Instruction Manual

NTN PORTABLE VIBROSCOPE

Model No.: DAT-HV0002

NTN Corporation

Revision history

Revision	Date	Content of revision
First edition	December 13, 2019	

Contents

1 Introduction

Thank you indeed for purchasing the NTN PORTABLE VIBROSCOPE (referred to “this device” afterward) this time. Please read this Instruction Manual well to use this device correctly before you use it. Moreover, please keep this Instruction Manual carefully in order to refer to it at any time if necessary.

1.1 Outline and features of this device

- This device is a simple type vibroscope[*1] excellent in portability and operability.
- By selecting[*2] a bearing parts number from list and creating the measurement point, FFT analysis [*3] and the judgement of the measured vibration data can be performed.
- The FFT analysis result can be displayed on the tablet equipped with iOS which you have.
- The measured and analyzed results are saved in the tablet[*4] and can be converted into CSV format. The CSV data can be imported to a PC which you have by way of iTunes.

*1 : The calibration function is not provided in this device.
*2 : The customer can add the bearing parts number which has not been registered yet in the list.
*3 : The inspected result is a reference and does not guarantee the state of the bearing.
*4 : The volume of data that can be saved changes depending on the capacity of your tablet.

1.2 Necessary equipment

The tablet equipped with iOS is necessary to use this device. The tablet is not attached to this device, and you have to prepare it. Because the internet line is used when dedicated application (referred to “application” afterward) is installed into the tablet, communication contract with the telecommunication enterpriser is necessary. The customer must bear the communication charge. Please confirm "2.2 Operating environment" for the details of the operating environment of each equipment.

1.3 Sales and restrictions in use

This device conforms to the legal regulation of Japan and other countries, and the applicable countries are described on the nameplate of this device and the packing box. When this device is used in countries other than the described countries, our company cannot assume any responsibility at all.

1.4 SSID

This device has individual SSID allotted to each device. SSID described on the nameplate on the back of this device needs to be selected from the Wi-Fi setting of the application to perform the connection process. In addition, please check SSID seal attached when you purchased this product or seal labeled on the side of packing box to confirm SSID.

1.5 Install and update of software

It is necessary to install the dedicated application into the tablet before you use this device. Please install the application in accordance with "4.1 Preparation of application" Moreover, please get the application of latest version in accordance with the similar procedure.

1.6 Disclaimers

- For operation of the related systems such as software and hardware of this device, the scrupulous care is taken. However, our company doesn't guarantee at all that there is neither a misprint nor a bug in the program, that there is no error in the bearing data, or that there is no inconvenience which does not conform to the usage purpose of users. Moreover, there is a possibility that an error is caused in the measurement result due to the difference in measuring method.
- The results of measurements such as the OA value, the FFT analysis result, and the judgment result obtained by using this device do not guarantee the state of the measured bearing or things and do not guarantee the provision of a specialized advice on the individual case. The customer should make the final judgment concerning the state of the bearing, with the reference to the measurement results with this device.
- The criterion value for FFT measurement judgement with which the bearing damage judgment is performed should be set by the customer based on the experiences of the customer etc. The validity of the value is not guaranteed by our company at all. Moreover, our company doesn't assume the responsibility of any damage and the disadvantage etc., that occur because of the improper setting of the FFT measurement judgment criterion value.
- The application used with this device is operated on the operating environment described in the Instruction Manual, but operation is not guaranteed for all the tablets etc. Our company doesn't guarantee that the application can be operated on any tablet etc. customer uses.
- The measurement data etc. saved in the tablet customer uses has a possibility of disappearing without previous notice due to convenience in the system operation or an inevitable trouble etc. Our company does not guarantee at all against any damage or disadvantage etc. caused by it. Moreover, our company doesn't owe the obligation for restoration of the data that has disappeared.
- Our company doesn't guarantee the measurement result when the measurement is performed by the usage which does not follow the procedure described in the Instruction Manual. Moreover, our company doesn't guarantee against the breakdown etc. that occurs when the device is not used or kept as described in the Instruction Manual.
- This device complies with IP65 protective class for dustproof and waterproof property, but our company doesn't guarantee against the breakdown etc. that occurs when this device is used or kept in a very bad environment such as a place where a lot of dust always exists or where the device is exposed to the moisture.
- Regarding the contents of the system such as software and hardware for this device and the Instruction Manual, the appearance and specification etc. of this device might be changed without previous notice in order to respond to the technical advancement and the improvement. Our company doesn't assume at all the responsibility of damage and the disadvantage etc. caused by the change.
- By our convenience, it is likely to stop or discontinue completely the service of the upgrade etc. for the application. Our company doesn't assume at all the responsibility of the damage and the disadvantage etc. caused by the stop, discontinuance or the end etc.

2 Before using this device

2.1 Safety precautions

Please always follow the content of this Instruction Manual. This device is manufactured based on the design that considers customer's safety, but please use it after understanding the following notes very well.

Please always follow using conditions such as temperature, humidity etc. described in the Instruction Manual when you use this device. By using this device under the condition of high temperature, high humidity, in the hot sun, there is a possibility of causing breakdown, damage etc. of this device.

This device is precision equipment. Please don't throw and drop it.

Please use specified battery. Please follow notes when you change or use the battery, and use with attention to safety.

2.1.1 Notes

The condition of workers who handle this device is as follows.

- The content of this Instruction Manual can be understood before use and can be executed.
- Safety precautions is understood well.

2.1.2 About the alarm display

In this Instruction Manual, what should be observed during usage of this device is divided in "Danger" and "Attention" according to the level of risk severity and displayed. However, there are some which do not have the applicable level. Notes for the possibility influencing the function/performance or causing a breakdown are also described. Please confirm them.

Table 2.1 About alarm display

 Warning	Describes the "content of imminent danger to death or serious injury assumed to happen" when the device is mishandled.
 Caution	Describes the "content of danger to injury or damage to the property assumed to happen" when the device is mishandled.
 Prohibited	The sign having a left slash inside the circle reflects the content of "Prohibition" which should not be done.
 Follow Instructions	The sign shown by the blue circle reflects the content of "Instruction of compulsion" which should be done without fail.

Table 2.2 Instruction on safety (Warning)

Warning	
	A person who has a pacemaker shall not use or approach to this device. The pacemaker might malfunction because this device and tablet generate electric wave.
	This device complies with IP65 protective class, but it shall not be used in places exposed to strong jet liquid, near the combustibles and in the corrosive or flammable atmosphere. There is a possibility of causing an electric shock, fire or breakdown.
	Do not touch this device with a wet hand. There is a possibility of causing a breakdown or serious accident.
	When charging with the USB cable, do not put a heavy thing on the cable. There is a possibility of causing an electric shock, fire or breakdown.
	When this device is used with the strap attached, take care for it not to roll in the rotating portion. There is a possibility of causing a breakdown or serious accident.
	The thing to be measured is hot in some case. Confirm the temperature of the thing to be measured with a thermometer etc. before measurement.

Table 2.3 Instruction on safety (Caution)

Caution	
	Do not disassemble or remodel this device. There is a possibility of causing the breakdown. If this device is disassembled or remodeled, it becomes not to be covered by the warrantly.
	Do not use or keep this device in the environment where the temperature or humidity is high or low (Outside of atmospheric temperature range of +5℃ to +50℃ and humidity range of 30% to 90%). There is a possibility that this device doesn't work normally.
	Use two chargeable batteries of size AAA (Ni-MH battery) for this device. Moreover, do not use mixed batteries of old/new ones or different types. There is a possibility of causing the breakdown.
	Do not give a high impact to this device or the magnet, or do not drop them. There is a possibility of causing the breakdown.
	When this device gets dirty, wipe off it with dry cloth etc. Do not use water and organic solvent to wipe off dirt. There is a possibility of causing the breakdown.
	Do not give unreasonable force to the connecting portion of the USB connector. The connecting portion may be damaged, which causes a fire or the malfunction.
	Usable battery for this device is chargeable battery of size AAA. Do not use primary battery. Moreover, usable chargeable battery is Ni-MH battery. Do not use lithium ion battery. When you change the batteries, check direction of batteries and insert it with correct +/- poles. If these are inserted in the wrong direction, there is a possibility of causing the breakdown, transformation by heat or explosion.
	Close the USB waterproof cap surely so that there is no clearance. There is a possibility of the breakdown due to the invasion of water, oil or dust.

	Detach the battery from the measuring instrument when you do not use this device for a long time. The measuring instrument might be damaged by the battery liquid leakage etc. Moreover, the battery is kept in the device for a long time, there is a possibility not to charge by using circuit on the device. When the battery can not be charged by keeping it in the device, use battery charger for Ni-MH battery.

2.2 Operating environment

Please confirm the following tables for the operating environments of this device and tablet.

Table 2.4 NTN PORTABLE VIBROSCOPE

Item	Operating specification	
Power supply	2 chargeable batteries of size AAA (Ni-MH battery)	
Operating temperature	+5℃ to +50℃	
Operating humidity	30% to 90% (no dewfall)	
Operating environment condition	Indoor use :	When you use this device outside, it must be kept out of the wind and rain, the sun. There is a possibility of causing the breakdown and damage.
	Operating height :	2,000m or less
	Pollution level :	Pollution level 3 (General factory)
	Overvoltage category :	OVC Ⅰ

Table 2.5 Tablet

Item	Operating specification
OS	iOS12.0 or later
Display	12.9/11/10.5/9.7/7.9 inch

※It is not to guarantee the operation for all tablets equipped with iOS.

2.3 Components

The packing box contains this device, the magnet, the USB cable 1 piece for each, Quick Instruction Manual, Inspection Report, Warranty 1 sheet for each, and 2 chargeable batteries of size AAA.

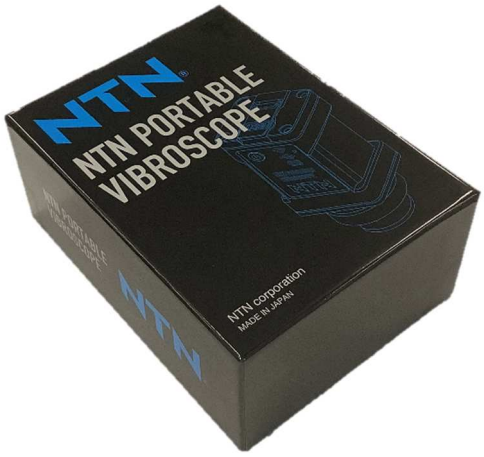


Figure 2.1 Packing box

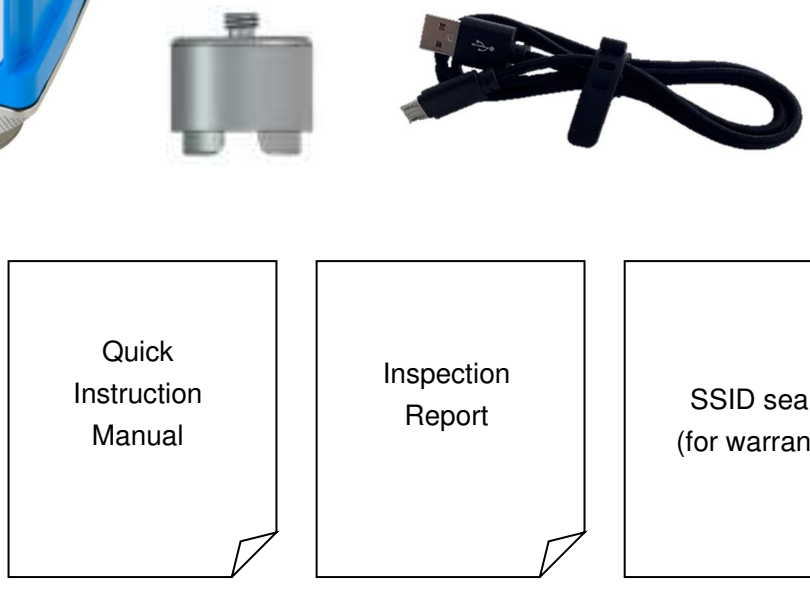


Figure 2.2 Components

Please inquire to our company if anything is missing.

3 Handling of this device

3.1 Name of each parts of this device

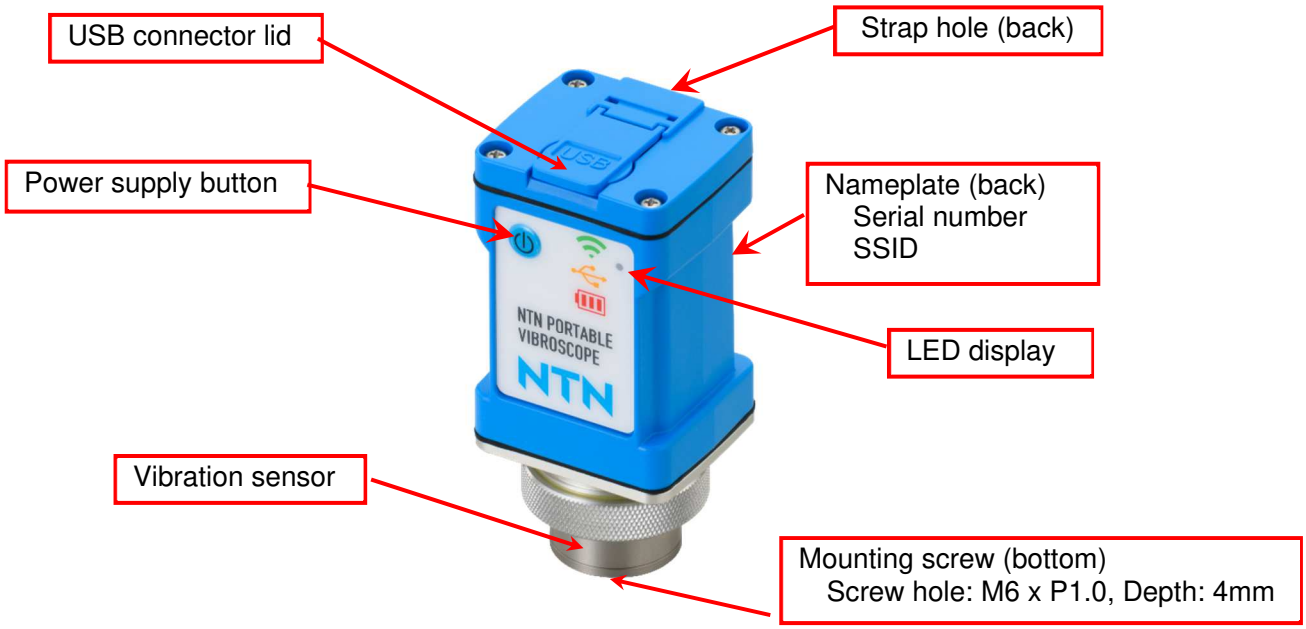


Figure 3.1 Name of each parts

Table 3.1 Color and state of LED display lighting

Red	**Lighting**	**Error generated**
	Blinking	**Wi-Fi waiting**
Green	**Lighting**	**Wi-Fi connection established (Data is not sent yet)**
	Blinking	**Wi-Fi connection established (Data is being sent)**
Red / **Orange**	**Alternate blinking**	**During charging**

3.2 How to put in and detach chargeable battery

	Use 2 chargeable batteries of size AAA (Ni-MH battery) for this device. Moreover, do not use mixed batteries of old/new ones or different types. There is a possibility of causing the breakdown.
	Insert the battery into this device with correct + - poles.
	Detach the battery of the measuring instrument when you do not use this device for a long time. The measuring instrument might be damaged by the battery liquid leakage etc.

The battery box upper lid is detached by removing screws at 4 positions while power supply is turned off. Then remove the screws at 2 positions and detach the battery box middle lid. Insert the 2 chargeable batteries of size AAA with taking care of the direction of +- poles. After inserting the batteries, insert the packing to secure each lid firmly.

When detaching the battery, remove the screws at 4 positions and detach the battery box upper lid while turning off the power supply. Moreover, remove the screws at 2 positions and detach the battery box middle lid to detach 2 chargeable batteries of size AAA. When this device is not used for a long time, keep it with detaching the battery.

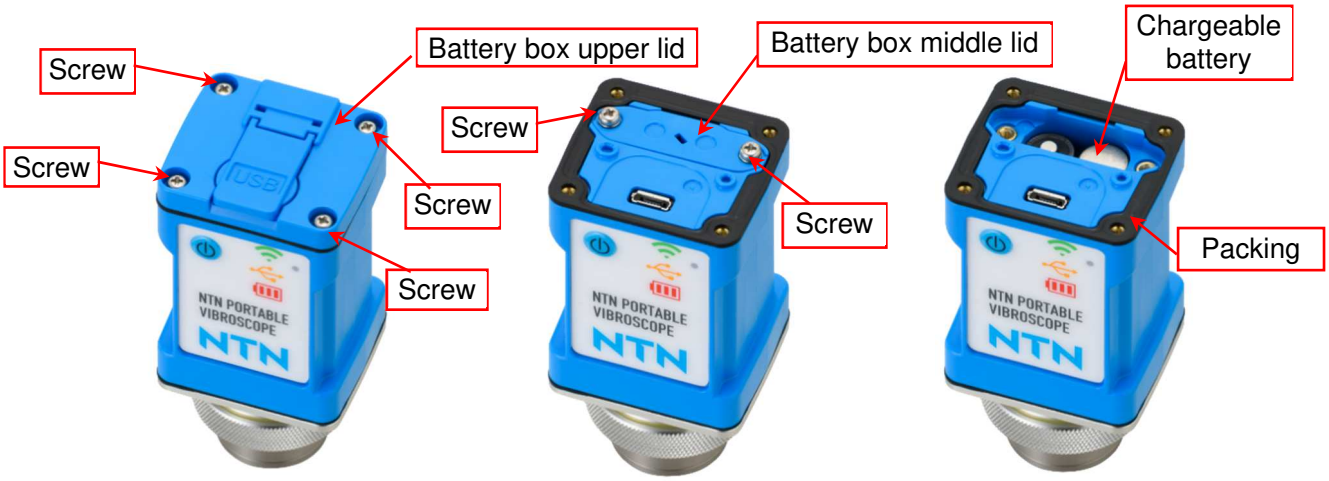


Figure 3.2 How to put in and detach chargeable battery

3.3 Input of device sensitivity and selection of unit of acceleration

This device needs to be used after inputting sensitivity described on inspection report from “Wi-Fi” button on menu screen of application to correct measurement error. Unit of acceleration also needs to be selected on the same screen before measurement.

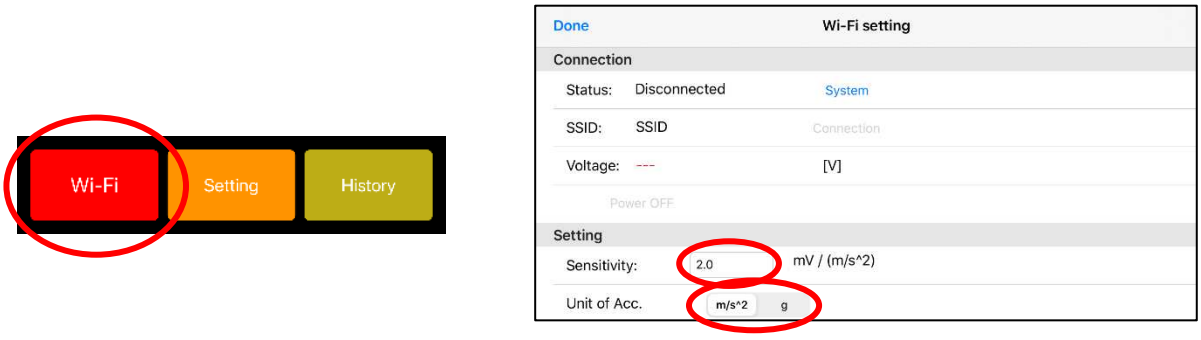


Figure 3.3 Screen of input of sensitivity and select of unit of acceleration

3.4 Rotational speed and direction of rotation

This device may not be able to perform FFT analysis when rotational speed of the bearing is extremely low or extremely high from the characteristic reason. Moreover, this device is applicable only for the bearing with inner ring rotation for the detection of abnormality and the abnormality judgment cannot be performed for the bearing with outer ring rotation.

3.5 Measuring method

Please note the following points when you set up this device. Improper set-up is the cause of correct measurement being impossible.

3.5.1 Measurement condition

The vibration value and the bearing vibration frequency change depending on the use condition of the bearing. For observing the change with time, please measure it under the same condition (bearing load, rotational speed etc.) each time.

3.5.2 Measurement at the same position

The vibration has the direction of generation and it might be attenuated or amplified depending on the measurement position. Therefore, when observing the change with time, please measure it by fixing the device at the same position each time.

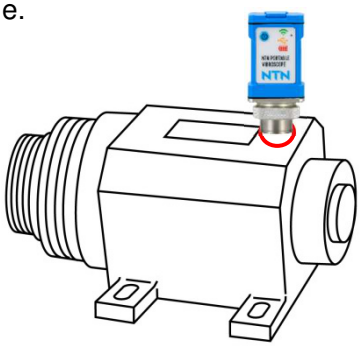


Figure 3.4 Measurement position

3.5.3 Contact resonance

Please use the attached magnet for fixing this device. While the contact pin can be used to measure easily, the measured vibration is amplified or attenuated from the actual value, depending on the frequency, and therefore high measurement accuracy cannot be obtained. Moreover, when the equipment to be measured has a screw hole of M6xP1, the set bolt (length: about 10 mm) is used to fix the device such that the end face of acceleration pick-up and the surface of the equipment to be measured come to close contact with each other, then the higher accuracy of the measurement is possible.

Contact pin Magnet Double-faced tape Screwing

Figure 3.5 Fix method of this device

3.5.4 About measuring position

Please fix this device to the place where any part does not exist that possibly attenuate or amplify the vibration such as preload spring or ball bush between this device and bearing to be measured, or where the number of parts is as small as possible.

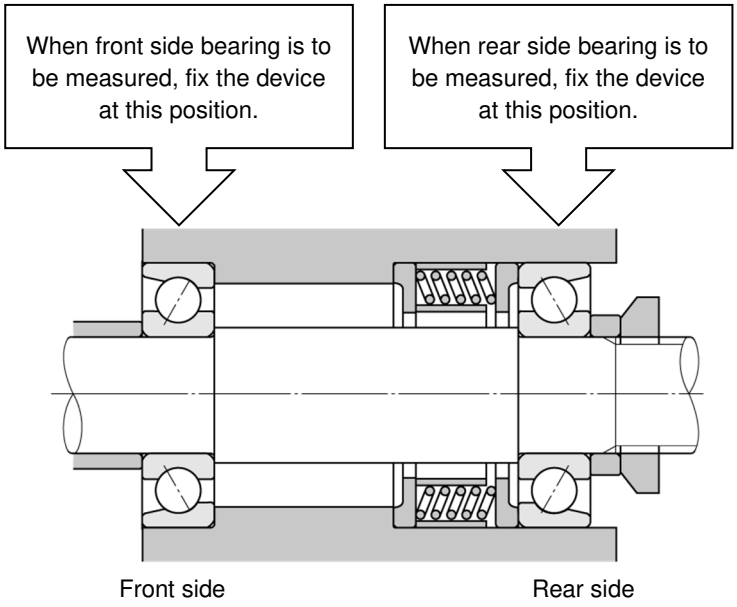


Figure 3.6 Fix position of this device (example)

3.5.5 About mounting face

Please mount this device on the plane unless it is unavoidable. If it is mounted on the curved face, the measurement accuracy decreases. In case where the mounting face is uneven, the measurement value is not stable. Therefore, please mount this device on the face which is as even as possible.

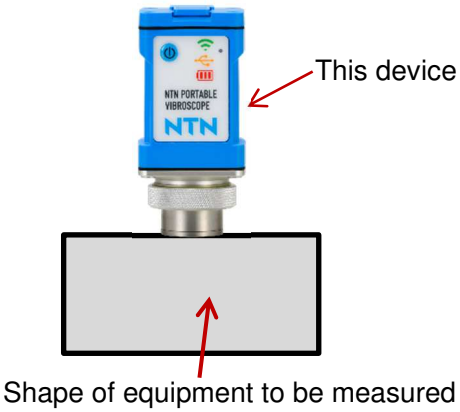


Figure 3.7 Mounting method of this device (on plane)

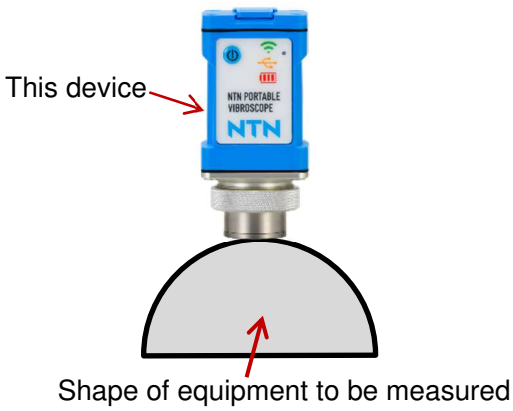


Figure 3.8 Mounting method of this device (on curved face)

4 Operation for measurment

The measurement can be performed by operating application display screen on the tablet.

4.1 Preparation of application

Here, the method setting up the application is explained on the assumption that the customer has Apple ID. The flow installing the application is as follows.

(1) Connect iPad to the Internet.

(2) Activate App Store on iPad.

(3) After the activation, tap the icon for search and input “NTN” in the search window. After the search, some candidate application are displayed and tap "Get" button of "NTN PORTABLE VIBROSCOPE" (upper figure of Figure 4.1) to download/install it.

(4) After the installation ends, the icon of "NTN PORTABLE VIBROSCOPE" is displayed on the iPad screen.

(5) If the icon is tapped and the screen of lower figure in Figure 4.1 is displayed, the installation is completed.

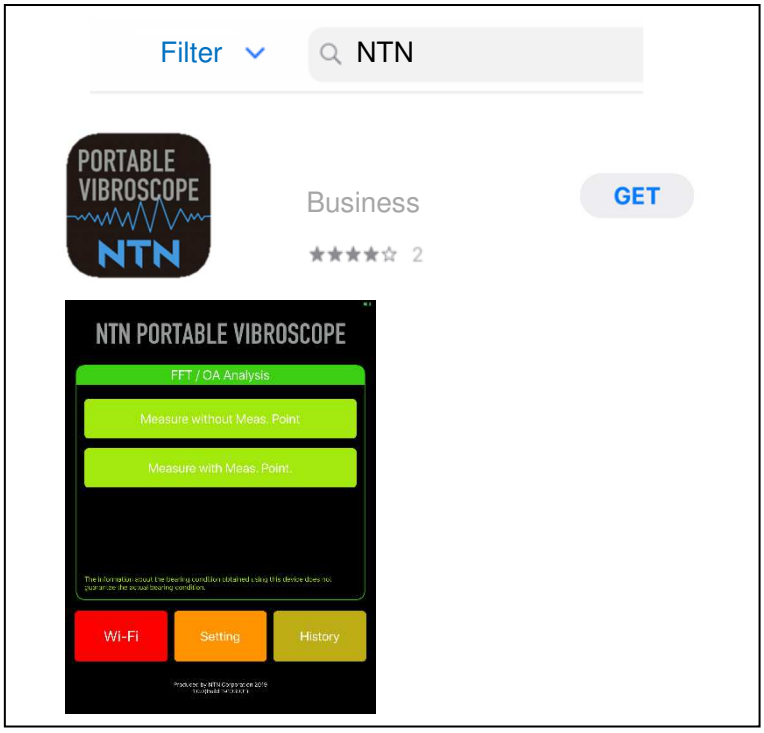


Figure 4.1 Getting of application from App Store

4.2 Wi-Fi connection setting

Because it is necessary that the Wi-Fi connection between iPad and this device has been established before measurement is performed, turn on the power of this device and tap the “Wi-Fi” button at the lower left on application home screen. Moreover, Wi-Fi connection can also be established by tapping “Wi-Fi” button at the upper left on the screens of " Measure without Meas. Point " and "Measure with Meas. Point".

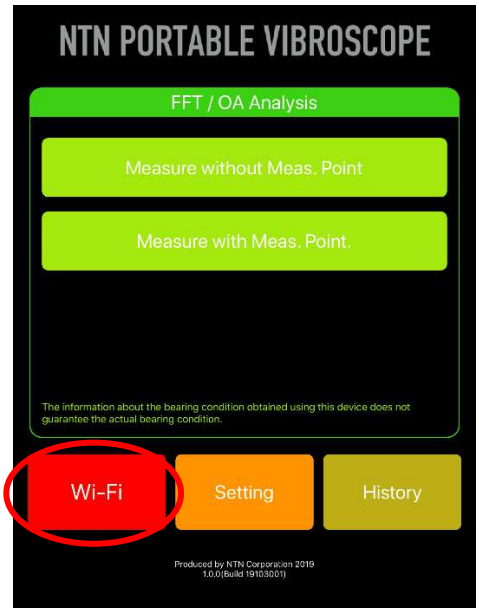


Figure 4.2 Selection of Wi-Fi button

Move to the Wi-Fi setting screen and tap “System”. As the confirmation window appears, select the “OK.”

Figure 4.3 Wi-Fi setting screen

Select "Wi-Fi" from the system setting screen.

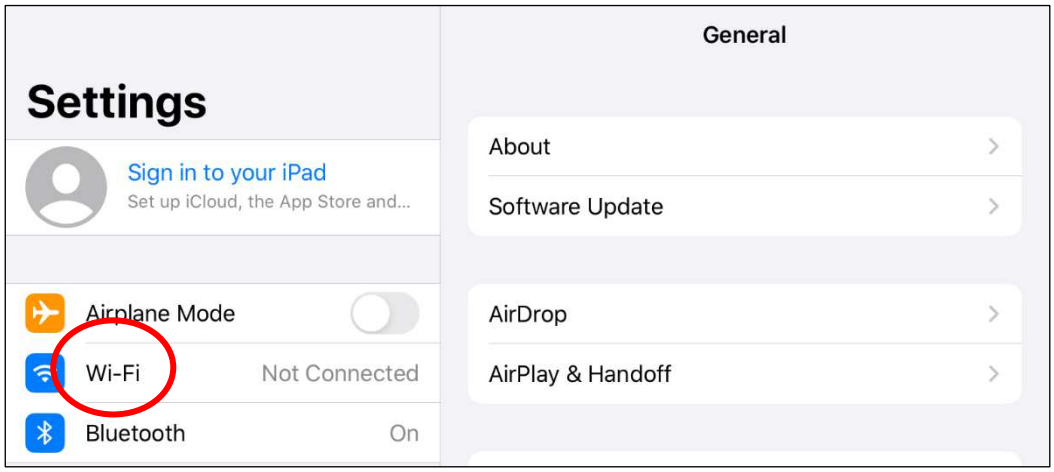


Figure 4.4　System setting screen

Select the network of this device that is activated from the displayed network. SSID that begins with "NTN" is the network ID of this device. After selection, return to the Wi-Fi setting screen and confirm that the connection status changes to “Connected”, and tap the “Done” button.

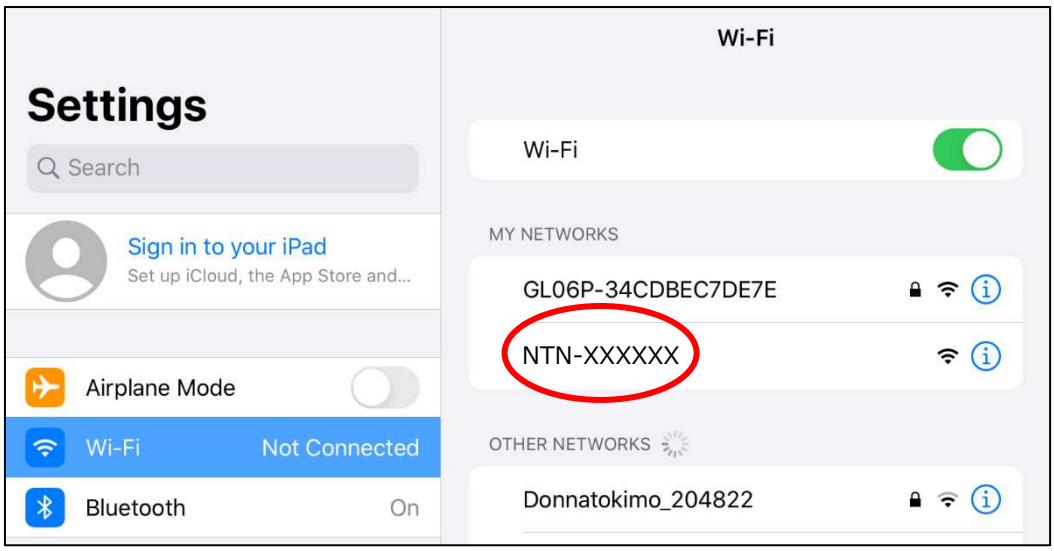


Figure 4.5　Selection of SSID

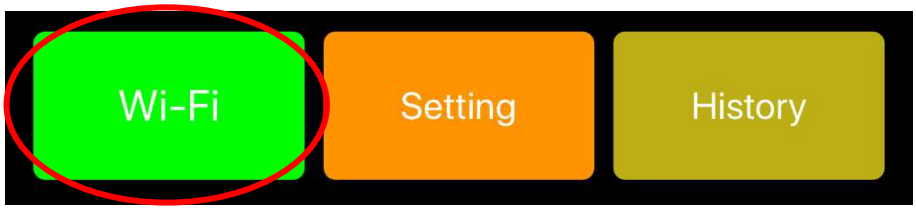


Figure 4.6　Wi-Fi connection completed

4.3 Setting

⚠	When the measured data is judged or saved, it is necessary to register the measurement point information. Moreover, when judging the bearing not registered in the data base, a special bearing or other company's bearing etc., it is necessary to register the bearing parameter beforehand.

From "setting" botton, measurement point information and bearing information can be registered and edited newly. When the following "4.5 Measure with measurement point" is performed, the input of measurement point information and bearing information is indispensable. The bearing parts number to be measured, rotational speed, judgment criterion value, FFT measurement result, OA measurement result, judgment result, and history management etc. are all managed by the measurement point name set in the measurement point information.

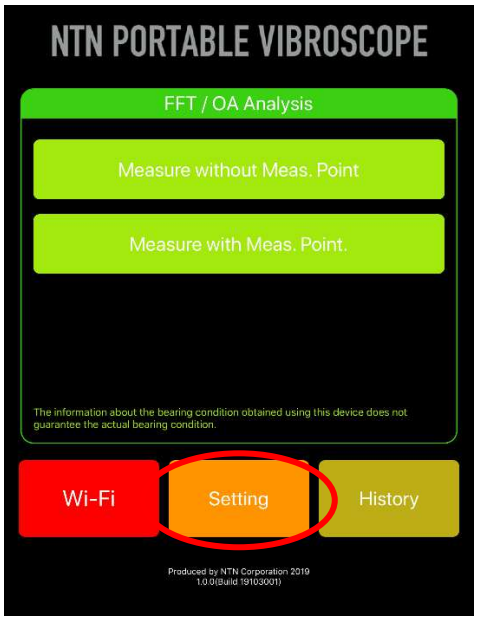


Figure 4.7 Setting

4.3.1 Edit measurement point

When tap "setting" button on the home screen, the menus of "Edit Meas. Point" and "Edit bearing spec." are displayed, then select "Edit Meas. Point"

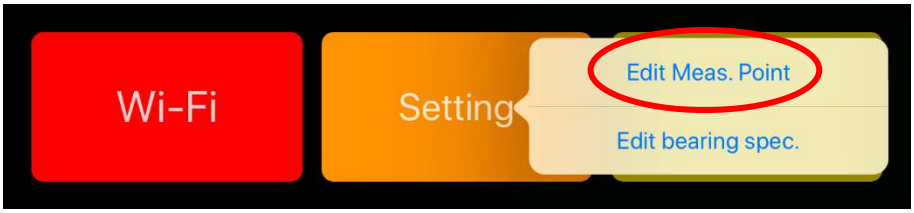


Figure 4.8 Edit measurement point

(1) New registration of measurement point

Tap "Edit" button on the screen of “List of Meas. Point”.

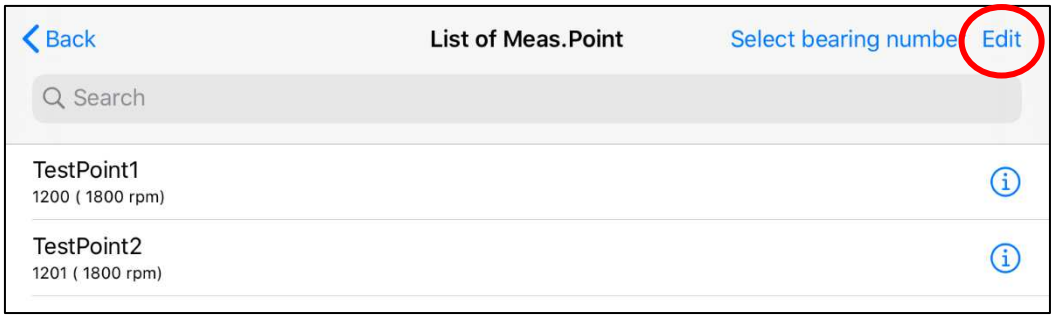


Figure 4.9　List of measurement point

Tap "+" button on the upper left of the screen.

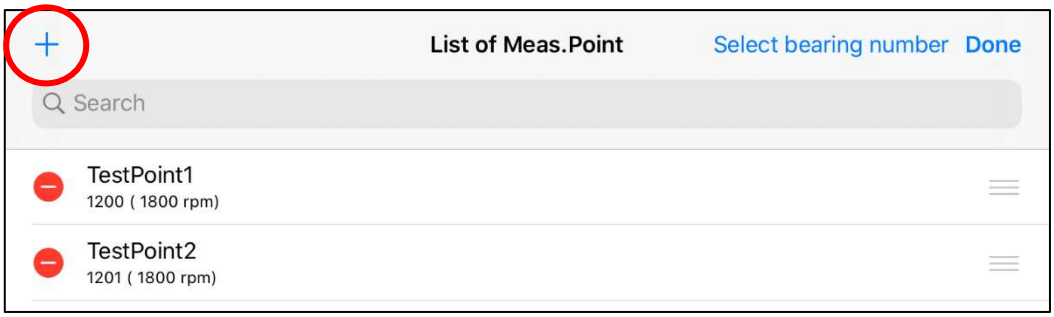


Figure 4.10　Selection of new editing

After adding required number of measurement points, tap "Done" button.

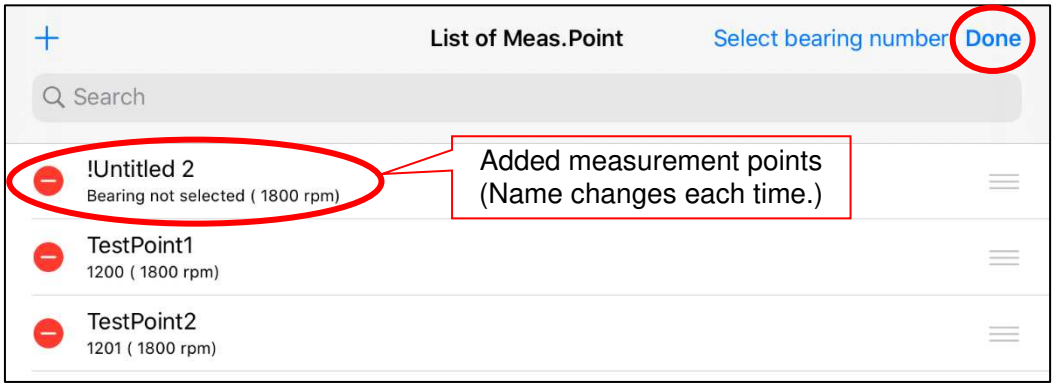


Figure 4.11　New registration of measurement point

To register information on the added measurement point, tap the measurement point name and edit the content.

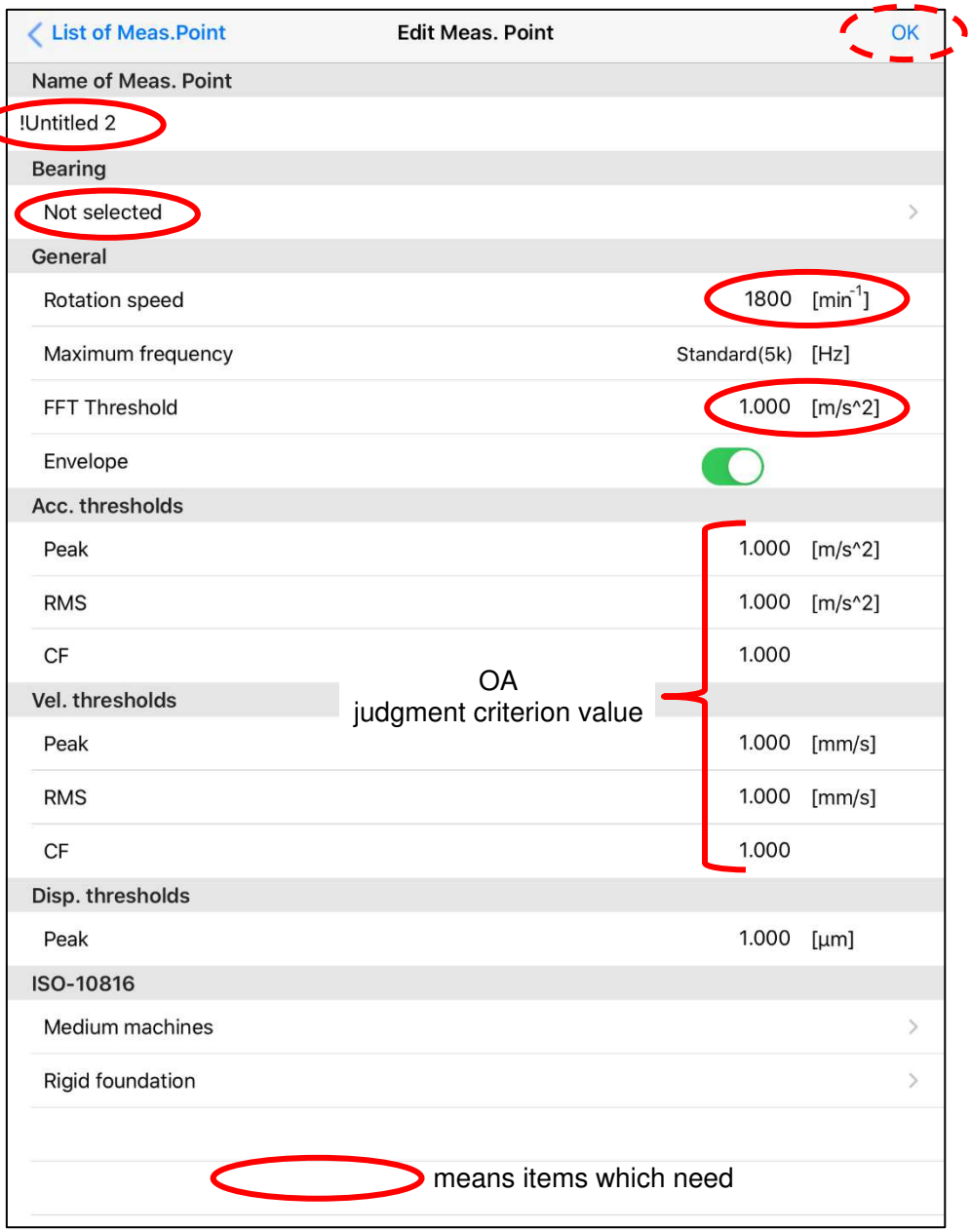


Figure 4.12　Edit of information of measurement point

1. Adopting plant name, equipment name, measurement position etc. as the measurement point name makes the history management easy.
2. Select the bearing parts number without fail. It is impossible to measure if it is not selected.
3. Input the value as accurate as possible for the rotational speed. Otherwise, the measured vibration frequency of the bearing may be shifted and the judgment of the FFT measurement may become impossible.
4. Select maximum frequency referencing Table 4.1 as the guide.

Table 4.1 FFT judgement

Low (1k)	300min^{-1} or less
Standard (5k)	300 to 20000min^{-1}
High (20k)	20000min^{-1} or more

5. FFT judgment criterion value should be based on 1.000m/s^2 and it is changed in accordance with the equipment situation.
6. Select the envelope ON or OFF in accordance with the measurement condition.
   Select envelope “ON” for vibration measurement of bearings and gears etc., and envelope “OFF” for the measurement of unbalance etc.

After necessary information is input, tap "OK". New measurement point is registered.

When "Bearing" on edit measurement point screen is tapped, the list is displayed as shown in Figure 4.13.
By inputting figures/characters into the "Search" window, the search can be narrowed.
Tap the bearing parts number to be measured from displayed bearing parts numbers and select it.

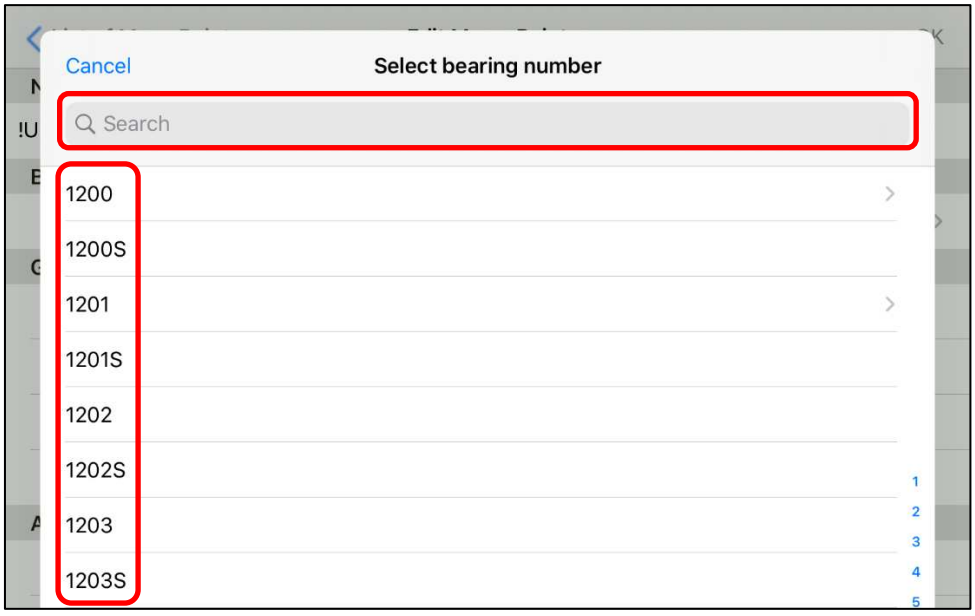


Figure 4.13　Bearing parts numbers selection screen

(2) Editing of registered measurement point

Information on the measurement point that has already been registered can be edited. The edit screen is displayed when the measurement point to be edited is selected from the list of measurement points, then correct it as needed and tap "OK."
Moreover, "Select bearing number" on the upper right of the screen sorts the measurement point name in the order of bearing parts numbers and displays.

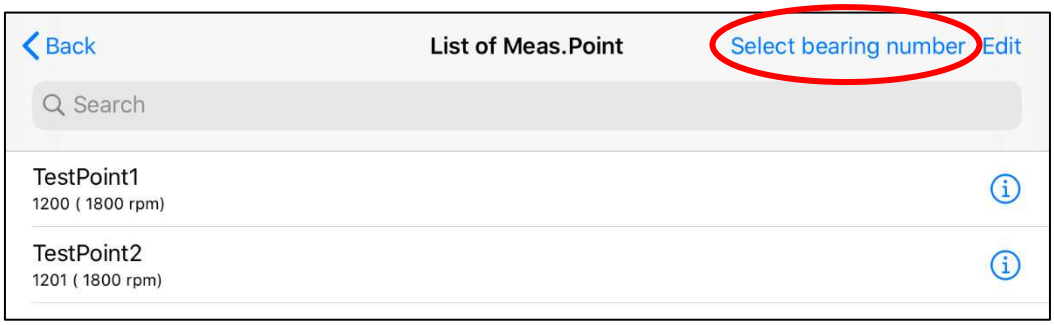


Figure 4.14　List of measurement points

(2) Copy of measurement points

By pressing and holding the measurement point name to be copied, Delete, Edit and Copy menus are displayed and the information on the measurement point which has been registered can be copied.

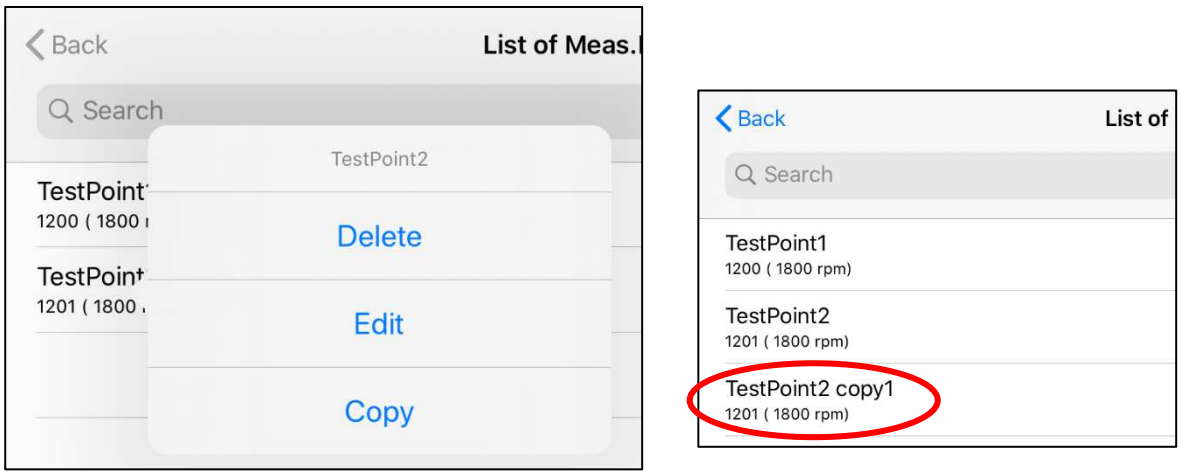


Figure 4.15 Delete, Edit and Copy menus of measurement points and the copied measurement point

4.3.2 Edit bearing specification

When a bearing parts number other than ones that have been registered beforehand is to be registered, it is used. When tap the “setting” button on the home screen, menus of “Edit Meas. Point” and “Edit bearing spec.” are displayed, then select " Edit bearing spec."

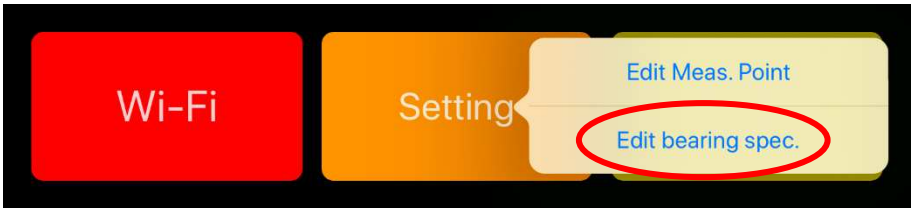


Figure 4.16 Edit bearing specification

Tap "Edit" on the screen of bearing number list.

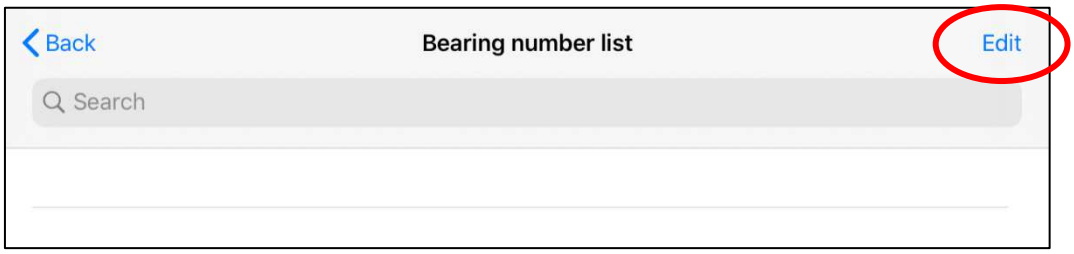


Figure 4.17 Selection of bearing editing

Tap "+" on the upper left of the screen.

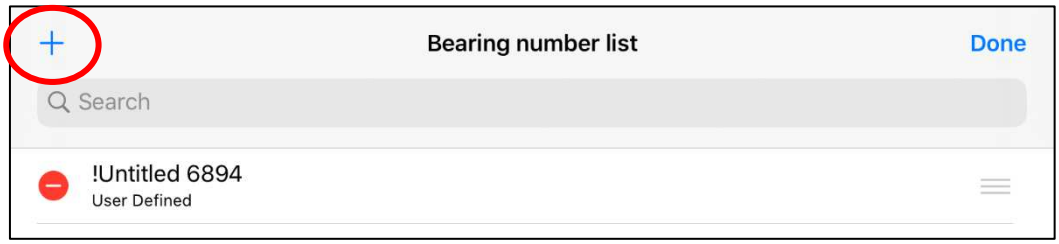


Figure 4.18　Addition of bearing parts number

After adding the required number of bearing parts numbers, tap "Done".

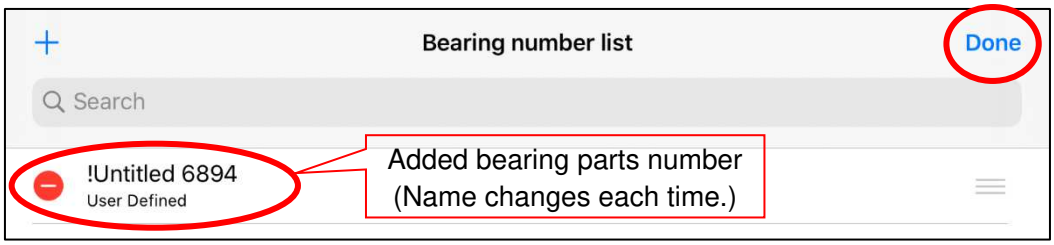


Figure 4.19　New registration of bearing parts number

To register the information to the added bearing parts number, tap the bearing parts number to edit the content.

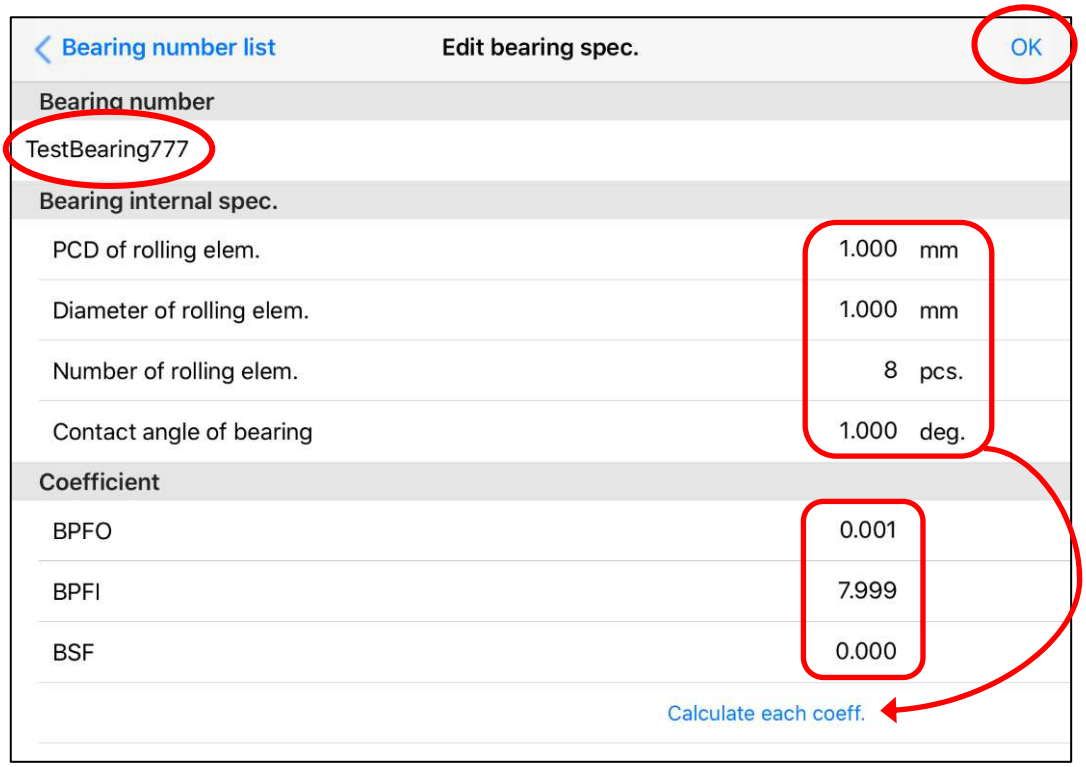


Figure 4.20 Registration of bearing information

As the bearing information, input the bearing number and either of bearing parameters or coefficients. When bearing parameters are input, tap “Calculate each coeff.” and obtain the coefficients without fail. After inputting, tap “OK”. When selecting bearing parts number at edit measurement point, the bearing number which is registered here is displayed.

4.4 Measure without measurement point

This is a mode that operates as a general vibration measuring instrument. The judgment other than ISO-10816, history display and measurement data saving cannot be performed, but the vibration measurement can be performed easily without setting of measurement point information.

(1) Tap "Measure without Meas. Point" from the home screen of the application.

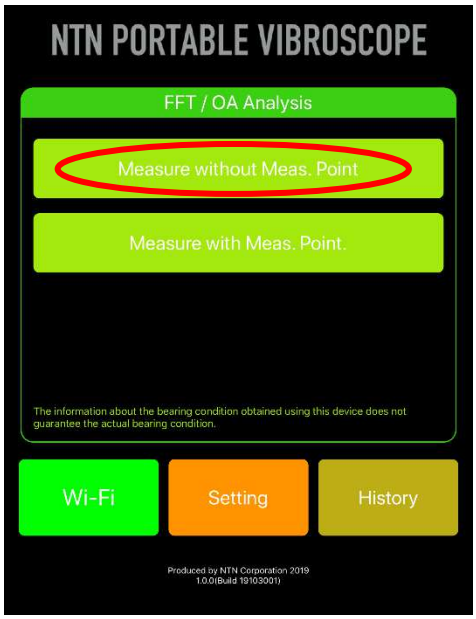


Figure 4.21 Selection of Measure without Meas. Point

(2) Confirm that "Wi-Fi" button on the upper left of the Measure without Meas. Point screen is green (connected). When the "Wi-Fi" button is red (not connected), tap the "Wi-Fi" button first to display Wi-Fi setting screen and establish the connection.(Refer to "4.2 Wi-Fi connection setting" for the connection method.)

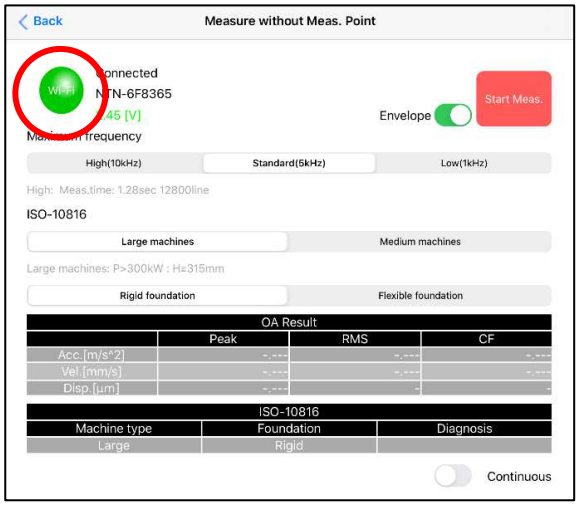


Figure 4.22 Measure without Meas. Point screen

(3) Select Envelope ON-OFF, maximum frequency and the ISO-10816 judgment criterion, and tap the "Start Meas." button at the upper right.

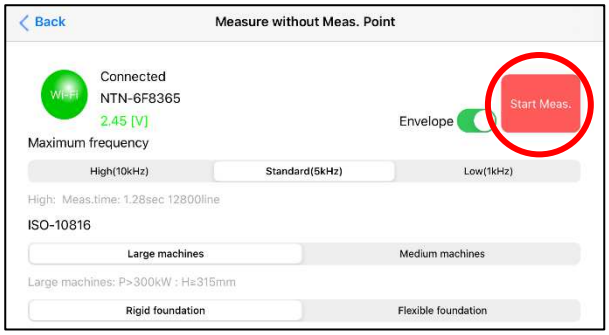


Figure 4.23 Measure without Meas. Point screen

(4) When the measurement is completed, the judgment result of ISO-10816 is displayed.

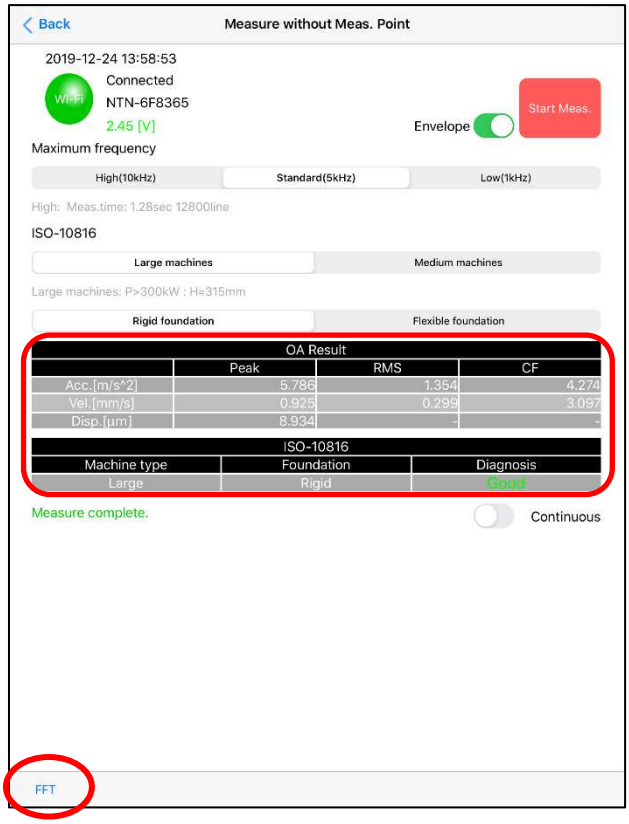


Figure 4.24 Result screen of Measure without Meas. Point

(5) When tapping "FFT" of the result screen of Measure without Meas. Point, FFT spectrum is displayed. When tapping the frequency button at the bottom of the screen, the frequency range of the graph can be specified.

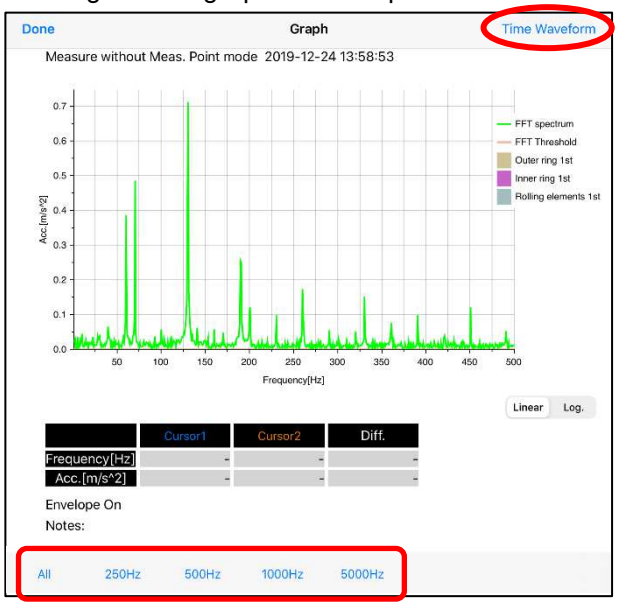


Figure 4.25 FFT spectrum screen of Measure without Meas. Point

(6) When tapping "Time Waveform" at the upper right, the time waveform is displayed.

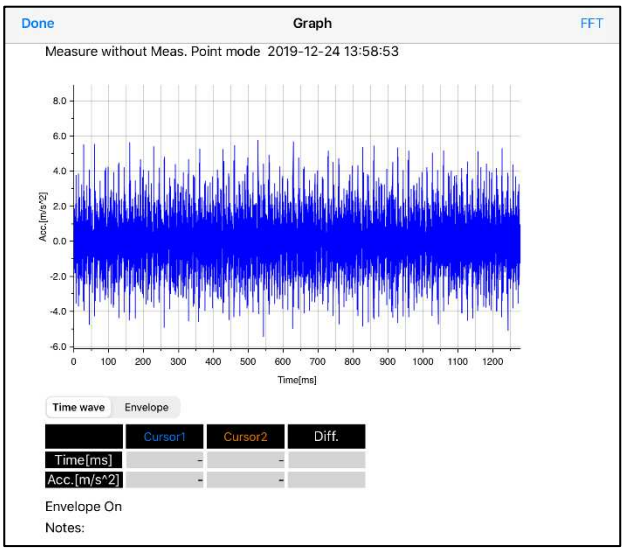
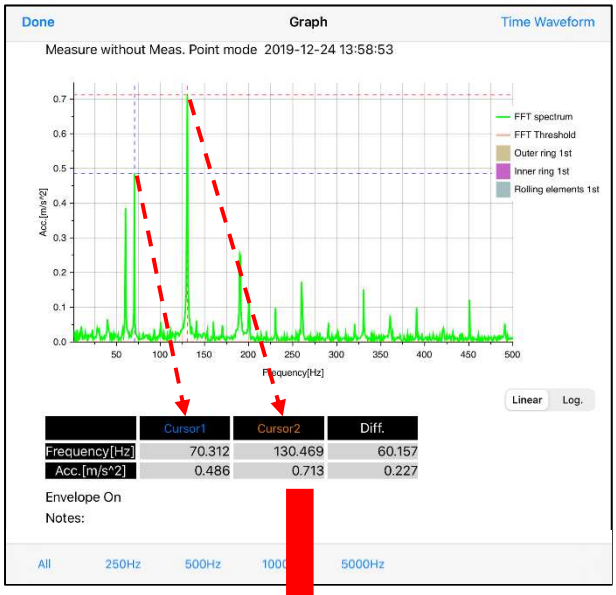


Figure 4.26 Time waveform screen of Measure without Meas. Point

(7) Both of FFT spectrum and time waveform, after tapping the cursor 1 or cursor 2 at the bottom of the graph and swiping them on the graph, the cross cursor moves. By releasing the finger from the screen, the position is established. The displayed cursor coordinates are the coordinates of the cross intersection of cursors 1 and 2, and the difference. The waveform graph can be expanded or reduced by pinch-out or pinch-in. Moreover, a horizontal axis can be scrolled with horizontal swipe.



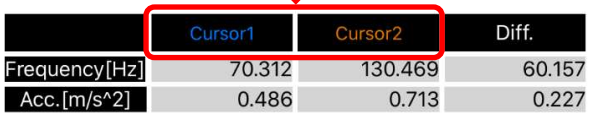


Figure 4.27 Cursor coordinates

4.5 Measure with measurement point

This is a mode in which the tendency management can be done by setting measurement point information. Judgment with the set judgment criterion, judgment of ISO-10816, save of measurement result and history display can be performed.

⚠	The judgment results of the FFT measurement and the OA measurement are the reference result of judging measurements based on the judgment criterion value set by the customer, and does not guarantee the objective state of the bearing to be measured.

(1) Tap "Measure with Meas. Point" from the home screen of the application.

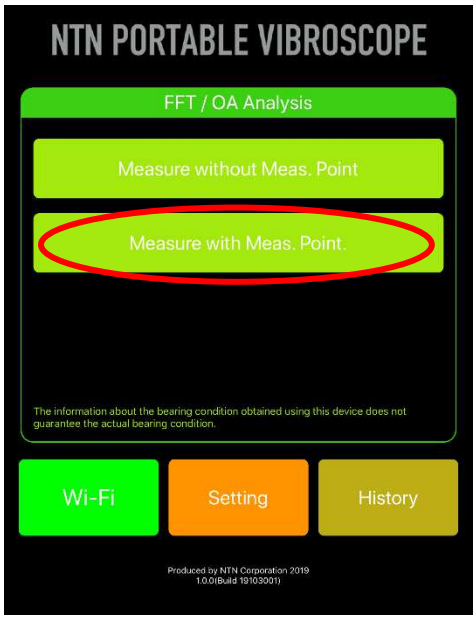


Figure 4.28 Selection of Measure with Meas. Point

(2) The target measurement point name is selected from the screen of Select Meas. Point.

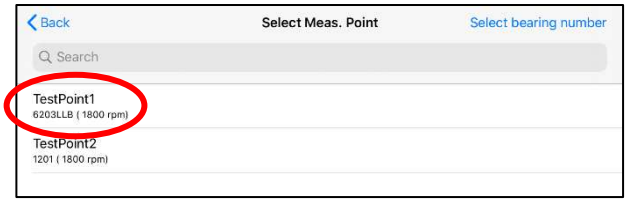


Figure 4.29 Select measurement point name

(3) The condition is selected and it is confirmed that the "Wi-Fi" button on the upper left of Measure with Meas. Point screen is green (connected). When "Wi-Fi" button is red (not connected), tap the "Wi-Fi" button first to move to Wi-Fi setting screen, and after establishing the connection, the measurement is started. (Refer to "4.2 Wi-Fi connection setting" for the connection method.)

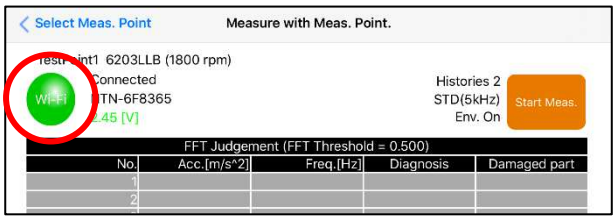


Figure 4.30 Measure with Meas. Point screen

(4) Tap the “Start Meas.” button on the upper right of the screen of Measure with Meas. Point.

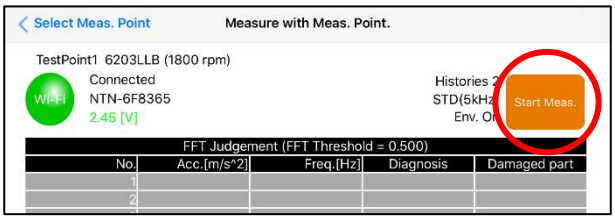


Figure 4.31 Measure with Meas. Point screen

(5) When the measurement is completed, the acceleration and its frequency of the top 10 of the FTT analysis result, as well as judgment result based on the set judgment criterion value, assumed damaged position, OA measurement result value and the judgment result based on the set judgment criterion value, ISO-10816 judgment result are displayed.

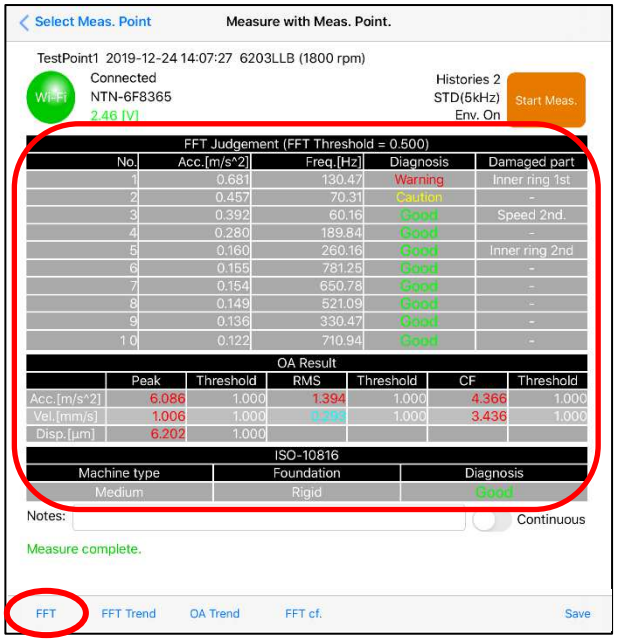


Figure 4.32 Result screen of Measure with Meas. Point

Table 4.2 FFT judgment

Condition	Judgment
80% or less of the judgment criterion value	Good
Exceeding 80% and 100% or less of the judgment criterion value	Caution
Exceeding the judgment criterion value	Warning

Table 4.3 OA judgment

Condition	Judgment
Less than the judgment criterion value	Measurement value is displayed in blue.
Exceeding the judgment criterion value	Measurement value is displayed in red.

Table 4.4 ISO-10816 judgment

Judgment
Good
Acceptable
Caution
Warning

(6) When the "FFT" button on the bottom left of the measurement result screen is tapped, FFT spectrum is displayed. When the frequency button at the bottom of the graph is tapped, the frequency range of the graph can be specified. When "Time Waveform" on the upper right of the screen is tapped, the time waveform is displayed.

Figure 4.33 FFT spectrum screen of Measure with Meas. Point

(7) By using the bottom left button on the graph, raw waveform or the waveform after envelope processing can be selected.

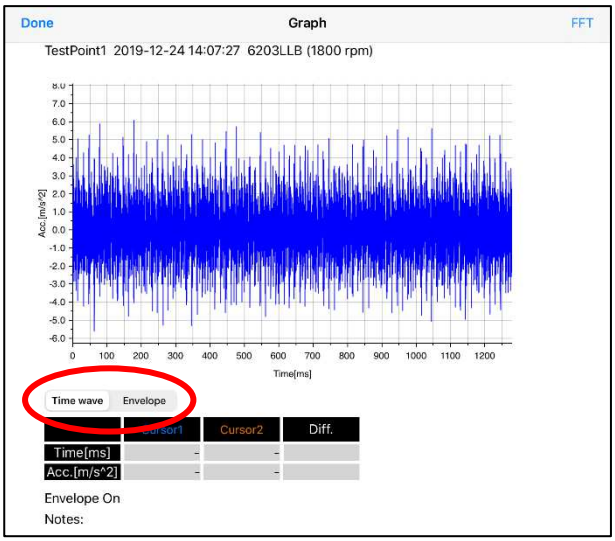


Figure 4.34 Time waveform screen (raw waveform)

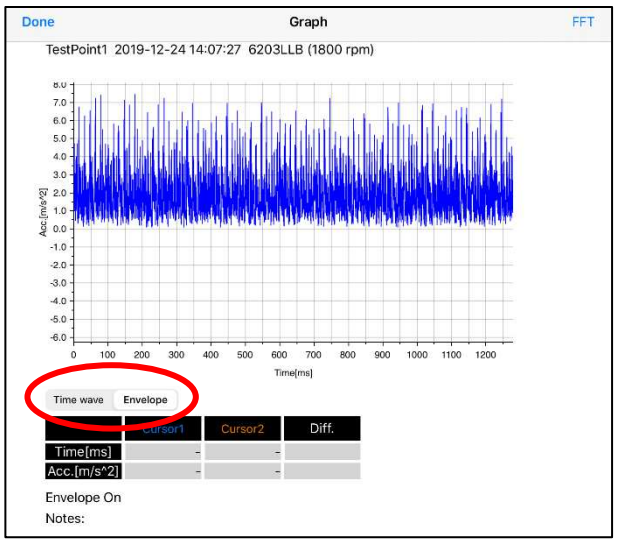


Figure 4.35 Time waveform screen (waveform after envelope processing)

(8) When saving the data, "Save" at the bottom right of the measurement result screen is tapped.

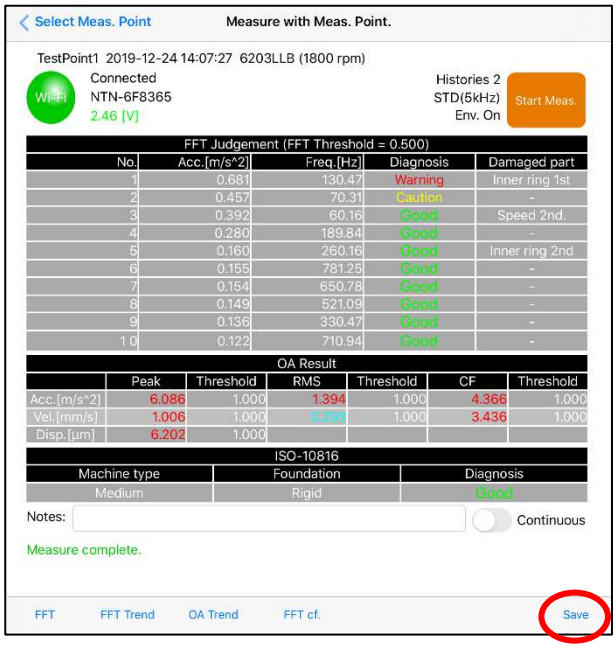


Figure 4.36 Data save

(9) If there is a saving history of data for the selected measurement point on the screen of Measure with Meas. Point, "FFT Trend", "OA Trend", and "FFT cf." at bottom of the screen become active and the display of the history is possible.

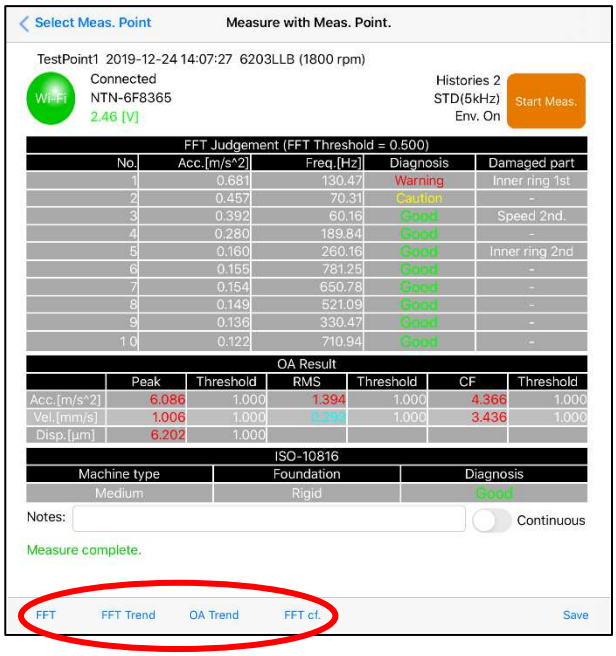


Figure 4.37 History display

(10) By using FFT Trend, the tendency management of the acceleration that corresponds to the damage frequency of the inner ring, outer ring and rolling elements of the bearing can be performed.

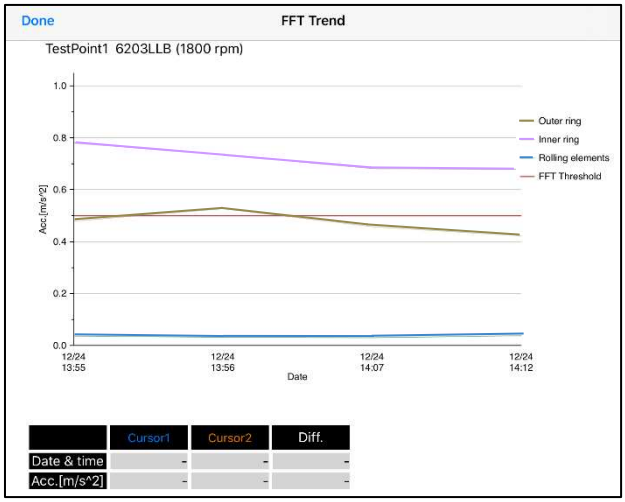


Figure 4.38 FFT Trend

(11) The tendency management of the acceleration, speed and displacement of the vibration can be performed by using the OA Trend.

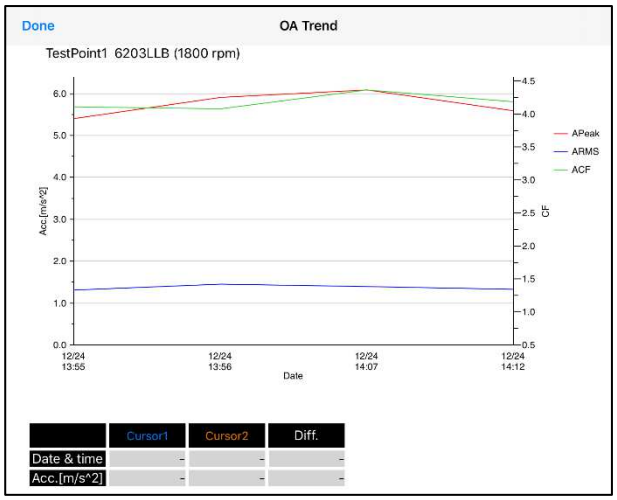


Figure 4.39 OA Trend

(12) FFT cf. displays FFT spectrums of the past 3 times with overlapping them.

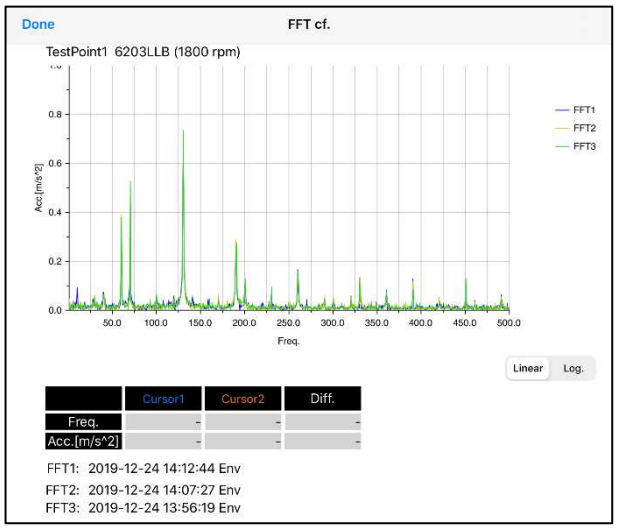
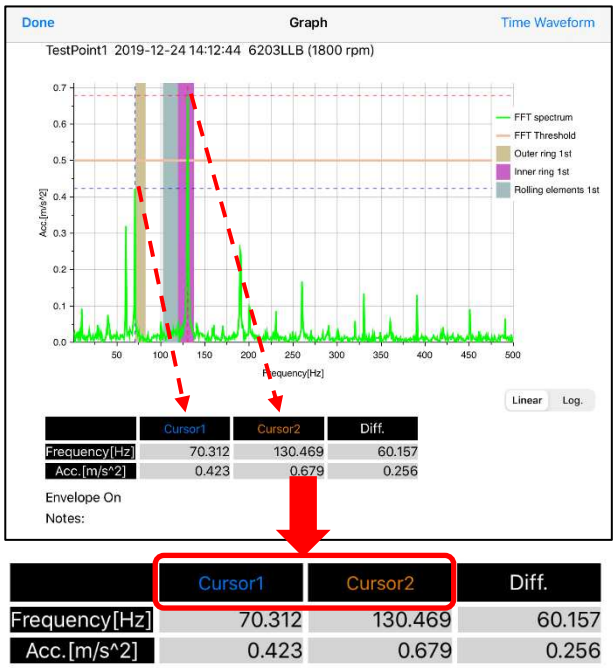


Figure 4.40 FFT cf.

(13) Both of FFT spectrum and time waveform, after tapping cursors 1 and 2 at the bottom of the graph, swiping them on the graph moves the cross cursor, and by releasing the finger, the position is established. The displayed cursor coordinates are the coordinates of the cross intersection of cursors 1 and 2 and the difference. The waveform graph can be expanded or reduced by pinch-out or pinch-in. Moreover, by swiping in horizontal direction, the scroll in horizontal axis can be performed.



	Cursor1	Cursor2	Diff.
Frequency[Hz]	70.312	130.469	60.157
Acc.[m/s^2]	0.423	0.679	0.256

Figure 4.41 Cursor coordinates

4.6 History

Tapping “History” on the home screen of the application shows the selection screen of the measurement point, and the saved measurement data can be read.

Figure 4.42 Selection of “History”

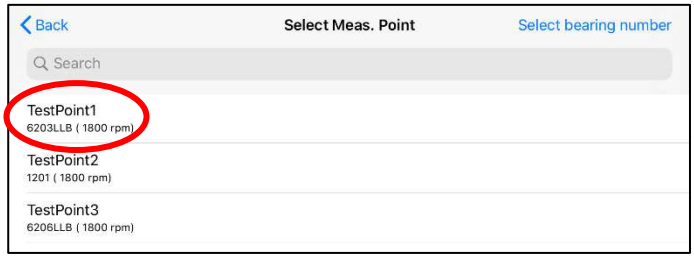


Figure 4.43 Selection of measurement point name

By selecting the measurement point name, the measurement data is displayed in the list in the order of saving date and time. By tapping the desired measurement date and time, the measurement result screen is displayed. The operation after screen is displayed is the same as "4.5 Measure with Meas. Point".

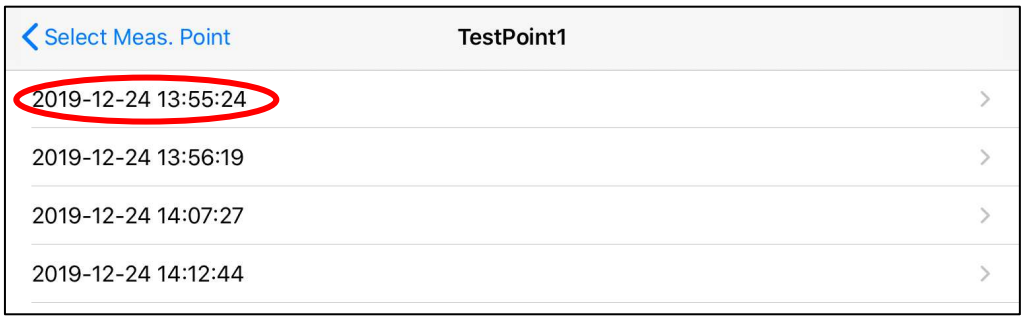


Figure 4.44 Selection of measurement date and time

By pressing and holding the specific measurement point name on the Select Meas. Point screen, the graphs of FFT Trend and OA Trend can be displayed.

Figure 4.45 Selection of Measurement point name

4.7 CSV output of measurement data

The measurement data of each measurement point can be converted into CSV format.

1) Tap the “History” on the home screen of the application.
2) Press and hold the measurement point name desired to output from the displayed list, “Export to CSV” button is displayed.

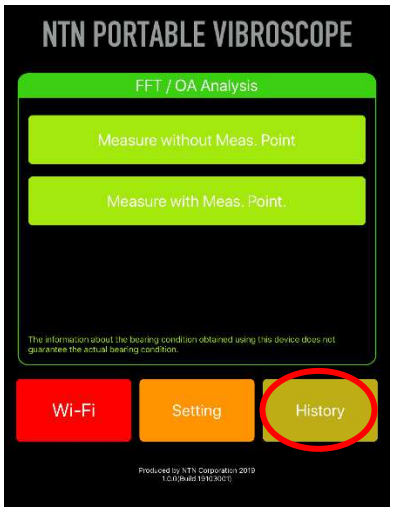


Figure 4.46 Home screen

Figure 4.47 CSV output screen

3) Tap displayed “Export to CSV” button.
When the following screen is displayed, CSV file has been output in the iPad memory.

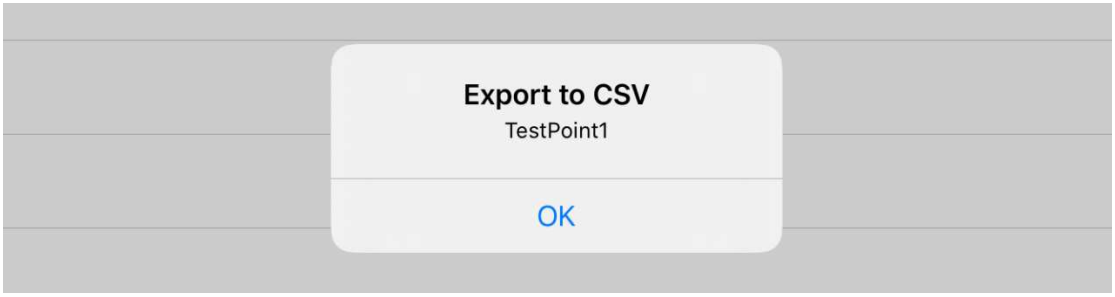


Figure 4.48 CSV output completion screen

4.8 Changing method of vertical axis maximum value of graph

The maximum value of the vertical axis on the graph displayed on the tablet can be changed.

(1) When tapping the scale of vertical axis on the graph, the screen where Ymax can be input appears.

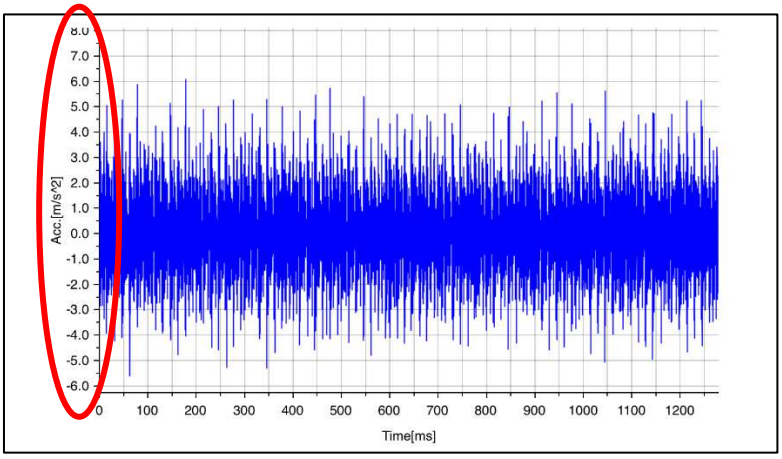


Figure 4.49 Graph before change

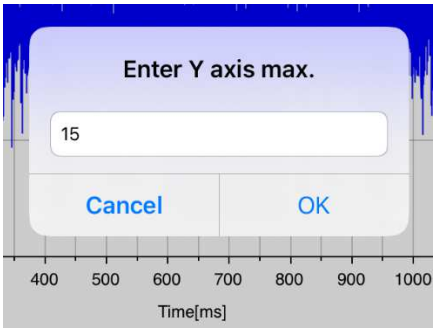


Figure 4.50 Ymax input screen

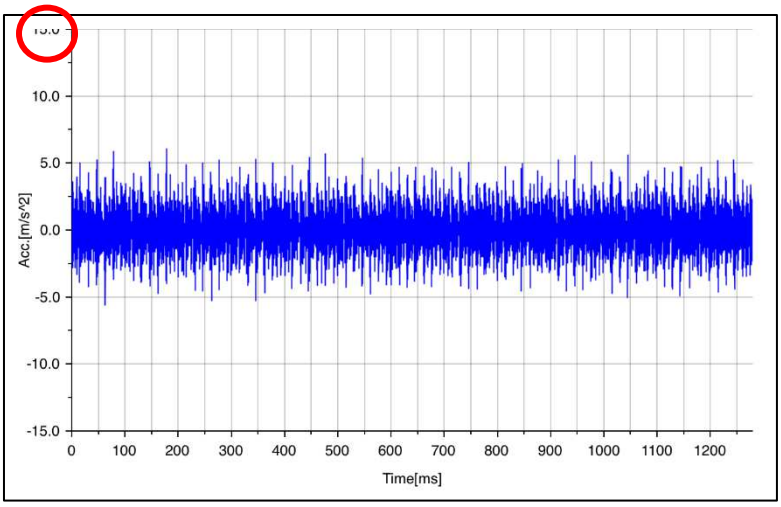


Figure 4.51 Graph after change

(2) Besides the time waveform graph, a similar change is possible even for the FFT graph and the trend graph.

4.9 Notes input function on measured data screen

The notes can be input to the measured data screen.

(1) Because there is a notes column at the bottom of the table where the measurement result is displayed, an arbitrary character can be input by tapping its column.

(2) Irrespective of the number of characters, they can be input either with half-width or full-width forms without limitation.

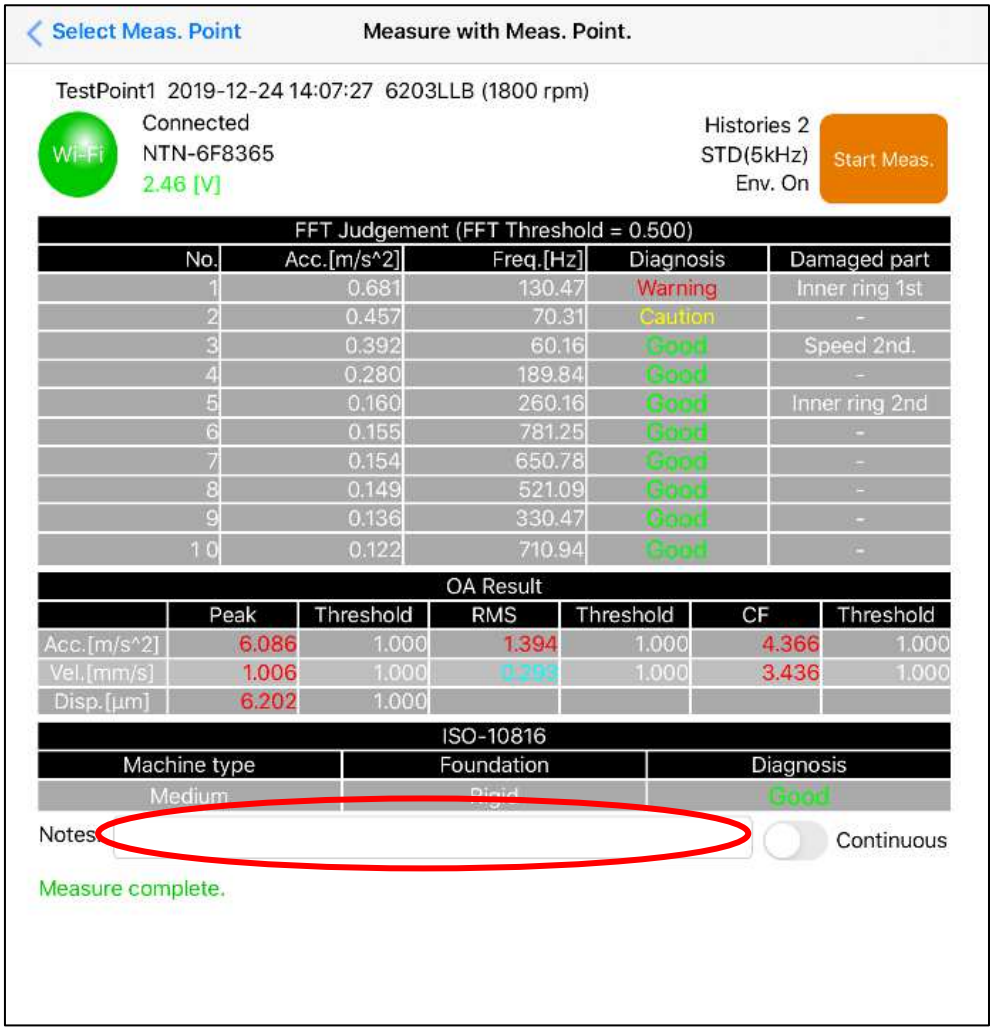


Figure 4.52 Notes input column

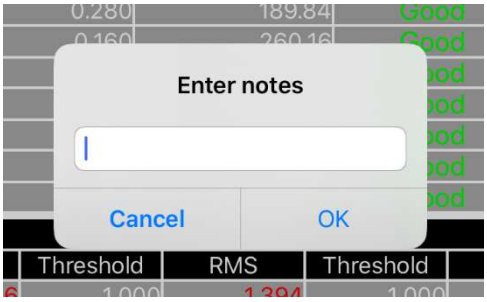


Figure 4.53 Notes input screen

4.10 Delete of mesurement data on specific date and time

Saved measurement data on specific date and time can be deleted.

After tap “History” button and select measurement point name, deletion screen is displayed by pressing and holding specific measurement date and time.

Figure 4.54 Home screen

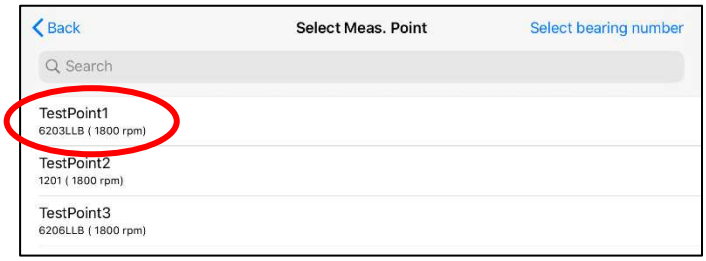


Figure 4.55 Selection of Measurement point name

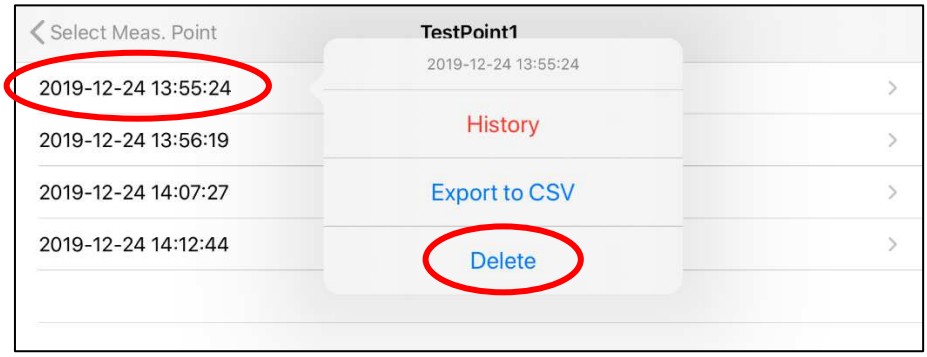


Figure 4.56 Selection of measurement date and time

4.11 Import data into PC

The measurement data saved in the tablet can be imported into a PC by using iTunes. Here, it is explained on the assumption that iTunes has been installed in the PC you have.

(1) Connect PC and the tablet with a cable. (The customer must prepare Apple genuine cable.)
(2) Activate iTunes on the PC.
(3) When the connected tablet is recognized, the following screen is displayed. Then, tap the icon of the device that is displayed under the menu bar.

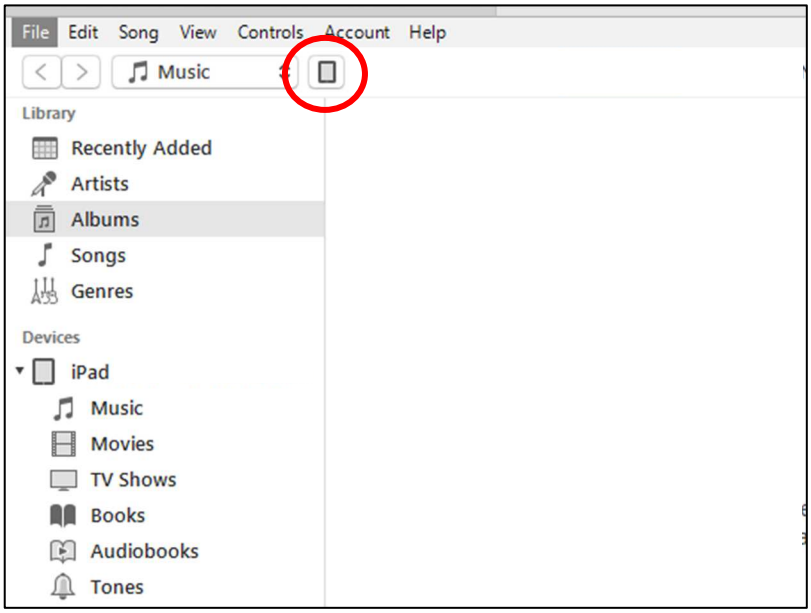


Figure 4.57 iTunes activation screen

(4) Next, select "Apps" from the setting of the left of the screen.

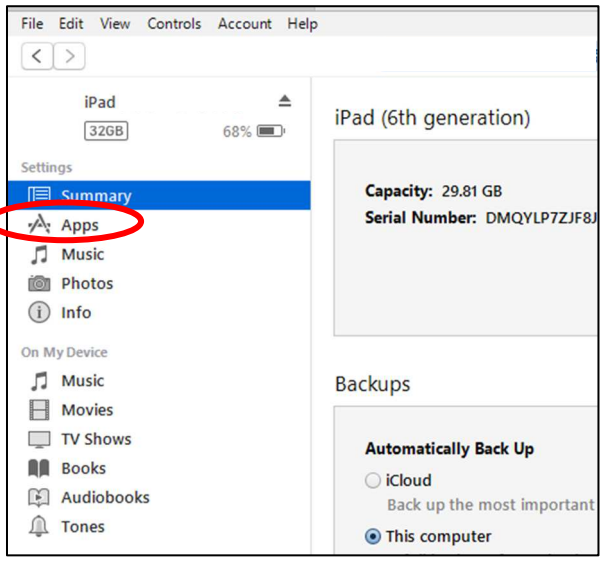


Figure 4.58 iTunes connection completion screen

(5) When selecting "NTN PORTABLE VIBROSCOPE" from the application on the displayed file sharing screen, the document screen is displayed.

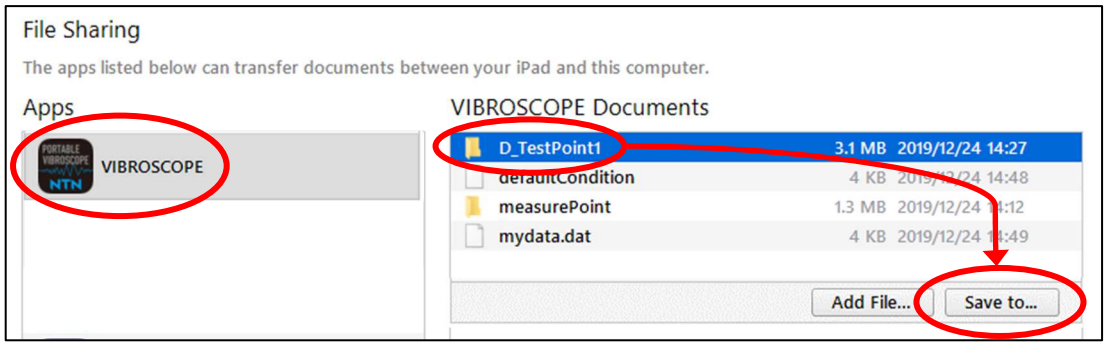


Figure 4.59　File sharing screen and document screen

(6) The measured data that is output as CSV file from the application is in the folder of the measurement point name on the displayed document screen. Then, the window to select location for saving the file is opened by selecting the folder and pressing “Save to…”. The measured data is imported by selecting the desired location for saving the file.

(7) After import of the measured data is completed, close iTunes, and detach the tablet and the cable.

*Do not delete following files and folders absolutely because all measurement history is deleted.

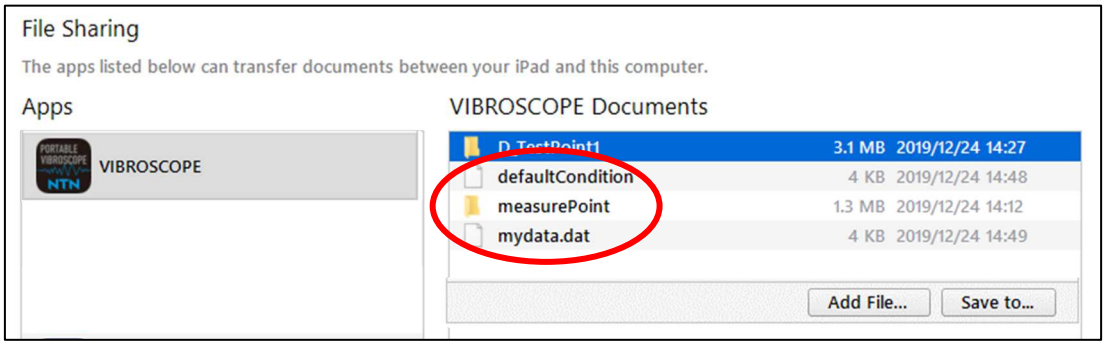


Figure 4.60　File sharing screen

*Refer to the operation method of iTunes of the Apple, Inc. for the back-up and the restoration of the tablet.

5 Specification

5.1 Outside dimensions

The external dimensions are described in the figure below. (mm)

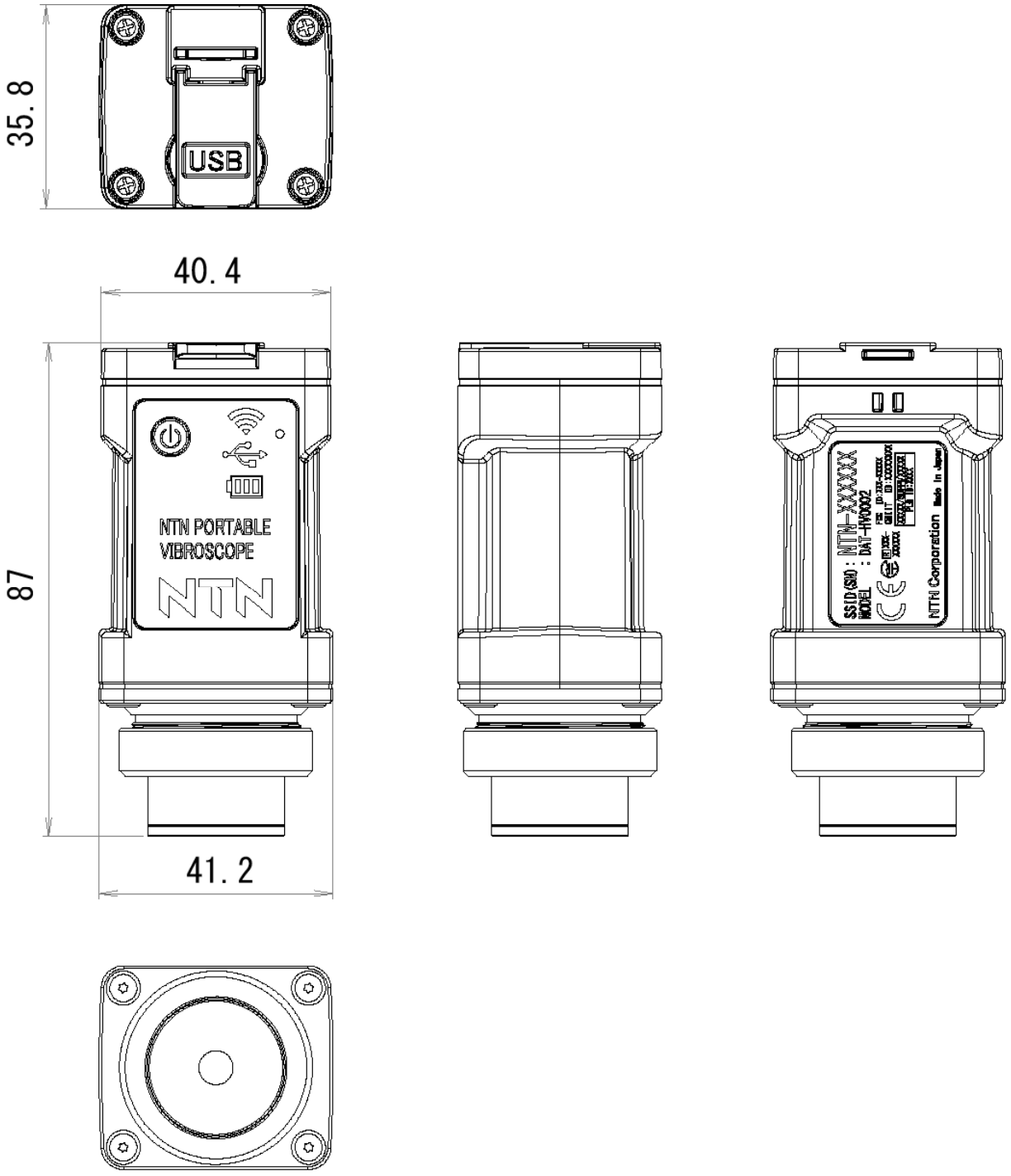


Figure 5.1 External dimensions

5.2 Main specifications

The main specifications of this device are described as follows.

Table 5.1 Main specifications

			NTN PORTABLE VIBROSCOPE
Measurement portion	Interface		Wireless LAN: IEEE802.11b/g, Wi-Fi conforming
	Wireless communication mode		Infrastructure mode
	Wi-Fi certification		CE (Europe) / MIC (Japan)
	Installed memory capacity		4Mbit x 16bank
	Used power supply		2 chargeable batteries of size AAA
	Operating temperature range		+5 to +50˚C (Guaranteed only with attached battery)
	Operating humidity range		30 to 90% (No dewfall)
	Environment-proof		IP65
	Power consumption		About 150mA, possible to use for about 6 hours by full charge
	Battery charging		USB connection (Full charging time: About 7 hours)
	Wireless distance		10m (No obstacle)
Data processing portion	Sampling frequency		25.6kHz / 12.8kHz / 2.56kHz
	AD resolution		16bit
	Number of samples		32768 (maximum)
	Frequency band	Acceleration (OA, PEAK)	10-10kHz
		Speed (OA, PEAK)	10-1kHz
		Displacement (OA, PEAK)	10-150Hz
	Antialiasing filter		10kHz
	Window function		Hanning
Acceleration sensor portion	Sensitivity		2.0 mV/(m/s^2) (standard)
	Weight		145g
	Size		41×87×36 mm
	Resonance frequency		Piezo-electric sensor: 15kHz or more
	Response frequency range		10Hz to 10kHz (±3dB)
	Preamp		Differential type charge amplifier: 1mV/1pC
	Maximum measurement acceleration		500m/s^2
	Maximum permissible acceleration		500m/s^2 (Except dropping impact)
	Maximum output voltage		±2.5V

5.3 Bearing parameters and bearing vibration frequency

5.3.1 Bearing parameters

The bearing parameters which need to calculate the vibrational frequency of the bearing are rolling element pitch circle d_p (mm) of bearing, diameter D_w (mm) of rolling element, number Z (pcs) * of rolling elements, contact angle α (°) of bearing. The positions for the dimension of main bearing parameters are as follows.

*It is the number of rolling elements for each row for the double row bearings.

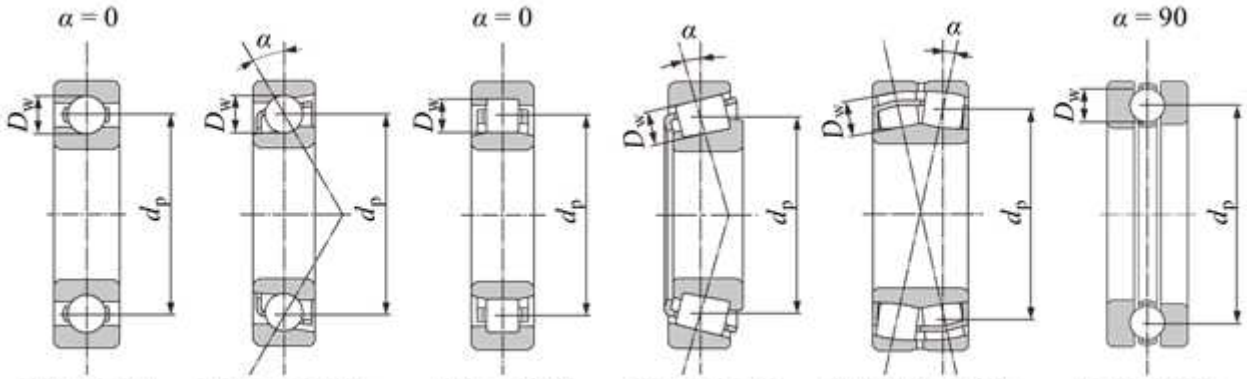


Figure 5.2 Main bearing parameters

5.3.2 Calculating formulas of bearing vibration frequency

The calculating formulas of the bearing vibration frequency are shown below. n_i is the rotational speed (min^{-1}) of inner ring.

Table 5.2 Calculating formulas of bearing vibration frequency Unit: Hz

Calculation item	Sign	Calculating formula (inner ring rotation)
Rotational speed of inner ring	f_{ri}	$f_{\mathrm{ri}} = \frac{n_{\mathrm{i}}}{60}$
Rotational speed of outer ring	f_{re}	$f_{\mathrm{re}} = 0$
Rotational speed of retainer	f_{c}	$f_{\mathrm{c}} = f_{\mathrm{ri}} \times \frac{d_{\mathrm{p}} - D_{\mathrm{w}} \cos\alpha}{2d_{\mathrm{p}}}$
Rotational speed of retainer in relation to inner ring	f_{i}	$f_{\mathrm{i}} = f_{\mathrm{ri}} \times \frac{d_{\mathrm{p}} + D_{\mathrm{w}} \cos\alpha}{2d_{\mathrm{p}}}$
Rotational speed of retainer in relation to outer ring	f_{e}	$f_{\mathrm{e}} = f_{\mathrm{c}}$
Passing frequency of rolling element in relation to inner ring, BPFI (Vibration frequency due to inner ring flaw)	Zf_{i}	$Z \times f_{\mathrm{i}}$
Passing frequency of rolling element in relation to outer ring, BPFO (Vibration frequency due to outer ring flaw)	Zf_{e}	$Z \times f_{\mathrm{e}}$
Rotation frequency of rolling element, BSF/2 (Vibration frequency due to rolling element flaw)	f_{b}	$f_{\mathrm{b}} = f_{\mathrm{ri}} \times \frac{{d_{\mathrm{p}}}^2 - {D_{\mathrm{w}}}^2 \cos^2\alpha}{2d_{\mathrm{p}}D_{\mathrm{w}}}$

*The frequency observed due to flaw on rolling element is twice the rotation frequency of rolling element.

*The bearing vibration frequency for the bearing inner ring rotation can be calculated with the bearing technological calculation tool in our homepage, excluding some bearings.

5.3.3 NTN bearing registered in application

The bearing parameters which is necessary for the abnormality judgment of the bearing are registered in the application. The bearing parts numbers (as a guide) registered in the application are as follows. When selecting the bearing to be measured, if you do not know the bearing parts number to be registered, please inquire to our company. In addition, if there is a special bearing made by our company that is not registered in the application, please inquire to our company.

Examples of bearing parts number that are registered in application

A) General radial bearings described in Ball and Roller Bearings catalog and the bore diameter number is from 00 to 40.
B) Angular contact ball bearings (except some) and cylindrical roller bearings (except some) described in Precision Rolling Bearings catalogue.
C) General rolling bearing unit described in Bearing Units catalog.
D) Old standard bearings made by our company (1212K, 5206, LH-22222B etc.)

6 Regulatory compliance information

6.1 USA – Federal Communications Commision (FCC)

FCC ID: 2AVEZHV0002
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

The changes or modifications not expressly approved by NTN Corporation could void the user's authority to operate the equipment.

6.2 Canada – Innovation, Science and Economic Development Canada (ISED)

IC: 25934-HV0002
Model: DAT-HV0002
CAN ICES-003(A)/NMB-003(A)

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:
1.This device may not cause interference.
2.This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:
1.L'appareil ne doit pas produire de brouillage
2.L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

6.3 Caution for exposure to Radio Frequency (RF) radiation

This device must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

Cet appareil doit être installé de manière à fournir une distance de séparation d'au moins 20 cm de toutes les personnes et ne doit pas être colocalisé ou fonctionner avec une autre antenne ou un autre émetteur.

7 After-sales service

7.1 NTN PORTABLE VIBROSCOPE product warranty

Warranty and free repair provision consent form

Model No.		DAT-HV0002
SSID (Attach a seal)		
Warranty period		1 year from date of purchase
Date of purchase		
Customer information	Name	
	Address	〒
	Phone number	
Distributor information	Distributor	
	Address	〒
	Phone number	

NTN Corporation

〒550-0003

1-3-17 Kyomachibori, Nishi Ward, Osaka City, Osaka Prefecture

TEL: 06 (6443) 5001 URL: http://www.ntn.co.jp

Guarantee conditions

Please contact to distributor you purchased this product for after sales service and breakdown.

NTN repairs this product for free during 1 year from date of purchase by filling in necessary information in “Warranty and free repair provision consent form” and submitting it to us if this product is breakdown by using in accordance with note such as instruction manual. If there are some blanks or inaccurate contents in “Warranty and free repair provision consent form”, it might repair for a fee or might be impossible to guarantee even during the warranty period. Please have person in charge of sales in distributor fill in distributor information and stamp shipping date from distributor at the time of purchase because customer needs to certify the date of purchase.

Please send our distributor repair product with sufficient packing and document which describes repair position. In addition, the customer needs to pay freight charge.

Free repair provision

1. NTN repairs this product for free in accordance with this provition if this product is breakdown during warranty period by using normally in accordance with instruction manual. When you request free repair, please contact to distributor you purchased this product.
2. NTN basically repairs this product for a fee even during warranty period in the following case. However, there are cases that we can not receive to repair depending on the situation, we deliver replacement instead of repair.
   A) Breakdown and damage generated due to disassembly, remodeling and by not using in accordance with note in instruction manual.
   B) Breakdown and damage generated due to relocation, transportation, drop etc. of this product after purchase.
   C) Breakdown and damage generated due to permanent installation in vehicle, machine etc.
   D) Not submit warranty or there are some blanks, inaccurate contents.
   E) Transcription of contents and wording for date of purchase, customer information, distributor information in warranty.
   F) Exchange of consumable parts and maintenance.
   G) Trouble of this product generated due to trouble except this product.
   H) Appearance defect generated due to aging such as fading of painting, and wear with use etc.
3. This warranty is valid only in Japan.
4. This warranty is not reissued. Please keep it in a safe place.
5. This warranty provides assurance free repair of this product during warranty period based on free repair provision. We receive repair for a fee after warranty period and please contact to distributor you purchased this product. However, it might be impossible to receive request for repair because it is difficult to obtain repair parts etc.

*Personal information customer filled in might be used for free repair during warranty period.

7.2 Inquiries

Please inform the following office about an inquiry and technological consultation concerning the product.

Sales Engineering Representative for technological consultation

Tokyo	Nagoya	Osaka
TEL: 03(6713)3624 FAX: 03(6713)3682	TEL: 052(222)3347 FAX: 052(222)3341	TEL: 06(6449)6715 FAX: 06(6448)7296

NTN Sales Japan Corporation

Tokyo Branch	TEL: 03(5780)7903 FAX: 03(5780)7899	〒108-0075 2-16-2 Konan, Minato Ward, Tokyo (on 24th floor of Taiyo Life Insurance Company, Shinagawa Building)
Hokkaido Branch	TEL: 011(822)8820 FAX: 011(822)8835	〒003-0809 2-2-37 Kikusuikyujo, Shiroishi Ward, Sapporo City, Hokkaido
Tohoku Branch	TEL: 022(262)6201 FAX: 022(262)6205	〒980-0014 1-12-30 Honcho, Aoba Ward, Sendai City, Miyagi Prefecture (on 7th floor of Taiyo Life Insurance Company, Sendai Station North Building)
Sagamihara Branch	TEL: 042(757)1011 FAX: 042(758)2150	〒252-0239 3-14-7 Chuo, Chuo Ward, Sagamihara City, Kanagawa Prefecture (on 2nd floor of Central Building)
Numazu Sales Office	TEL: 055(962)7573 FAX: 055(951)6427	〒410-0801 3-8-23 Otemachi, Numazu City, Shizuoka Prefecture (on 3rd floor of Nissei Star Building)
Nakanihon Branch	TEL: 052(222)3328 FAX: 052(222)3341	〒460-0003 2-3-4 Nishiki, Naka Ward, Nagoya City, Aichi Prefecture (on 11th floor of Nagoya Nishiki Front Tower)
Hamamatsu Sales Office	TEL: 053(454)2800 FAX: 053(454)2589	〒430-0928 110-5 Itayamachi, Naka Ward, Hamamatsu City, Shizuoka Prefecture (on 7th floor of Hamamatsu Daiichi Seimei Nittsu Building)
Osaka Branch	TEL: 06(6449)6706 FAX: 06(6448)7296	〒550-0003 1-3-17 Kyomachibori, Nishi Ward, Osaka City, Osaka Prefecture
Hokuriku Sales Office	TEL: 076(263)8673 FAX: 076(263)8628	〒920-0031 1-1-35 Hirooka, Kanazawa City, Ishikawa Prefecture (on Room 402 of Kanazawa 2nd Building)
Mizushima Sales Office	TEL: 086(425)6311 FAX: 086(425)6322	〒710-0057 2-4-6 Showa, Kurashiki City, Okayama Prefecture (on 3rd floor of Kurashiki Arc Square)
Hiroshima Branch	TEL: 082(568)1472 FAX: 082(568)5913	〒732-0824 1-2-19 Matobacho, Minami Ward, Hiroshima City, Hiroshima Prefecture (on 7th floor of Arbus Hiroshima)
Kyushu Branch	TEL: 092-292-3806 FAX: 092-292-3808	〒802-0003 1-2-5 Hakataekimae, Hakata Ward, Fukuoka City, Fukuoka Prefecture (on 11th floor of Kamiyohakata Building)
Kitakyushu Sales Office	TEL: 093(513)3188 FAX: 093(513)3190	〒802-0003 1-1-7 Komemachi, Kokurakita Ward, Kitakyushu City, Fukuoka Prefecture (on 7th floor of Kokuraekimae Okuda Building)

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