

# Fish Analyzer

## Fish Analyzer™ PRO [DFA110]

# Operation Manual



Yamato Scale Co., Ltd.

- Be sure to read this manual for proper use before using the device.
- Be sure to keep the manual in a convenient place so as to be available at any time.

## Introduction

Thank you for purchasing the Fish Conditioner “Fish Analyzer™” or “Fish Analyzer™ PRO”. Please read this manual carefully and use it for branding and quality control of fish.

## Message from supervisors

Traditionally, the quality of marine products at the distribution stage has been subjectively evaluated by the experience of distribution specialists and has not been quantified on a certain basis. In order to digitize, it requires specialized knowledge and special equipment, and we have to rely on time-consuming chemical methods. Therefore, with the aim of developing a compact device that can measure the content of fat, which is one of the deliciousness indexes as quality information of marine products, simply and nondestructively, Nagasaki University Fisheries Department, Nagasaki Prefectural Fisheries Research Institute, Chiba Prefectural Fisheries Research Center, Yamato Scale Co., Ltd., Fisheries Research Institute (currently National Research Development Corporation Fisheries Research and Education Organization) jointly developed the technology conference on agriculture and forestry and fisheries technology 2010 "New Practical Technology Development Project to Promote Agriculture, Forestry and Fisheries Policy" and "Development of quality measurement equipment aiming at improvement of fish prices and provision of high quality marine products and fish processing products", we developed Fish Analyzer™ Pro and have been sold. Fish Analyzer™ Pro can measure the fat content of horse mackerel, yellowtail, tuna, sea bream, bonito, and sardines nondestructively and quickly at fishery sites.

In addition, it is also possible to distinguish fresh fish from frozen / thawed fish. Quality information that can be measured with this device is branding of tasty superior aquatic products, grasping of raw material characteristics at the time of manufacturing processed products, quality control of farmed fish, etc. We hope that it contributes to the sustainable supply of high quality products to consumers.

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# Chapter 1 Read before use

## 1-1. For safety use

Read "For your safely use" before using this product for protecting yourself or your property. After you read it, keep it with care so as to be available whenever you need it.

•Marks used in this manual and the meanings

	<b>Danger:</b>	Indicates operations without complying with the instruction may result in fatal or serious injury.
	<b>Warning:</b>	Indicates operations without complying with the instruction may result in bodily injury or damage of properties
	<b>Caution:</b>	Indicates operations without complying with the instruction or correcting your practice may result in damage of the entire product.
	<b>Prohibit:</b>	Indicates things to be prohibited
	<b>Enforce:</b>	Indicates things to be enforced

•Before use please read "Danger", "Warning" and "Caution" carefully to comply with accordingly.

	<b>Danger</b>
	For preventing from electric shock accident Do not remove any screw on the back of the housing.
	For preventing from explosion or fire accident This device does not have non-explosion feature. Do not use the device where flammable gas or hazardous substances exist.
	For preventing from fire and/or electric shock accident Using it in such an abnormal situation where there is smoke or unusual smell may result in fire and/or electric shock. Remove batteries and confirm that no smoke comes out before asking the vendor for its repair. Do not try to repair by yourself as it is dangerous.

**Warning**

-  For preventing from injury or damage
- 1 When the housing or electrodes are damaged by being dropped, do not use it because it may damage fish or injure you by the damaged portion of the device.
  - 2 When the display liquid comes out by being dropped, as the liquid is toxic, be careful not to accidentally put it in the mouth.



**Caution:**

-  Not to damage the device
- 1 Use the designated batteries. Otherwise, rupture or leakage of batteries may cause fire, injury or damage.
  - 2 Do not put a battery in fire or water, or heat it. It may burst
  - 3 Do not mix alkaline and manganese batteries. It may cause liquid leakage or explosion
  - 4 Set batteries correctly as shown by the polarity marks (+ and -). Incorrect installation may cause liquid leakage or explosion.
  - 5 Remove batteries when the equipment is left unused for a long time (about 1 month or longer). Otherwise, they may leak and cause the inside of the equipment to be corroded.
  - 6 Do not separate or modify the device.
  - 7 Do not drop the device. It may cause damage on the device.
  - 8 Do not sink the device in water or store it under humid environment. It may damage the device.

## 1-2. Preparation

### ●Cause of trouble

- 1 Do not separate or modify the device.
- 2 Do not hit a display and keyboard with a nail tip or a sharp tool.
- 3 Hold the main body when you carry it.
- 4 Do not drop the device or do not give excessive shock or vibration.
- 5 Do not apply thinner, benzine, etc.

### ●Cause of inaccuracy

- 1 Do not operate near the place of fire, steam, direct sunlight or wind from air conditioner.
- 2 Do not operate near the device like a microwave, which generate excessive shock, vibration or electro-magnetic discharge.

- 3 Operate under the designated environment 10 40 30 RH 85 RH

Measuring error may happen even under the conditions if dew condensation generates:

- 1 Being operated or stored for long time under humid environment.
- 2 When temperature changes rapidly even under low humidity (giving cold water on the device)
- 3 Being operated in the circumstances where the device is exposed with cold air from a refrigerator or steam.

### Storage and Disposal

#### ●Storage

- (1) Do not store the equipment in the place with high temperature/humidity or receiving direct sunlight for a long period of time. It should also be noted that substantial changes in the ambient temperature may cause condensation inside the equipment, resulting in a failure of the operation
- (2) This is an electronic precision equipment. Do not store it in the place where vibration and/or shock can be expected.

#### ●Disposal

- (1) When the device is disposed of, it must be disposed of as an industrial waste (nonflammable waste). Make sure to observe the local regulations when disposing.
- (2) When used batteries are disposed, put scotch tapes on electrodes and dispose according to the local regulations.

### 1-3. Available functions

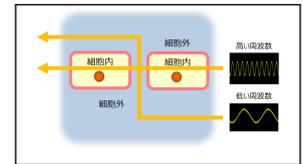
#### 1 Nondestructive measurement method that does not damage fish.

This device uses the "bioelectrical impedance method" to send a weak electricity into the fish using four electrodes and estimate the fat percentage from the impedance. Therefore, the fat rate is displayed in only 4 seconds without damaging the fish.



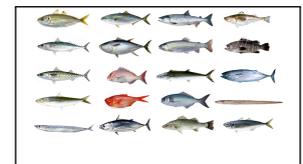
#### 2 The multi-frequency measurement method is adopted.

When electricity flows in the low frequency band, electricity flows mainly outside the cell, and when it flows in the high frequency band, electricity also flows in the cell. This device has adopted a multi-frequency measurement method in which electricity flows at multiple frequencies for achieving high accuracy.



#### 3 Measuring the fat percentage of 20 species of fish. (P.11)

This device can measure horse mackerel 1, mackerel 1, Mackerel 2, sardine, saury, Bluefin tuna (back, belly, tail), Sea bream, Alfonsino, Bonito 1, Salmon, Rainbow trout, Spanish mackerel, Butterfish, Sea bass, Sailfin sandfish, Grouper, Bonito 2, Sea eel, Horse mackerel 2.



#### 4 You can also estimate the fat ratio of unregistered fish. (P.20)

It is equipped with "calibration curve mode" to measure unregistered fish. In impedance mode, the impedance value at 100 kHz is displayed instead of the fat percentage. From this number, you can know the approximate fat ratio, and you can also use Fish A, Fish B, and Fish C to create the original formula.



#### 5 Detecting defrosted products

After freezing and thawing the fish, the cell membrane will be destroyed, so the difference in the flow of electricity will not be seen. Using this feature, fish with frozen history will be displayed as "defrosted". However, please note that the fat percentage of the thawed product is not displayed.



#### 6 Displaying the average value of the measurement results. (P. 19)

In order to determine the fat percentage from multiple measurement results, and also to weigh several fish in a container, and to present it as the average value of the container, the "average value calculation function" is equipped. The average value is displayed at the bottom of the screen until you press  or turn off the power.



#### 7 Displaying the fish status (freshness index) in 5 levels (P. 16)

Fish Analyzer TM PRO allows you to determine the condition of fish at the same time as the fat percentage. The status of the fish is a function to see changes in in-cells and out-cells, and changes to A', A, B, C, D according to the deterioration of cells and the decrease in water holding capacity. It can be used for cooking guidelines and quality control.



#### 8 Strict quality control can be performed. (P.20)

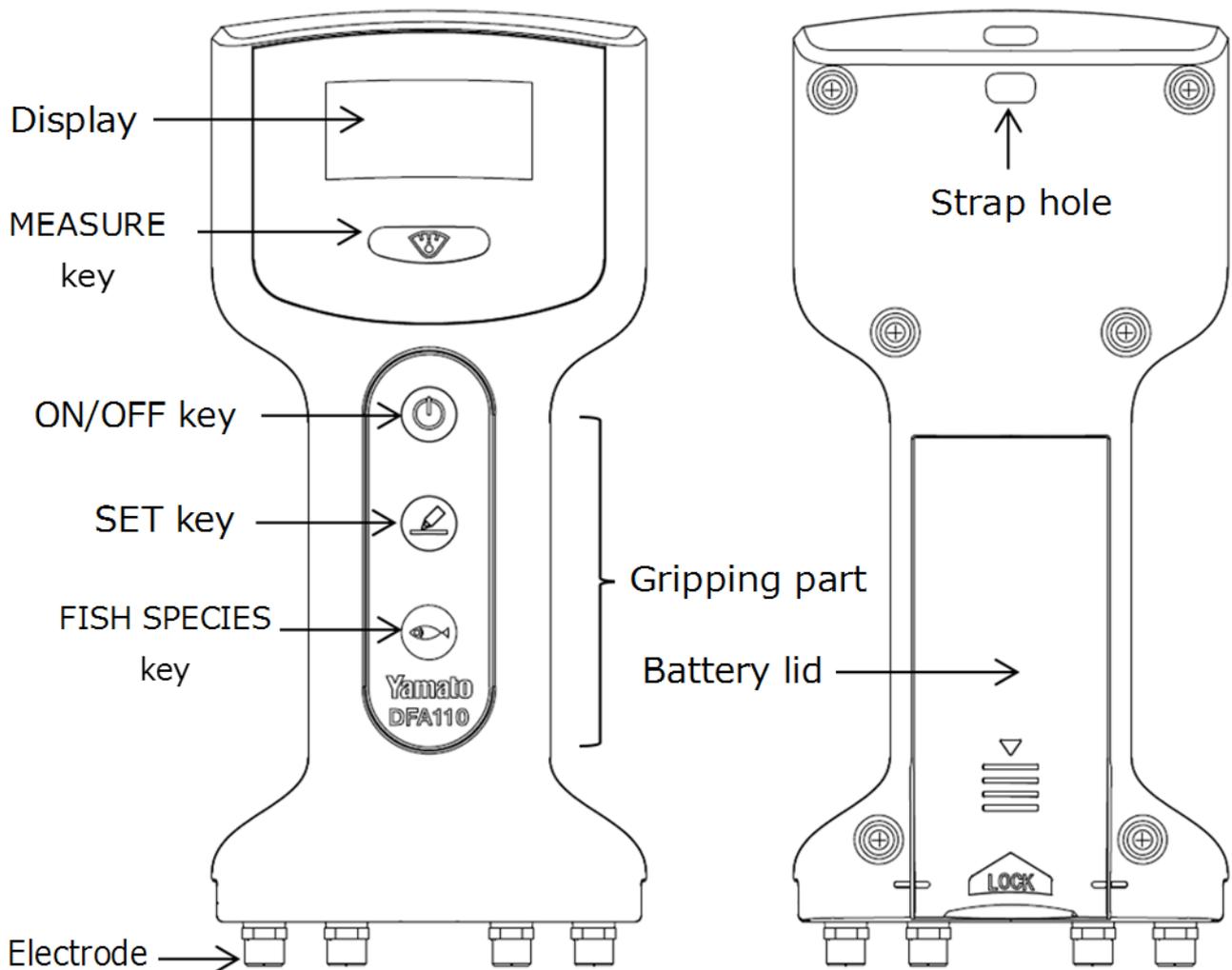
Fish AnalyzerTM PRO is equipped with "Fish status mode". In the fish status mode, impedance at 5kHz is displayed along with the 5-step judgment. As the impedance decreases along with the decrease in freshness, stricter quality control can be performed by following this process.



1-4. Product package

Main body	Accessories
	 <p>Dry batteries (C size x 2)</p>  

1-5. Name of parts



**1-6. To keep the device effectively**

- If the electrode and attachment are left with salt water or fish slime, the stainless steel part may rust. After use, wash out salt water and slime of on the stainless steel part with fresh water, then wipe off moisture and dirt with a towel.
- To prevent falling, pass your straps through the strap holes and fix the straps to your body.
- After replacing the batteries, securely tighten the case. At this time, do not open or close the battery cover in places with lots of sand, dust or dirt. If foreign matter adheres to the packing, waterproofness may be impaired.
- If the battery cover is not closed firmly, water may get inside. The following shows how to slide the battery cover and how to clean the inside of the battery box. Clean the inside of the battery box regularly, and after cleaning, close the battery cover firmly.

Wipe off dirt and dust with a dry tissue etc. mainly on the contacts for batteries. If water drops are found, wipe them out. In addition, if the packing (transparent color) embedded around the battery cover is lifted, promptly contact the store where you purchased it.

At setting the battery cover, push the battery cover firmly from the bottom so that there is no gap. There are lines on the main unit and the battery cover, so please match the lines.



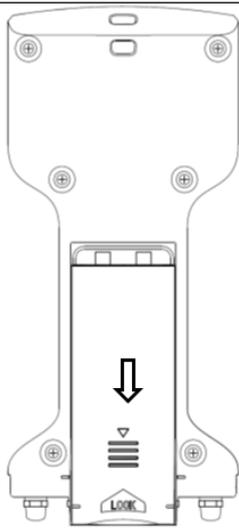
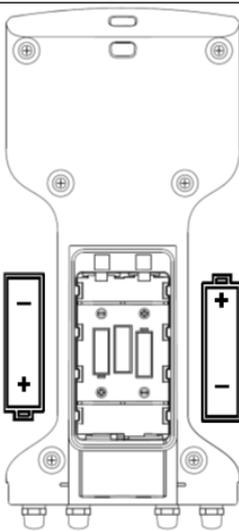
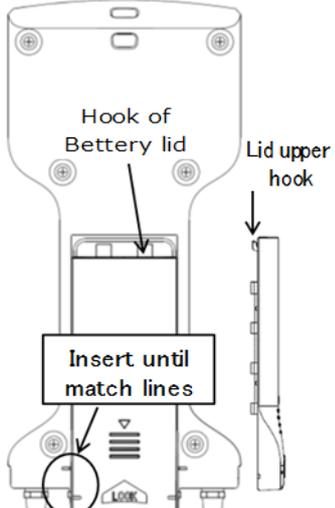
- If the attachment is set to the main body while dirt like seawater or dirt is adhering on the attachment, the dirt will also be adhering to the connection terminal of the attachment, then the accurate measurement cannot be performed (the display will not change from ). Clean without fail always after use.

<p>Be sure to wipe off any dirt adhering to the electrodes with water or alcohol before mounting the attachment.</p>	<p>If dirt is adhering to the connection terminal of the attachment, moisten the tip of the swab with water or alcohol, and then slide the swab toward the inside of the connection terminal to wipe off dirt.</p>	<p>Be careful. If you press the outside of the connection terminal downward, the connection terminal will bend outward.</p>

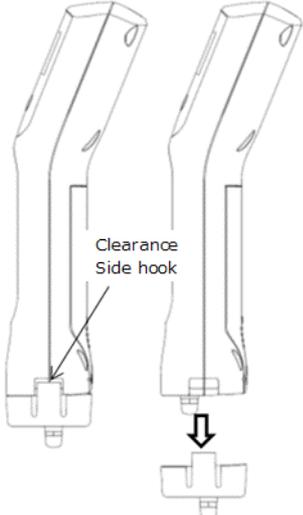
**Chapter 2 Preparation before use**

**2-1. How to set the accessories**

- Dry batteries

Step	Step	Step
Slide the battery lid down to remove it.	Insert the dry cells, paying attention not to mistake the polarity.	Insert the top hook of the battery lid into the battery lid hook and push the battery lid upward from the bottom.
		

#### ●Attachment

Step	Step	Step
Align the convex to the front and fit it straight up toward the body.	Installation is completed when the side hooks catch the body.	For removing, put your finger in the space on the side hook and pull it down slightly. The attachment will come off.
		

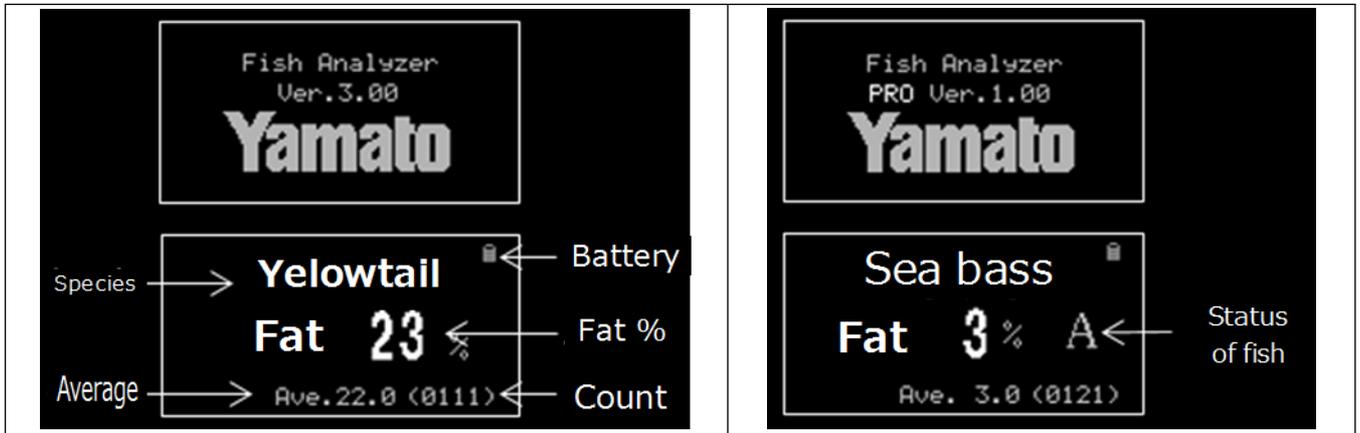
1 For measuring horse mackerel, sardine, saury, grouper and sea eel, be sure to use the attachment.

2 For measuring in impedance mode or fish status mode, use an attachment if the thickness of fish is 3 cm or less.

## 2-2. Display and keys

### Display

Fish Analyzer™ Ver.3.00	Fish Analyzer™ PRO Ver.1.00
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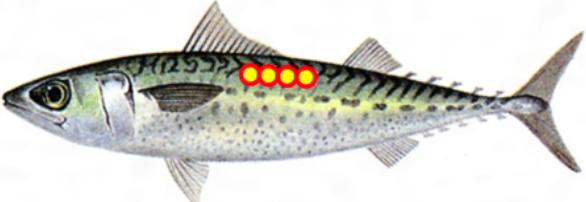
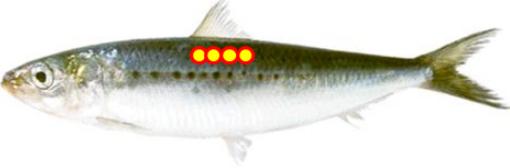
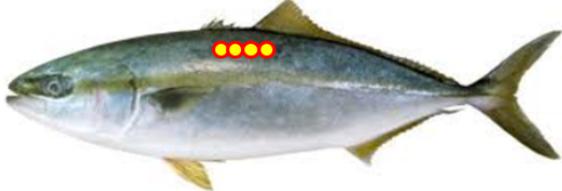
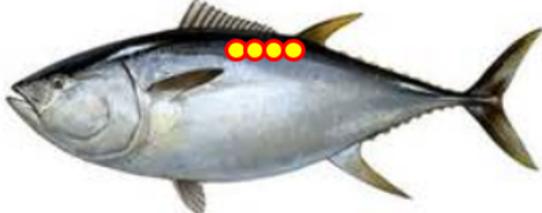
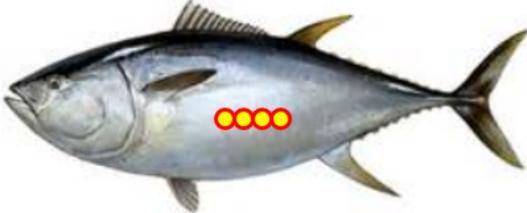
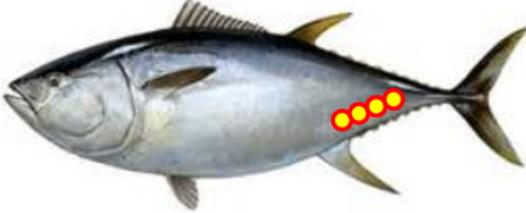
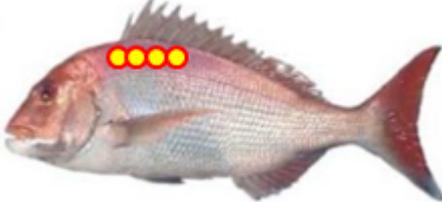
●Special symbol

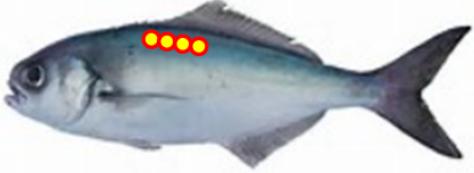
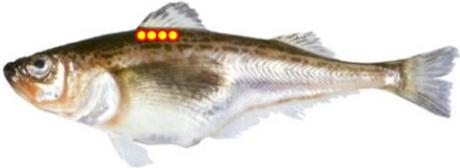
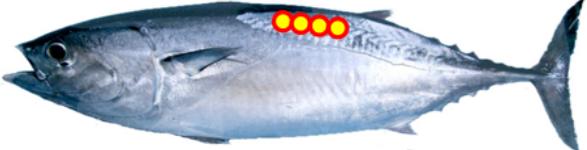
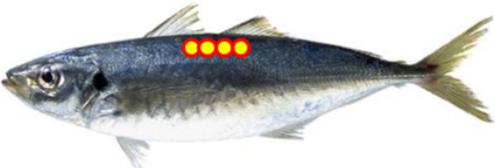
<p>Battery level</p> 	<p>It displays the battery level in 3 levels. Replace batteries when only one  is displayed.</p>
<p>Attachment</p> 	<p>It means that the attachment is needed for measurement.</p>
<p>Next day</p> 	<p>It means the measurement mode for the next day of catching. If you want to measure on the day of catching, please select the mode without this symbol.</p>
<p>Not in contact</p> 	<p>It means that the contact of the electrode to the fish is insufficient.</p>

Keys

<p>Measurement</p> 	<p>Press to start measurement under the normal screen. Press to return to the previous display under setting or measurement mode.</p>
<p>ON/OFF</p> 	<p>Press to turn on the power when the power is off. Press to return to the normal screen when setting or measurement mode. Hold down the key awhile to turn off.</p>
<p>Set</p> 	<p>Press to display the past measurement result under the normal screen. Hold down the key awhile to display the setting screen under the normal screen. Press to finalize the setting during the setting mode.</p>
<p>Fish species</p> 	<p>Press to display a fish species under the normal screen. Press to advance to the next display during setting or confirming the measurement result.</p>

## 2-3. Fish species and measuring points

<p>No.1 Horse mackerel 1  Attachment</p> 	<p>No.2 Mackerel 1</p> 
<p>Centering the electrode between the first and second fins, apply the electrode a little above the side line.</p>	<p>Centering the electrode on the back of the dorsal fin, place the electrode a little above the side line.</p>
<p>No.3 Mackerel 2</p> 	<p>No.4 Sardine  Attachment</p> 
<p>Centering the electrode on the back of the dorsal fin, place the electrode a little above the side line.</p>	<p>Centering the electrode on the center of the dorsal fin, place the electrode a little above the side line.</p>
<p>No.5 Saury  Attachment</p> 	<p>No.6 Yellowtail</p> 
<p>Centering the electrodes on the center of the belly fin, place the electrodes a little above the side line.</p>	<p>Centering the electrode between the first and second fins, apply the electrode a little above the side line.</p>
<p>No.7-1 Bluefin tuna (back)</p> 	<p>No.7-2 Bluefin tuna (belly)</p> 
<p>Aligning the tip of the electrode to the back end of the chest fin, place the electrodes a little above the side line.</p>	<p>Aligning the tip of the electrode to the back end of the chest fin, place the electrodes between the base of the belly fin and the side line.</p>
<p>No.7-3 Bluefin tuna (tail)</p> 	<p>No.8 Sea bream</p> 
<p>Aligning the tip of the electrode to the back of the anal position, place the electrode slightly below the side line.</p>	<p>Centering the electrode on the back of the dorsal fin, place the electrode a little above the side line.</p>
<p>No.9 Alfonsino</p> 	<p>No.10 Bonito 1</p> 

<p>Centering the electrode on the center of the dorsal fin, place the electrode a little above the side line.</p>	<p>Centering the electrode between the first and second fins, apply the electrode a little above the side line.</p>
<p>No.11 Salmon</p>	<p>No.12 Rainbow trout</p>
	
<p>Centering the electrode on the center of the dorsal fin, place the electrode a little above the side line.</p>	<p>Centering the electrode on the center of the dorsal fin, place the electrode a little above the side line.</p>
<p>No.13 Spanish mackerel</p>	<p>No.14 Butterfish</p>
	
<p>Aligning the back of the electrode to the tip of the second fin, place the electrode a little above the side line.</p>	<p>Centering the electrode on the tip of the dorsal fin, place the electrode a little above the side line.</p>
<p>No.15 Sea bass</p>	<p>No.16 Sailfin sandfish  Attachment</p>
	
<p>Align the back of the electrode to the back end of the 1st fin, place the electrode a little above the side line.</p>	<p>Centering the electrode on the tip of the dorsal fin, place the electrode a little above the side line.</p>
<p>No.17 Grouper</p>	<p>No.18 Bonito 2</p>
	
<p>Centering the electrode on the tip of the dorsal fin, place the electrode a little above the side line.</p>	<p>Centering the electrode between the first and second fins, apply the electrode a little above the side line.</p>
<p>No.19 Sea eel  Attachment</p>	<p>No.20 Horse mackerel 2</p>
	
<p>Straightening the fish, aligning the tip of the electrode to the anal position, place the electrode slightly above the lateral line.</p>	<p>Centering the electrode between the first and second fins, apply the electrode a little above the side line.</p>

## 2-4. Selection of the day of catching or the next day of catching

This device measures the percentage of fat from the information inside and outside the cells, but as the cell condition is different on the day and the next day of catching (the day of lethality), it has two modes for accurate measuring. Therefore, make sure that you should choose a mode (the day or the next day) as well as a fish species.

As for Saury, Bonito, Sea bream, Sailfin sandfish, Sea ell, Horse mackerel, there is no mode for measuring on the next day, so measurement should be performed on the day of catching. For measuring correctly in both modes, fish should be kept in an ice storage.



- The day of catching means measurement at the production area.

In the case of production areas, fish may still be alive. If you take measurements immediately after lethality, you may get a lower fat percentage. First, store it in an ice storage and wait at least one hour before making measurements. Also, if several days have passed since the death in the production area, please make measurements on the next day after catching.

In Fish Analyzer™ PRO, the status of the fish is displayed in 5 levels next to the fat percentage. when several days have passed since the lethality, if the device shows "A "" or "A", choose the day of catching and if it shows "B" or "C", choose the next day of catching.

- The next day of catching means measurement at the distribution site.

Fish Analyzer™ is affected by changes in freshness, so make measurements as soon as possible after procurement. In addition, Fish Analyzer™ PRO displays the status of fish along with the fat percentage in 5 levels. If the status of the fish is displayed as "D", please think that it is difficult to obtain an accurate fat percentage.

# Chapter 3 How to measure

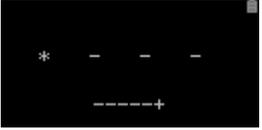
## 3-1. Posture to measure fish properly

Although this device is a non-destructive device that does not break fish, it is also a contact-type that directly touches the fish, so if the subcutaneous fat is crushed, the values may change. To make an accurate measurement, please read the following points and get familiar with the device.

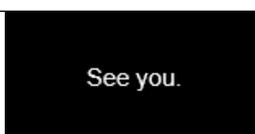
<p><b>1 Grasping properly</b></p>  <p>Press ON key and choose a fish species with the fish species key. Place your thumb on the measurement button and the remaining fingers grip the body.</p>	<p><b>2 Fixing not to move</b></p> <p>If touching fish is ok, support a fish with your fingertips and place the device.</p>  <p>If you cannot touch the fish, fix your arm to the measuring stand and place the device.</p> 	
<p><b>3 Touch the fish with the electrode</b></p>  <p>Lightly touch the four electrodes in place, make sure that they are firmly in contact, and then press the measurement key. Apply the electrode with 45 degree like an image that raises the body a little</p>	<p><b>4 Confirm not only the screen but also the electrode position</b></p>  <p>At measuring, first make sure that the “*” mark is displayed, then move your eyes to the electrode position to confirm the electrode position is not changed.</p>	

## 3-2. Measurement

ex Measuring a yellowtail

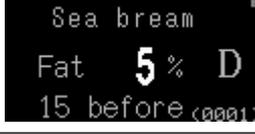
Operation		Screen
1	Press  key to turn on.	
2	Press  key to call “Yellowtail”. Choose “Yellowtail  ”.	
3	Afer returning to normal screen, place the electrode then press  key. During measurement “ ” mark moves.	

Operation		Screen
When the measurement is over, the fat percentage is displayed. When the average value display function is enabled, the average value is displayed at the bottom center of the screen (displayed to one decimal place). Fish Analyzer™ PRO displays also the status of the fish in 5 levels.		

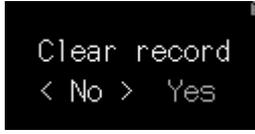
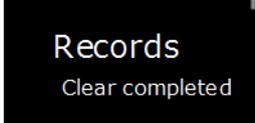
4	Hold down  key awhile to turn off after you get the result.	
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### 3-3. Measurement results in the past

#### ●How to find the measurement results in the past

	Operation	Screen
1	Press  key under normal screen.	
2	Each time pressing  key displays a measurement result in the past.	
	The past measurement results are stored up to 50 times before. The number of measurements is displayed up to 9999 times on the lower right of the screen, and returns to 0 times after 9999 times.	
3	Press  key to return to normal screen.	

#### ●Clearing the measuring result

	Operation	Screen
1	Hold down  key awhile under the result being displayed.	
2	Holding down the key "Result clear" is displayed. Choosing <Yes> with a cursor by moving it with  key, then press  key.	
3	Clearing results is started, and when "clear complete" is displayed, deletion of the past measurement results is completed. Press  key to return to the normal screen.	

Remarks: Please note that clearing results will erase all past measurement results and the number of measurements.

### 3-4. Status of fish

There is a K value as the freshness index of fish based on the result of biochemical analysis, but the "Status of fish" displayed on Fish Analyzer™ PRO is a freshness index based on "the electrical feature of cells", which is different from the K value.

This device uses a multi-frequency measurement method and basically the cell membrane has high electrical capacity and insulation at low frequency bands. As electricity flows outside the cell without flowing inside the cell, the impedance (electrical

resistance) is high. Conversely, at the high frequency band, the cell membrane is electrically shorted, and electricity flows inside the cell, resulting in low impedance.

This is the electrical feature of the cell, while the status of the fish after death changes with time, and the electrical feature of the cell also changes in the way that reflects it. After death, the impedance rises first in proportion to the tightness of the fish. This tightness level is "A" or "A' ". After that, the fish starts to soften and the impedance starts to decrease but the cell's electrical characteristics are still maintained. This status is "B". If the fish being measured immediately after death, the device may display "B" as the condition is similar to the one before the fish starts to tighten, and if blood remains, it may display "C". When freshness starts to fall rapidly, the impedance at the lower frequency band in particular drops significantly. This is because the cell's structure changes and the cell's electrical characteristics deteriorates. Moreover, the water holding capacity of cells decreases, and the intracellular fluid flows out of cells, which lowers the impedance at the lower frequency band. Since the ability to retain water in cells is undoubtedly an important factor in fish freshness, the electrical feature of the cells changes, and the status of poor water holding capacity is "C" or "D". Of course, the status of fish is not irrelevant to the K value, and the condition of the fish corresponding to the K value of 1% to 20% is "A", "A' " or "B", and the K value is 20% or more is equivalent to "C" or "D".

Note that "E" is displayed when a measurement error occurs, and "F" is displayed in the case of a thawed product in the impedance mode and the fish status mode in which "thawed product" is not displayed.

 Status of Fish	A Or A'	B	C	D
 How to eat	You can eat even raw.		You had better eat after cooking.	
 Recommend				
 K value (Ref.)	1%	10%	20%	30%

Remarks: It is not possible to decide whether the fish can be eaten raw only by the freshness evaluation as well as the K value.

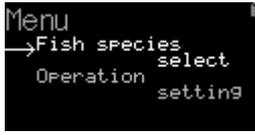
Basically, fish such as salmon and mackerel, which are not eaten raw, should be cooked before eating even if the status of fish is good

## Chapter 4 User parameters

### 4-1. Choosing a fish species

Normally, a fish species to be measured is selected with  key each time, but it is possible to select in advance only the fish species to be measured and not to display fish species not to be measured.

ex in case of choosing “mackerel “

	Operation	Screen
1	Press  key to turn on. Under the normal screen hold down  key until Menu is displayed.	
2	Match cursor (→ to “Fish species select” and press  key to change screen.	
3	Move the cursor (→ by pressing  key to a fish species (in this case, mackerel) and press  key. The species with check mark (✓) are only displayed.	
4	After setting, press  key to return to Menu screen. Press  key again to return to normal screen then setting is completed. Then only the selected species are displayed with  key.	

#### List of all fish species

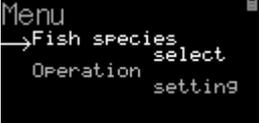
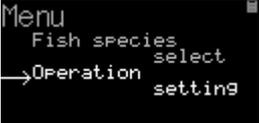
Impedance mode	Bluefin tuna (back)	Salmon	Bonito 2
Horse mackerel 1	Bluefin tuna (back) 	Salmon 	Bonito 2 
Horse mackerel 1 	Bluefin tuna (belly)	Rainbow trout	Sea eel
Mackerel 1	Bluefin tuna (belly) 	Rainbow trout 	Horse mackerel 2
Mackerel 1 	Bluefin tuna (tail)	Spanish mackerel	Fish
Mackerel 2	Bluefin tuna (tail) 	Spanish mackerel 	Fish B
Mackerel 2 	Sea bream	Butterfish	Fish C
Sardine	Sea bream 	Sea bass	Status of fish
Sardine 	Alfonsino	Sea bass 	
Saury	Alfonsino 	Sailfin sandfish	
Yellowtail	Bonito 1	Grouper	
Yellowtail 		Grouper 	

### 4-2. Setting for saving energy

#### Settings for saving energy

- 1.Auto off 1 When the set time has passed, the power is automatically turned off.
- 2.Auto off 2 The screen turns off automatically when the set time has passed. After turning off, press any key to display the screen displayed last time (The power is turned off when the setting time of auto off 1 has elapsed).
- 3.Brightness Choose the level from “Saving energy”, “Normal” or “Bright”.

(ex Setting 10 seconds for Auto off 2

	Operation	Screen
1	Press  key to turn on. Under normal screen hold down  key until Menu is displayed.	
2	Match a cursor → to Operation setting and then press  key.	
3	When operation setting are displayed, move the cursor → to 2. Auto off 2 by pressing  key twice and then press  key.	
4	Set 10 seconds by pressing  for decreasing or pressing  for increasing and then press  key.	
5	Press  key under operation setting screen to return to normal screen. Then the setting is completed.	

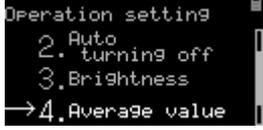
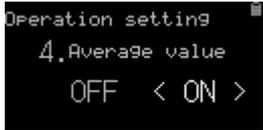
●Cancelling Auto off 1 or Auto off 2

	Operation	Screen
1	Choose OFF to cancel Auto off 1 or Auto off 2 with  or  key.	

**4-3. Display of average value**

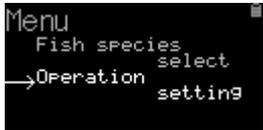
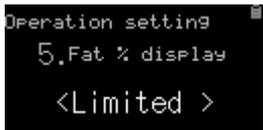
By enabling the operation setting "4. Average value", the average value of the measurement results so far is displayed at the bottom of the screen. It can be used to determine the fat percentage from multiple measurement results, or to weigh several fish in a container and present them as the average value in the container.

	Operation	Screen
	Press  key to turn on. Under normal screen hold down  key until Menu is displayed. Match a cursor → to Operation setting and then press  key.	
	When operation setting are displayed, move the cursor → to 4. Average value	

	by pressing  key and then press  key.	
4	Choose ON by pressing  key and then press  key. Press  key under operation setting screen to return to normal screen.	
5	The setting is completed. With this setting, the average value is displayed at the bottom of the screen until you press  key or the power is turned off.	

#### 4-4. Limiting function of fat percentage display

As this device is affected by the change in freshness, it becomes difficult to obtain an accurate fat percentage if the freshness falls. Fish status is displayed but when the status of fish is "D", it has a function not to display the fat percentage, and it is possible to display only the fat percentage with high reliability.

	Operation	Screen
	Press  key to turn on. Under normal screen hold down  key until Menu is displayed. Match a cursor → to Operation setting and then press  key.	
	When operation setting are displayed, move the cursor → to 5. Fat % display by pressing  key and then press  key.	
4	Choose Limited by pressing  key and then press  key. Press  key under operation setting screen to return to normal screen.	
5	The setting is completed. Any fat % would not be displayed when the status of fish is "D".	

## Chapter 5 Evaluation by actual measuring result

### 5-1. Evaluation by impedance mode

The impedance mode is for the actual measurement value for those who want to know 1) the fat riding of unregistered fish species, 2) the fat riding other than the back, and for those who want to do a fat riding evaluation by their own way. Here, the impedance at 100 kHz is displayed instead of fat percentage (unit:  $\Omega$ ). This device is measuring by feeding electricity into a fish body. There is an electricity feature that electricity is easy to flow to tissues containing much water but on the other hand, it shows high resistance to fat containing almost no water. It is the particular feature that the higher the impedance at the high frequency band, the more fat it has.

In impedance mode, it is important to decide the standard to be a guide and to decide the timing of measurement (at x hours after the lethal). You can easily evaluate fat riding from the measured impedance.

### 5-2. Evaluation of "Status of fish" by actual measurement value

The status of fish mode is a mode for performing freshness evaluation with actual measurement values for those who want more accurate quality control. Here, the impedance at 5 kHz is displayed along with the 5-levelled judgment (unit:  $\Omega$ ). On this device, measurement is carried out by feeding electricity to a fish. The electrical characteristics of the cells change with the decrease in freshness and the water holding capacity of the cells also decreases, which makes it easier for the electricity at the low frequency band to flow and then the impedance drops.



In the status of fish mode, it is necessary to keep track of the impedance at regular intervals, and it is possible to perform optimal quality control from the calculated amount of change in impedance.

### 5-3. Measuring in impedance mode

(ex How to measure in impedance mode)

Operation	Screen
Make sure that the "Impedance mode" has a tick mark (✓) under " fish species selection" beforehand.	<p>The screenshot shows a menu titled 'Fish species select'. There are three options: 'Impedance', 'Horse mackerel 1', and 'Horse mackerel 1'. Each option has a checkbox to its left. The 'Impedance' checkbox is checked with a white tick mark. There is a right arrow next to the 'Impedance' option.</p>
Start measuring after choosing "Impedance mode" by pressing  key.	<p>The screenshot shows a black screen with the word 'Impedance' in a large, bold, white font.</p>
After measurement, the impedance value at 100kHz is displayed instead of the fat percentage.	<p>The screenshot shows a black screen with the word 'Impedance' at the top. Below it, the number '100' is displayed in a large font, followed by the Greek letter <math>\Omega</math>. At the bottom, there is a small number '(0012)'.</p>

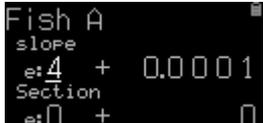
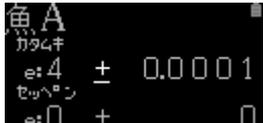
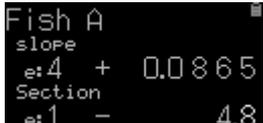
### 5-4. How to make an original algorithm (Impedance mode)

This program is a mode mainly for research institutes, and using this program requires an environment in

which the actual fat mass can be measured and Soxhlet method or hydrometry can be used.

"Fish A", "Fish B" and "Fish C" are provided in the fish species. These are fish species for displaying the percentage of fat in the original algorithm. First, measure the impedance value in the impedance mode, and then measure the fat percentage using the Soxhlet method or the hydrometry. Finally, regression analysis with impedance value is performed based on this fat percentage, and by entering its slope and section, you can create your own fat percentage formula.

(ex For making an algorithm for "Fish A" by entering 0.0865 for slope and -4.8 for section

	Operation	Screen
1	Move a cursor → to Fish A and press  key. Then put a check mark ↵ on Fish A.	
2	Hold down  key awhile to go to slope and section screen. Press  key to enter a value for slope.	
3	Press  decreasing or  increasing to enter a value. e means digits after the decimal point. So enter "4" for 4 digits after the decimal point.	
4	Next enter the sign (+ or -). In this case, no need to change from +, press  key.	
5	Finally enter a numerical value. Press  key to move the digit, so while moving the digit, enter "0.0865".	
6	Next match a cursor to section by pressing  key and then press  key. Taking the same procedures, enter -4.8 for section. After entry the cursor locates on section, press  key.	
7	After returning to fish species selection screen, press  key to return to normal screen.	
8	Choose Fish A by pressing  key and measure. Then fat percentage of fish based on the original algorithm is displayed.	

## Chapter 6 Others

### 6-1. Error messages

If a display like the one below appears, this is an error message. Take corrective action according to the countermeasures.

If the display other than the following appears or if the following countermeasures does not recover, please consult with "Product inquiry" on our website. <http://www.yamato-scale.co.jp/en/>

Error	Countermeasures
E-3 Status E	This is displayed when electrodes may touch inadequately. Read 3-1. Posture to measure properly and follow accordingly.
E-7	This is displayed when there is a problem with the surface of a fish. Wipe the surface with a damp cloth and measure with some moisture remaining.
E-2	This is displayed when stable measurement cannot be performed. After turning off the power, perform measurement again. If it still appears, contact <a href="http://www.yamato-scale.co.jp/en/">http://www.yamato-scale.co.jp/en/</a> .
E-4 Error100	Displayed when there is a device problem. After turning off the power once, measure again If it still appears, please consult with <a href="http://www.yamato-scale.co.jp/en/">http://www.yamato-scale.co.jp/en/</a>

### 6-2. Frequent Q&A

Question	Answer
Q1. What kind of fish do you measure fat percentage?	Horse mackerel, mackerel, yellowtail, sea bream, Bluefin tuna, salmon, rainbow trout, sea bass, etc. 20 kinds in total (Page 12)
Q2. Defrosted or F is displayed	The device is for raw fish. When it judges that the fish is once frozen from the measuring result, it would not display fat % and just display "Defrosted". Page 6
Q3. The fish I want to measure is not registered	As of the fish not registered, impedance can be measured in impedance mode. (Page 20)
Q4. I want to check the past measuring result	The device can store 50 past measuring results. (Page 15)
Q5.  What does it mean?	It means that an attachment should be mounted. (Page 10)
Q6.  What does it mean?	Means the measurement on the next day after catching or measurement at a point of distribution. Page 13
Q7.  What does it mean?	Means no contact or poor contact of electrodes with a fish. (Page 10)
Q8. Power turns off	When the preset time passes, the power is turned off automatically. (Page 18)

Question	Answer
Q9. Screen turns off	When the preset time passes, the screen is turned off automatically. (Page 18)
Q10. I want to change brightness	The screen brightness can be chosen from "Saving power", "Normal" or "Bright". (Page 18)
Q11. E-3 is displayed on screen	This error message is displayed when measuring error happens or when the device is damaged. Page 22
Q12. Status E is displayed	This is displayed when electrodes may touch inadequately. Page 22

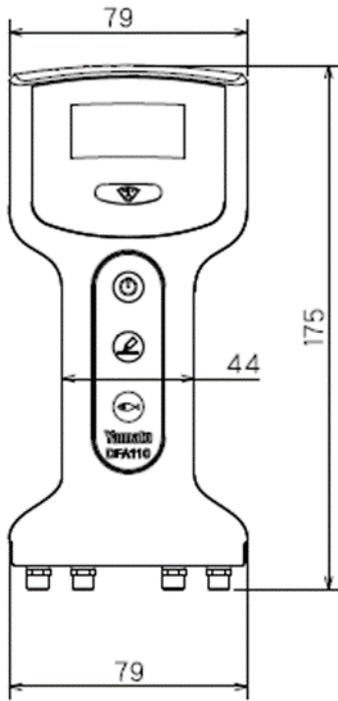
Q13. Fat % is not displayed	Fat % is not displayed when the status of fish is "D" under the setting for fat percentage display with a limitation. Page 19
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## 6-3. Specifications

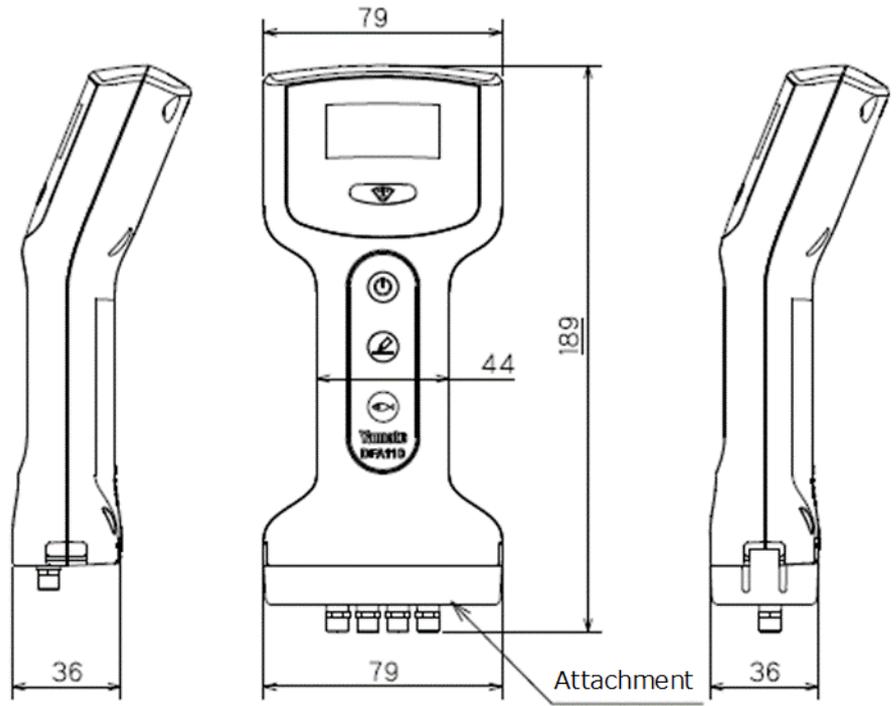
### ■ Product appearance and specifications are subject to change without notice.

- |     |                        |       |   |
|-----|------------------------|-------|---|
| 1.  | Product name           | Model | Fish Analyzer™ PRO DFA110   |
| 2.  | Measuring method       |       | Bioelectrical impedance method (4 electrode type)   |
| 3.  | Fish species           |       | Horse mackerel 1, Mackerel 1, Mackerel 2, Sardine, Saury, Yellowtail, Bluefin tuna(back, belly and tail), Sea bream, Alfonsino, Bonito 1, Salmon, Rainbow trout, Spanish mackerel, Butterfish, Sea bass, Sailfin sandfish, Grouper, Bonito 2, Sea eel, Horse mackerel 2, 20 kinds in total<br>Original 3 fish Fish A, Fish B and Fish C<br>Impedance mode Impedance at 100kHz band<br>Status of fish (Impedance at 5kHz band) |
| 4.  | Display                |       |   |
|     | Display method         |       | Organic EL display (white), dot matrix system   |
|     | Main display           |       |   |
|     | Fat percentage         |       | 1 to 70% unit: 1%   |
|     | Impedance              |       | 30Ω to 999Ω unit: 1Ω  |
|     | Status of fish         |       | Freshness A' A B C D (5 levels), E Error, F = Defrosted   |
|     | Battery level          |       | 3 levels for remaining battery  |
|     | Others                 |       | E-3 Status E E-7 E-2 E-4 Error100   |
| 5.  | Keys                   |       | Refer to 2-2. Display and keys  |
| 6.  | Functions              |       |   |
|     | Fat % display          |       | Displays fat amount that a raw fish contains in %   |
|     | Status of fish display |       | Displays freshness in 5 levels  |
|     | Display of defrosted   |       | Judges defrosted or not   |
|     | Impedance entry        |       | Makes an original algorithm   |
|     | Auto off 1             |       | Automatically turns off the power (0 to 60 minutes)   |
|     | Auto off 2             |       | Automatically turns of the screen (0 to 60 minutes)   |
|     | Brightness             |       | Brightness in 3 levels  |
|     | Average fat % display  |       | Displays an average fat percentage of measuring results   |
|     | Measuring result       |       | Stores 50 past measuring results in maximum   |
| 7.  | Appearance             |       |   |
|     | Dimensions             |       |   |
|     | Main body              |       | (W)79×(D)36×(H)175mm  |
|     | Main body+ attachment  |       | (W)79×(D)36×(H)189mm  |
|     | Net weight             |       |   |
|     | Main body              |       | Approx.155g excluding batteries   |
|     | Main body+ attachment  |       | Approx.180g excluding batteries   |
|     | Material               |       |   |
|     | Housing                |       | ABS resin   |
|     | Electrodes             |       | SUS304  |
| 8.  | Protection             |       | IP65  |
| 9.  | Power                  |       |   |
|     | Power source           |       | 2 x C3 dry battery  |
|     | Rated voltage          |       | DC3V  |
|     | Power consumption      |       | Approx.90mA   |
|     | Battery life           |       | Continuous measuring 15,000 times with alkaline batteries   |
| 10. | Operating conditions   |       |   |
|     | Operating temperature  |       | -10 to +40  |
|     | Operating humidity     |       | 30 R.H. to 85% R.H. no condensation   |
| 11. | Outside view drawing   |       | unit mm   |

•Normal



•with attachment





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