along on Oise-mairi, a pilgrimage to the Ise Shrine.

There are several different types of himono based on the method used. These include dried-salted fish, boiled-dried fish, steam-dried, grill-dried, and mirin-dried. Regardless of the method, the first step is to brine in 10 to 15% salt water. This concentration varies depending on the type of fish and how much fat the fish contains. Bluefish and fish with a high fat content require a longer time in higher salinity brine. **PAL-03S** is recommended to measure the concentration of the brine solution.

To test fish after bringing, **PAL-SALT PROBE** is recommended. The probe is directly inserted into the fish for more convenient measurement. **PAL-SALT PROBE** can be used to monitor fish brined in different concentrations of brine solutions.

**The Salt Content of Dried Fish (Rough guide)**

Iwashi maruboshi (Dried whole sardine)	5.8%
Katakuchi Iwashi no Niboshi (Boiled and dried half mouth sardine)	4.3%
Shirasu Boshi (Dried baby sardine)	4.1%
Shirasu Boshi (Semi-dried baby sardine)	6.6%
Ajino Hiraki Boshi (Butterflied and dried mackerel)	1.7%
Saba Hiraki Boshi (Butterflied and dried mackerel)	1.7%
Sanma Hiraki Boshi (Butterflied and dried mackerel pike)	1.3%
Sanma Mirin Boshi (Prepared mackerel pike)	3.6%
Dried Surume (Dried squid)	2.3%
Saki Ika (Dried and seasoned squid)	6.9%



Dried surume (squid)



Ajino hiraki boshi



Niboshi

**Recommended Products**

Salinity / Snow-melting agent  
**PAL-03S**  
Cat.No.4403

For further product details [P.B18](#)

Salinity  
**PEN-SW(W)**  
Cat.No.3756  
**PEN-SW(WV)**  
Cat.No.3757

For further product details [P.B20](#)

# Full of much needed nutrients



Consuming too much of a cured product is not good!

Fish eggs have a high concentration of nutrients and is a great source of vitamins.

Fish Processing products

## Roe

Fish eggs that are consumed as food includes kazunoko (herring egg), tarako (pollock roe), ikura (salmon roe), sujiko (salted salmon roe in the sack), karasumi (mullet roe) and caviar. Fish eggs have antioxidants and contain immune-boosting vitamins like zinc and copper. On the down side, they are high in cholesterol.

**[Kazunoko]**  
Herring eggs are called kazunoko in Japan. They are preserved in several ways, including being salted or dried. Because of the high price and elegant color, kazunoko is often referred to as “diamonds of the ocean.” Salted Kazunoko is prepared by soaking overnight in lightly salted water (salinity of about 1%), changing the water a couple of times.

**[Tarako]**  
Brined pollock roe can be eaten uncooked or it can be grilled. The salt content of Tarako is about 5%.

**[Mentaiko]**  
Spicy pollock roe made by soaking in a marinade which contains red peppers. The salt content is similar to that of tarako at about 5%. Although Mentaiko has a high salt content and it's recommended to consume sparingly, if 20g of Mentaiko is eaten together with a bowl of rice, the salt content is about 1.1g. This small amount is similar to or less than many types of soups.

**[Ikura/ Sujiko]**  
Brined salmon roe that is separated into individual eggs is called Ikura, while salmon roe still in the sack is called Sujiko. The same is true for trout eggs. Ikura contains about 1.2g of salt per 50g.

**[Karasumi]**  
Karasumi is known as one of the top (and most expensive) Japanese delicacies. It is made by curing the roe sac of mullet in salt over the span of a couple days and then dried under the sun. The salt content is around 5%.

**[Caviar]**  
Brined sturgeon eggs is called caviar and it is one of the top three delicacies of the world. Russia and Iran are known for their all natural caviar. Caviars to be exported are brined in 7 to 10% salt, but if sold in the country of origin, 3 to 5% salt is sufficient.

**PAL-SALT PROBE** is recommended to measure salinity of the fish eggs to test the brined level and quality control of different batches. The ability to directly insert the probe into the fish egg makes it more convenient than other instruments. For the highest accuracy, mince the fish roe and dilute with water (by dilution factor of 10). Mix well, let settle for a few minutes, and then measure the liquid solution. We recommend the **PAL-SALT** for this type of measurement.

**PAL-SALT** and **PAL-SALT PROBE** use the conductivity method to detect salt in a sample. Since fish roe is very dense, roe can be difficult to measure. For the most precise results, we recommend mixing 10g of minced roe with 90g of distilled water.

Select from **PAL-SALT**, **PAL-SALT PROBE**, **PAL-03S** (or **PAL-04S**, **PAL-05S**), **PEN-SW** to measure salt water used for cleansing the fish roe.

Contact ATAGO for more details.

**The Salt Content of Roe (Rough guide)**

Kazunoko – Herring roe (salt cured and soaked in water)	1.2%
Tarako	4.0 to 5.0%
Karashimentaiko (Spicy pollack roe)	5.6%
Ikura	2.3%
Sujiko	4.8%
Karasumi	3.6%
Caviar	4.1%

**Recommended Products**

Salt Concentration  
**PAL-SALT**  
Cat.No.4250

For further product details [P.B12](#)

Salt Concentration  
**PAL-SALT PROBE**  
Cat.No.4222

For further product details [P.B16](#)

Salinity / Snow-melting agent  
Salinity specific gravity  
Salinity  
**PAL-03S** Cat.No.4403  
**PAL-04S** Cat.No.4404  
**PAL-05S** Cat.No.4405

For further product details [P.B18](#)

Salinity  
**PEN-SW(W)**  
Cat.No.3756  
**PEN-SW(WV)**  
Cat.No.3757

For further product details [P.B20](#)

The role of salt is to bring the elasticity and texture to food.

Processed fish products are healthy!

Surimi is a world renowned Japanese product made from ground fish paste. Salt is added to create a unique texture. Surimi is made by adding salt to the ground fish paste and then it is shaped and heated for pasteurization.

Fish Processing products

## Fish Paste Products

Processed fish products earn high marks for nutrition because they are high in protein. They are a better source of protein because they contain more nutrients and less fat than other meats but deliver the same amount of protein. In addition, other surimi products such as Tsumire (minced fish balls) and Satsuma age (fried fish cake) are rich in calcium. Adding salt to the surimi creates a unique texture and produces another dimension to the flavor. Most processed foods may have a high salt content, but in processed fish products, it is quite the opposite; they have a lower salt content.

When compared to other processed foods, fish cakes contain much less salt. Frozen gyoza (dumplings) and curry in a pouch contains an average of 1.3g salt per serving. Processed fish products such as Kamaboko (cured surimi), Satsuma age (fried fish cake), Hanpen (fish cake), and Chikuwa (tube shaped fish cake) only contain 0.6g of salt per serving.

Processed fish products are mainly grilled, steamed, or boiled after the fish is made into a paste. The final products can be categorized according to the pasteurizing process. Some of the major processed fish products are shown below.

- Grilled:** Chikuwa (tube shaped fish cake), Sasakamaboko (bamboo leaf shaped fish cake), and Datemaki (sweet rolled fish omelette).
- Steamed:** Kamaboko (cured surimi), Kanikama (crab sticks), Suji-Kamaboko (gristly fish paste), Sumaki-Kamaboko (rolled cured surimi), fish sausage
- Boiled:** Hanpen (fish cake), Tsumire (minced fish balls), Naruto (cured fish with swirling pattern)
- Deep fried:** Age Kamaboko (Deep fried cured surimi), Satsuma age (fried fish cake), Tempura, Tsuke Age (fried fish cake), shrimp tempura, young sardine tempura, Gansu (Vegetables and spices mixed with fish paste and deep fried).

**PAL-SALT PROBE**, which can be inserted directly into the product, is recommended for measuring salt content of processed fish products. With **PAL-SALT PROBE**, measuring the salt concentration after brining and controlling salt content between different production lots can be easily accomplished. For measuring concentration of pure salt water, **PAL-03S** or **PEN-SW** is recommended.



Sasakamaboko



Kamaboko



Naruto

The Salt Content of Fish Paste Products (Rough guide)

Chikuwa.....	2.1%
Kamaboko.....	2.5%
Hanpen.....	1.5%
Satsuma age.....	1.9%
Naruto.....	2.0%
Fish sausage.....	2.1%

**Recommended Products**

**Salt Concentration PAL-SALT PROBE** Cat.No.4222

**Salinity / Snow-melting agent PAL-03S** Cat.No.4403

**Salinity PEN-SW(W)** Cat.No.3756

**Salinity PEN-SW(WV)** Cat.No.3757

For further product details [P.B16](#) For further product details [P.B18](#) For further product details [P.B20](#)

Shellfish are an abundant source of taurine.

Let's see how much salt was removed from the shellfish.

Shellfish contain active ingredients such as taurine which can lower cholesterol and blood glucose levels.

Fish Processing products

## Shellfish

Shellfish (manila clams, clams, oysters, scallops, and so on) contain active ingredients such as taurine which can lower cholesterol and blood glucose levels. Taurine also inhibits increases in blood pressure. Scallops not only contain taurine but are the most protein rich among all shellfish. Oysters are called the "Milk of the Sea" referring to their well-balanced nutrients. Shijimi (corbicula clam) contains substances that can facilitate kidney function. Every shellfish has valuable nutrients that are fundamental to health.

**PAL-SALT PROBE** which can directly be inserted to the clam is the recommended unit for measuring residual salt in clams.

Depending on the desired result (salt concentration of seawater or for seafood packaging), select from the following units: **PAL-SALT, PAL-SALT PROBE, PAL-03S, PAL-04S, PAL-05S, or PEN-SW.**



Manila clams



Clams



Scallops

The Salt Content of Shellfish (Rough guide)

Manila clams.....	2.2%
Clams.....	2.0%
Oysters.....	1.3%
Scallops.....	0.8%

**Recommended Products**

**Salt Concentration PAL-SALT** Cat.No.4250

**Salt Concentration PAL-SALT PROBE** Cat.No.4222

**Salinity / Snow-melting agent Salinity specific gravity PAL-03S** Cat.No.4403

**Salinity PAL-04S** Cat.No.4404

**Salinity PAL-05S** Cat.No.4405

**Salinity PEN-SW(W)** Cat.No.3756

**Salinity PEN-SW(WV)** Cat.No.3757

For further product details [P.B12](#) For further product details [P.B16](#) For further product details [P.B18](#) For further product details [P.B20](#)

# Rich in Sea Minerals

Easily evaluate the quality of products before shipping them out!

Out of all the varieties of seaweed, “Wakame” is the one that most graces dining tables in Japan. Wakame is rich in iodine, but is also full of other sea minerals like calcium, potassium, and zinc.

Fish Processing products

## Seaweeds (Kelp & wakame seaweed)

The pleated spore case located at the base of the wakame is called the “mekabu.” It is said to have the greatest nutritional value out of all the parts of the wakame. Wakame protects our bodies from active oxygen, and it is said to contain the same amount of vitamins as many vegetables. These include vitamin C, which strengthens the immune system, beta carotene which guards against rough, chapped skin, and colds. Wakame also contains niacin, vitamin A, B vitamins, and vitamin K.

Salted preserved wakame makes up 90% of all varieties of wakame products. The quality evaluation of salted preserved wakame is commonly determined by measuring its water activity. There are many small scale producers in the wakame processing industry, and this causes many discrepancies. If the salt content is too low, the possibility that the quality will degrade during storage becomes higher, and so measuring the water activity is one method of quality evaluation. By measuring the water activity

of salted and preserved wakame, it becomes possible to easily evaluate the quality of products before shipping them out.

We recommend the **PAL-03S** to measure the salt content of wakame.

### Measurement method

Remove the salt from the wakame leaves. Take 10g of the salted and preserved wakame, add 90g of boiled water and stir. Let stand for approximately 1 minute, take 2 or 3 drops of the liquid, and measure it. Multiply the value on the salt meter by 10 to receive the original salt concentration of the wakame.

\*Water activity is a good indicator of the perishability of a food product. The water activity of water is defined as, “1.” The addition of salt or sugar to the food, or drying or dehydrating the food, causes the water activity value to be less than 1. This decreases the perishability of the food product.



Konbu



Mekabu (raw)



Miso soup with wakame, tofu, and deep-fried tofu

The Salt Content of Seaweeds (Rough guide)

Rishiri-konbu (a species of konbu commonly used for soup stocks)	6.9%
Wakame (raw)	1.5%
Wakame (dried)	16.8%
Wakame (cut and dried)	24.1%
Mekabu (raw)	0.4%

**Recommended Products**

Salinity / Snow-melting agent  
**PAL-03S**  
Cat.No.4403



For further product details [P.B18](#)

**MASTER-S10α**  
**MASTER-S28α**  
**MASTER-S10M**  
**MASTER-S28M**

Salinity  
Cat.No.2471  
Cat.No.2481  
Cat.No.2473  
Cat.No.2483



For further product details [P.B21](#)

Salinity  
**PEN-SW(W)**  
Cat.No.3756  
**PEN-SW(WV)**  
Cat.No.3757



For further product details [P.B20](#)

# The salt concentration of seawater differs around the world, but is generally between 3.1 to 3.8%.

The 3% salt concentration found in seawater is derived from trace amounts of minerals found in the ocean.

The salt concentration of seawater used in ocean research and tanker ballasts, as well as artificial seawater for marine biology applications, is constantly monitored.

Seawater

## Seawater

### [Salt Concentration of Seawater]

The salt concentration of artificial seawater used in aqua farming on dry-land for raising juvenile fish, is between 30 to 35‰. Brackish water is required for prawns and certain species of fish. The salt concentration of brackish water is generally between 0.5 to 30‰.

From the perspective of oceanic ecology preservation, there are regions where measuring the salt concentration of ballast water in vessels (like tankers) is crucial. In the waterways around New York State, water must be more than 30‰ in order to be released back into the water system.

1% = 10‰  
(1 percent = 10 per mill)

Researchers have measured, monitored, and recorded the salt concentration of seawater in every ocean region around the world. Interesting trends have been discovered based on this research. It seems that the beautiful coral reefs that stretch out across the sea cannot be formed if the salt concentration is not between 33 to 35‰.



Tanker ballasts



Live shrimp being raised in holding tanks



An aqua farm in the ocean

The Salt Content of Seawater (Rough guide)

Artificial seawater (aqua farming)	3.5%
Brackish water for raising animals that inhabit such environments	2.8 to 3.4%
Coral reefs	3.1 to 3.8%
Ballast water in tankers	3.5%

**Recommended Products**

Seawater  
Seawater specific gravity  
**PAL-06S** Cat.No.4406  
**PAL-07S** Cat.No.4407  
**PAL-08S** Cat.No.4408

Seawater specific gravity  
Cat.No.2491  
Cat.No.2493



For further product details [P.B19](#)

Seawater specific gravity  
**MASTER-S/Mill α**  
Cat.No.2491  
**MASTER-S/Mill M**  
Cat.No.2493



For further product details [P.B21](#)

# Saline is used in various aspects of everyday life



What is the salt concentration of the saline that is around us?

Salt water has many uses, but is commonly used in the medical field, for cooking, and for selecting seeds (by the differences in specific gravity).

## Brine (Isotonic sodium chloride solution), For Cooking (Water after boiling seafood) For Agriculture (Seed selection based on specific gravity)

Normal saline is defined as 0.9w/v% sodium chloride in water. The concentration is important because it is very close to the salt concentration of the human body. Normal saline is used to wash injuries and to help replenish fluids or cleanse wounds. On the other hand, for cooking, salt water is used to boil seafood and pasta. It is commonly said that the best way to cook pasta is to use boiling water with the same salinity as seawater, but in reality, the key to al dente is for the salinity to start at about 0.85% and change to 1% by the time the pasta is finished boiling. When boiling crab, salt concentration is important in bringing out the best flavor, "umami." In most cases, a salt level close to ocean salinity (3 to 4%) is used, with slight differences depending on the type of crab or the chef's preference. Too much salt can ruin the taste of crab but too little salt will result in bland, flavorless crab. Controlling salt levels to achieve the best flavor may appear like a simple task, yet it is critical. Why not take more control with an instrument that can quickly and accurately measure the salt level? The recommended instrument is **PAL-03S**.

Baby sardines and whitebait perish very quickly once caught, making the freezing storage method difficult. Soon after they are caught, heat processing is used to preserve the fish fresh. This is done by boiling the fish in lightly salted water. To manage salt concentration, **PAL-03S** is recommended.

Inline salt meters are available for customers that would like to automatically manage salt concentration. Please feel free to contact us for more details.

In the agricultural industry, salt water is used for seed selection. High quality seeds will sink, while low quality seeds will float. Different concentrations of salt water are used depending on the variety of seed. Once seeds are selected, they are washed in fresh water.



For boiling crab, the concentration should be close to that of the ocean water, which is between 3 and 4%.



A change in the salt concentration from 0.85% to 1% is the key to al-dente pasta.



Whitebait thoroughly boiled in salt water.

The Salt Content of Brine (Rough guide)

Normal saline	0.9%
Salt water used to boil pasta	1.0%
Salt water used to boil seafood	3.0 to 4.0%

**Recommended Products**

<p>Salt concentration <b>PAL-SALT</b> Cat.No.4250</p>	<p>Salinity / Snow-melting agent Salinity Salinity specific gravity <b>PAL-03S</b> Cat.No.4403 <b>PAL-106S</b> Cat.No.4506 <b>PAL-04S</b> Cat.No.4404 <b>PAL-05S</b> Cat.No.4405</p>	<p>Salinity <b>MASTER-S10α</b> Cat.No.2471 <b>MASTER-S28α</b> Cat.No.2481 <b>MASTER-S10M</b> Cat.No.2473 <b>MASTER-S28M</b> Cat.No.2483</p>	<p>Sodium chloride (Baume) <b>PEN-SW (Baume)</b> Cat.No.3765</p>
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For further product details [P.B12](#)    For further product details [P.B18](#)    For further product details [P.B21](#)    For further product details [P.B20](#)

# Healthier quality farm-raised fish in a closed recirculation system.



Precise salt control for fish farm tank

Fish farming is categorized into two systems: irrigation ditch and sea cage. The sea cage system uses cages submerged directly into the ocean, lakes, or ponds. The irrigation ditch system utilizes above ground irrigation systems to raise the fish. Above ground fish farming with closed loop water circulation is called a "closed recirculation aquaculture system."

## Aquafarming Onsen Tora-fugu (Japanese tiger pufferfish aquafarmed in artificial seawater) & Koi (Carp)

**[Onsen Tora-fugu (Closed Recirculation Aquaculture System)]**  
Recent media coverage in Japan has increased public awareness of "Onsen Tora-fugu" (Tiger Pufferfish) that are raised in natural hot spring water. The hot spring raised pufferfish are market-ready in one year, a full six months faster than when a sea cage system is used. Onsen Tora-fugu are raised in salt water at no less than 0.4% salt concentration. Right before shipment, they are transferred to an artificial seawater tank with salt concentration at 3.4 to 3.5% salt. Without strict control of the salt content in the natural hot spring water, Onsen Tora-fugu could turn a dark color, and eventually it can lead to death. Aquaculture farming allows areas with no access to the ocean to raise not only pufferfish, but other saltwater creatures (like shrimp). These farms can help to revitalize the economy of nearby cities or towns.

**[Koi]**  
When koi (carp) have topical damage or a bacterial infection, a salt water bath is recommended. Through osmosis, the salt water allows the koi to readjust and recover. Most commonly, a 0.3 to 0.7% salt bath is used for between 48 to 120 hours. The effectiveness of salt baths is significant, especially when treating fin/tail rot, or narcolepsy. However, the wrong concentration of salt, such as a high concentration, could affect the color of the fish, and could even result in death.



Tora-fugu (tiger pufferfish) raised in closed recirculation aquaculture system.



Fugu Chiri Nabe (pufferfish hotpot)



Farming of carp

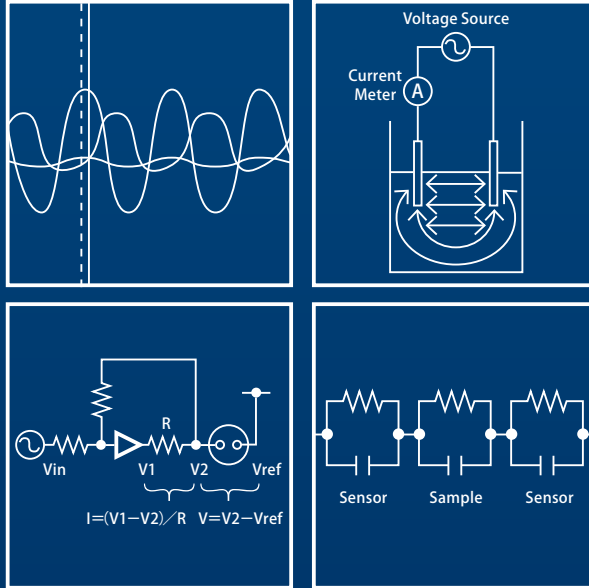
The Salt Content of Aquafarming (Rough guide)

Tora-fugu	1.2%
Shrimp	0.5 to 4.0%
Koi	0.3 to 0.7%

**Recommended Products**

<p>Salt concentration <b>PAL-SALT</b> Cat.No.4250</p>	<p>Salinity / Snow-melting agent <b>PAL-03S</b> Cat.No.4403</p>	<p>Seawater <b>PAL-06S</b> Cat.No.4406</p>
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For further product details [P.B12](#)    For further product details [P.B18](#)    For further product details [P.B19](#)



# Salt Meter Guide

To users measuring salinity through the titration method, hydrometers (Baume scale), or low-end salt meters.

# Are You Having Trouble Managing the Salinity of Your Products?

Until now, food processing sites and commercial kitchens had no effective way of measuring salinity. One major contributing factor is that there were no convenient and easy to use salt meters available.

The titration method requires dangerous reagents, which cannot be used in commercial kitchens or processing sites.

Salt meters designed for common household use are available; however, they are not accurate enough to fulfill the needs of manufacturing sites or commercial kitchens.

ATAGO recognized this demand and introduced salt meters that fulfilled the requirements of these industries. ATAGO's salt meters are highly suitable for use in any food processing site or commercial kitchen.



<http://www.atago.net/> [overseas@atago.net](mailto:overseas@atago.net)

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- ATAGO INDIA Instruments Pvt. Ltd.** TEL : 91-22-28544915, 40713232
- ATAGO THAILAND Co., Ltd.** TEL : 66-21948727-9
- ATAGO BRASIL Ltda.** TEL : 55 16 3913-8400
- ATAGO ITALIA s.r.l.** TEL : 39 02 36557267
- ATAGO CHINA Guangzhou Co., Ltd.** TEL : 86-20-38108256
- ATAGO RUSSIA Ltd.** TEL : 7-812-777-96-96
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**HACCP GMP GLP**

ATAGO products comply with HACCP, GMP, and GLP system standards.

Certification Scope :  
Headquarters/Fukaya Factory

- [customerservice@atago-usa.com](mailto:customerservice@atago-usa.com)
- [customerservice@atago-india.com](mailto:customerservice@atago-india.com)
- [customerservice@atago-thailand.com](mailto:customerservice@atago-thailand.com)
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\* Specifications and appearance are subject to change without notice.

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### For Users Measuring Salinity for the First Time ▶

..... Please turn over and flip the booklet upside down.

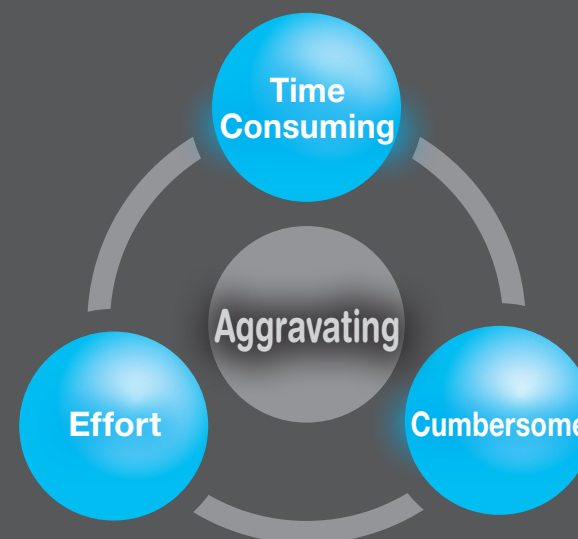
### Product Information ▶

Electrical conductivity	PAL-SALT.....	B12
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# Titration Method

For users measuring salinity through titration

“This is too much trouble!”

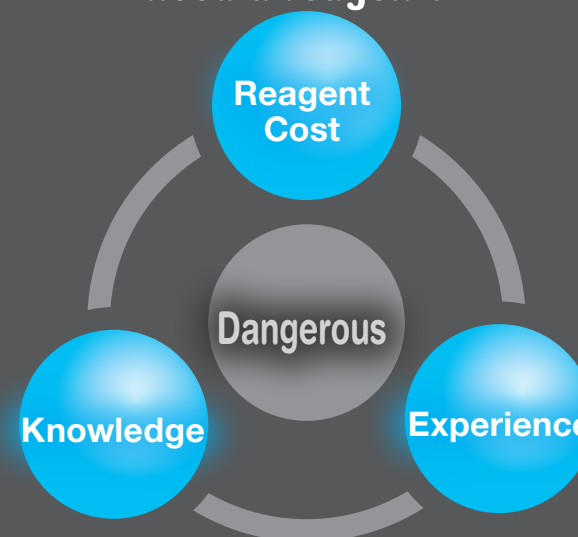


The titration method requires various lab equipment and the set-up/clean-up requires time and effort. Measurements must also be taken on a table or benchtop. This method is not portable or convenient.

**ATAGO's Salt meter...**

- ▶ Does not require any lab equipment.
- ▶ Does not require complicated procedures-just dilute with water.
- ▶ Can be used anywhere.

“Isn't there a method that doesn't need a reagent?”

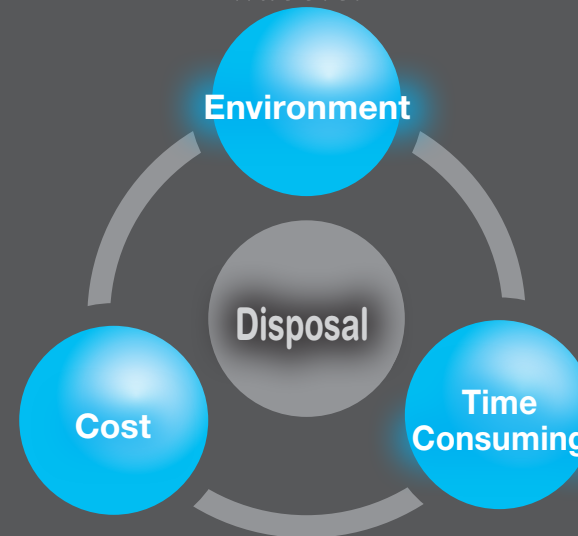


The titration method requires dangerous and costly reagent. Using the reagents safely is time consuming and requires proper training.

**ATAGO's Salt meter...**

- ▶ Absolutely no reagent required.
- ▶ Take just 3 seconds to measure.
- ▶ Easy to operate and can be used by anyone.

“Disposing of liquid waste is a hassle.”



After measurements are completed, the titration method requires proper disposal of the sample liquid, liquid silver nitrate, and the reagent.

**ATAGO's Salt meter...**

- ▶ Does not require reagent. Zero liquid waste.
- ▶ No disposal cost.
- ▶ Environmentally friendly and does not harm the earth.

# Hydrometer (Baume scale)

For Users Measuring Salinity With Hydrometers

Fragile

**“I accidentally broke it.”**

A Hydrometer (Baume scale) is a fragile glass product which may cause damage if shattered. When used in facilities such as food product factories, special care and consideration is necessary for handling any shattered glass or chemicals contained in the hydrometer.

**ATAGO's Salt meter...**

- Does not break—no need to worry about damage.
- No need to clean any shattered glass.
- No cost of replacing broken hydrometers.

Frustrating

**“Where do I read?”**

Hydrometers can be difficult to read because the constant motion of the hydrometer causes the scale to move. This makes it difficult to find the exact point where the surface of the liquid corresponds to the hydrometer scale. Furthermore, air bubbles may adhere to the scale and interfere with readings. Hydrometers can only measure clear samples. They also require a large amount of sample.

**ATAGO's Salt meter...**

- Simply place a few drops on the sample stage to measure. Only a minute amount of sample is needed!
- Fully digital display. Measurements can be read instantly (an accurate and easy to read analog version is also available).
- Colored, opaque, and paste-like samples can be measured.

Difficult

**“Temperature compensation is such a hassle.”**

The ability to read a small scaled hydrometer requires experience. Hydrometers also require manual temperature compensation.

**ATAGO's Salt meter...**

- No experience or calculation needed.
- Measurement results are directly displayed.
- No need to take temperature into account—the automatic temperature compensation feature will calculate it for you.



# Low-end Salt meters (Electrical Conductivity Method)

For Users Measuring Salinity With Simplified Salt Meters



Unreliable

## “This is really not so accurate.”

Most low-end salt meters only display an estimated value of the salt content. Depending on the measurement method, there can be a discrepancy in the values after each measurement. This calls into question whether or not measurements are being taken correctly.

Low-end salt meters are also sensitive to temperature. A change in temperature can produce vastly different measurement results, even among the same samples. There are even some salt meters that cannot measure samples that are too hot, and some that cannot measure samples that are too cold.

ATAGO's Salt meter.

- ▶ Displays actual values-- not just an estimate
- ▶ Highly accurate measurement
- ▶ Equipped with Automatic Temperature Compensation .

Frail

## “This breaks easily.”

Some low-end salt meters break or stop functioning within one year. In many cases, this is due to corrosion on the electrode, water damage (body of units not water resistant), or heat damage to the plastic body.

ATAGO's Salt meter.

- ▶ Measurement temperature up to 100°C.
- ▶ Can be washed under running water.
- ▶ Durable, corrosion resistant electrodes (PAL-SALT only).

Short-Lived

## “Disposable units end up costing you more.”

Many of the low-end salt meters cannot be calibrated. If the readings become unstable, a new unit must be purchased. Not only do you risk fluctuating readings, the cost of replacing unit after unit make the low-end salt meters much more expensive over time.

ATAGO's Salt meter.

- ▶ Zero sets with air (electrical conductivity method), Zero sets with water (refractive method)
- ▶ Calibration function for accurate measurement (Electrical conductivity method)
- ▶ Reference Setting function allows for long-term, reliable use.



## Electrical Conductivity Method

## Refractive Method

### Digital Pocket Refractometer

Model	PAL-SALT	PAL-SALT Mohr	PAL-SALT PROBE	ES-421	PAL-03CS	PAL-03S	PAL-106S	PAL-04S	PAL-05S	PAL-06S
Cat.No.	4250	4251	4222	4211	4393	4403	4506	4404	4405	4406
Scale	Salt concentration (g/100g)	Salt concentration (g/100g)	Salt concentration (g/100g)	Salt concentration (g/100g)	Salinity/snow-melting agent (g/100g), Freezing Point	Salinity/Snow-melting agent (g/100g)	Salinity (g/100mL)	Salinity specific gravity	Salinity (Baume)	Seawater (Salinity)
Image										
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## Refractive Method

### Digital Pocket Refractometer

### Digital Dip-Type Refractometer

### Hand-Held Refractometer

Model	PAL-07S	PAL-08S	PEN-SW (W)	PEN-SW (WV)	PEN-SW (Baume)	MASTER-S/ Milla	MASTER-S/ Mill M	MASTER-S10α	MASTER-S10M	MASTER-S28α	MASTER-S28M	MASTER-BX/ S28M
Cat.No.	4407	4408	3756	3757	3765	2491	2493	2471	2473	2481	2483	2484
Scale	Seawater specific gravity	Seawater (Baume)	Salinity (g/100g)	Salinity (g/100mL)	Salinity (Baume)	Seawater specific gravity	Seawater specific gravity	Salinity (High Accuracy)	Salinity (High Accuracy)	Salinity (Wide Range)	Salinity (Wide Range)	Brix & Salinity
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Page	<a href="#">P.B19</a>	<a href="#">P.B19</a>	<a href="#">P.B20</a>	<a href="#">P.B20</a>	<a href="#">P.B20</a>	<a href="#">P.B21</a>	<a href="#">P.B21</a>	<a href="#">P.B21</a>	<a href="#">P.B21</a>	<a href="#">P.B21</a>	<a href="#">P.B21</a>	<a href="#">P.B21</a>



### What is the difference between salt meters that use the electrical conductivity method and salt meters that use the refractive method?

Select a salt meter which uses the electrical conductivity method when you wish to measure only the salt concentration of samples that contain other ingredients besides salt. When measuring pure salt water or seawater, either type of salt meter (electrical conductivity method or refractive method) can be used.

Salt meters which use the refractive method are capable of measuring salt water samples with a salinity of up to 28% (g/100g) without dilution. However, when

### use the electrical refractive method?

measuring salt water samples with a high concentration, dilution is necessary when using an ATAGO salt meter which uses the electrical conductivity method. For this reason, when measuring pure salt water or seawater samples, a salt meter which uses the refractive method is much more convenient. Please select a salt meter which uses the conductivity method when measuring a variety of samples (salt water and samples containing other ingredients, like condiments).

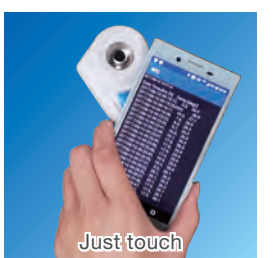


(Near Field Communication) Scheduled to be installed sequentially



Measurement history (up to 100 items) can be read by touching a contactless IC card reader / writer connected to a smartphone or a personal computer.

\* The N-Mark is a trademark or registered trademark of NFC Forum, Inc. in the United States and in other countries.



# Control salt with this innovative and convenient measurement method

Salt concentration 10.0%  
Features Offset Function  
Digital Model



Digital Hand-held "Pocket" Salt Meter

**PAL-SALT** Cat.No.4250

Scale	Measurement Range	Measurement Accuracy	International Protection Class
Salt concentration (g/100g)	0.00 to 10.0%	Refer to Specifications	IP65



### Long lasting salt meter

Durable titanium electrode

Uses titanium electrode that is highly resistant to corrosion from salt water and seawater. Long lasting and durable. Is not damaged by friction and can withstand harsh usage in the kitchen or at factory sites.



### Stable reading

Apply just a few drops of sample on the sample stage

Salinity can be measured by placing a few drops of sample on the sample stage. The measurement stability is not affected by substances containing oil or substances at a high temperature. Measuring without inserting the salt meter into the sample is more sanitary.

### Easy calibration for reliable results

Zero Setting & Reference Setting

One press of ZERO button to zero set with air. Additionally, 2.50% saline solution allows for testing a known point. Unlike disposable salt meters, the PAL-SALT gives reliable stable measurement results.



### Measurement Method



### When displayed result is compared against the titration method

#### Off Set function

Features the offset function which enables the programming of a coefficient and a constant to automatically convert measured values. Able to directly display measurement value correlated to other principles, such as titration. Also, by setting the dilution factor, the original salt concentration can be directly displayed.

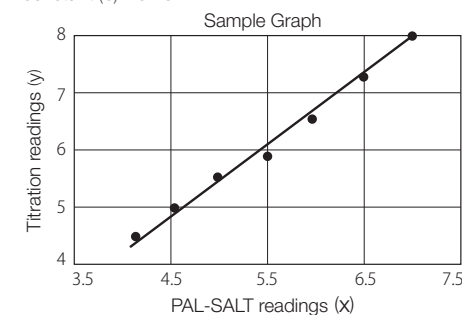
$$y = Ax + b$$

$y$  : Value displayed on the unit  
 $x$  : Measured value by the unit  
 $A$  : Coefficient  
 $b$  : Constant

### Offset Feature Example 1

If a different detection principle (such as titration) results in different measurement values, unit can be programmed with a correlation coefficient (A) and a constant (b) to display values close to the other detection principle.

In this graph:  
coefficient (A)=1.18  
constant (b)=-0.40



### Offset Feature Example 2

If a 10% dilution is made, entering the Dilution Factor (A)=10 will display the value of the original, undiluted sample.

[Example]  
When measured value is 0.90 for a sample with dilution factor of 10,

$$0.90 \times 10 \text{ (dilution factor)}$$

The actual salt concentration is 9.0%. Input the coefficient (A) of 10, and the value multiplied by 10 will be displayed.

$$9.0 \text{ ← Display value}$$

### Sanitary design

Waterproof design



The whole unit can be rinsed under running water. Very safe and sanitary for use in the food industry.

### Specifications

Model	PAL-SALT
Cat.No.	4250
Scale	Salt concentration (g/100g) Temperature
Measurement Method	Conductivity method
Measurement Range	0.00 to 10.0% of salt concentration 5.0 to 100°C
Resolution	0.01% for salt concentration of 0.00 to 2.99% 0.1% or salt concentration of 3.0 to 10.0% 0.1°C
Measurement Accuracy	Displayed value ±0.05% (for salt concentration of 0.00 to 0.99%) Relative precision ±5% (for salt concentration of 1.00 to 10.0%) ±1%
Sample Temperature	5 to 100°C
Ambient Temperature	10 to 40°C
Sample Volume	At least 0.6mL
Measurement Time	Approx. 3 seconds
Power Supply	Size AAA alkaline batteries × 2
International Protection Class	IP65 Dust-tight and Protected against water jets.
Dimension & Weight	55(W) × 31 (D) × 109 (H) mm, 100g (Main unit only)

## Relationship between electric conductivity method and titration method

Correlating the difference in detection principle and measurement results for salt meters using conductivity method (PAL-SALT etc.) and Mohr method.

### Detection principle for conductivity method

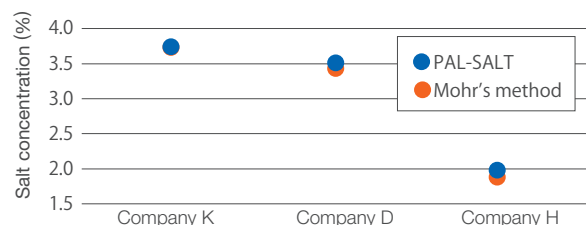
PAL-SALT uses the conductivity method in which the amount of electrolytes in the sample is detected and converted to salt concentration. Mohr's method detects the amount of chlorine in the sample and converts it to salt concentration. The unit used for Mohr's method is weight/volume (g/100mL) while PAL-SALT uses weight/weight (g/100g). Food contains various ingredients and for this reason a value computed by PAL-SALT and Mohr may not match. To compensate for the difference, a conversion chart can be created by plotting points for measurement values by both methods.

Please refer to P.B11 for Offset function.

### There is a correlation between the conductivity method and Mohr's method.

#### Measuring Salinity of Ketchup

Testing ketchup shows that results obtained by PAL-SALT and Mohr's method were very close.

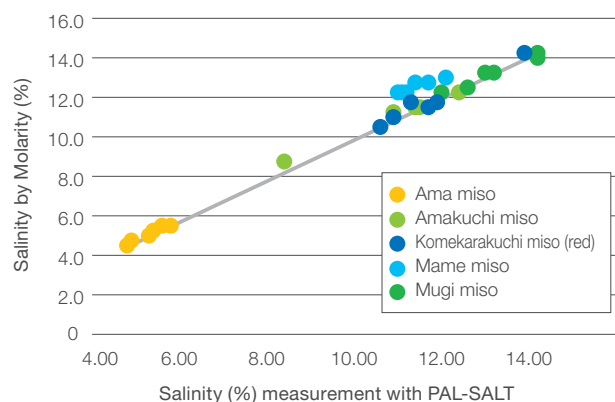


Salinity of Ketchup: Correlation between the conductivity method and Mohr's method (%)

	Salt concentration	
	PAL-SALT	Mohr's method
Company K	3.74	3.73
Company D	3.51	3.43
Company H	1.98	1.88

#### Measuring Salinity of Miso Soup

The following chart shows a comparison of measurement results for PAL-SALT and titration method for different types of miso. As shown in the graph, there is a correlation between the PAL-SALT measurement and the results obtained by titration.



Salinity of miso: Correlation between the conductivity method and Mohr's method (%)

	Salt concentration	
	PAL-SALT	Mohr's method
Ama miso	4.50	4.8
	4.75	4.9
	5.00	5.3
	5.25	5.4
	5.50	5.6
Amakuchi miso	5.50	5.8
	12.25	12.4
	11.00	10.9
	8.75	8.4
	11.50	11.5
Komekarakuchi miso (red)	11.25	10.9
	11.50	11.4
	12.25	12.0
	14.00	14.2
	14.25	14.2
Mame miso	13.25	13.2
	12.50	12.6
	12.25	11.0
	12.75	11.4
	12.75	11.7
Mugi miso	13.00	12.1
	12.25	11.1
	12.25	11.2
	11.00	10.9
	11.50	11.7
	10.50	10.6
	11.75	11.9
	11.75	11.3
	14.25	13.9

## For Measurement in the Weight/Volume Ratio as in Titration (Mohr Method)

Salt concentration 10.0%

Offset feature

Unit g/100mL



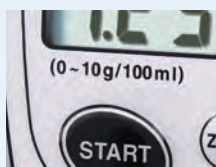
Digital Hand-held "Pocket" Salt Meter

### PAL-SALT Mohr Cat.No.4251

Scale	Measurement Range	Measurement Accuracy	International Protection Class
Salt concentration (g/100mL)	0.00 to 10.0%	Refer to Specifications	IP65

#### Salt concentration is displayed in g/100mL

Salt concentration is displayed in the same units as used in titration (Mohr method)



Titration (Mohr method) mostly quantifies salt concentration in terms of the weight/volume ratio (g/100mL). The PAL-SALT Mohr was designed with this in mind, so there is no need to convert the readings because this unit displays salt concentration in weight/volume.

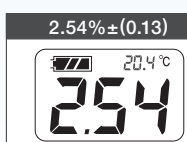
#### Upgraded and revolutionary features

Specifications are the same as the PAL-SALT (excluding unit readout).

With the exception of the unit readout (w/v), the PAL-SALT Mohr shares common features and specifications with the PAL-SALT, such as the Offset feature. When measuring a sample that has been diluted by a factor of 10, the PAL-SALT Mohr also has a function that can display the actual salt concentration before dilution.

#### Reference Check

Calibrating (checking the reference point) with 2.50g/100g of salt water



2.50g/100g=2.54g/100mL

A 2.50g/100g salt water solution will read 2.54 ± 0.13% (w/v) on the PAL-SALT Mohr. If measurement values are abnormal, the unit is equipped with a reference set feature.

#### Specifications

Model	PAL-SALT Mohr
Cat.No.	4251
Scale	Salt concentration (g/100mL) Temperature
Measurement Method	Conductivity method
Measurement Range	0.00 to 10.0% of salt concentration 5.0 to 100°C
Resolution	0.01% for salt concentration of 0.00 to 2.99% 0.1% or salt concentration of 3.0 to 10.0% 0.1°C
Measurement Accuracy	Displayed value ±0.05% (for salt concentration of 0.00 to 0.99%) Relative precision ±5% (for salt concentration of 1.00 to 10.0%) ±1%
Sample Temperature	5 to 100°C
Ambient Temperature	10 to 40°C
Sample Volume	At least 0.6mL
Measurement time	Approx. 3 seconds
Power Supply	Size AAA alkaline batteries × 2
International Protection Class	IP65 Dust-tight and Protected against water jets.
Dimension & Weight	55(W) × 31 (D) × 109 (H) mm, 100g (Main unit only)

#### Measurement Method



# For measuring salt concentration of solid samples



Salt concentration 7.0%  
Probe model

Digital Hand-held "Pocket" Salt-Meter

**PAL-SALT PROBE** Cat.No.4222

# Quality assurance for food factory



Salt concentration  
10.0%  
Long selling electric conductivity model

Digital Salt Meter

**ES-421** Cat.No.4211

Scale	Measurement Range	Measurement Accuracy	International Protection Class
Salt concentration (g/100g)	0.00 to 7.0%	Refer to Specifications	IP65

Scale	Measurement Range	Measurement Accuracy	International Protection Class
Salt concentration (g/100g)	0.00 to 10.0%	Refer to Specifications	IP64

## Simple measurement

Probe can be inserted directly to measure solid samples

Insert probe directly into the sample to measure. Check for salt penetration, salt extraction, or salt presence.

## Various examples



Dairy : Cheese



Processed meat : Ham, sausage, bacon, chashu (Barbequed Pork)



Processed seafood : Sundried fish, herring egg, fish sausage



Onigiri (Rice ball), bread

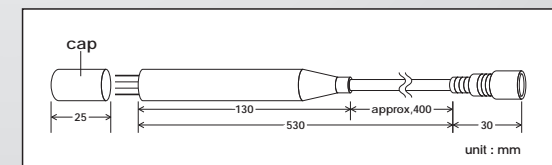
### Specifications

Model	PAL-SALT PROBE
Cat.No.	4222
Scale	Salt concentration (g/100g)
Measurement Method	Conductivity method
Measurement Range	0.0 to 7.0% (ATC)
Resolution	0.01% (0.00 to 1.99%) 0.1% (2.0 to 7.0%)
Measurement Accuracy	±0.1% (0.00 to 1.99%) Relative precision ±5% (2.1 to 5.0%) Relative precision ±10% (5.1 to 7.0%)
Sample Temperature	3 to 30°C
Measurement Time	Approx. 3 seconds
Power Supply	Size AAA alkaline batteries × 2
International Protection Class	IP65 Water resistant.
Dimension & Weight	Main unit : 55(W) × 31 (D) × 109 (H) mm, 100g Electrode probe : ø10 × 530mm (Cable length : Approx. 400mm)

※ About displayed value  
PAL-SALT probe can accurately measure salt water in percentage (g/100g) within specifications. For samples containing non-salt substances, or if the probe is directly inserted into a solid sample, measurement result should only be used as a reference.

※ Dilute with water when measuring samples above 7% salt concentration or above 6% brix.

### Probe Dimension



### Measurement Method



## Lightweight and ergonomic design

Stable on the table yet compact to carry

Sample stage is made of SUS316L resin which is known for its durability against corrosion. A sample can be measured while the device is in your hand or set on a desk.

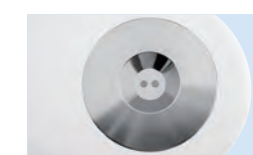
## Equipped with Offset Feature

Redesigned and upgraded with a convenient, brand new feature.

Newly equipped with a convenient offset feature for measurement. This feature enables the instrument to produce values which are close to those of other measurement principles, such as titration. For details, please see P.B13.

## High accuracy

Cup shaped sample stage



Only requires 0.6mL of sample. High accuracy of ±0.05% for salt concentration under 0.99%.

### Specifications

Model	ES-421
Cat.No.	4211
Scale	Salt concentration (g/100g)
Measurement Method	Conductivity method
Measurement Range	0.00 to 10.0% (ATC)
Resolution	0.01% for salt concentration of 0.00 to 2.99% 0.1% for salt concentration of 3.0 to 10.0%
Measurement Accuracy	Displayed value ±0.05% (for salt concentration of 0.00 to 0.99%) Relative precision ± less than 5% (for salt concentration of 1.00 to 10.0%)
Sample Temperature	5 to 100°C
Ambient Temperature	10 to 40°C
Measurement Time	Approx. 3 seconds
Power Supply	006P Dry battery (9V)
International Protection Class	IP64 Dust-tight and Protected against splashing water.
Dimension & Weight	170 (W) × 90 (D) × 40 (H) mm, 220g(Main unit only)

### Other features

- Easy operation, apply small amount of sample and press start.
- Zero set with air
- Simple design with only two buttons.

## For Managing Salt water and Seawater Concentration

# PAL series

## Digital Hand-Held "Pocket" Refractometer



PAL-03CS  
NFC Equipped Model



PAL-03S  
NFC Equipped Model

### Salinity/Snow-melting agent (g/100g)

**PAL-03CS** Cat.No.4393  
**PAL-03S** Cat.No.4403

Salinity

Specifications	PAL-03CS	PAL-03S
Scale	Sodium chloride (g/100g) Freezing point	Sodium chloride (g/100g)
Measurement Range	Sodium chloride : 0.0 to 28.0% Freezing point : 0 to -22°C	0.0 to 28.0%
Resolution	Sodium chloride : 0.1 % Freezing point : 1 °C	0.1 %
Measurement Accuracy	Sodium chloride : ±0.2% Freezing point : ± 1 °C	±0.2 %
Temperature Compensation	10 to 40 °C	

### Salinity (g/100mL)

**PAL-106S** Cat.No.4506

Salinity

Specifications	
Scale	Sodium chloride (g/100mL)
Measurement Range	0.0 to 33.0 %
Resolution	0.1%
Measurement Accuracy	±0.2 %
Temperature Compensation	10 to 40 °C



PAL-106S  
NFC Equipped Model



PAL-04S  
NFC Equipped Model

### Salinity specific gravity

**PAL-04S** Cat.No.4404

Salinity

Specifications	
Scale	Sodium chloride (S.G.)
Measurement Range	1.000 to 1.217
Resolution	0.001
Measurement Accuracy	±0.002
Temperature Compensation	10 to 40 °C

### Salinity (Baume)

**PAL-05S** Cat.No.4405

Salinity

Specifications	
Scale	Sodium chloride (Baume)
Measurement Range	0.0 to 25.7 °
Resolution	0.1°
Measurement Accuracy	±0.2°
Temperature Compensation	10 to 40 °C



PAL-05S



PAL-06S  
NFC Equipped Model

### Seawater (Salinity)

**PAL-06S** Cat.No.4406

Sea-water

Specifications	
Scale	Seawater (Salinity)
Measurement Range	0 to 100 ‰
Resolution	1‰
Measurement Accuracy	± 2 ‰
Temperature Compensation	10 to 40 °C

### Seawater specific gravity

**PAL-07S** Cat.No.4407

Sea-water

Specifications	
Scale	Seawater (S.G.)
Measurement Range	1.000 to 1.070
Resolution	0.001
Measurement Accuracy	± 0.002
Temperature Compensation	10 to 40 °C



PAL-07S  
NFC Equipped Model



PAL-08S

### Seawater (Baume)

**PAL-08S** Cat.No.4408

Sea-water

Specifications	
Scale	Seawater (Baume)
Measurement Range	0.0 to 10.0 °
Resolution	0.1 °
Measurement Accuracy	± 0.2 °
Temperature Compensation	10 to 40 °C

### Common Specifications

Temperature	10 to 40 °C Resolution : 0.1 °C Measurement Accuracy : ± 1 °C
Sample Volume	At least 0.3mL
Measurement Time	Approx. 3 seconds
Power Supply	2x AAA Batteries
International Protection Class	IP65 Dust-tight and Protected against water jets.
Dimensions & Weight	55(W)× 31(D) ×109(H) mm,100g (Main unit only)

Equipped with ATC (Automatic Temperature Compensation)  
Equipped with ELI (External-Light Interference) for reliable outdoor measurements

### ELI Feature

(External-Light-Interference) Patented

When intense light penetrates the prism of a digital refractometer, the light waves interfere with the sensor, which may lead to inaccurate measurements. To ensure accurate measurement results, the PAL is programmed with the ELI feature, which displays the [nnn] warning message when intense direct light is detected. Shading the sample stage with your hand and re-pressing the START key will ensure accurate measurement results each time.

### Measurement Method



Apply 2 to 3 drops of sample on the prism surface.



Press the START key.



Measurement value is displayed in 3 seconds.

## Three Ways to Measure: Touch, Dip, Stir

# PEN series

## Digital Hand-Held "PEN" Refractometer

Salinity (g/100g)



Salinity

### PEN-SW (W) Cat.No.3756

Specifications	
Scale	Salinity (g/100g)
Measurement Range	Salinity (g/100g) : 0.0 to 28.0% (Automatic Temperature Compensation)
Resolution	Salinity (g/100g) : 0.1%
Measurement Accuracy	±0.2%
Temperature Compensation	10 to 40 °C
Power Supply	1 × Size AAA alkaline battery
International Protection Class	IP65 Dust-tight and Protected against water jets. Prism head IP67 Dust-tight and Protected against the effects of temporary immersion in water.
Dimension & Weight	160(W) × 38 (D) × 18 (H) mm, 70g (Main Unit only)

Salinity (g/100mL)



Salinity

### PEN-SW (WV) Cat.No.3757

Specifications	
Scale	Salinity (g/100mL)
Measurement Range	Salinity (g/100mL) : 0.0 to 33.0% (Automatic Temperature Compensation)
Resolution	Salinity (g/100mL) : 0.1%
Measurement Accuracy	Salinity (g/100mL) : ±0.2%
Temperature Compensation	10 to 40 °C
Power Supply	1 × Size AAA alkaline battery
International Protection Class	IP65 Dust-tight and Protected against water jets. Prism head IP67 Dust-tight and Protected against the effects of temporary immersion in water.
Dimension & Weight	160(W) × 38 (D) × 18 (H) mm, 70g (Main Unit only)

Sodium chloride (Baume)



Salinity

### PEN-SW (Baume) Cat.No.3765

Specifications	
Scale	Sodium chloride (Baume)
Measurement Range	Sodium chloride (Baume) : 0.0 to 25.7 ° (Automatic Temperature Compensation)
Resolution	Sodium chloride (Baume) : 0.1 °
Measurement Accuracy	Sodium chloride (Baume) : ±0.2 °
Temperature Compensation	10 to 40 °C
Power Supply	1 × Size AAA alkaline battery
International Protection Class	IP65 Dust-tight and Protected against water jets. Prism head IP67 Dust-tight and Protected against the effects of temporary immersion in water.
Dimension & Weight	160(W) × 38 (D) × 18 (H) mm, 70g (Main Unit only)

**Measurement Method**

Dip (or touch) the tip into the sample. Press the START key. Measurement value (salt water concentration) is displayed after 2 seconds.

### Easy and Simple Operation!

Ideal for spot checking – No need for a pipette or spoon. Just insert the PEN directly into the sample. Convenient one-handed operation. Easy cleaning.

Ultimate Functionality. Unsurpassed Quality. Seamless Usability. Perfection pursued for function, operation, and design. The ultimate hand-held refractometer.

# MASTER series

## Hand-Held Refractometer

Seawater specific gravity



Sea-water

### MASTER-S/Mill α Cat.No.2491 ATC\*Water Resistant MASTER-S/Mill M Cat.No.2493

Specifications	MASTER-S/Mill α	MASTER-S/Mill M
Measurement Range	① Salinity : 0 to 100‰ ② Specific gravity : 1.000 to 1.070	
Minimum Scale	① 1‰ ② 0.001	
Measurement Accuracy	① ± 2‰ * ± 1‰ ② ± 0.001 * ± 0.0005 (10 to 30°C)	
Dimension & Weight	32(W) × 34 (D) × 207 (H) mm, 110g	

\*Repeatability

Salinity (High Accuracy)



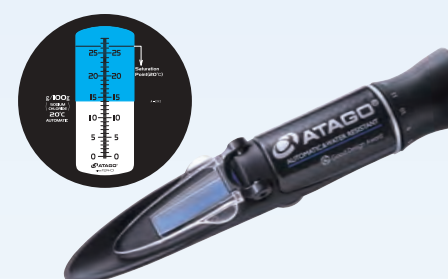
Salinity

### MASTER-S10 α Cat.No.2471 ATC\*Water Resistant MASTER-S10 M Cat.No.2473

Specifications	MASTER-S10 α	MASTER-S10 M
Measurement Range	Sodium chloride : 0.0 to 10.0g/100g (Automatic Temperature Compensation)	
Minimum Scale	0.1g / 100g	
Measurement Accuracy	± 0.2g / 100g * ± 0.1 / 100g (10 to 30°C)	
Dimension & Weight	32(W) × 34 (D) × 203 (H) mm, 105g	

\*Repeatability

Salinity (Wide Range)



Salinity

### MASTER-S28 α Cat.No.2481 ATC\*Water Resistant MASTER-S28 M Cat.No.2483

Specifications	MASTER-S28 α	MASTER-S28 M
Measurement Range	Sodium chloride : 0.0 to 28.0g / 100g (Automatic Temperature Compensation)	
Minimum Scale	0.2g / 100g	
Measurement Accuracy	± 0.2g / 100g * ± 0.1 / 100g (10 to 30°C)	
Dimension & Weight	32(W) × 34 (D) × 168 (H) mm, 90g	

\*Repeatability

Brix & Salinity



Brix

Salinity

### MASTER-BX/S28 M Cat.No.2484

Specifications	MASTER-BX/S28 M
Measurement Range	① Brix : 0.00 to 33.0% ② Sodium chloride : 0.0 to 28.0g / 100g
Minimum Scale	① 0.5% ② 0.5g / 100g
Measurement Accuracy	
Dimension & Weight	32(W) × 34 (D) × 168 (H) mm, 90g

\*Repeatability

**Measurement Method**

Apply 1 to 2 drops of sample onto the prism. Close the daylight plate. Look through the eyepiece. Read the measurement value where the blue boundary line intersects the scale.


### 6 Features of the MASTER Series

- IP65 Water Resistant \***  
After measuring, the instrument can be easily cleaned with running water under a faucet.
- ATC Automatic Temperature Compensation (ATC) \***  
Upgraded Automatic Temperature Compensation automatically adjusts the measurement value in response to changes in ambient temperature conditions.
- Visibility**  
A bright field of vision and a distinct boundary line allow for truly clear readings with a single glance.
- Durability**  
The MASTER series has passed all water resistance, dust resistance, and drop tests.
- Hygienic Design**  
Smooth grip eliminates the possibility of food and samples being trapped, resulting in contamination and bacterial growth.
- ASD Automatic Sample Distribution (ASD)**  
Automatic Sample Distribution (ASD) allows for even sample distribution across the prism, without having to open the daylight plate to manually distribute the sample.

\* α type only

## Optional Accessories

### NaCl Solution for Calibration

	Parts No.	Contents	Concentration	Models	Shelf life
	RE-120250	5mL	2.50±0.05%	PAL-SALT PAL-SALT Mohr (2.54%) ES-421 PAL-SALT PROBE	6 Weeks
	RE-143025	30mL	2.5%	PAL-SALT PROBE	1 year
	RE-145025	500mL	2.5%	PAL-SALT PROBE	1 year

\* If actual displayed concentration differs, displayed values will be contained within the ( ) after the applicable models.



### PAL Silicone Cover

Parts No.	Models
RE-39413	PAL series



### PAL-case

Parts No.	Models
RE-39409	PAL series Excluding PAL-SALT PROBE



### Strap

Parts No.	Models
RE-39410	PAL · PEN series



### MAGIC™

Parts No.	Models
RE-39446	PAL series

# Q&A

## PAL-SALT

### Q1 What can this instrument measure ?

Various types of food that contain salt – soups, sauces, condiments, dressings, fish, ham, bacon, deli meats, brine, cheese, butter, dairy, crackers, chips, and more.



### Q5 The readings are unstable.

For samples containing oils or fats, try stirring the sample after placing on the sensor, and measure. This will help stabilize readings.

### Q6 What's the key for measuring cold or hot sample ?

We recommend leaving the sample on the sensor for 30 seconds before measuring. This will allow the sample to acclimate. Alternatively, take multiple readings until the readings stabilize.

### Q2 How do I measure my sample ?

Different types of sample require different preparation for measurement. Please refer to "Measurement Techniques."

### Q7 How often does it need to be calibrated ?

Zero-set the instrument at the beginning of each day before taking any measurements. Clean the sample stage thoroughly and press ZERO with nothing on it (zero-set with air). If measurement values are irregular, please refer to " Q8 What should I do if the measurement values are irregular? " For manufacturer calibration, please contact an official ATAGO service center.

### Q3 Can I use tap water for dilutions ?

Distilled water is the best, but tap water may also be used. Tap water may affect the readings slightly (approx. 0.01%). Do not use mineral water as it may affect the readings.



### Q8 What should I do if the measurement values are irregular?

Apply water or ethyl alcohol on the sample stage and wipe it off with lint-free tissue paper. Repeat the process a few times if using water. If this does not resolve the issue, reference set with a 2.50% standard Sodium chloride (NaCl) solution.

### Q4 How do I clean it ?

The unit is waterproof, so the entire body can be washed under running water. Use a mild cleanser to remove persistent residue, such as oil. Clean greasy residue with ethyl alcohol and rinse with water.

### Q9 How should I store the unit ?

If the unit will not be used for an indeterminate amount of time, place the unit in the storage case that it came with.



## Thin, drinkable liquids

Thinner or lower concentration liquids, such as soup or miso soup, can be measured by placing a few drops of the sample directly on the sensor.



## Thick, syrupy or paste-like liquids



Sauces, soup bases, seasonings, gravies and such need to be diluted to 10% for accurate measurement results. Anything that is highly concentrated (anything that measures above 6% Brix with a refractometer), must be diluted. The PAL-SALT and ES-421 measure the conductivity of electrolytes through electrical currents (conductivity). The thicker a solution is, the more closely the molecules are packed, and therefore, the less conductive. This makes the sample more difficult to measure. If not diluted, the measurement values may appear lower than the actual salt content.



## Products with a salt content that exceeds the measurement range (above 10% salt)



Products that contain more than 10% salt, such as pickle brine, need to be diluted. For example, the 10 times dilution of 12% salt brine will measure 1.2%, and the 5 times dilution will measure 2.4%. Adjust the dilution factor so that the salinity falls within the measurement range.

## Solid food



Solid foods (ham, bacon, dried foods, and fish) need to be minced, ground, or crushed, diluted with water (1:10 dilution), and mixed thoroughly. As a general guideline, let sit for a few minutes (approx. 3 minutes) to allow the salt to leach out of the food. Depending on the qualities of the sample (whether or not the salt is easily drawn out into the water), the salt concentration of the food, the mincing or crushing method, or how well the sample is mixed with the water, the time needed for the salt to be drawn out into the water will vary.



Set a soaking period that works for each product (that allows the salt to be thoroughly drawn out). Measure the salinity of the water and multiply the reading by 10. The PAL-SALT PROBE also has a probe sensor that can be inserted directly into the solid sample for measurement.

## Oily / fatty food

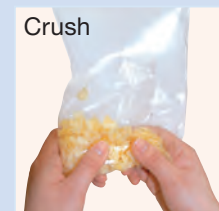
Foods containing oil or fats can also be measured. However, the measurement values of foods that have oil floating on their surface, such as Ramen soup (a Japanese noodle soup), may be unstable. If the readings fluctuate when measuring oily/fatty foods, try stirring the sample, and measure again for more stable readings. When measuring the salinity of oil-packed products, extract the sample from the oil and allow excess oil to drain. Mix 10g of sample with 90g of water to create a 10% dilution. Mix or shake very well and let settle. Residual oil should float to the top of the container. Take a sample from below the oil layer and place on the sensor. Multiply the displayed reading by 10 to obtain the salt concentration of the original sample.



## How to Make a 10% Dilution

### Preparing the sample

Solid samples that crumble easily, such as crackers, are best crushed up. Solid samples that are firmer, such as salami, deli meats or pickles, are best diced up.



Weigh out approximately 10g of sample on a scale.



Add water until the total weight reaches 10 times the amount in step 1.



Mix well.