Texture Analyzer FRTS Series $\mathrm{C}\mathrm{E}$

Instruction Manual

Thank you for your purchase.

Proper operation of the machine is essential to its safe function.   Read these instructions thoroughly before using the machine.   After you have finished reading the manual, keep it always at hand for ready reference.   If a questionable point is found, please contact the dealer that you have purchased it from.

Index

Texture Analysis

This texture analyzer can digitalize texture such as firmness, viscosity, and more, allowing for data management.   It offers a wide range of measuring methods to fit your measurement needs.   It shows you the instructions to set up, thus, you only have to follow it.   You will finish measurement before you knew it.
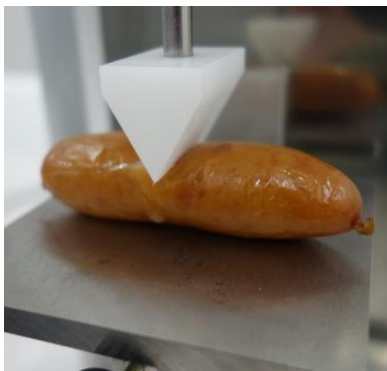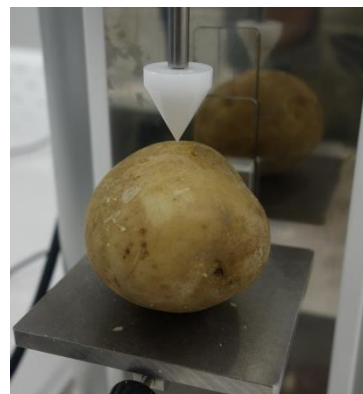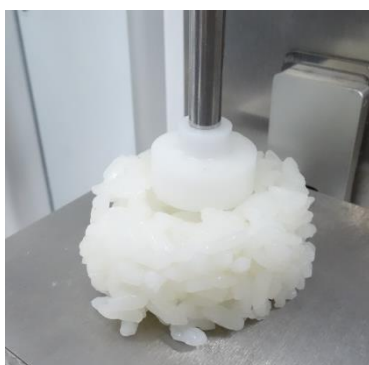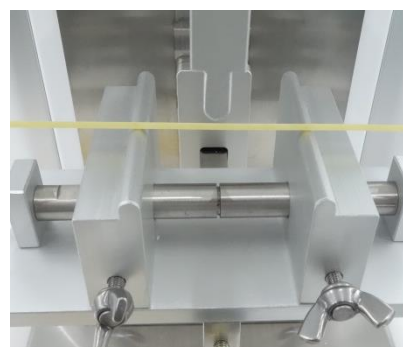
Compression

### Break

Shear

Puncture

Viscosity

Bend break（OP）

Texture Profile

Texture Profile Analysis (TPA) is a method to analyze texture by a combination of several parameters.　This texture analyzer can handle complicated analysis requiring TPA on [Texture Profile Analysis] in "Programmable mode" or on a test complying with "Food for person having difficulty in swallowing."This analyzer adopts Szczesniak's profile.
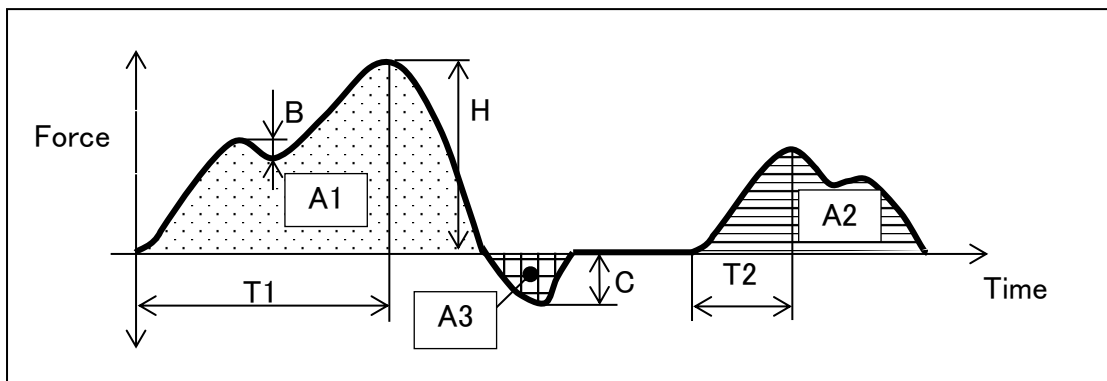
Characteristics determined by texture profile

Characteristic	Mark	Description	表現
Hardness (N/m^2)	H	Maximum force to push a sample	Soft, Hard
Viscosity (N/m^2)	C	Maximum force of stickiness	Dry, Sticky
Cohesiveness	A2/A1	Parameter for pieces of food in a mouth to join together into a mass ready for swallowing	Cohesiveness
Adhesiveness (J/m^3)	A3	Tendency for a material(food) to peel from a throat or other parts in a mouth	Sticky
Springiness	T2/T1	Deformation amount or ratio of 1st to 2nd. "T" indicates deformation amount of a material(food)	Elastic, Not elastic
Gumminess (N/m^2)	H×A2/A1	Energy required to break down a semi-solid food to a state ready for swallowing	Gummy-like
Fracturability (N/m^2)※	B	The drop "B" is determined as the Fracturability.	Crunchness
Chewiness (N/m^2)※	H×A2/A1×T2/T1	Tendency for solid food to be crushed with teeth	Chewy

※ You need an PC and the accessory software to analyze the characteristics above except Hardness and Viscosity.

1. Safety Notes

Keep it in mind that the danger and its extent by mishandling below.

| ⚠ **Danger**	This indicates the condition that may lead to malfunction or damage and even that can cause injury or death if this analyzer is used in a manner not specified by IMADA.
⚠ **Warning**	This indicates the condition that may lead to malfunction or damage and even that possibly can cause injury or death if the analyzer is used in a manor not specified by IMADA.
⚠ **Caution**	This indicates the condition that may lead to equipment malfunction or damage if the analyzer is used in a manor not specified by IMADA..

<p align="center">┌──────────────────┐
│ ⚠ Danger │
└──────────────────┘</p>

- Wear eye, face, and body protection, and cover the analyzer especially when measuring fragile samples that have the potential to scatter liquid, fragments, and chemicals under force.
- The analyzer has a moving table. Exercise great caution while measuring or whenever the table is moving.   Never place your fingers or a part of your body inside the column.
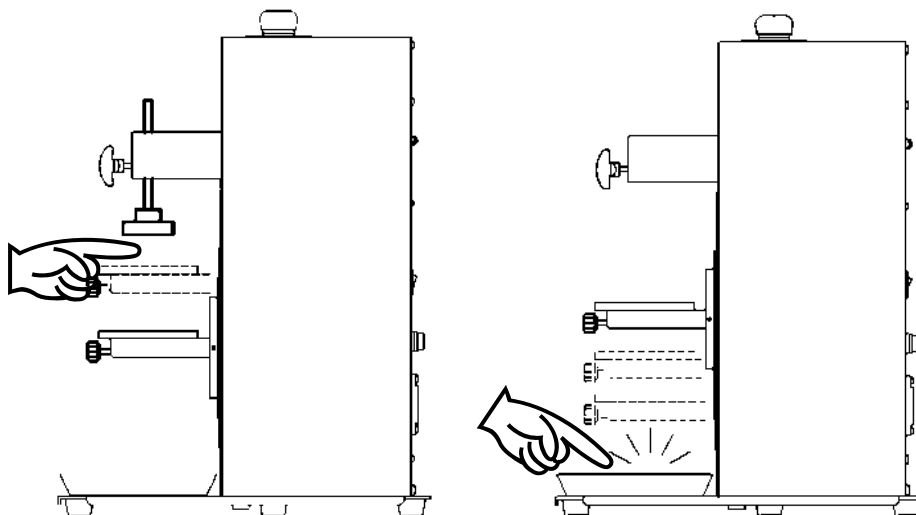
- Take sufficient safety measurement in use.
- Do NOT use it under the explosive environment since the analyzer has not been designed for explosion-proof construction.

1. Safety Notes

⚠ Warning

- This texture analyzer has been designed for indoor use only.　Ensure that its connector part is kept away from water.
- Do not use the analyzer for any purposes except texture analysis (force mesurement).
- Ensure that the analyzer's capacity is NOT exceeded.　Applying a force greater than its capacity can damage the internal sensor.
- The analyzer is equipped with the overload preventing function to protect sensor from overload, however, we do NOT guarantee the complete prevention.
- Do NOT disassemble or modify the analyzer and accessories.

⚠ Caution

- The analyzer is precision equipment.　Handle with care.
- Do NOT disassemble or modify the analyzer and accessories.
  Use IMADA's services of inspection and repair when the analyzer breaks down.

⚠ Storage Notes

- Keep away the analyzer from oil, dust, high temperature, and high humidity.
- Do NOT apply load or impact to the attachments even its power is OFF..
- Use a soft and clean cloth to wipe the analyzer without using organic solvent such as thinner.

⚠ Accuracy Notes

- This analyzer should get inspected or calibrated periodically to maintain the accuracy. We recommend that it gets calibrated once a year.　Contact the dealer that you have purchased it from or IMADA to calibrate it.
- Use the analyzer within the specified range of temperature to achieve greater accuracy.
- Do NOT disassemble or modify the analyzer and accessories.

⚠ Vibration Notes

- Put the analyzer on a stabilized place to reduce the influence of the vibration since the vibration influences to the measurement and the operation using Start Trigger function.　.

1. Safety Notes

⚠ Overload Notes

- Note this analyzer's capacity before use and ensure that the capacity is not exceeded. Otherwise, the internal load cell would be damaged.　An overload can occur whether it is powered ON or OFF.
- Do NOT apply torsion/torque force to the sensor, which lead to breakdown.
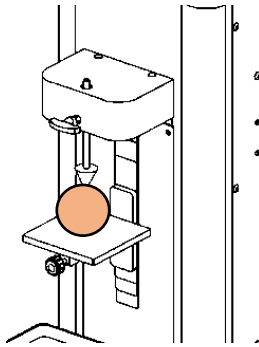
～How to Release～

- Switch OFF the analyzer, and loosen the probe knob to reduce load to the sensor.
- Switch　ON　the analyzer again.
- Contact us when you still see the screen above even after you switch ON it again since it is highly likely to be broken.

⚠ Emergency Button Notes
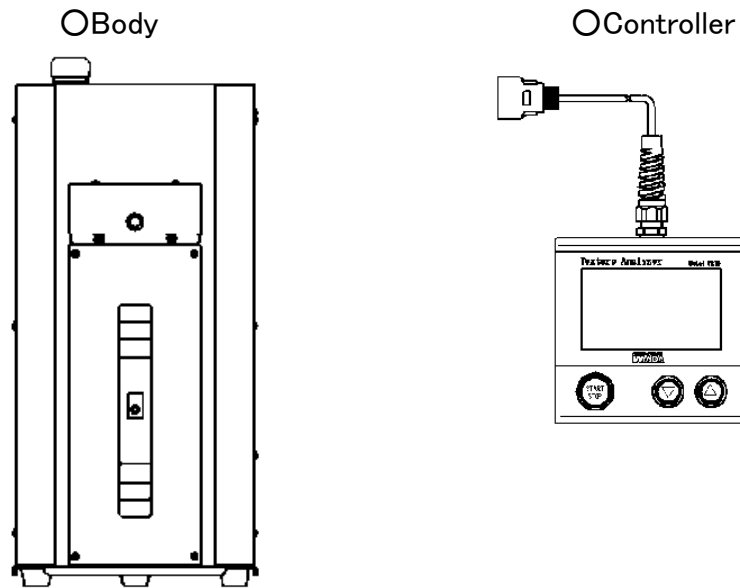
- Press the emergency button to stop an operation.
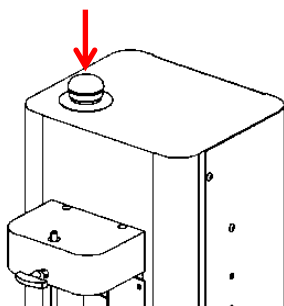
～How to Release～

- Switch OFF the power first, and turn the button to left and pull it up.
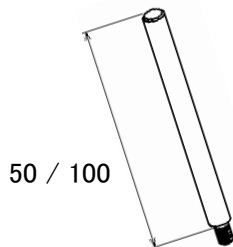- Switch ON to use it again.

2. What is Inside

Main parts

○Body   ○Controller
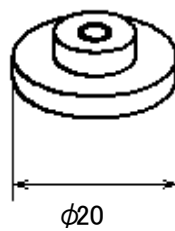
Accessories（Attachments）

○Probe shaft

  50mm : FR-JS-50

  100mm : FR-JS-100

  50 / 100

○Disk probe

  FR-HA-20J　(5N/50N)

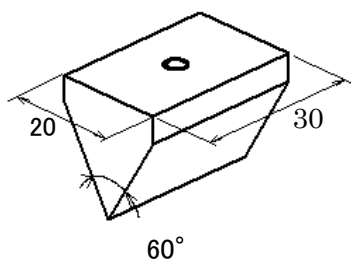 FR-HA-20S　(100N)

  φ20

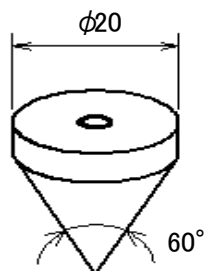○Sphere probe

  FR-SR-20S

  SR20

○Wedge probe

  FR-KS-2030-60J (5N/50N)

  FR-KS-2030-60J (100N)

  20   30

  60°

○Conical probe

  FR-ES-60-20J　(5N/50N)

  FR-ES-60-20J　(100N)

  φ20

  60°

○Tension Knob

  FR-HN

2. What is Inside

Accessories for the main part
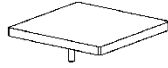
○Tray   ○Table   ○Probe knob   ○Table knob

Accessories for the controller

○Hanging pin   ○Plate

○M3 Knurled screws (2pcs)   ○M4 Wing screws (2pcs)   ○Size AA batteries (2pcs)

Others

○Power cable   ○USB cable   ○USB flash drive   ○Spare hues

○Software CD-ROM Force Recorder Professional (FRTS Ver.)

○Warranty card   ○Inspection certificate   ○Instruction manual (This paper)

3. Names and Functions

Body

Emergency button

FRTS body

Sensor box

Probe knob

Attachment
(Probe and Probe shaft)
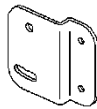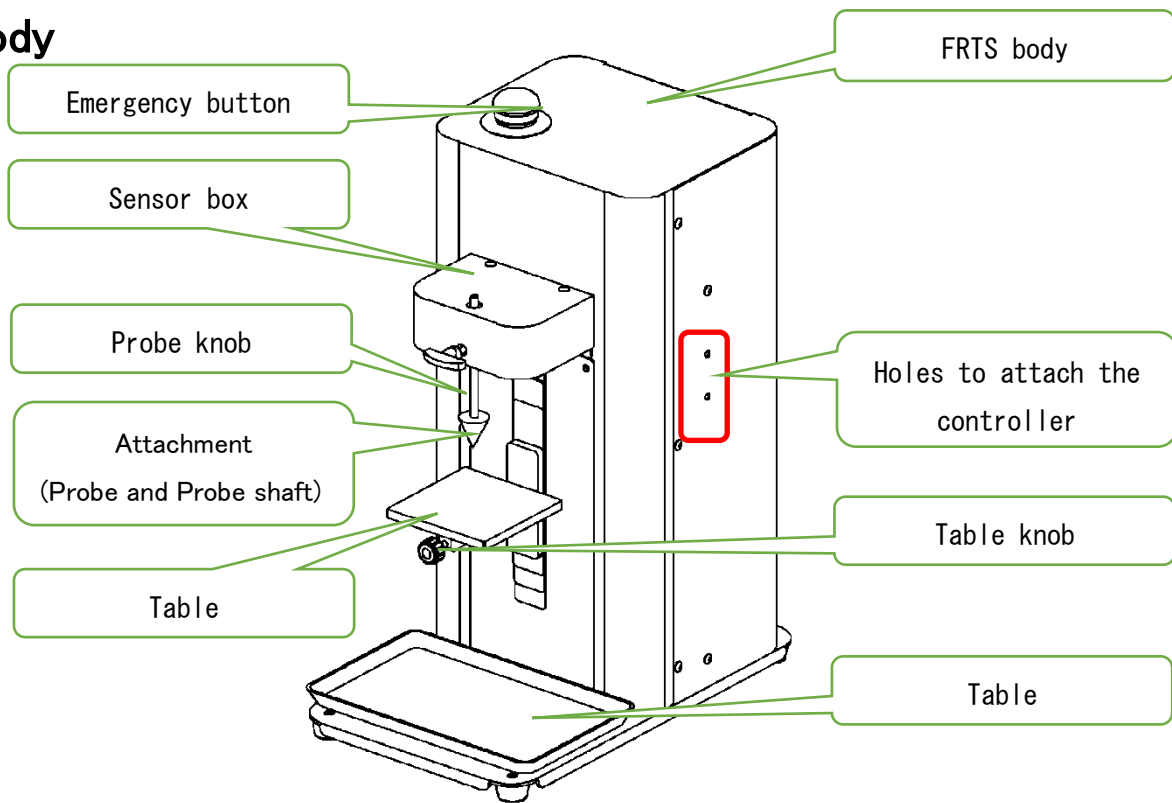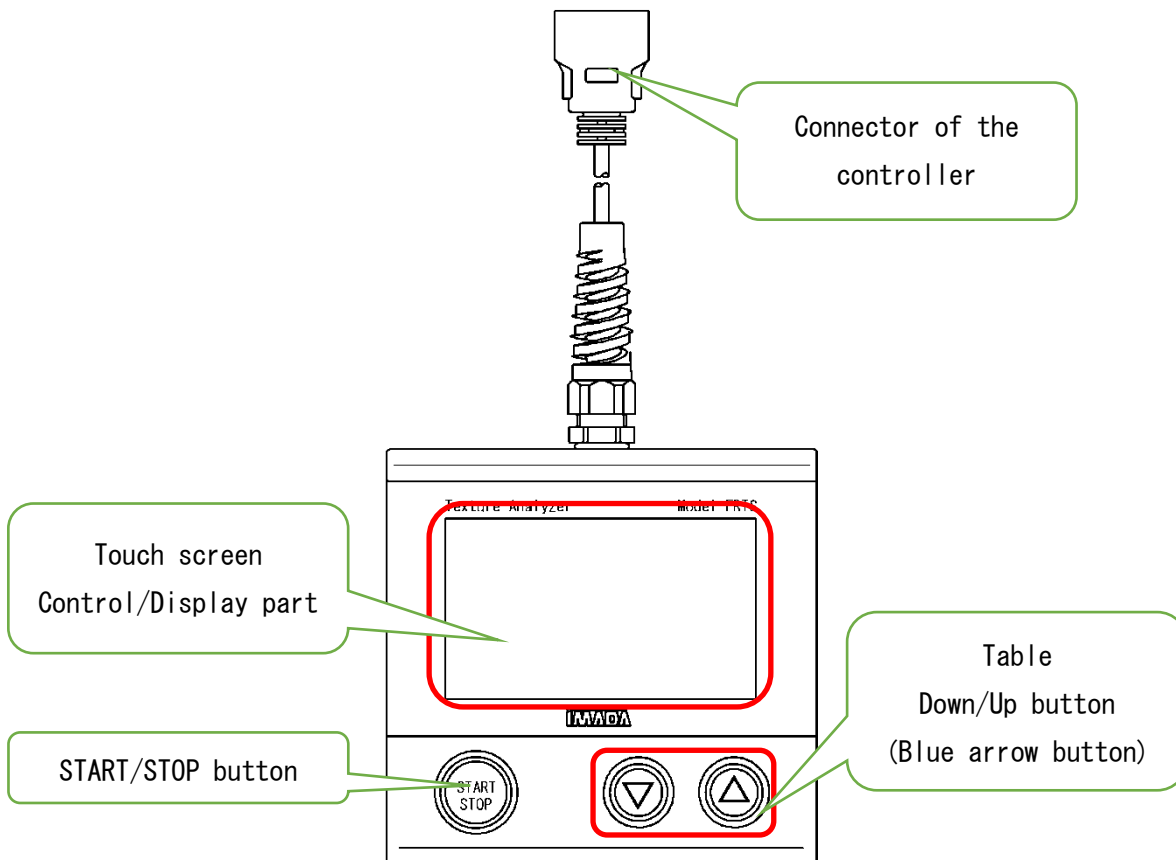
Holes to attach the controller

Table knob

Table

Table

FRTS body	This is the main body. It has connectors and an on/off switch on its back. Place it on a flat place like a table.
Emergency button	You can press the button to stop its operation in emergency. To avoid danger, always be ready to press it.
Sensor box	This part has a sensor built-in.
Attachment (Probe and Probe shaft)	They are necessary components to perform test, sensing force. The shaft has a screw-on top, therefore, you can replace probes as required.
Probe knob	Loosening this knob, you can move the probe and the shaft up and down.
Table	You can put your test sample on this table. You can remove the table and wash it. We offer a few kinds of optional tables.
Table knob	You can attach the table using this knob.
Tray	The tray is made of stainless. When your test sample falls or overflows from the table, the tray receives it.
Holes to attach the controller	Use the holes and an accessory plate to mount a controller on the body.

3. Names and Functions

Controller

Connector of the controller

Touch screen
Control/Display part

Table
Down/Up button
(Blue arrow button)

START/STOP button

|	
Connector of the controller	You can combine the controller and the body using this connector. FRTS body has its connector on its back.
Touch screen Control/Display part	The controller has a touch screen, so simply follow the instructions on the screen by touching it for setup.
START/STOP button	Press this button to start a test. Press it to stop the operation while testing. It lights a green lamp when it is ready for testing, and it blinks while testing.
Table Down/Up button (Blue arrow button)	You can manually move the table down/up using these buttons. They light in blue when they are ready. The table moves in the arrow's direction while you press it.

4. Preparation （Body/Controller）

4-1. Place the body.

- Place the body on a flat table.

4-2. Insert the AA batteries into the controller.

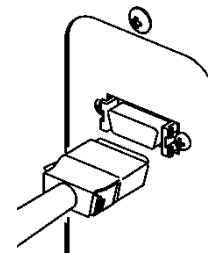- Open a cover on its back, and insert the supplied AA batteries.

⚠ Caution
Pay attention to the direction, and insert them appropriately following the instruction.
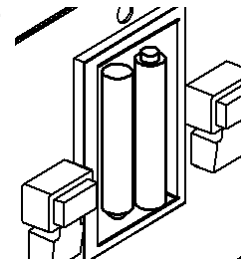
4-3. Connect the controller to the body.

- Plug the connector of the controller in the back of the body.

⚠ Caution
Pay attention to the direction, and insert it appropriately.

4-4. Connect the power cable.

- Plug the power cable in the back of body.
- Plug the opposite side of the cable in an outlet.

| ⚠ Danger |
| --- |
| ・You must use only the power cable supplied with this FRTS. If you do not use the supplied one, FRTS could be broken or ignite.
 ・We recommend that you plug the power cable directly in an outlet without using power strips since other electric device may influence FRTS.
 ・The power cable has a ground (an earth) wire, so connect it to the outlet to prevent breakdown or electric shock due to leakage.　Do NOT connect it to any water taps, gas pipes, telephones, and lightning rods, otherwise, it causes overcurrent or fire. |
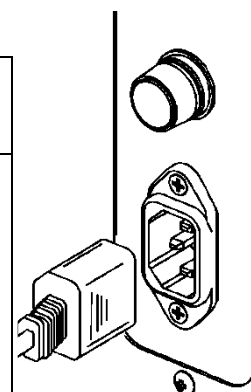
4. Preparation （Body/Controller）

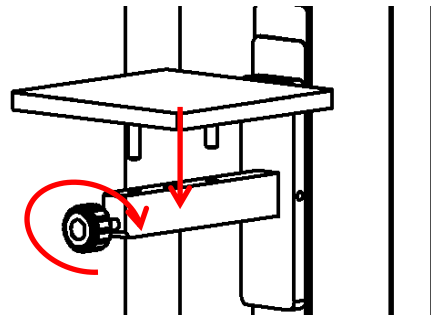## 4-5. Connect the USB flash drive

- Insert the accessory USB flash into the right side of the controller, paying attention to its direction.

  ※You can perform measurement without the USB flash drive,

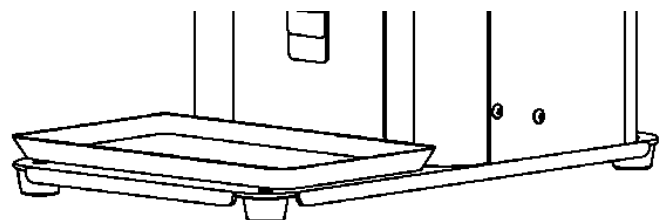 however, in this case, you cannot save the

  measured result.
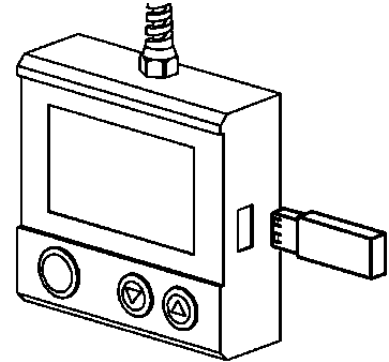
4-6. Mount the table.

- Mount the table on the arm using table knob.

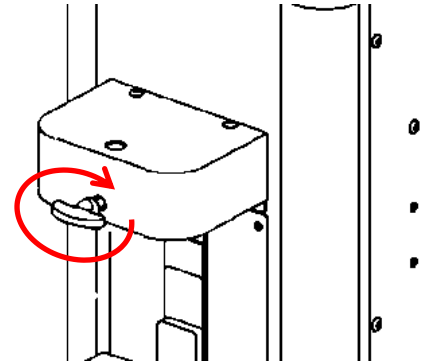## 4-7. Place the tray.

- Place the tray on the bottom of the body.

4. Preparation（Body/Controller）

4-8. Mount the probe knob.

- Mount the probe knob on the sensor box, and
  tighten a screw temporarily.

⚠ Cautions
・Probe knob is directly linked with the sensor, thus, tighten it gently to prevent an overload (sensor breakdown).

4-9. Mount an attachment.

- Combine a desired attachment with the probe shaft.

  ※Change attachments as required.

  Tighten it fully.
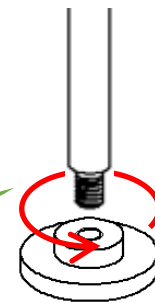
- Insert the probe shaft slowly from the underside of
  the sensor box.
- Now turn the probe knob fully to fix the probe shaft.
  Do not tighten it too much, otherwise,
  the sensor would be broken.

⚠ Caution
To prevent an overload (sensor breakdown)… ・Do NOT pull/push the attachment whether it is powered ON or OFF. ・Do not insert the probe shaft forcefully.
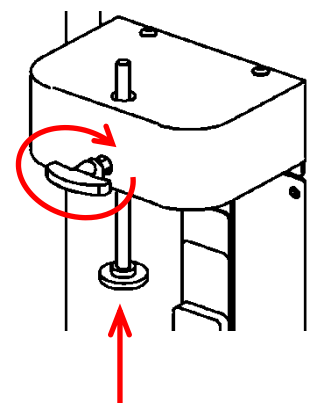
4. Preparation （Body/Controller）

4-10. How to use the controller

How to use 1

Mount it on the body.
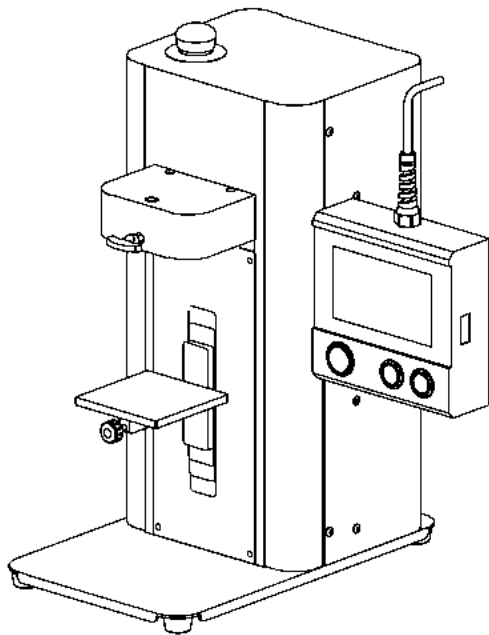
How to mount it on the body
Mount the plate using two pieces of the M3 knurl screws.
Adjusting the angle, mount the controller using two pieces of the wing screws.
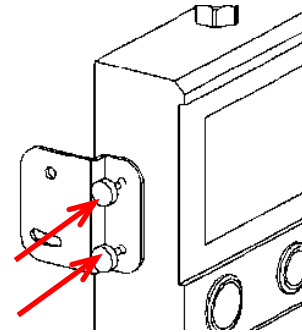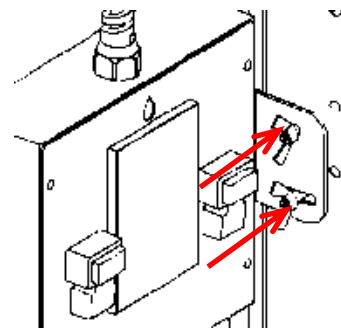
How to use 2

Place it on the table.
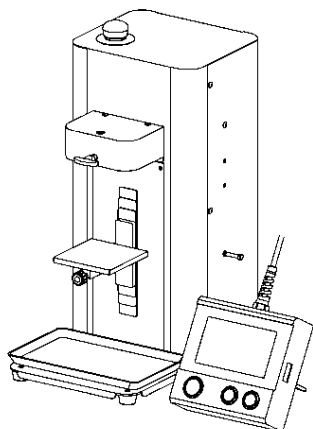
How to use 3

Hold it by hand.
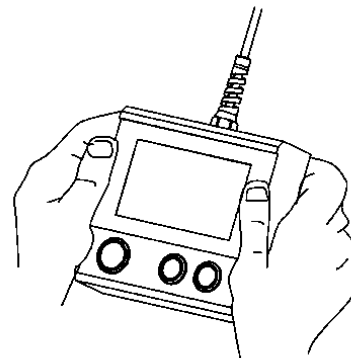
4. Preparation （Body/Controller）

4-11. How to store the controller

- You can hang the controller on the right side of the body when you do not use it.

Hanging pin
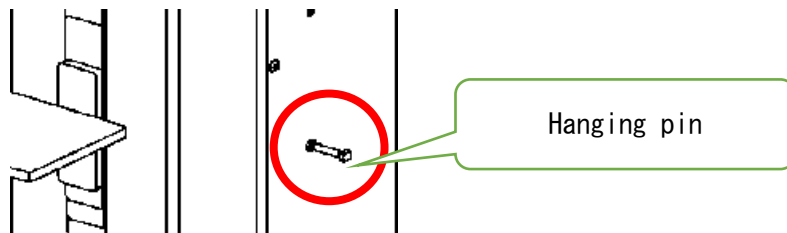
Attach the pin on the right side of the body, and hang the controller.
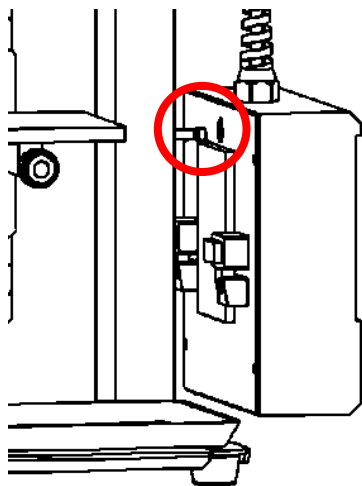
4. Preparation（Software）

4-12. STEP1. Installing FRTS series Driver

You need to install FRTS series device driver prior to software (Force Recorder) installation.

Install the driver

Firstly, install the FRTS device driver to computer.

Turn on the FRTS and connect it with computer using the attached USB cable.

The driver can be installed from 'FRTS_Driver_Installer.exe' in [Driver] folder found in software CD-ROM.

Has the driver been properly installed…?

Check the driver Install following the instruction below.

Turn on FRTS series, and connect it to the computer using USB cable. Start [Device Manager] and unfold [Ports (COM&LPT)] group. [IMADA FRTS Series] should be found if the driver has been successfully installed.
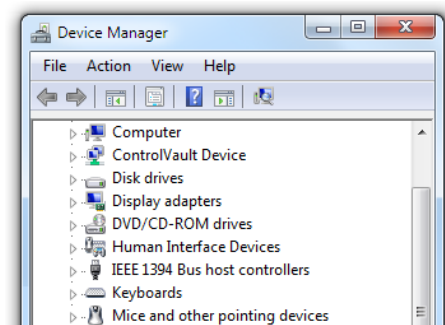
4. Preparation （Software）

4-13. Installing Force Recorder

Once the driver has been installed successfully, install Force Recorder Professional (FRTS Ver.).

Open 'English' in 'Software' folder on the CD-ROM and start Setup.exe.

① Click [Next] to start setup wizard.

②Please read through the software license agreement. If the terms are agreed, click [Next] to continue.

③ Input product key, which is found on the CD-ROM case.
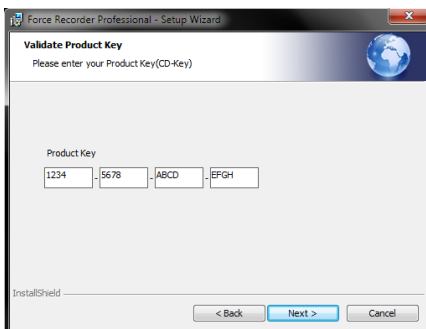
④ Click on [Install] to start installing.

⑤ Setup is completed. Click [Finish] to exit.

Installing Microsoft .Net Framework

Force Recorder operates on Microsoft .NET Framework 4.6. If .NET Framework 4.6 is not installed, Open the folder [DotNetFramework] – [English] in software CD-ROM and install .NET Framework 4.6.

Starting Force Recorder

Connect FRTS Series to computer using the supplied USB cable. Turn on FRTS series.

Go to Windows [Start] – [All Programs] – [IMADA] – [Force Recorder Professional FRTS Ver.] to start Force Recorder. Further details on operation are available from [HELP] in [HELP] menu on the main window of Force Recorder.

5. Switch on FRTS

- Connect the controller to the body, and press the ON/OFF switch on the back to turn on the power.
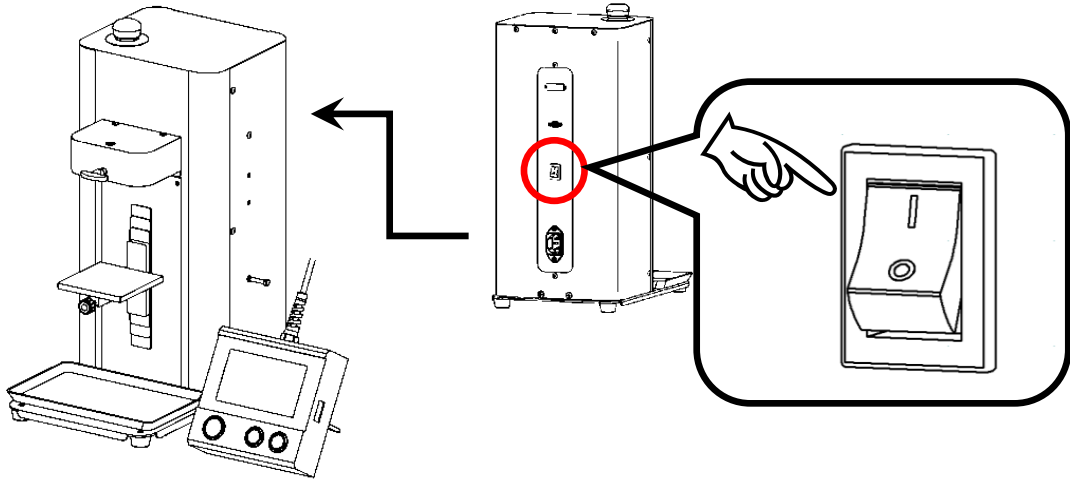
- Following the instructions on touch screen, Press (START STOP) to move the table to the bottom.
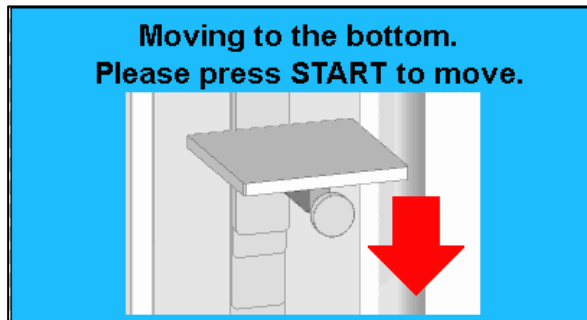
⚠ **Caution**
・Soon after pressing the button, the table starts to move to the bottom, so be careful not to catch your finger or anything in.

- After the table has reached the bottom, it shows you Main menu below.
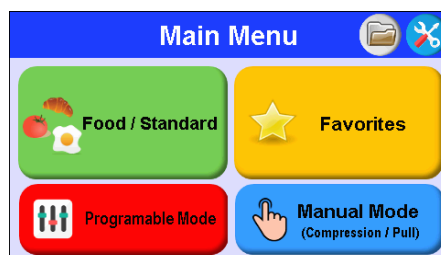
6. Main Menu
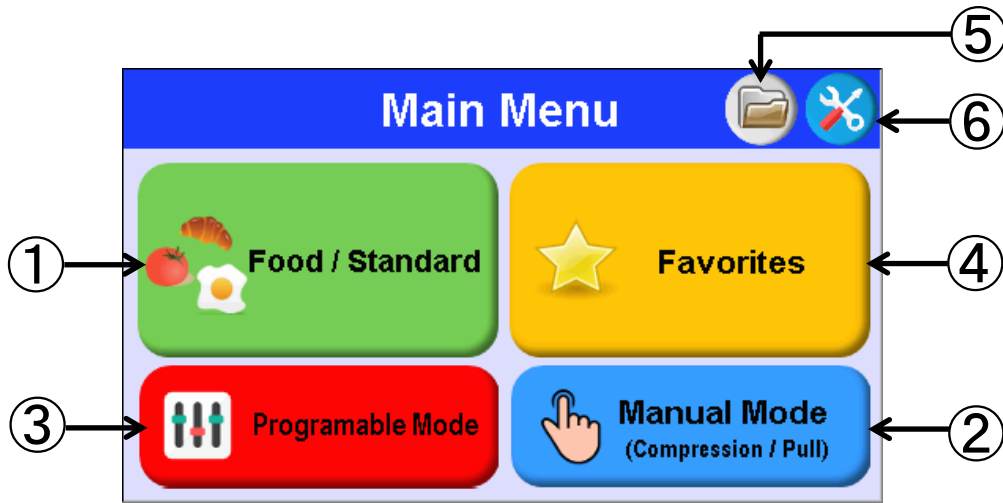
Display	Contents	Reference
① Food/Standard mode	≪Select from Food List (Food Mode)≫ A wide range of food are listed. You only have to select the desired food (or the most similar one), and follow the instructions appeared on the screen. ≪Select from Standards (Standard Mode)≫ Some representative standards are listed. You only have to select the desired standard, and follow the instructions appeared on the screen.	Page 23
② Manual Mode	You can manually move the table down/up while pressing the blue arrow button.	Page 40
③ Programmable Mode	You can set measuring conditions such as displacement, test speed, test cycles by yourself. You can select once or twice in test cycles. You can perform Texture Profile Analysis (TPA) on this mode.	Page 44
④ Favorite	You can add maximum 6 testing conditions to "Favorite" to recall them quickly.	Page 59
⑤ USB Drive Data	You can check the data saved in the USB flash drive.	Page 62
⑥ Default Settings	It is common setting menu. You can switch ON/OFF in some functions such as auto save (into the USB flash drive), test completion buzzer, etc.	Page 67

7. How to Select a Mode

You can select one mode from Food/Standard, Manual, or Programmable mode, and each mode offers different results.

Mode			Acquirable results								
			Hardness	Viscosity	Cohesiveness	Adhesiveness	Springiness	Gumminess	Fracturebility	Chewiness	Judge
Food/ Standard mode	Food mode（Preset conditions）		✔	✔							
	Standard mode	Food for person having difficulty in swallowing	✔	✔	✔	✔	✔	✔	△	△	✔
		Universal design food	✔								✔
		JIS K6503 Animal glues and gelatins	✔								
		ISO 16305 Butter	✔								
		ISO 9665 Animal glues	✔								
		Former JAS Special packaging for Kamaboko and similar	✔								
Manual mode			✔								
Programmable mode（You set up conditions by yourself）			✔	✔	✔	✔	✔	✔	△	△	–

※See the page 4 about the terms of Acquired results.

✔ means that you can acquire the result.

△ means that the results are indicated only on the supplied software.

Use this chart to find the ideal mode to fit your needs.

```
                    ┌────────────────────┐              ┌──────────────┐
                    │ You will perform   │              │ You will     │
                    │ a compression test │              │ perform a    │
                    │ such as            │              │ tension test │
                    │ -Break             │              │              │
                    │ -Shear             │              │              │
                    │ -Viscosity etc     │              │              │
                    └────────────────────┘              └──────────────┘

  ┌──────────────┐      ┌──────────────┐   ┌──────────────┐
  │ You have     │      │ You do not   │   │ You will just│
  │ decided/known│      │ know the way │   │ push your    │
  │ the way of   │      │ of measuring.│   │ sample.      │
  │ measuring.   │      │              │   │              │
  └──────────────┘      └──────────────┘   └──────────────┘

┌──────────────┐ ┌──────────────┐  ┌──────────────┐
│You would like│ │You would like│  │You would like│
│to set up     │ │to perform    │  │to know       │
│measuring     │ │measurement   │  │recommended   │
│conditions in │ │complying with│  │measuring     │
│detail by     │ │a standard    │  │methods.      │
│yourself.     │ │              │  │              │
└──────────────┘ └──────────────┘  └──────────────┘

  Programmable      Standards         Food             Manual
     mode             mode            mode             mode
   Page 44          Page 27         Page 23          Page 40
```

See the page 55 for common screens of each mode.

8. Select Measuring Conditions (Food/Standard mode)

This texture analyzer includes a wide range of preset measuring conditions.

You only have to select a desired food or standard to set measuring conditions.

I. <Food Mode>

Select Measuring Conditions from Food List

This texture analyzer includes a wide range of measuring conditions over 100.   You only have to select a desired food (or the most similar one), and follow the instructions displayed to set measuring conditions.

- Touch Food/Standard on Main Menu.
- Touch Select from Food List .
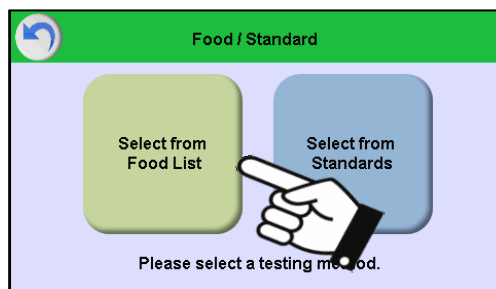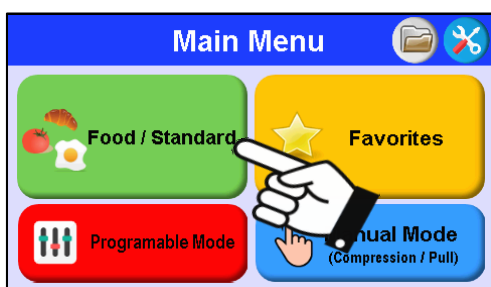
- You will see the list of food categories like Western Pastries, Japanese Pastries, Dairy products, and more, then touch a desired category.

  (Touch ▲▼ to scroll.)

- You will see the list of food after selecting a category, then touch a desired food (or the most similar one).

- You will see the list of measuring methods like shear, compression, and more, then touch a desired method.
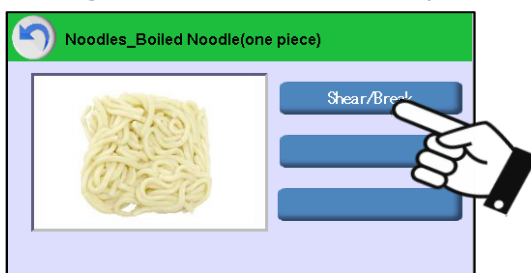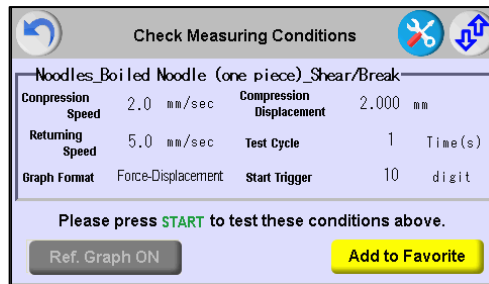
8. Select Measuring Conditions (Food/Standard mode)

- You will see the recommended measuring conditions. You can adjust the conditions like test speed as required. Touch ⎡Next⎤ to go to next.
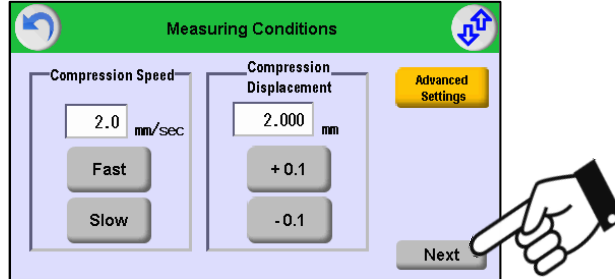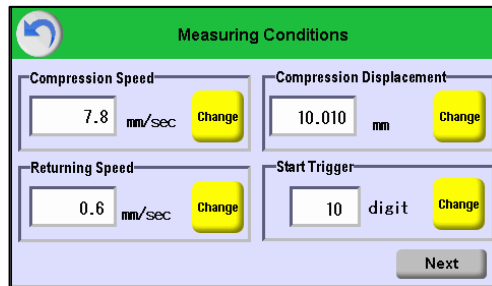

- You will see the confirmation screen, "Check Measuring Conditions," then, touch (START STOP) to start measurement.

Advanced Settings

Touch ⎡Advanced Settings⎤ to adjust measuring conditions in more detail.
Touch ⎡Change⎤ on the right of each item, and revise the value using numeric keypad.

You can change the values within the ranges below.

Item	The minimum value	The maximum value
Compression Speed	0.1 mm/sec	10.0 mm/sec
Returning Speed	0.1 mm/sec	10.0 mm/sec
Compression Displacement(※1)	0.01	100 mm
Compression Force(※1)	The minimum value in the currently set unit	The maximum value in the currently set unit (e.g. 50.00N, 5.00kg etc.)

※1… When you measure Viscosity, set compression force instead of compression displacement.
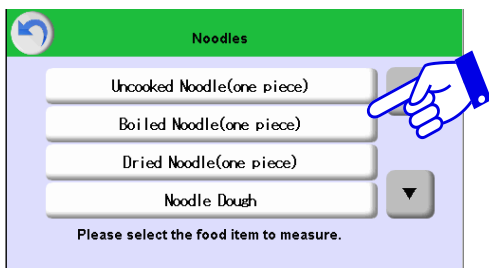
24

8. Select Measuring Conditions (Food/Standard mode)

（Measurement Example1） Shearing test of boiled noodle

① Touch Noodle from the list of food categories.

   Touch ▲▼ to scroll.

② Touch Boiled noodle (one piece).
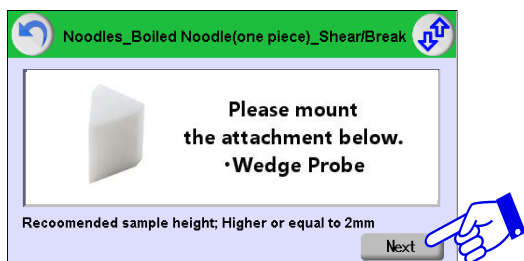

③ Touch Shear/Break as a measuring method.

④ Combine the recommended attachment with the probe

   shaft, and mount it on the body.

   Touch Next to go to next step after you have finished

   mounting it.

⑤ You will see the default （Compression Speed and Compression Displacement） of the selected food.
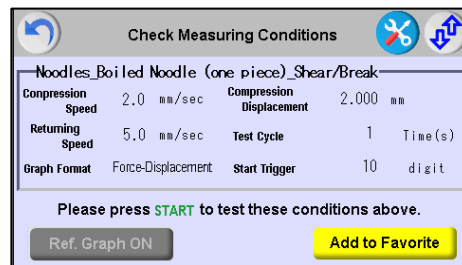
・Touch Fast / Slow to adjust Speed.

・Touch +0.1 / −0.1 to adjust Displacement.

・Touch Next to go to next step.

※Touch Advanced Settings to adjust measuring conditions in more detail. See the page 24 for further information.
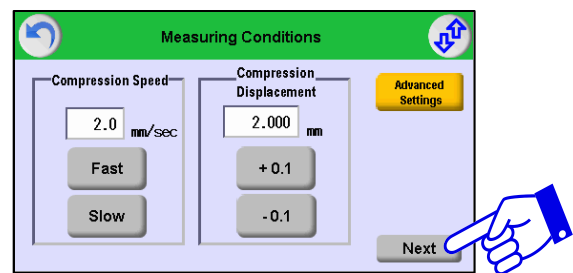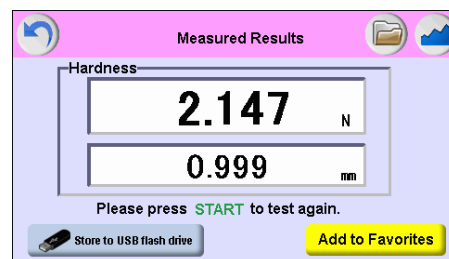

⑥ You will see the confirmation screen （"Check Measuring Conditions"）. See the page 56 about how to see it.

⑦ Put your test sample on the table, and touch [START STOP] to start measurement.

⑧ You can see the measured result after measurement has finished.

Press [START STOP] to perform measurement again under the same measuring conditions.

25

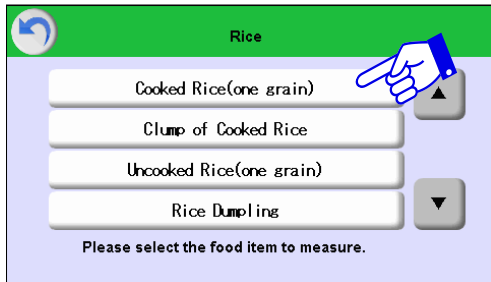# 8. Select Measuring Conditions (Food/Standard mode)

(Measurement Example 2) Viscosity test of cooked rice (one grain)

① Touch Rice from the list of food categories.
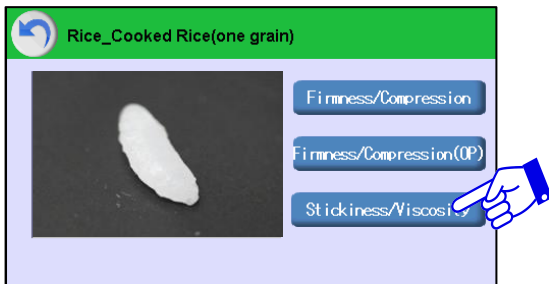
    Touch ▲▼ to scroll.

Select from Food List
- Butter
- Noodles
- Bread
- Rice

Please select the category of food.

② Touch Cooked Rice (one grain) .

Rice
- Cooked Rice(one grain)
- Clump of Cooked Rice
- Uncooked Rice(one grain)
- Rice Dumpling

Please select the food item to measure.

③ Touch Stickiness / Viscosity .

Rice_Cooked Rice(one grain)
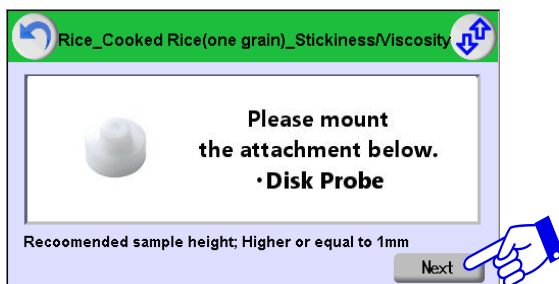- Firmness/Compression
- Firmness/Compression(OP)
- Stickiness/Viscosity

④ Combine the recommended attachment with the probe

    shaft, and mount it on the body.

    Touch Next to go to next step after you have finished

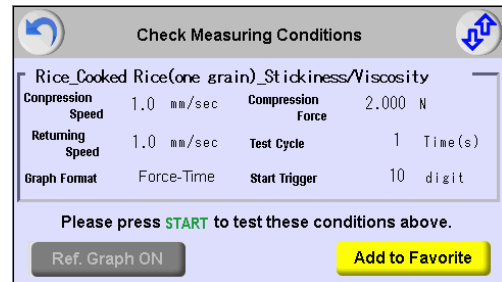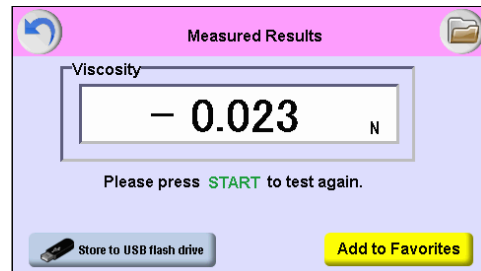   mounting it.

Rice_Cooked Rice(one grain)_Stickiness/Viscosity

Please mount
the attachment below.
・Disk Probe

Recoomended sample height; Higher or equal to 1mm

Next

⑤ You will see the default (Compression Speed and
Compression Force) of the selected food.

・Touch Fast / Slow to adjust the speed.

・Touch +0.1 / −0.1 を to adjust the force.

・Touch Next to go to next step.

※Touch Advanced Settings to adjust measuring conditions in more
    detail.　See the page 24 for further information.

Measuring Conditions

Compression Speed
1.0 mm/sec
Fast
Slow

Compression Force
1.000 N
+0.1
−0.1

Advanced Settings

Next

⑥ You will see the confirmation screen (Check Measuring
    Conditions). See the page 56 about how to see it.

Check Measuring Conditions

Rice_Cooked Rice(one grain)_Stickiness/Viscosity

Compression Speed	1.0 mm/sec	Compression Force	2.000 N
Returning Speed	1.0 mm/sec	Test Cycle	1 Time(s)
Graph Format	Force-Time	Start Trigger	10 digit

Please press START to test these conditions above.

Ref. Graph ON   Add to Favorite

⑦ Put your test sample on the table,
    and touch START STOP to start measurement.

⑧ You can see the measured result after measurement
    has finished.

Measured Results

Viscosity
− 0.023 N

Please press START to test again.

Store to USB flash drive   Add to Favorites
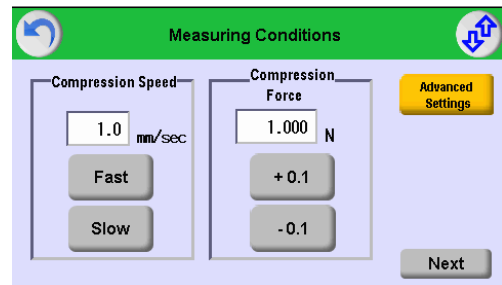
Press START STOP to perform measurement again under the
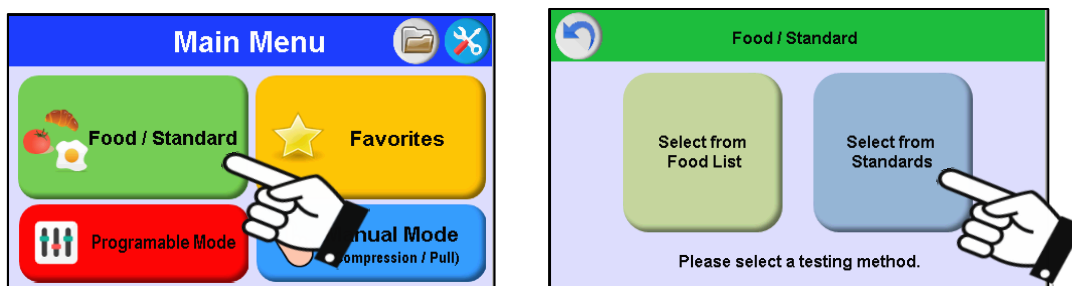same measuring conditions.

8. Select Measuring Conditions (Food/Standard mode)

II. <Standard Mode>

Select Measuring Conditions from Standards

This texture analyzer includes some measuring conditions.　You only have to select a desired standard (or the most similar one), and follow the instructions displayed to set measuring conditions.

- Touch [Food/Standard] on Main Menu.
- Touch [Select from Standards].

- You will see the list of standards like Food for person having difficulty in swallowing, Universal design food (UDF), and more, then touch a desired category.
  （Touch ▲▼ to scroll.)

- Follow the instructions appeared on the screen.
  See the page 28 for further information.

- Touch [↩] to go back.

8. Select Measuring Conditions (Food/Standard mode)

List of selectable standards in FRTS

Standard	Outline
Food for person having difficulty in swallowing *1 To page 29	It is a type of special-use food determined by Consumer Affairs Agency of Japan, which is aimed to ease swallowing problems and prevent accidents such as misswallowing and suffocation. It measures hardness, cohesiveness and adhesiveness to give 3-step judgement based on the results.
Universal Design Food *1 To page 33	It is designed to provide widely accepted food regardless of age or medical conditions. Japan Care Food Conference defines 4-step judgement depending on hardness.
JIS K6503 Animal glues and gelatins *2 To page 36	It specifies animal glues and gelatins and often used for jelly hardness testing. PFSB notification 0531No.3 by the Japanese Pharmacopoeia states the same method. It is also known as gel strength (bloom value).
ISO16305 Butter *1 To page 37	It is an international standard for measurement of solid butter hardness, which is also effective in Japan.
ISO9665 Animal glues *1 To page 38	This international standard outlines measurement of animal glues. It can be used to measure hardness of jelly in accordance with the standard.
Former JAS Special packaging for Kamaboko and similar *1 To page 39	This standard states method to measure elasticity of Kamaboko (pasted fish) and similar food in casing.

*1 The marked standards above use only N and mm as unit.

*2 JAS K6503 uses g/kg as unit.

Disclaimer of standard contents

The contents in this manual are based on the information gathered from each standard. It however shall not guarantee the accurateness, dependability, conformity or any results obtained from the measurement using this tester. The interpretation or the accurateness shall depend on users by their decisions.

The standards referred to in this manual may change without prior notice.

Food for Person Having Difficulty in Swallowing *PC required

This standard specifies testing method to measure hardness, cohesiveness and adhesiveness to determine 3-step permission criteria.

The results also include tackiness, elasticity and gumminess, which are irrelevant to the criteria judgement.

Permission Criteria

Standard[*1]	Results		
Hardness (N/m^2)	2.5×10^3 to 1×10^4	1×10^3 to 1.5×10^4	3×10^2 to 2×10^4
Cohesiveness(J/m^3)	Less than 4×10^2	Less than 1×10^3	Less than 1.5×10^3
Adhesiveness	0.2 to 0.6	0.2 to 0.9	---
Judgement	Permission Criteria I[※2]	Permission Criteria II[※3]	Permission Criteria III[※4]

*1 The results should be within the standard regardless of the testing condition either at room temperature or serving temperature.

*2 Homogeneous food (e.g. jelly food)

*3 Homogeneous food (e.g. jelly food, mousse food, etc.) excluding the food meeting Permission Criteria I.

*4 Fully or partly heterogeneous food (e.g. rice porridge, jellied food, etc.) excluding the food meeting Permission Criteria I or II.

Outline of method

Prepare a container (40mm diameter and 20mm height). Put the sample to fill 15mm of the container. Push in with disk probe (FR-HA-20J 20mm diameter) at 10mm/sec. Continue until the disk reaches 5mm from the bottom of the container. Repeat the test twice to measure hardness, cohesiveness and adhesiveness.

Hardness: H
Cohesiveness: A2/A1
Adhesiveness: A3
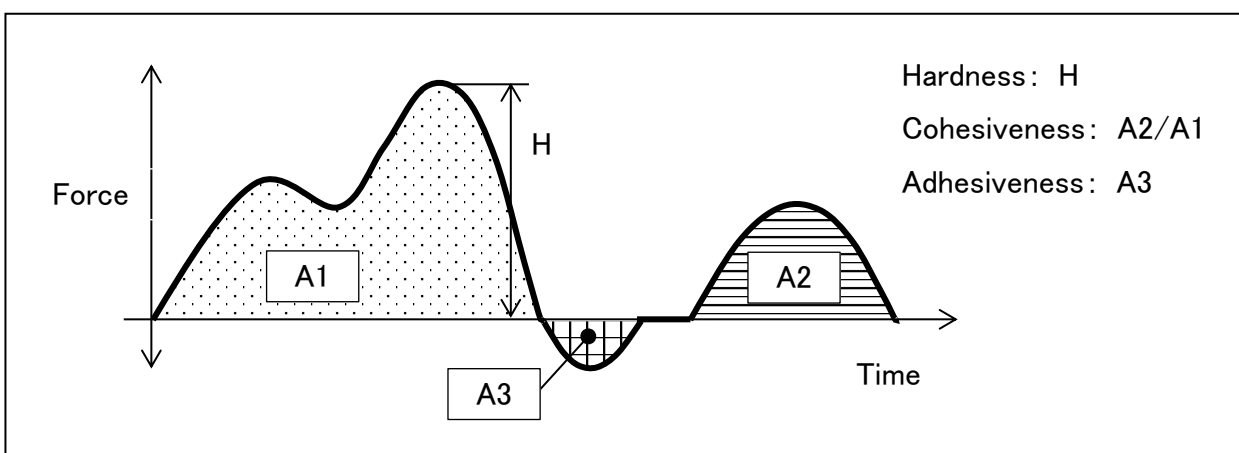
Food for Person Having Difficulty in Swallowing *PC required

Setting the unit

This standard uses N for force and mm for displacement.

Set the unit to N prior to testing.

See the page 69 for the instructions to switch the unit from N to kgf or lbf.

Prepare PC and install software

The supplied software, Force Recorder Professional (FRTS ver.) is required for this test. Install it (see the page 17 and 18 for details), connect FRTS and PC with the supplied USB cable and have this software standby.

Preparation

Mount the attachment
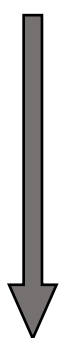
- Follow the instruction appeared on the screen, and prepare the disk probe (FR-HA-20J 20mm diameter).
- Fix it on probe shaft 100mm.
- Insert the probe in FRTS upwards to top and tighten it.

  *Ensure to use disk probe 20mm diameter.

  The results are unreliable otherwise because it calculates the results based on the premise that this attachment is used.

Set start position
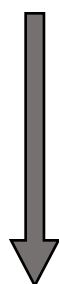
- Prepare an empty container 40mm diameter and 20mm height. Set it on the table.
- Move the table to the top end.
- Loosen the probe knob to let the disk probe sit on the table
- Tighten the knob with the probe tip touching the table.
- Table moves downwards automatically to give some space for setting the sample.
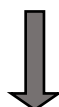
Set food sample

Take the container (40mm diameter and 20mm height) and put the food sample to fill 15mm of the container.

To be continued→

Food for Person Having Difficulty in Swallowing *PC required

Adjust start/finish position
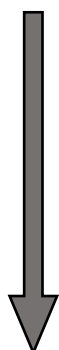
The current table position is the start and finish point. Adjust the position to test efficiently when the surface of food and the probe are far apart.

- Touch ⬍ button to activate manual mode for adjustment. Move the table while ▽ △ are on.
- Touch Next to complete.

Ready to test
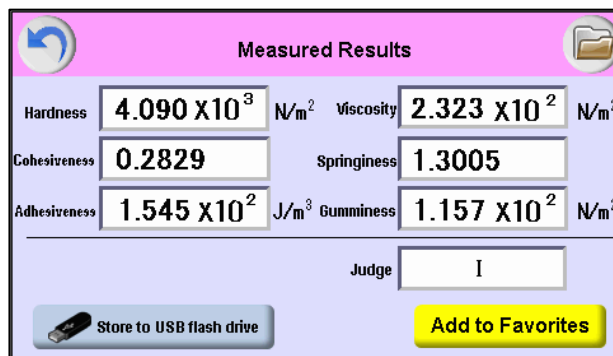
31

Food for Person Having Difficulty in Swallowing *PC required

Start testing and see results

Press (START STOP) lit in green to start testing. The table moves to apply compression force twice. The software automatically starts and finishes recording.

The table returns to the start position once measurement is completed. Wait while the display show the message below as texture profile is getting calculated.

Calculating the results…
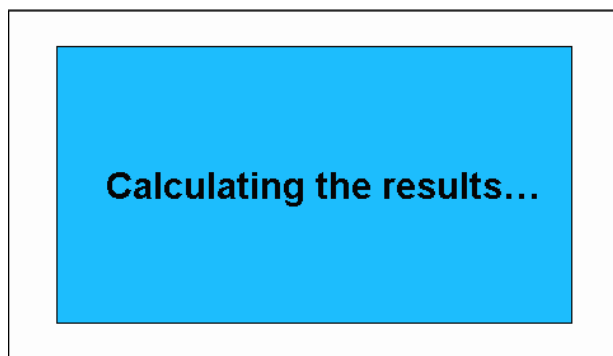
Test results appear as below. It shows judgement of permission criteria I/II/II based on hardness, cohesion and adhesiveness.

Measured Results

Hardness	4.090×10^3	N/m²	Viscosity	2.323×10^2	N/m²
Cohesiveness	0.2829		Springiness	1.3005	
Adhesiveness	1.545×10^2	J/m³	Gumminess	1.157×10^2	N/m²

Judge: I

Store to USB flash drive   Add to Favorites

Press (START STOP) to repeat test with another sample. (The button lights in green when it is in standby.)

Universal Design Food

It measures hardness in the specified method to determine the permission criteria.

	Results			
Upper limit of hardness (N/m^2) **Gel ***	Up to $5x10^5$	Up to $5x10^4$	Up to $2x10^4$	Up to $5x10^3$
Upper limit of hardness (N/m^2) **Sol***			Up to $1x10^4$	Up to $3x10^3$
Judgement	Requires light chewing	Requires smashing with gums	Requires smashing with tongue	Requires no chewing
Masticatory force level	Difficult to eat hard or large piece of food	Difficult to eat hard or large piece of food	Possible to eat soft food in small pieces	Difficult to eat any solid foods regardless of size
Swallowing ability level	No difficulty in swallowing	Difficult to swallow certain foods	Difficult to drink water/tea occasionally	Difficult to drink water/tea

＊ 'Sol' is the state of solid or liquid dispersed in liquid.

'Gel' is the state of 'Sol' losing fluidity in jelly solid.

Outline of method

Prepare a container (40mm diameter and 20mm height). Put the sample to fill 15mm of the container. Push in with disk probe (20mm diameter) at 10mm/sec. Continue until the probe reaches 5mm from the bottom of the container to measure hardness, cohesiveness and adhesiveness.

Force

H

Hardness: H

33
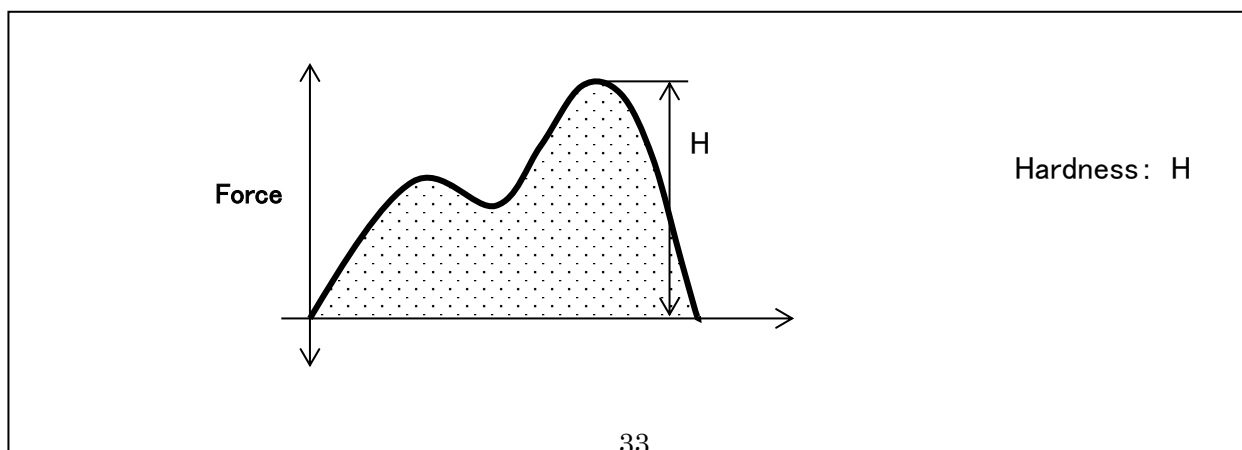
Universal Design Food

Preparation

Mount the attachment
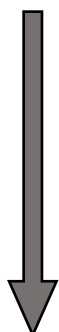
- Follow the instruction appears on the touch screen and prepare the disk probe (20mm diameter).
- Fix it on probe shaft 100mm.
- Insert the probe in FRTS upwards to top and tighten it.

  *Ensure to use disk probe 20mm diameter.

  The results are unreliable otherwise because it calculates the results based on the premise that this attachment is used.

Set start position
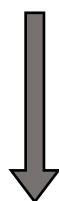
- Move the table to the top end.
- Loosen the probe knob to let the disk probe sit on the table
- Tighten the knob with the probe tip touching the table.
- Table moves downwards automatically to give some space for setting the sample.
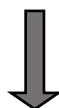
Set food sample

Prepare the container (40mm diameter and 20mm height) and put the food sample to fill 15mm of the container.

Adjust start/finish position
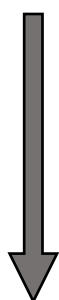
The current table position is the start and finish point. Adjust the position to test efficiently when the surface of food and the probe are far apart.

- Touch button to activate manual mode for adjustment. Move the table while   are on.
- Touch Next to complete.

Ready to test

Universal Design Food

Start testing and see results

Press (START STOP) lit in green to start testing. The table moves to apply compression force once.

The table returns to the start position once measurement is completed. Test results appear as below. It shows judgement of permission criteria based on hardness.
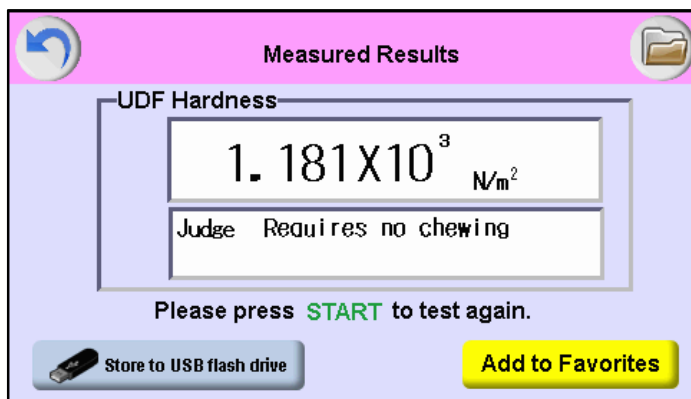
Press (START STOP) to repeat test with another sample. (The button lights in green when it is in standby.)
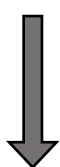
JIS K6503 Animal glues and gelatins

It measures gel strength in the method specified in JIS K6503.

Outline of method

Prepare a container (60mm diameter and 60mm or taller height) and fill it with jelly. Push in with cylindrical probe (optional: FR-EC-12.7J) at 0.5mm/sec for 4mm deep from the surface of jelly.

Preparation

Mount the attachment

- Prepare the cylindrical probe (12.7mm diameter).
- Fix it on probe shaft 100mm.
- Insert the probe in FRTS upwards to top and tighten it.

Set start position
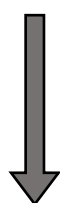
- Move the table to the top end.
- Loosen the probe knob to let the cylindrical probe sit on the table.
- Tighten the knob with the probe tip touching the table.
- Move the table downwards to have sufficient space to set the sample.

Set food sample
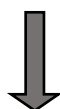
- Prepare the container (60mm diameter and 60mm height) and fill it with jelly.
- Set the container in the center of the table.

Ready to test

Start testing and see results

Press [START STOP] lit in green to start testing. The table moves to apply compression force once on the sample.

The table returns to the start position once measurement is completed. Test results appear on the screen.

Press [START STOP] to repeat test with another sample. (The button lights in green when it is in standby.)

ISO16305 Butter (Method for measuring hardness of butter) *PC required

It measures butter hardness in the method specified in ISO 16305.

Outline of method

Prepare a block of butter in approx. 22mm cube tempered at 10 ℃.

Prepare wire-cutter probe (optional: FR-WK-85). Slice through the sample at 1mm/sec for 18mm deep. The hardness test result is the mean force between 8mm – 16mm of travel.

*Use the supplied software Force Recorder Professional (FRTS Ver.) to calculate the mean.

(Results are only acceptable when the difference between the minimum and the maximum force is less than 10% of the calculated arithmetical mean of the firmness.)

Preparation

Mount the attachment
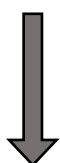
- Prepare wire-cutter probe.
- Fix it on probe shaft 50mm.
- Insert the probe in FRTS upwards to top and tighten it.

Set start position
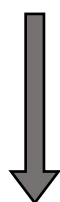
- Move the table to the top end.
- Loosen the probe knob to let the wire-cutter probe sit on the table.
- Tighten the knob with the wire touching the table.
- Move the table downwards to have sufficient space to set the sample.

Set food sample

- Set the block of butter in the center of the table.

Ready to test

Start testing and see results

Press (START STOP) lit in green to start testing. The table moves and cut into the sample.

The table returns to the start position once measurement is completed. Test results appear on the screen.

Press (START STOP) to repeat test with another sample. (The button lights in green when it is in standby.)

ISO 9665 Animal glues (ISO gel strength test)

It measures jelly or gelatin hardness in the method specified in ISO 9665.

Outline of method

Prepare a wide-neck bottle (59mm inner diameter and approx. 85mm height) with a capacity of 155ml and fill it with jelly. Depress it with cylindrical probe with an edge radius of 0.39mm (optional: FR-EC-12.7J) to a depth of 4mm at 0.8mm/sec or slower to determine gel strength.
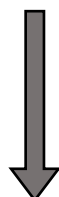
Preparation

Mount the attachment
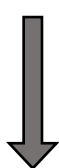
- Prepare the cylindrical probe (12.7mm diameter).
- Fix it on probe shaft 100mm.
- Insert the probe in FRTS upwards to top and tighten it.

Set start position

- Move the table to the top end.
- Loosen the probe knob to let the cylindrical probe sit on the table.
- Tighten the knob with the probe tip touching the table.
- Move the table downwards to have sufficient space to set the sample.

Set food sample
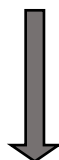
- Prepare the container (59mm inner diameter and approx. 85mm height) and fill it with jelly.
- Set the container in the center of the table.

Ready to test

Start testing and see results

Press [START STOP] lit in green to start testing. The table moves to apply compression force for 4mm deep on the sample.

The table returns to the start position once measurement is completed. Test results appear on the screen.

Press [START STOP] to repeat test with another sample. (The button lights in green when it is in standby.)

## Former JAS Special Packaging for Kamaboko and Similar

It measures elasticity of Kamaboko (pasted fish) and similar food in casing based on Former JAS standard.

Outline of method

Prepare a sample by cutting off 1 cm from the edge and then slice 2.5cm to make a cylindrical piece. Push in with sphere probe (optional: FR-SR-7S) on the sliced surface to measure the elasticity.
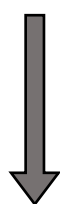
Preparation

Mount the attachment
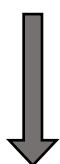
- Prepare the sphere probe (7mm diameter).
- Fix it on probe shaft 100mm.
- Insert the probe in FRTS upwards to top and tighten it.

Set start position

- Move the table to the top end.
- Loosen the probe knob to let the cylindrical probe sit on the table.
- Tighten the knob with the probe tip touching the table.
- Move the table downwards to have sufficient space to set the sample.

Set food sample
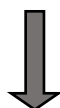
- Set the sample (cylindrical piece in 2.5cm) in the center of the table.

Ready to test

Start testing and see results

Press [START STOP] lit in green to start testing. The table moves to apply compression force once on the sample.

The table returns to the start position once measurement is completed. Test results appear on the screen.

Press [START STOP] to repeat test with another sample. (The button lights in green when it is in standby.)

9. Manual Mode

In this mode, you can manually move the table up/down while pressing (▽) (△) .

This mode is perfect for simple hardness test, or checking measuring conditions (speed/displacement).

Note that you can perform tension tests (of noodles and more) in this Manual mode only.
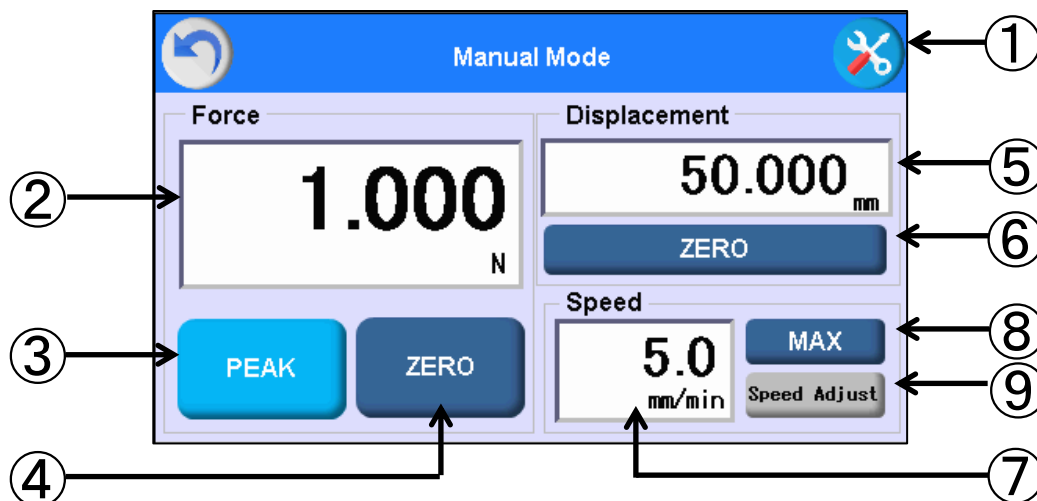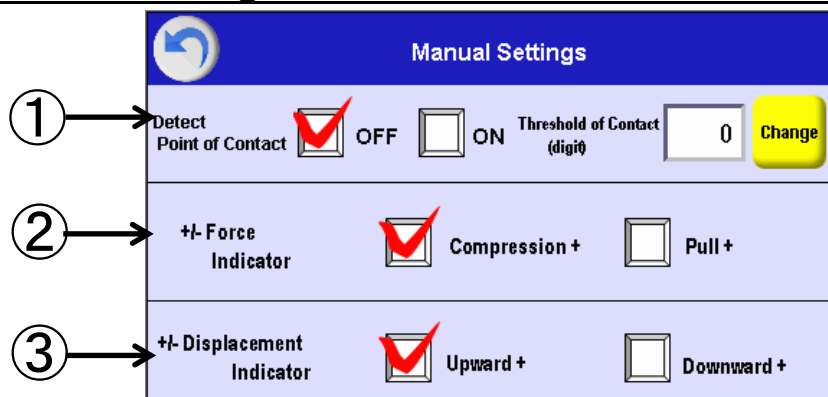

Item	Contents
① Manual Settings	You can set up things in Manual mode. Please see the page 25 for further information.
② Force	It indicates the real-time force value or the peak vale.
③ Peak	You can select a measuring method between the peak test and the real-time test. This button is in red while the peak test mode is ON. In this case, you can see the peak value at ②.
④ Force Zero Button	Touch this button to zero the force value at ②. (It also zero the peak value.)
⑤ Displacement	It indicates the real-time displacement.
⑥ Displacement Zero button	Touch this button to zero the displacement at ⑤. When [Detect Point of Contact] is ON, you cannot zero it manually since the function zero the displacement automatically.
⑦ Speed	It indicates the set measuring speed.
⑧ MAX Button	Touch this button to set test speed fastest (10mm/sec). This button is in red while it is activated. Use it to move the table fast.
⑨ Speed Adjust Button	Touch this button to change the speed. You can select speed from 0.1/1/2/3/4/5/6/7/8/9/10 mm/sec.

Touch (↩) to go to Main menu.

9. Manual Mode

9-1. Manual Settings

Item	Contents	Default
① Detect Contact Point※	It detects point of contact (the surface of your sample), and regards the point as the start (zero) of the displacement.　In advance, set the force value to be regarded as the point of contact. When it senses the set force value, it starts measuring the displacement. Touch Change and input a desired value in digit (resolution). (You can input the number from 1 to 99) <e.g.> When you put {2}, it zero the force value like mentioned below: －　FRTS-5N: 0.002N －　FRTS-50N: 0.02N －　FRTS-100N: 0.2N	OFF
② +/- Force Indicator	You can switch +/- of force. 　　When you push: Compression＋ 　　When you pull: Tension＋	Compression+
③ +/- Displacement Indicator	You can switch +/- of displacement. 　　When you push: Upward+ When you pull: Downward+	Upward＋

※ Minimize the influence of the vibration since it regards the vibration as a force, and detect point of contact by mistake.

● Touch to go back.

9. Manual Mode

9-2. Operation in Manual Mode

▽ △ light in blue when they are ready.

The table moves in the arrow's direction while you press it.
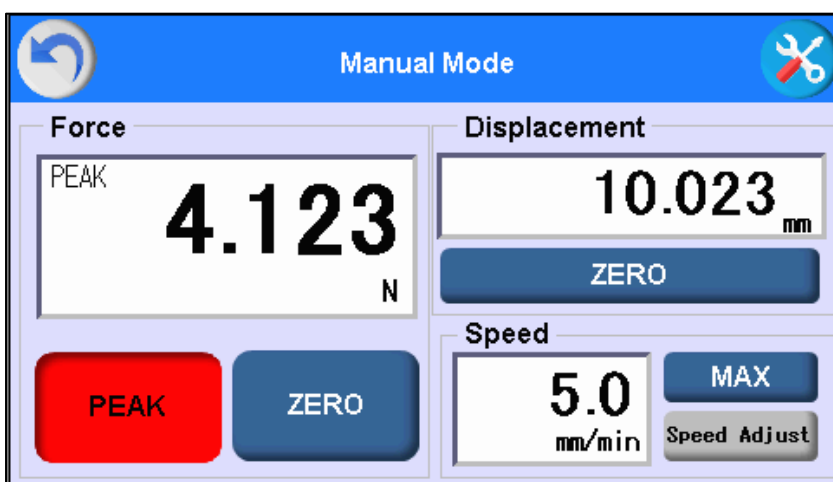
- **Speed Adjust**

  Touch | Speed Adjust | to set the test speed

  in Manual mode.

  Touch and move the red arrow to change the speed.

  Touch | OK | to confirm it and go back.
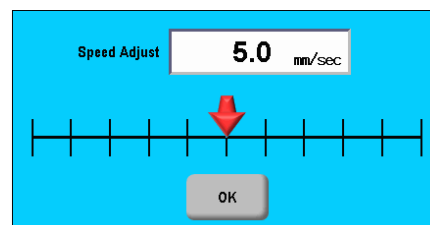
- **The Peak Test and Zero Reset**

  On the left, you can see the real-time force value.

  Touch | PEAK | to display the peak force value instead of the real-time one.

  While the peak test mode is ON, "PEAK" is displayed upper left, and the peak value is indicated.

  The larger peak is displayed between tension+ and compression+.

  Touch | ZERO | to zero the real-time force value/the peak force value.

9. Manual Mode

9-3. Measure Hardness in Peak Test Mode of Manual Mode

Preparation

Mount the attachment
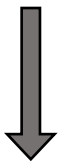
- Prepare the desired probe (Disk, Wedge, etc.).
- Fix it on probe shaft 100mm.
- Insert the probe in FRTS upwards to top and tighten it.

Set start position
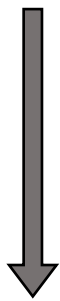
- Press △ to move the table to the top end.
  (Exercise great caution not to catch your fingers and
  bring the table into contact with the probe.)
- Loosen the probe knob to let the probe sit on the table.
- Tighten the knob with the probe tip touching the table.
- Move the table downwards to have sufficient space to set the sample.

Set Measuring conditions
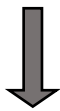
- Touch Speed Adjust at down right and set the speed in Manual mode.
- Touch PEAK to activate Peak test mode. (It shows you "PEAK" at upper left when it is ON.)

Perform measurement
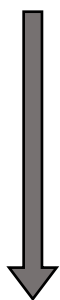
- Touch ZERO to zero the force value (of real-time/peak).
- Place your test sample on the table.
- Keep pressing △ to move the table, seeing the sample.
- Release △ after the sample has been broken or sheared.
- It indicates the peak value, which is the sample's hardness.
  (When you measure more than two samples, repeat the procedure of "Perform measurement")
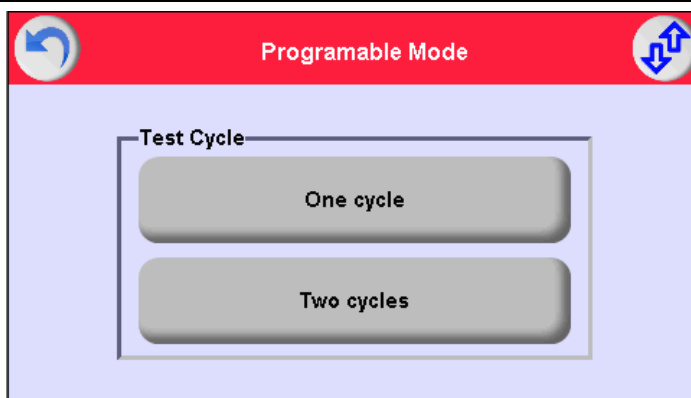
10. Programmable Mode

You can program your desired measuring conditions by yourself.

We recommend [Two cycles → Show texture analysis result] to evaluate the characteristics

of your test sample more objectively using multiple parameters.
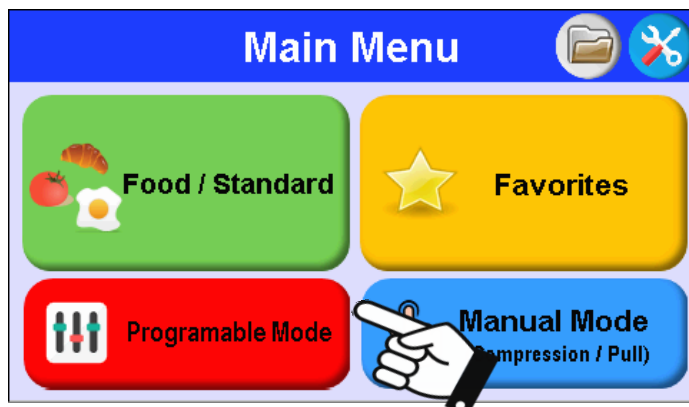
　　　　Touch Programmable Mode on Main Menu to start programing measuring conditions.
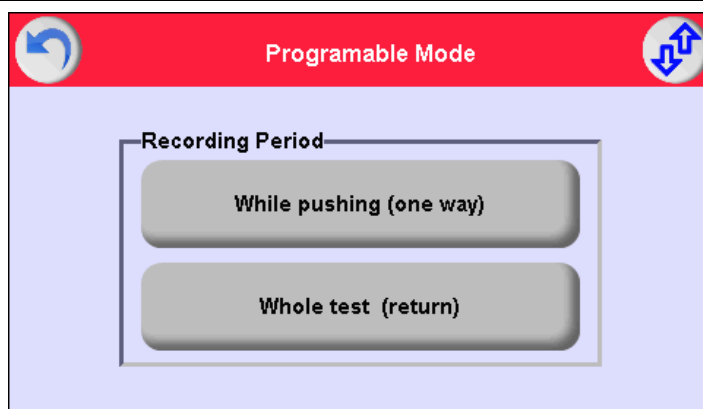

10-1. Select the Test Cycle

Item	Contents	Reference
One cycles	The table moves up from the current position, and returns to the starting position after a measurement.	Page 45
Two cycles	The table moves up and down twice. Select Two cycles to see the texture analysis result by texture profile.	Page 46

- Touch 　　　 to go back.

- Touch 　　　 to move the table.　See the page 55 for further information.

10. Programmable Mode

10-2-1. Select Recording Period (at One Cycle)

Item	Contents

While pushing (one way)	It performs measurement only while the table is moving up from the current position. It does NOT perform measurement while the table is returning to the starting position.
	≪Example of Application≫
	  You can utilize it for food easy to be broken like cookies.
	≪Acquirable Test Result≫
	  You can acquire the peak value(N, kg, g) of hardness in compression, and the displacement at the peak value.

Whole test (return)	It performs measurement through the cycle.
	≪Example of Application≫
	  You can utilize it for sticky food.
	≪Acquirable Test Result≫
	  You can acquire
	  - the peak value(N, kg, g) of hardness in compression, and the displacement at the peak value.
	  - the peak value of viscosity (N, kg, g) in tension, and the displacement at the peak value.

- Touch to go back.

- Touch to move the table.   See the page 55 for further information.

10. Programmable Mode

10-2-2. Select Result Format (in Two Cycles)
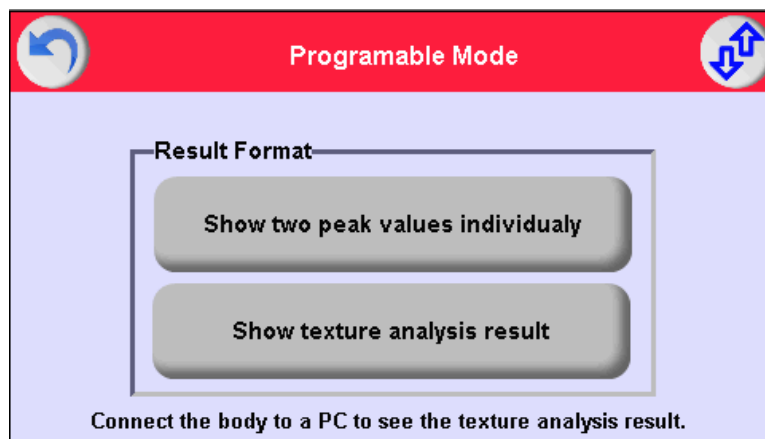
項目	内容
Show two peak values individually	You can see the hardness and viscosity of the first and the second cycle individually.
Show texture analysis result	You can see the overall texture analysis result by texture profile analysis (TPA) in the parameters of Hardness, Viscosity, Cohesiveness, Springiness, Adhesiveness, and Gumminess. ※

※You need a PC and the supplied software (Force Recorder FRTS Ver.) to perform texture profile analysis (TPA).

- Touch to go back.

- Touch to move the current position of the table. See the page 55 for further information.

10. Programmable Mode

10-3. Select Compression Test Mode
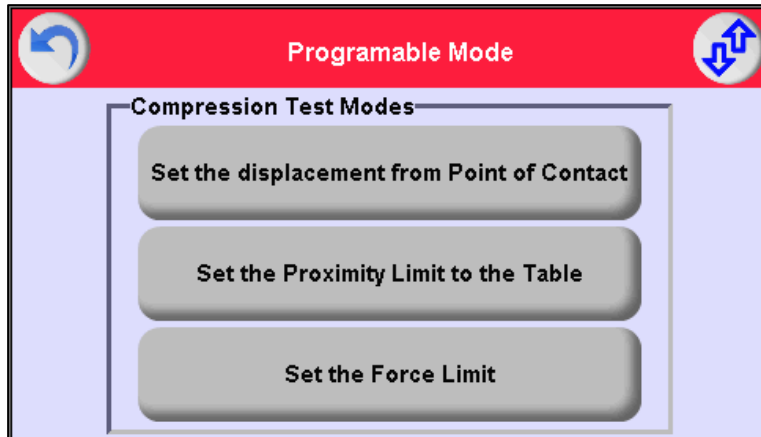
Item	Contents
Set the distance from point of contact	It compresses your test sample by the set displacement from point of contact.
Set the proximity limit to the table	The table moves to the specified position. (The top is as 0mm, and the bottom is as 100mm.)
Set the force limit	It applies compression force continuously until the force value reaches the set limit.

● Each test mode has different selections according to what you selected.

Item	One cycle		Two Cycles		Reference
	While pushing	Whole test	Peak	Texture	
Set the distance from point of contact	○	○	○	――	Page 48
Set the proximity limit to the table	○	○	○	○	Page 49
Set the force limit	○	○	○	――	Page 50

● Touch to go back.

● Touch to move the current position of the table. See the page 55 for further information.
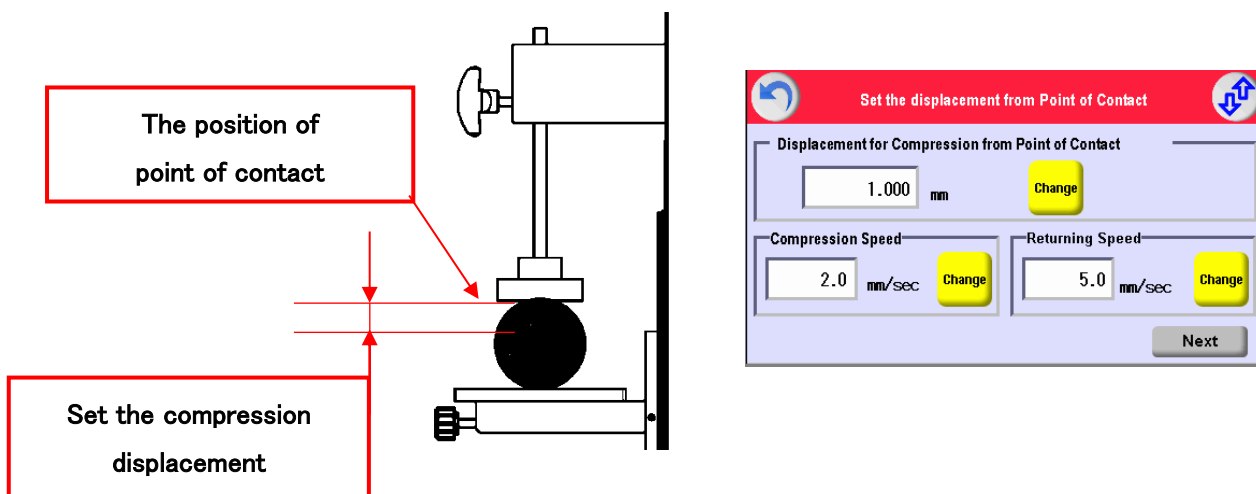
10. Programmable Mode

10-4. How They Work
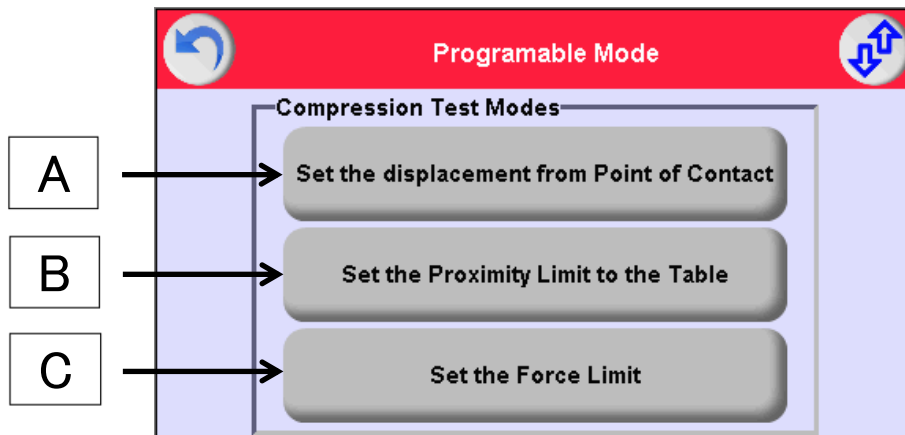
We will show you how A/B/C works.

Test Mode A	Set the distance from point of contact

The analyzer detects the surface (point of contact) of your test sample, and compress it by the set displacement from the point of contact.

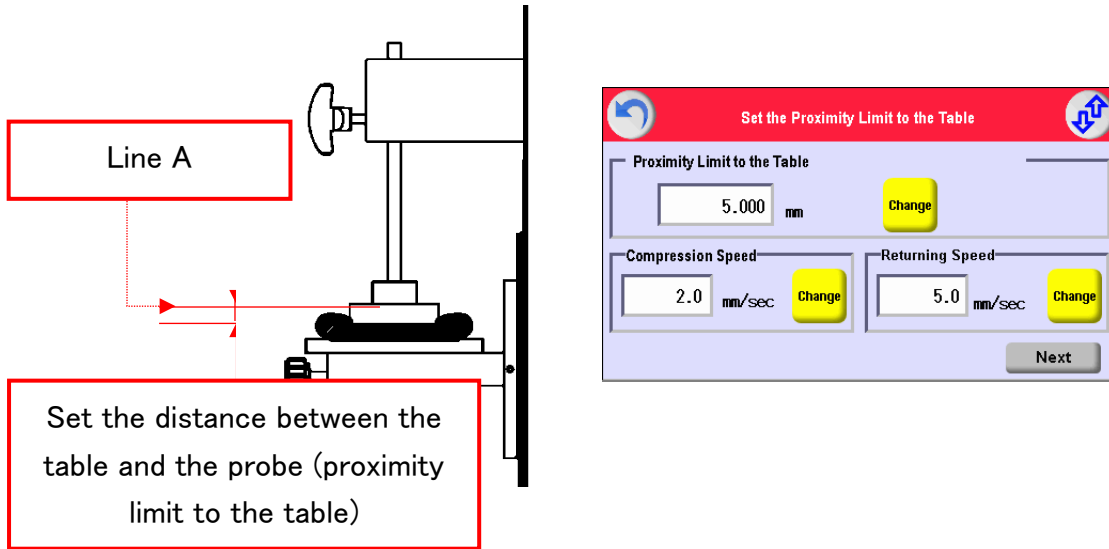e.g.)   Compress your test sample by 5mm from its surface (point of contact).

⚠ Caution
The compression displacement should be always lower than the sample's height.

10. Programmable Mode

## Test Mode B   Set the proximity limit to the table

Line A

Set the distance between the table and the probe (proximity limit to the table)

You can set the distance between the table and the probe, and it compresses your test sample until it reaches the Line A.

e.g.)   Compress your test sample at a distance of 5mm from the table.

| ⚠ Caution |
| --- |
| You need to adjust the positions of the table and the probe following the instructions on the screen to activate this test mode B. |

Adjust the Table and the Probe

① Move the probe upward to the top, and tighten it.
   Leave nothing on the table and touch 🔼 on the screen to move it to the top.

② Loosen the probe knob and bring it into contact with the table.
   Tighten the probe knob, and zero the displacement of the probe.
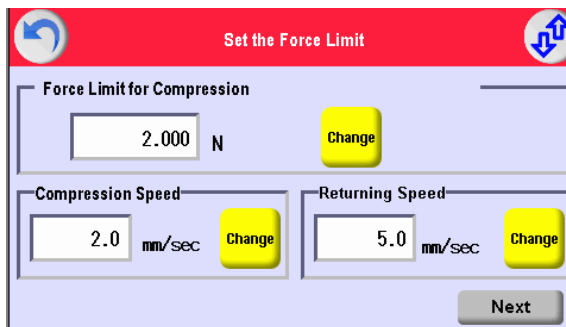   Move the table to the bottom, and place your test sample on.
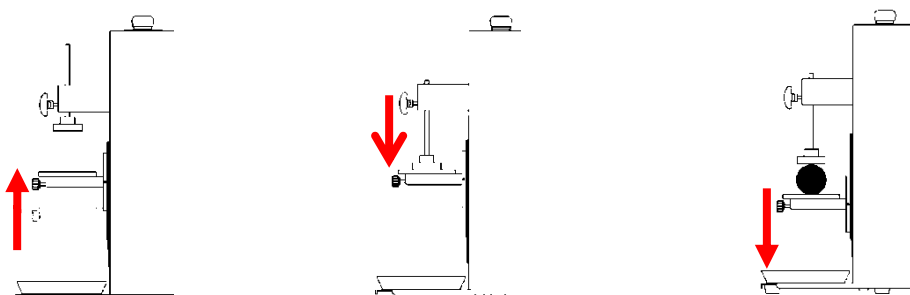
10. Programmable Mode

Test Mode C | Set the force limit |
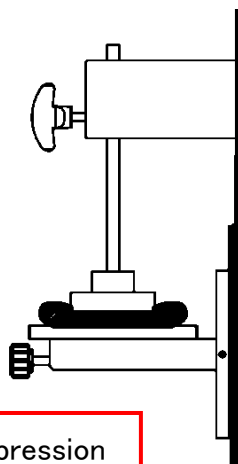
Apply compression
force of
the set value.

You can set the maximum force value to apply to your test sample as force limit, and the analyzer compresses the sample until it senses the set force limit.
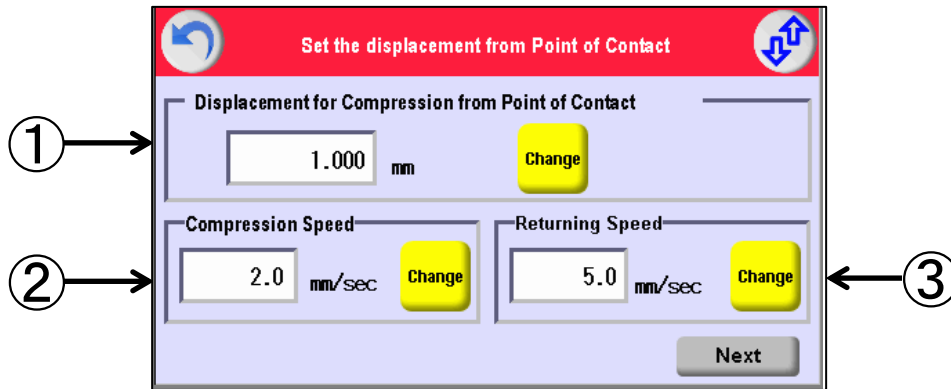
e.g.)   Viscosity test: Apply compression force at 5N as maximum
to your test sample, and pull it.

⚠ Caution
It may exceed the set force limit when the table moves fast.   If that happened, slow down the speed and try it again. When you set the force limit close to its capacity, exercise great caution not to overload the sensor.

10. Programmable Mode

10-5. Set Measuring Conditions

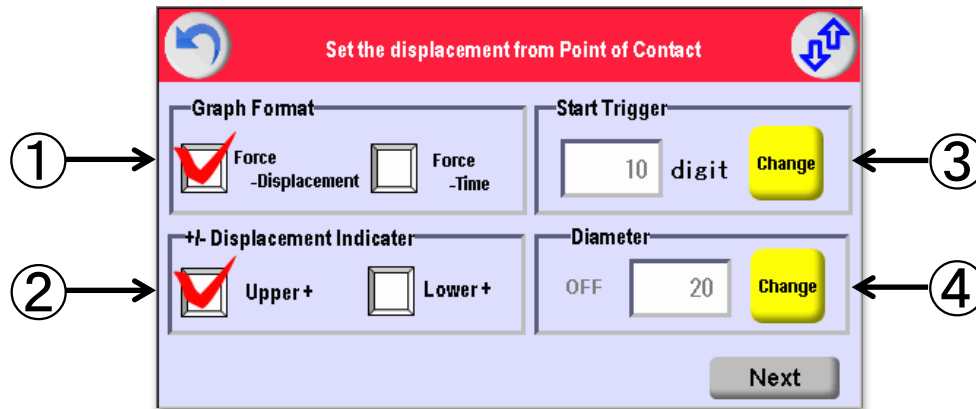You will see the setting screen after selecting one in Compression Test Mode.

① The set value	You will see one of each mentioned below according to selected test mode. ・Displacement for Compression from Point of Contact ・Proximity Limit to the Table (Distance between the table and the probe) ・Force Limit for Compression Touch Change to change the value.
② Compression Speed	It indicates the speed to move the table upward. Touch Change to change the value.
③ Returning Speed	It indicates the speed to move the table downward. Touch Change to change the value

- Touch [↩] to go back.

- Touch [⇕] to move the table position.   See the page 55 for further information.

Touch Next to go to next.

10. Programmable Mode

① Graph Type	Select graph type from force-displacement or force-time to be recorded on the accessory software.
② Displacement Indicator (*1)	Select the direction of the displacement. Upward+: The displacement value increases when the table moves up. Downward+: The displacement value increases when the table moves down.
③ Start Trigger(*2) (*3)	Set the value to start recording. The analyzer regards the set value as the point of contact, and it starts recording when it senses the set value. Touch Change to change the value. The value is input in digit (resolution). [You can input it from 1 to 99] ≪e.g.≫When you input [2] for FRTS-50N, it starts recording when it senses 0.02N.
④ Diameter	You can activate it only when you select Two Cycles and Texture Analysis . Use a disk probe for the test, and input the diameter of the probe. You will see the texture analysis result by texture profile analysis (TPA). The analyzer calculates the parameters using the set diameter. See the page 53 for further information.

*1 You can activate it only on Programmable mode.
*2 You cannot activate it when you select Two Cycles → Texture Analysis Result .
*3 The force value of Start Trigger should be always lower than the compression force.

● Touch to go back.

● Touch to move the table position. See the page 55 for further information.

Touch Next to go to the confirmation screen, "Measuring Conditions."

10. Programmable Mode

## 10-6. Texture Profile Analysis and the Probe Diameter

The analyzer shows you the texture analysis result by texture profile analysis when you select
Two Cycles   Texture Analysis .
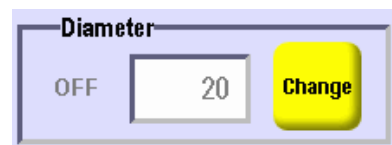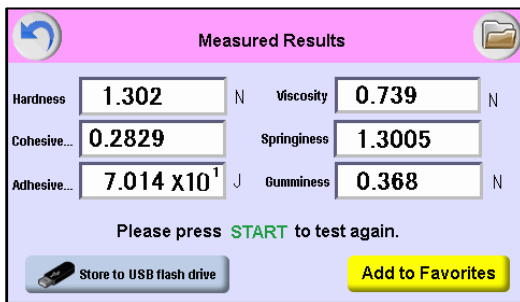The result format differs according to the setting of the probe diameter.

・When you have set the diameter of the probe
　The results have been calculated on the basis of the set diameter (the area of the probe
　surface).
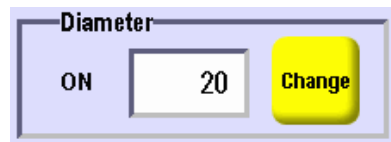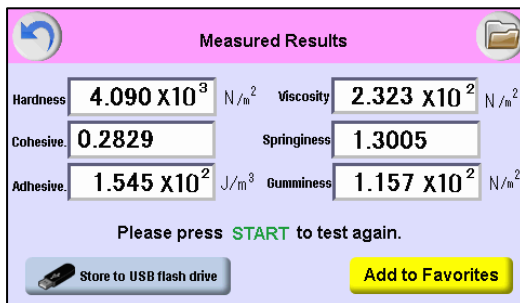
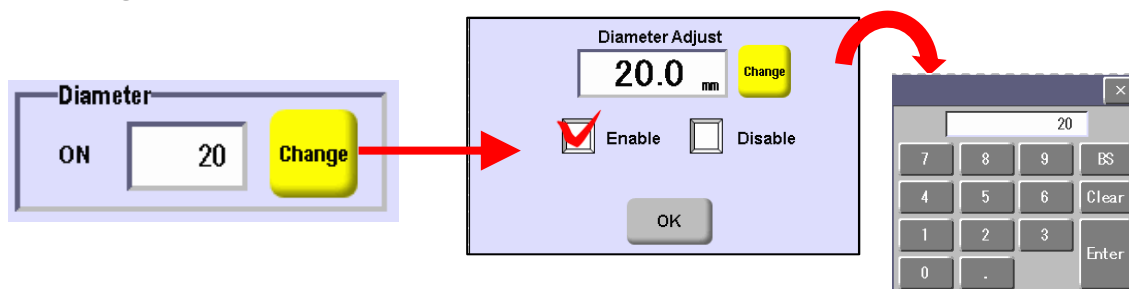・When you have NOT set the diameter of the probe.
The results are indicated in N or J without regard to the diameter.

Touch Change to change the diameter when you set measuring conditions.
Enter a check in the check box of ON, and input the value using the numeric keypad.
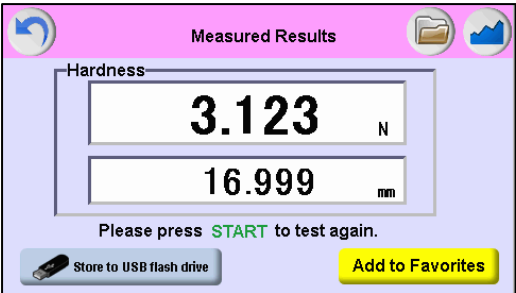(The range of the value: from 1 to 99.9mm)

10. Programmable Mode
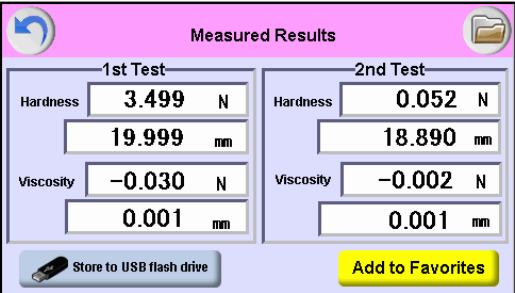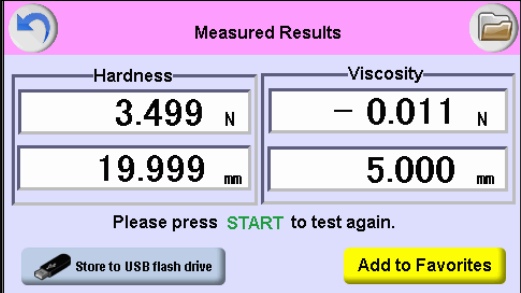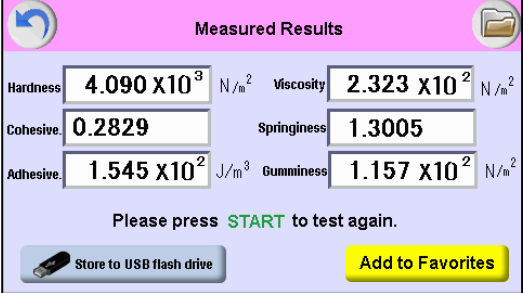
10-7. Result Format

You will see 4 kinds of the result format according to the selected compression test mode.

Result Format

| Test Cycle： One Cycle	Test Cycle： Two Cycles
Recording Period： While pushing (one way)	Result： Show two peak values individualy
Recording Period： Whole test (return)	Result： Show texture analysis result

11. Common Screens

Here you can see common functions and operations among Food/Standard mode, Manual mode, and Programmable mode.

11-1. Move the Table's Position

You will see [icon] upper right in many pages.   Touch the button, then [icons] lights in blue, and the screen switches to the "Move the Table's Position," which means they are ready to move the table.

You can utilize it for position adjustment such as when you move the sample closer to the attachment.
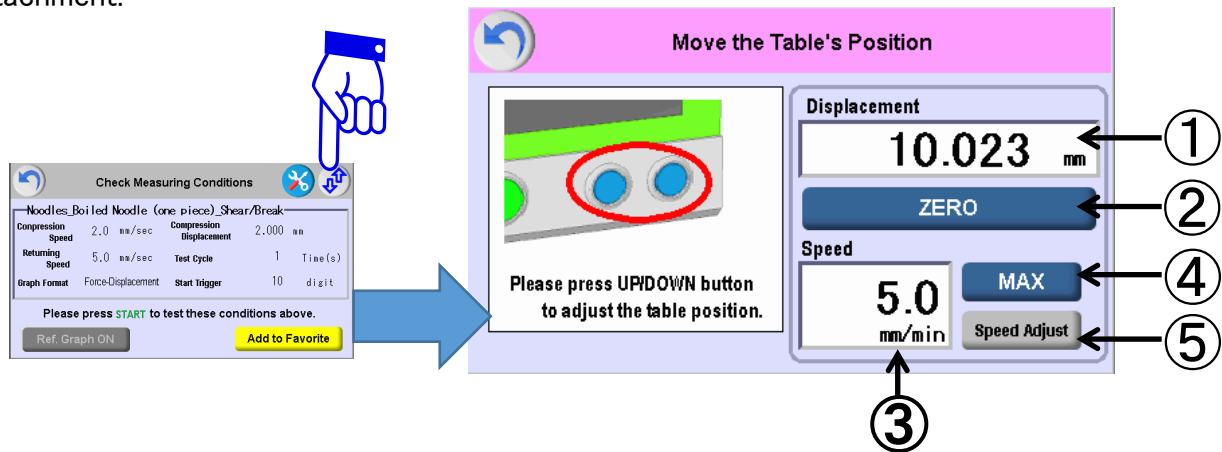
① Displacement	It indicates the real-time displacement.
② Zero Button	Touch this button to zero the displacement.
③ Speed	It indicates the real-time test speed.
④ MAX Button	Touch this button to set test speed fastest (10mm/sec). This button is in red while it is activated. Use it to move the table fast.
⑤Speed Adjust Button	Touch this button to change the test speed.

※Speed Adjust is synchronized among 3 modes (Manual, Programmable, and Food/Standard mode), therefore, after you changed the test speed in Manual mode, the changed speed is reflected also in Programmable or Food/Standard mode.

- Touch [icon] to go back to Main menu.

55

11. Common Screens

11-2. Check Measuring Conditions

When it is ready to start measurement in Food/Standard or Programmable mode, you will see the screen below.

Then, press ⬤ in green to start measurement.

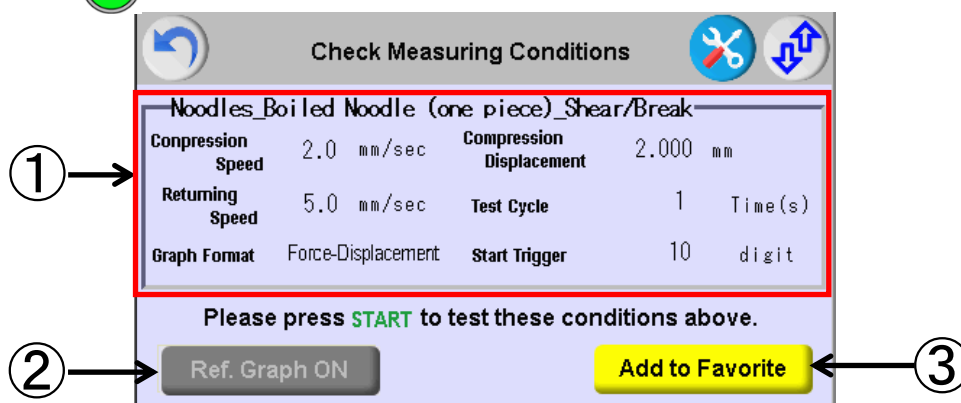| Item	Contents
①Measuring Conditions	Compression Speed： Speed to move the table upward Returning Speed： Speed to move the table downward Compression Force(※)： Force value to be applied to your test sample Compression Displacement(※)： Displacement to compress from the point of contact. Compression Position(※)： The minimum distance between the probe and the table Test Cycle： The number of test times Graph Type： Graph type recorded on PC 　　　　　　　(Force-Time or Force-Displacement) Start Trigger： Force value to start recording
②Add to Favorite	You can add the measuring conditions at ① to Favorite. Please see the page 59 for further information.
③Reference Graph ON (red) / OFF (black)	When it is ON (in red), the reference graph and the latest recorded graph are overlaid after measurement. Please see the page 63 for further information.

※The values of Compression Force, Compression Displacement, and Compression Position differ according to what you have selected.

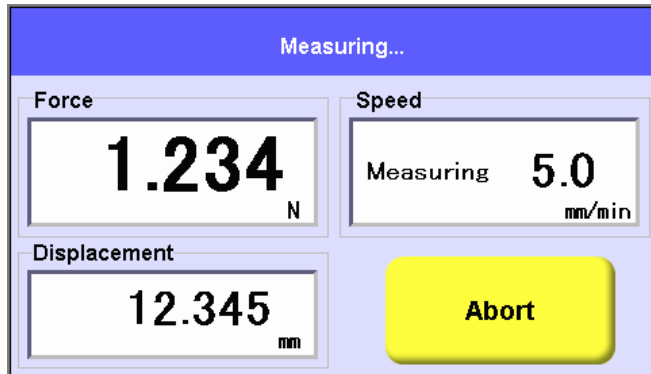# 11. Common Screens

11-3. Measuring…

Press 🔘 When it displays "Check Measuring Conditions" on the screen, then measurement starts, and the screen switches to the one below.

While measuring, you will see one of the state listed below at the left of the speed.

Approaching	The table is moving toward the test sample.
Contacting	The sensor detects the contact to the test sample.
Measuring	It is compressing the test sample.
Returning	Measurement is done, and the table is moving back to the starting point.

Touch ⎡Abort⎤ press 🔘 to cancel measurement.

Measurement would get canceled in the cases below.

- when you press the emergency button

- when the sensor is overloaded

- when the table reaches the limitation of the range of the movement.

11-4. Measurement Aborted

When you have canceled measurement, you will see the screen below.

Read the reason why measurement is canceled in the second line, press ⎡Close⎤ , and revise the measuring conditions or adjust the position of the probe/the table to perform measurment again.

11. Common Screens

11-5. Measured Results

After measurement has finihsed, you will see the measurement results on the screen.
The result format varies according ro the measuring conditions, so we will show you an example below.

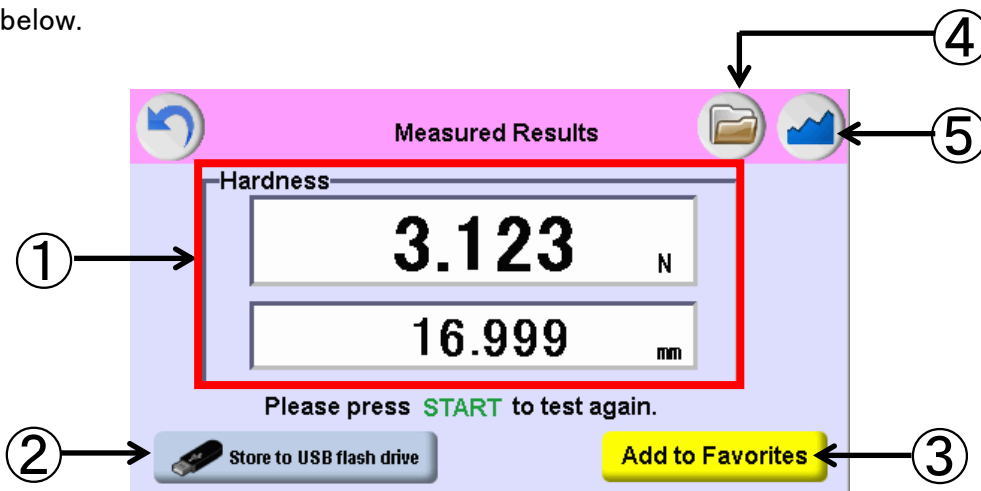| ① Measured Results	You can see the latest measured results. (※1)
② Store to USB flash drive	You can store the latest result to the USB flash drive connected to the cotrol panel. (※2)
③ Add to Favorite	You can add the measuring conditions used in the latest masurement to Favorite. See the page 59 for further information.
④ USB Drive Data	You can check the saved data in USB flash drive.
⑤ Force Distribution Graph (※3)	You can see the force distribution visually. See the page 63 for further information.

※1…You will see a variety of the result format according to the measuring conditions.

※2…When Auto Save is activated, it does NOT show you this button since the data is automatically stored into the USB flash drive.   You will not see the button also when the data has already saved.

※3…You cannot see the button depending on the measuring conditions.

● Press (START STOP) while the Measured Result is on screen to perform measurement again under the same measuring conditions.

● Touch (↩) to go back to [Check Measuring Conditions].

12. Favorite (Add to/Recall/Delete)

You can add 6 measuring conditions at maximum to Favorite, then you can recall them easily later.

12-1. Add to Favorite
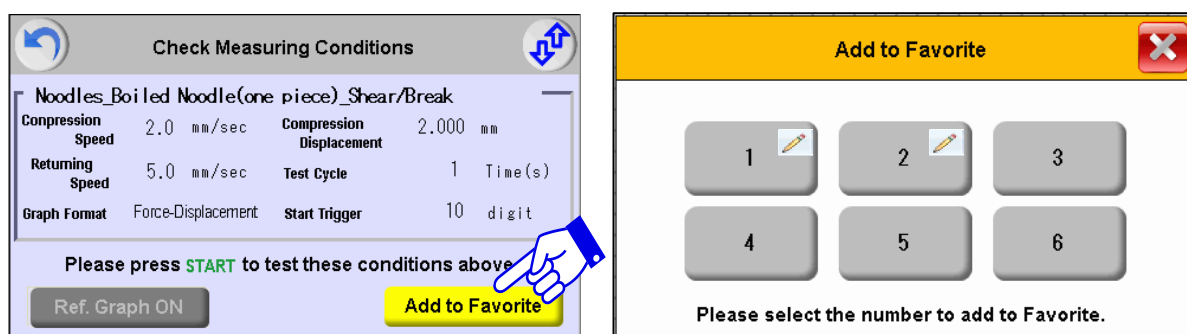
You can add measuring conditions to Favorite easily in Food/Standard mode or Programmable mode.

Touch ☐ Add to Favorite ☐ on the screen of "Measuring Conditions" displayed just before measurement, or "Measured Result" displayed after measurement.
Touch a desired number from 1 to 6 to add the conditions to Favorite in.

Touch to cancel adding to Favorite.

※The number has when you have added measuring conditions to the number.
When you select the number having , it overwrites.

12. Favorite (Add to/Recall/Delete)

12-2. Recall a Favorite/Measurement under the Favorite
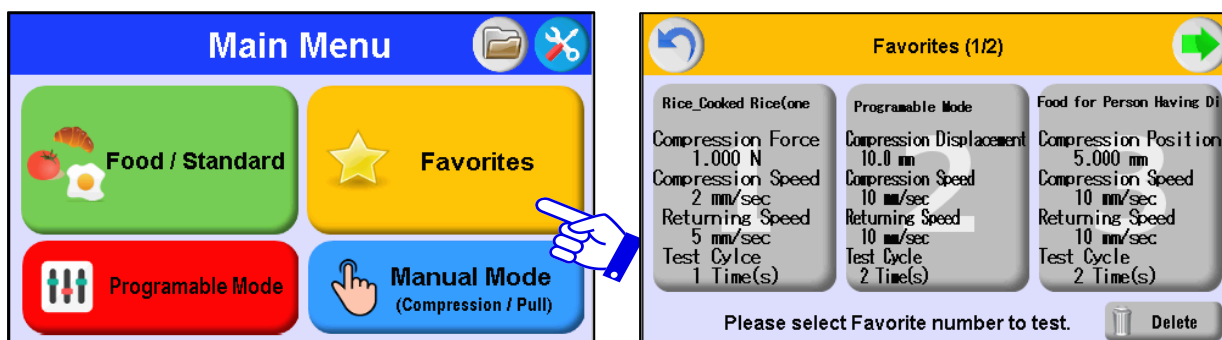
Touch 　Favorite　 on Main Menu to recall the favorite conditions, then you will see the list of the favorite conditions.

Touch a desired number, then you can perform measurement under the same condition.

(You will see 1 to 3 on the first screen.)

Touch 　　 to go to next page

Touch 　　 to go back.

Touch 　　 to go to Main Menu.

This screen above will pop up when a different unit is selected from the current setting.

Touch 　OK　 to change the current setting.

12. Favorite (Add to/Recall/Delete)

12-3. Delete from Favorite
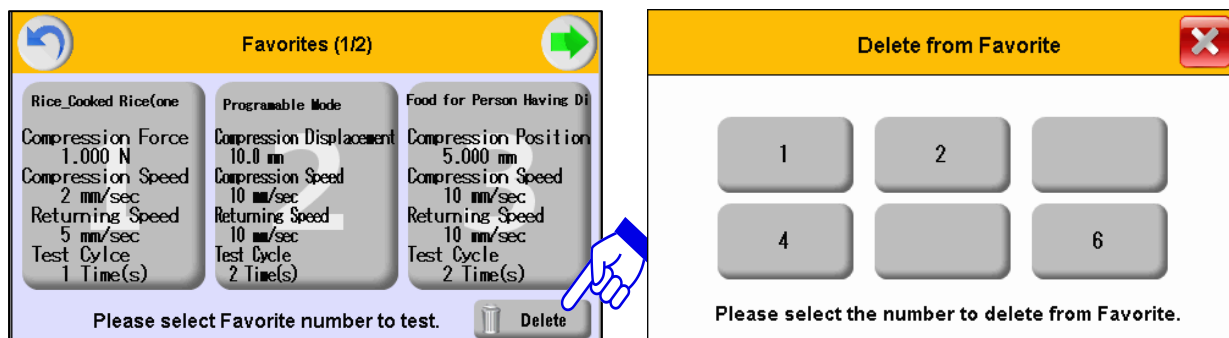
Touch ┃ Favorite ┃ on Main Menu to display the list of the favorite conditions.

Then, touch ┃ Delete ┃ at lower right, and touch a desired number to delete on the screen of "Delete from Favorite".

You cannot see the numbers when you have NOT added anything in them.

You cannot delete any conditions when ┃ Lock Favorite's content ┃ is ON.

Touch to cancel deleting from Favorite.

13. USB Drive Data
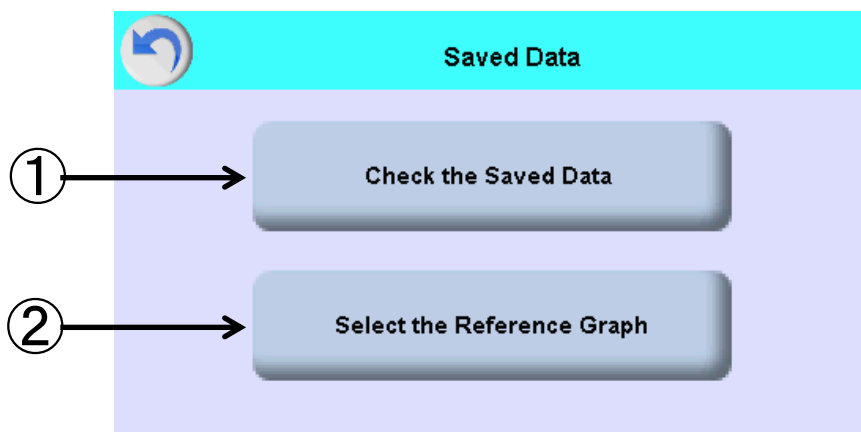
Idem	Contents
① Check the Save Data	You can see the data stored in the USB flash drive. You can also see force distribution graph. See the page 65 for further information.
② Select the Reference Graph	When you have saved the reference graph in advance, force distribution graph is displayed. Thus, you can compare the force distribution between the latest measured graph and the reference one. （The test result is displayed in black, and the reference data is displayed in red.）

※Please make sure to insert USB flash drive to activate these functions. If the USB flash drive is disconnected, or there is no data to select, you cannot activate them.

● Touch 🔙 .to go back.

See the page 63 to display the force distribution graph of the data in USB flash drive and the reference one.
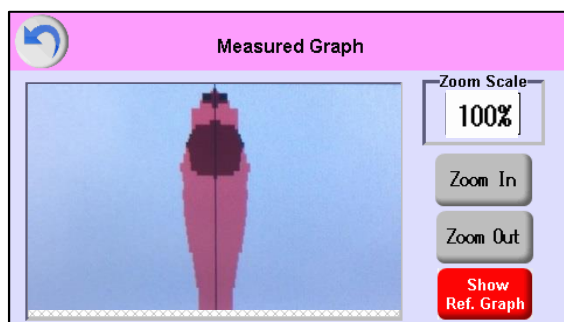
14. Force Distribution Graph

You can see the force distribution on the screen without a PC.

(You cannot see it in some measurement)
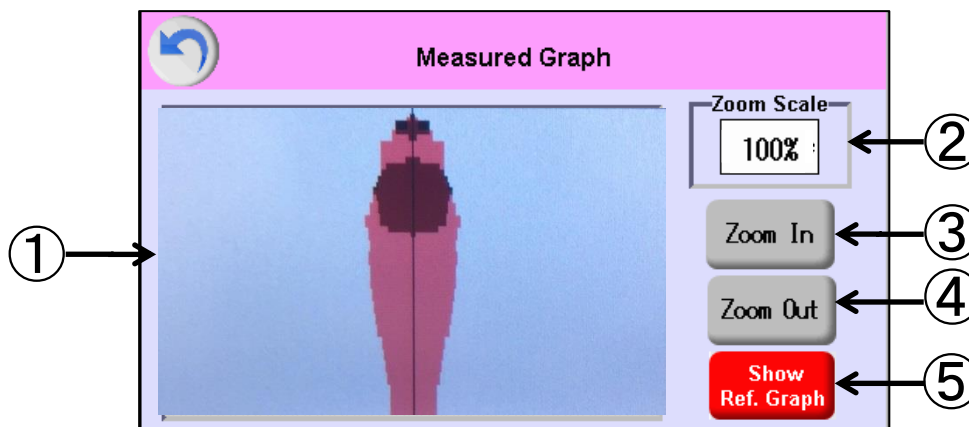
Item	Contents
① Graph Area	Continuous data is visualized into a graph (force distribution).
② Magnification Percentage	You can change the width of the graph. It indicates the current percentage. You can select the percentage from (Zoom Out)20 / 50 / 100 (Default)/ 200 / 500 / 1000% (Zoom In).
③ Zoom In	You can increase the percentage. (Make the graph larger)
④ Zoom Out	You can decrease the percentage. (Make the graph smaller)
⑤ Show Ref. Graph*1	When you have saved the reference graph in advance, the reference graph and the latest recorded one are overlaid for comparison. See the page 65 for further information of how to save.

*1 If the unit is different between the reference data and the current setting, it does NOT show you the reference data.

- Touch to go back.

14. Force Distribution Graph

14-1. How to See the Graph Area
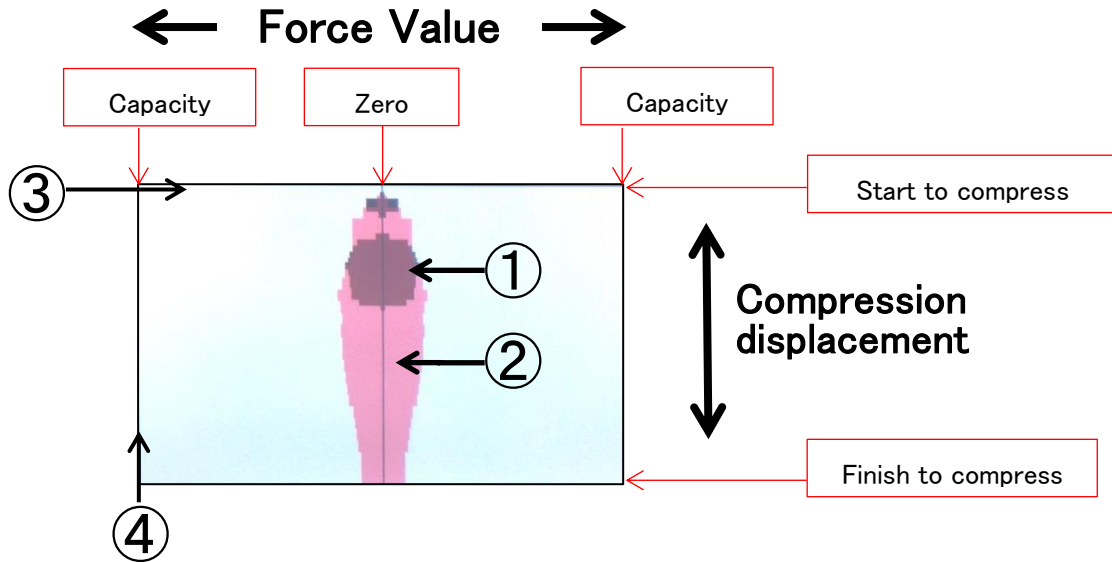
Item	Contents
① Black wave	The latest data's graph
② Red wave	The reference graph
③ Horizontal axis (Force)	Centering zero (no force), the waveform spreads to left and right. Both ends indicate the force capacity.
④ Vertical axis (Compression displacement)	The upper line indicates the starting point to compress your test sample. The lower line indicates the finishing point.

14-2. How to Show the Graph

Touch on the screen of [Measured Result] or [Saved Data].

※It does not display the button in some cases.
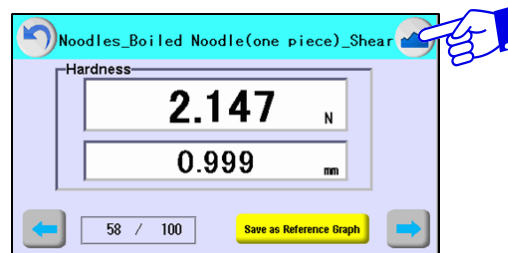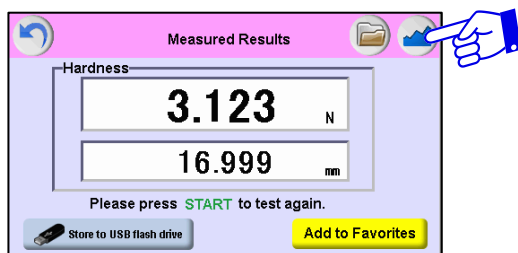
14. Force Distribution Graph

14-3 How to Save the Reference Graph

Touch │ Select the Reference Graph │ on the screen of USB Drive Data (page 62).
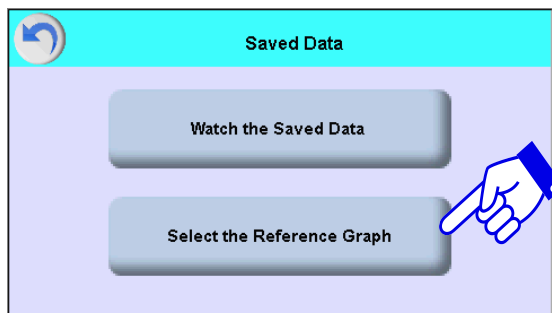
Enter a check in the checkbox of ON, and touch │ Change the Reference Graph │.

It shows you the data saved in the USB flash drive.

Touch [←] [→] to select one for saving the data as a reference data.

Touch │ Save as the Reference Graph │ to confirm.

65

15. Save and Check data in USB Flash Drive

You can connect the supplied USB flash drive, and save the measured data into it.

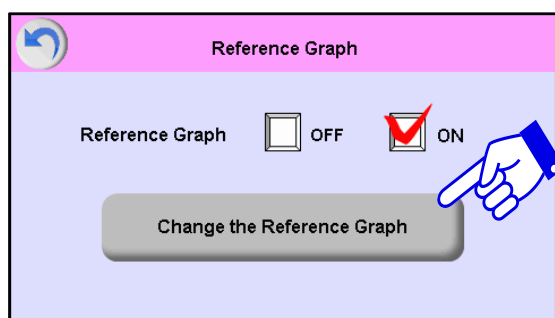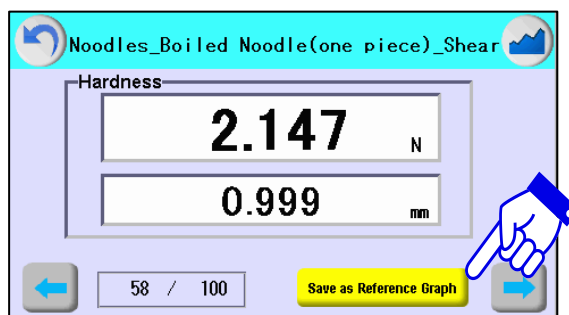|	A	B	C	D	E	F	G	H	
1	Num	Test Name	Probe Diameter	Hardness	Hardness Unit	Hardness Displacement	Disp. Unit	Viscosity	Visc
2		2	Western Pastries_Sponge Cake and similar_Firmness/Compression	1.201	kg	9.461	mm		
3		5	Food for Person Having Difficulty in Swallowing	38853.5	N/m^2			−477.71	N/m
4		2	Japanese Pastries_Rice Cracker_Firmness/Compression	11.08	N	1.011	mm		
5		2	Japanese Pastries_Pancake and similar_Puncture	14.97	N	1.08	mm		
6		2	Butter_Butter_Puncture	15.14	N	0.744	mm		
7		2	Fish and Seafood_Grilled Fish(Cooked Fish) and similar_Firmness/Cor	12.85	N	2.096	mm		
8		2	Nuts_Peanut and similar_Shear/Break	15.39	N	3.06	mm		
9									
10									
11									
12									

- You can find the individual statistics in the file 【IMADA】→【FRTS】→【FRTS_EN.CSV】 in the USB flash drive.
- The record formats of the statistics differ according to the measured result.

- You can find the continuous data in the file 【IMADA】→【FRTS】→【CSV】 in the USB flash drive.
- The CSV file's name of the continuous data is synchronized with the name (number) of 【CSV】 in 【FRTS_EN.CSV】, the statistics data.

- Do NOT directly edit or cut the files in the folders of【IMADA】→【FRTS】→【COMP】in the USB flash Drive since they contains the data of the reference graph.
  ※If the files and folders were edited or cut, the display on the screen will have the proble.

<div style="border:1px solid">

⚠ Caution

・Do NOT directly edit any CSV files in the USB flash drive.

 (For editing, transfer the data to a PC, and edit it on the PC.)

・Do NOT save any edited data in the supplied USB flash drive.

・We cannot compensate for any lost data.

・Do NOT leave the supplied USB flash drive exposed to the direct sunlight since it would get discolored

or deformed by the high temperature due to the sunlight.

・Do not insert anything except the supplied USB flash drive in the controller.

</div>

16. Default Settings
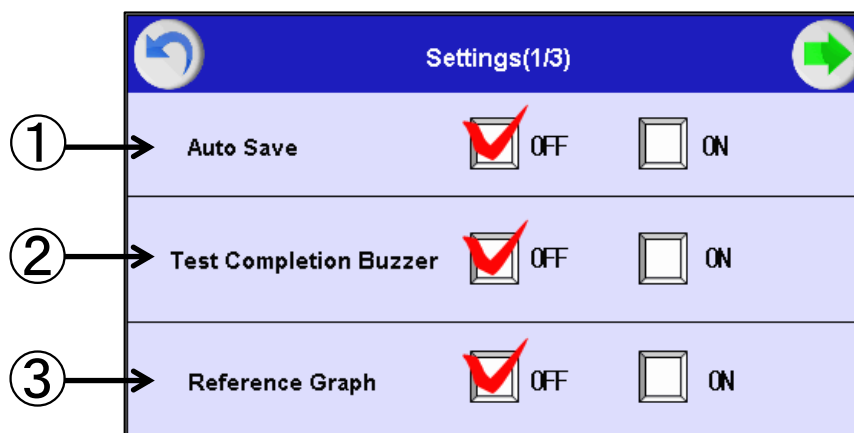
Item	Contents	Default
① Auto Save	The test result is transferred to the USB flash drive when the test finished.	OFF
② Test Completion Buzzer	A buzzer is sounded when the test finished.	OFF
③ Reference Graph	You can compare the data. See the page 63 for further information.	OFF

- Touch   to go back to Main menu.

- Touch   to go to next.

※The change is reflected after you go back to Main menu.

16. Default Settings

Item	Contents	Default
① Favorite's Edit Lock	You cannot edit/add to/delete Favorite when it is ON.	OFF
② Language	You can select the desired language.	EN (English)
③ Date/Time	You can set the current date and time. Touch Change to display the setting page. Touch up/down buttons to select the desired number, and press OK to confirm. Keep the AA batteries inside to maintain the date and time correctly. Change the AA batteries and set date and time again when it cannot maintain them correctly.	——

- Touch to go back.

- Touch to go to next.

16. Default Settings
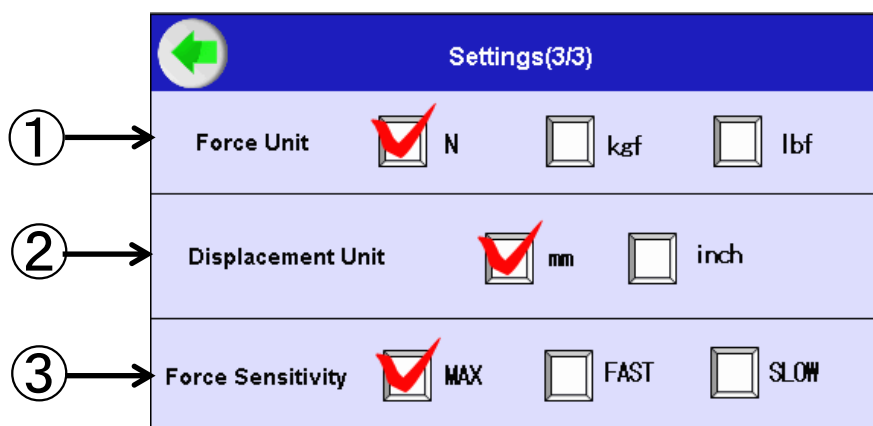
Item	Contents	Default
① Force Unit	You can select the force unit, N or kgf (gf) or lbf (ozf).	N
① Displacement Unit	You can select the displacement unit, mm or inch.	mm
② Force Sensitivity	You can select force sensitivity from MAX / FAST / SLOW [MAX] means the highest sensitivity (=the quickest response) When you choose [FAST] or [SLOW], you can decrease the influence of vibration, however, we recommend [MAX] to achieve greater accuracy.	MAX

- Touch to go back.

69

17. Specifications

Specifications According to Each Model.

Item	Specifications		
Model	FRTS-5N	FRTS-50N	FRTS-100N
Capacity	5N	50N	100N
Display	5.000N	50.00N	100.0N

Common Specifications

Item		Specifications
Accuracy	Force	±0.2%F.S±1digit
	Displacement	0.1mm±1digit
Unit	Force	N / kgf (g) / lbf (ozf)　(*)
	Displacement	mm / inch (*)
Indication	Force	4-digit
	Displacement	0.001mm (as the minimum resolution)
Sampling rate		1000Hz
Sample maximum height		70mm(*1)
Table travel distance		Max.100mm
Speed		0.1 to 10.0mm/sec
Functions		3 types of measuring method (Food/Standard(*2), Program, Manual), Add-a-favorites for measuring conditions (Max.6 conditions), Start-trigger function, Overload preventing function (*3)
Output		USB, USB flash drive
Operating environment (*4)		Temperature: 0 to 40 degree Celsius Humidity: 20 to 80 %RH
Weight		Body: 7.7kg / Controller: 0.8kg
Size		185 x 300 x 400 mm (except its controller)
Voltage		AC 100V-240V (*5) Fuse Rating : 250V 3A φ5mm,L20mm Glass-tube Fuse, Normal-Blow type

* The units are switchable.　The units differ from Japanese domestic model.
*1 It is the maximum distance from its table surface to the part where an attachment is mounted.
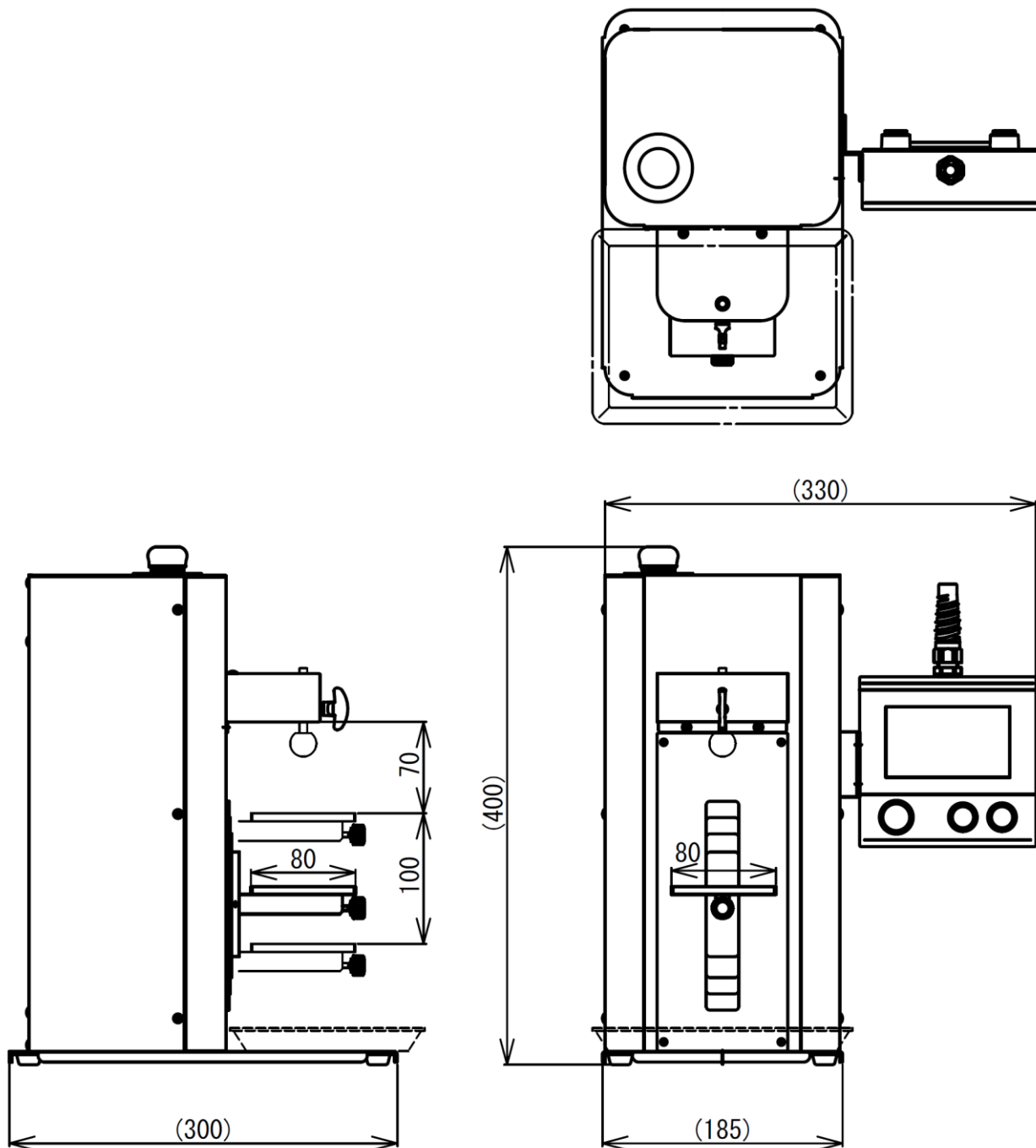*2 You need PC for measurement to comply with some standards.
*3 You cannot prevent overload in some cases.
*4 You cannot use this product in a vibratile environment.
*5 Power Connector needs to be changed when use under different voltage from one when purchased.
*6 Operating noise is lower than 70dB.

18. Dimensions

19. Software Operating Environment

Connectable device	Texture Analyzer FRTS series
Connection port	USB1.1, USB2.0 connector ＊We do NOT guarantee operation in USB3.0.
Connection cable	USB A to mini B cable (Supplied with FRTS series as an accessory)
Please check the operating environment on the software CD for requirements such as OS / hardware / platform / screen size.	

20. Calibration and Warranty

Calibration Notes

We provide the calibration services with charge.

Calibrating means checking if the texture analyzer maintains the initial accuracy or not.　We recommend that it is calibrated periodically (about once a year) and adjusted as required to conduct precise measurement continuously.

Contact the dealer in your area for a quotation and so on to use the calibration services.

Make sure to record the contents of the settings separately from the analyzer before you send it to the dealer for calibration since they may be deleted during the calibrating process.

Warranty Notes

• Read the supplied warranty card for further information before use.

• Without a valid warranty card, we cannot accept your claim and offer the services.