

# Vibration Measurement

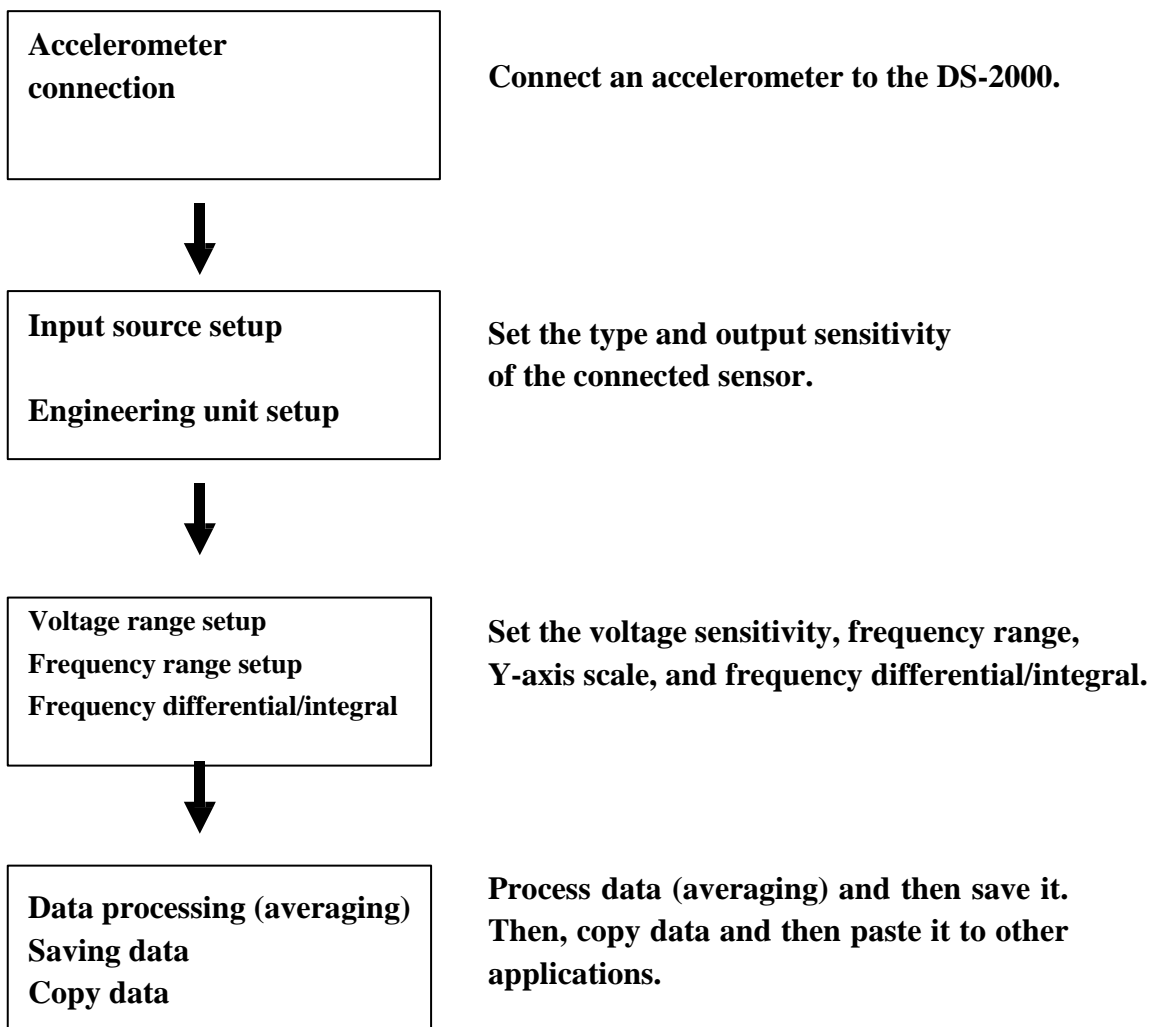


## Contents

1. Flow Chart to Measurement
2. Device Connections
3. FFT Analyzer Setup
4. Starting Measurement
5. Data Processing

## 1. Flow Chart to Measurement

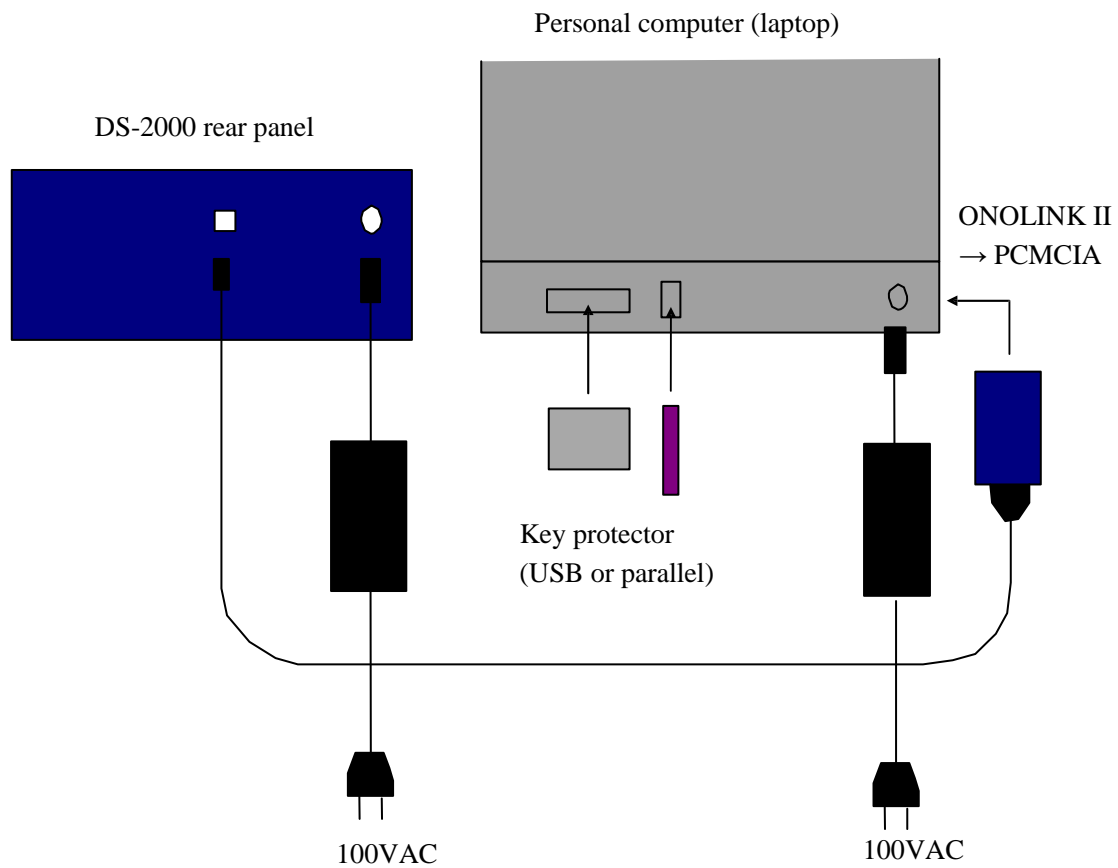
\* The following explains procedures for measuring vibration using an "accelerometer."



## 2. Device Connections

### 2-1 Device Connections

Connect the DS main unit and the PC as follows.



## 2-2 Connection with Sensor

Connect an "accelerometer" to the FFT analyzer. The accelerometer comes in two types: built-in amplifier type and charge output type. Basically, connect each sensor with the DS-2000 as follows:

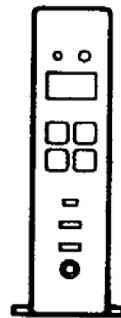
The NP-3000 series accelerometer can be directly input through a BNC conversion adapter.



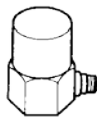
Signal input section



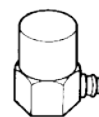
NP-0021 BNC conversion adapter



CH-1100  
Charge amplifier



NP-3000 Series  
Accelerometer



NP-2000 Series  
Accelerometer

Install the accelerometer perpendicularly to the vibration direction by closely contacting the bottom of the accelerometer and the measurement surface. Fixation by screw provides the highest frequency sensitivity. When using a magnet base, the use of silicon grease increases adhesion.

### 3. FFT Analyzer Setup

#### 3-1 Input Source Setup

Set the sensitivity, operating conditions, etc. of the sensor connected to the FFT analyzer. The following shows a case where a piezoelectric accelerometer based on the following sensitivity is used.



① → 電圧感度 (at 160Hz) 9.75 mV/ms<sup>-2</sup> : 95.6 mV/G  
 電荷感度 (at 160Hz) ——— pC/ms<sup>-2</sup> : ——— pC/G  
 静電容量\* ——— pF (1G=9.807ms<sup>-2</sup>)

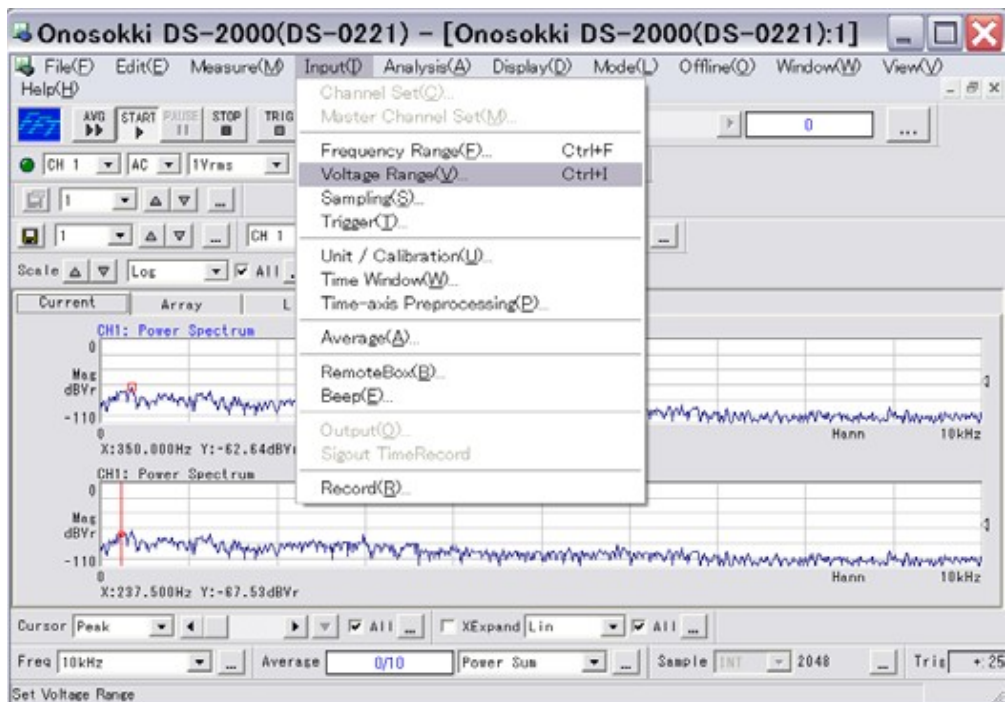
② → 駆動電流 (定電流駆動タイプ) 2.4 mA  
 備 考

検査

\*ケーブル容量を除く、但しケーブル直出し型はケーブル容量を含む。



Double-click the icon of DS-0221FFT to start the application. If a personal computer is connected with the measurement unit, the relay contact generates sound.



Select the Input menu and then select Voltage Range Set.

### 3-2 Engineering Unit Setup

Set the sensitivity of the sensor in order to directly read amplitude values using engineering unit.

Select Unit / Calibration from the Input menu.

EU	Name	Factor	Cal. Value	Offset	TEDS Info.
<input checked="" type="checkbox"/>	m/s <sup>2</sup>	0.00975	EU/V	0dB	EXEC
<input type="checkbox"/>	V	1	EU/V	0dB	EXEC
<input type="checkbox"/>	V	1	EU/V	0dB	EXEC
<input type="checkbox"/>	V	1	EU/V	0dB	EXEC
<input type="checkbox"/>	V	1			EXEC
<input type="checkbox"/>	V	1			EXEC
<input type="checkbox"/>	V	1			EXEC
<input type="checkbox"/>	V	1			EXEC

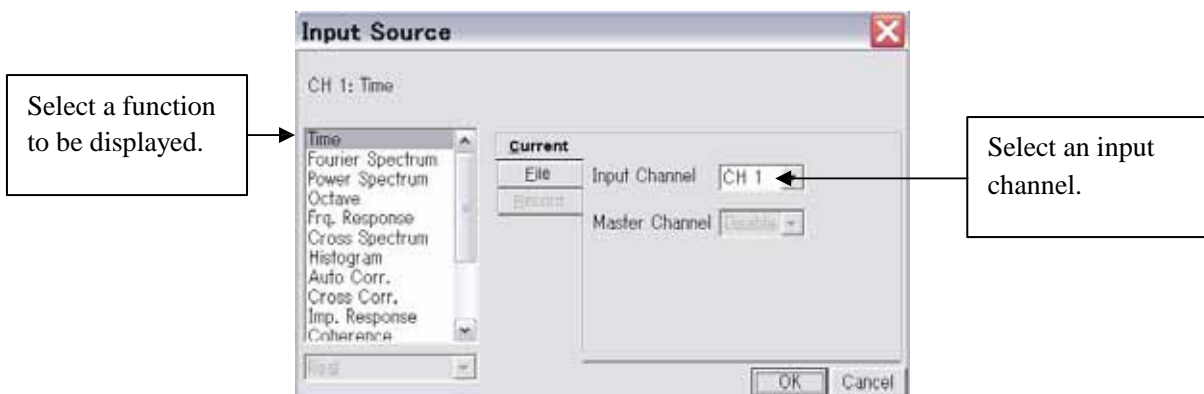
\* Numerical values and characters can be input from the keyboard. Further, clicking [...] on the right of the text box displays a pad for numerical and text input.

## 4. Starting Measurement

### 4-1 Voltage Range and Frequency Range Setup

First, observe the vibration waveform.

Since the screen displays power spectrums of CH1 and CH2 with the initial setup, select time-axis display of a channel subjected to signal input.



\* Double-click the comment area to display the Disp. Data Select dialog.  
Display the power spectrum of the input channel in the same manner.

Set the voltage sensitivity while monitoring the magnitude of the input signal. Make setting so that the waveform fits into the time-axis display screen.

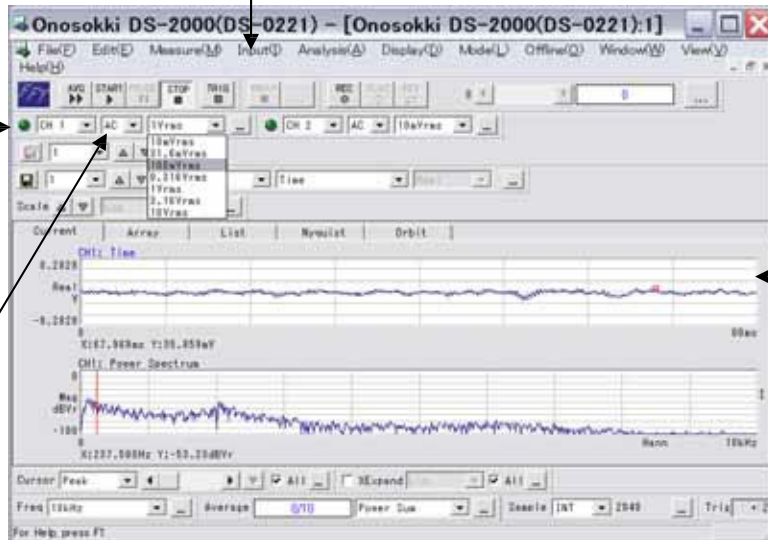
Click the Input menu and select Voltage Range (in the same manner as 3-1, "Input Source Setup) or select a button in the tool bar.

The sensitivity can also be set by selecting Voltage Range from the Input menu.

Adjust the sensitivity so that the waveform is not exceeded.

If the waveform is exceeded, an indicator lights up in red. (Normally green)

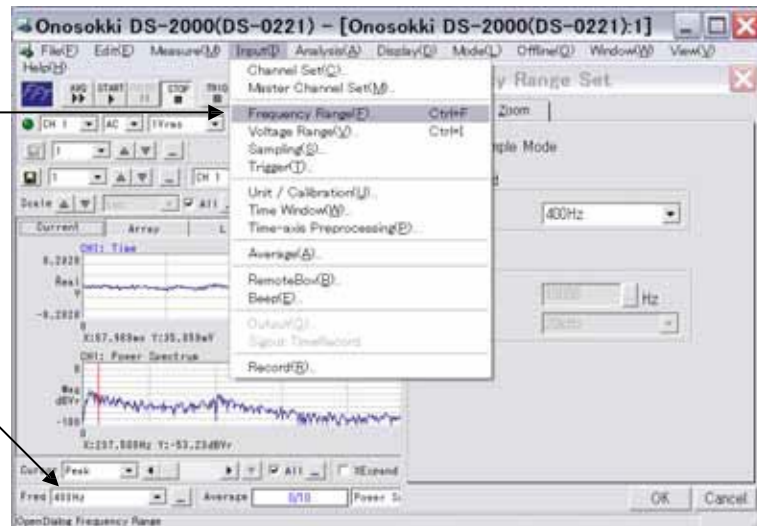
Set an input channel and voltage sensitivity in the tool bar.



Set a frequency range. Narrow down the range while monitoring the power spectrum.

Select Frequency Range from the Input menu and then set a range.

The range can also be set from the tool bar.



\* With the initial setup, the signal is sampled at 2048 points resulting in a frequency resolution of 1/800. Therefore, the narrower the frequency range, the higher becomes the frequency resolution.



## 4-2 Cursor Function

Read the frequency and the amplitude of power spectrum using the cursor function. With the initial setup, the peak search function is selected and therefore the maximum amplitude is automatically searched for. Further, change the Y-axis scale as required.

Display(D) Mode(L) Off

- Display Layout...
- Label(L)...
- Disp. Data Select(D)...
- X-Axis Set(X)...
- Y-Axis Set(Y)...
- Cursor Set(C)...**
- Graph Set(G)...

Select Cursor Set from the Display menu. To change the Y-axis scale, select Y-Axis Set.

**Cursor Conditions**

Cursor Crs.Format

Search Mode Peak

Cursor Peak

Search Search

Delta

Show Line

Enhance Function

Peak

Time Axis PEAK

Display 2Data

Delta

X Delta Diff

Y Delta Diff

Show Overall

ON

ALL OK Cancel

Select Search.

**Unit**

XUnit YUnit Phase

Data Attr Mag

Y-Axis Scaling

- Default
- Auto
- Manual

Upper 0

Lower -100

Spectrum Unit

- rms/0-P/P-P
- rms
- 0-Peak
- P-P

Y-Axis LIN/LOG

- Lin
- Log

MagdB

WV<sup>2</sup>

- V
- V<sup>2</sup>

PSD/ESD

- OFF
- PSD
- ESD

ALL OK Cancel

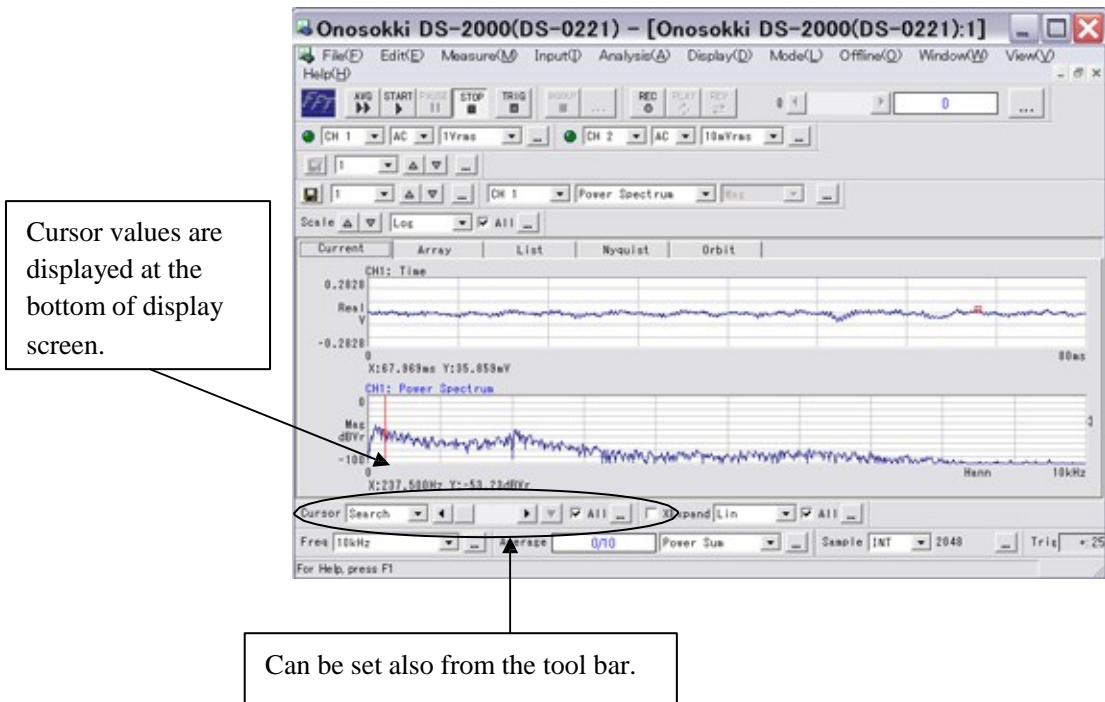
Select an option button.

- Default (initial setup)
- Auto (automatic setup)
- Manual (manual scale)

To make the same scale setting for all screens, check this box.

For Manual, set Upper and Lower limit values.

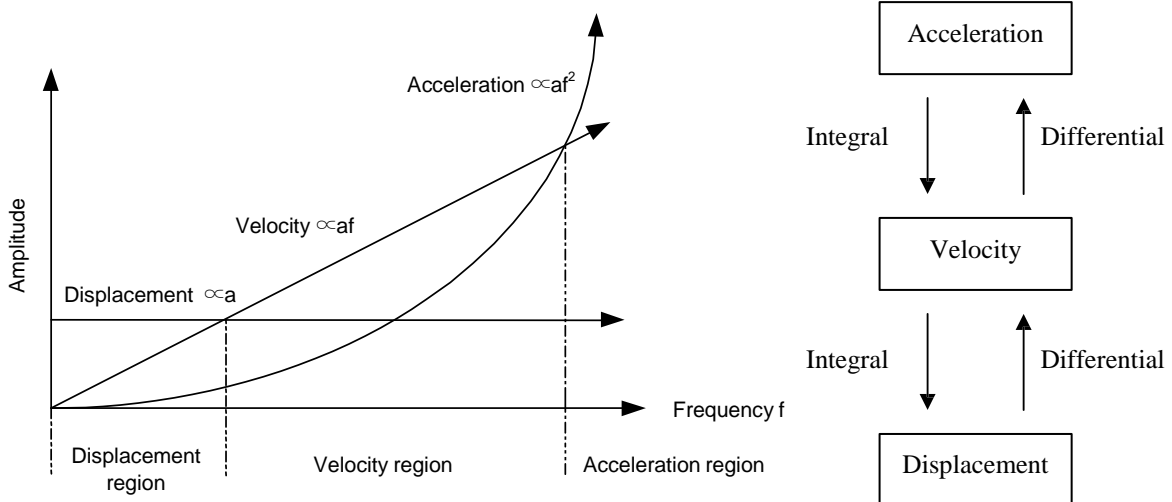
Select Lin or Log (logarithmic) scale. For vibration measurement, select Lin.



\* Menu can be easily opened by right-clicking on the screen.

### 4-3 Frequency Differential/Integral

At the time of vibration measurement, the vibration quantity is handled as acceleration, velocity, and displacement depending on the frequency to be measured. Relation between units is shown below.



\* Generally, the amplitude of the displacement, velocity, and acceleration increases at 10Hz or below, at 10Hz to 1kHz, and at 1kHz or above, respectively.

Perform frequency integral. Activate the spectrum screen, click the Analysis menu, and select Frequency jw.

Analysis(A) Display(D) Mk

- Frequency jw(j)...
- Frequency Weight(N)...
- Octave(O)...
- FRF(F)...
- Coherence(C)...
- IFFT(I)...
- Hilbert(H)...
- Lif.Spec(L)...
- Equalize(E)...
- TimeAnalyze(T)...
- ImpulseResponse(R)...
- Calculate(A)...

**Analysis**

Jw on Power Spectrum/FRF

Weighting: Jw OFF

Unit Convert

Convert

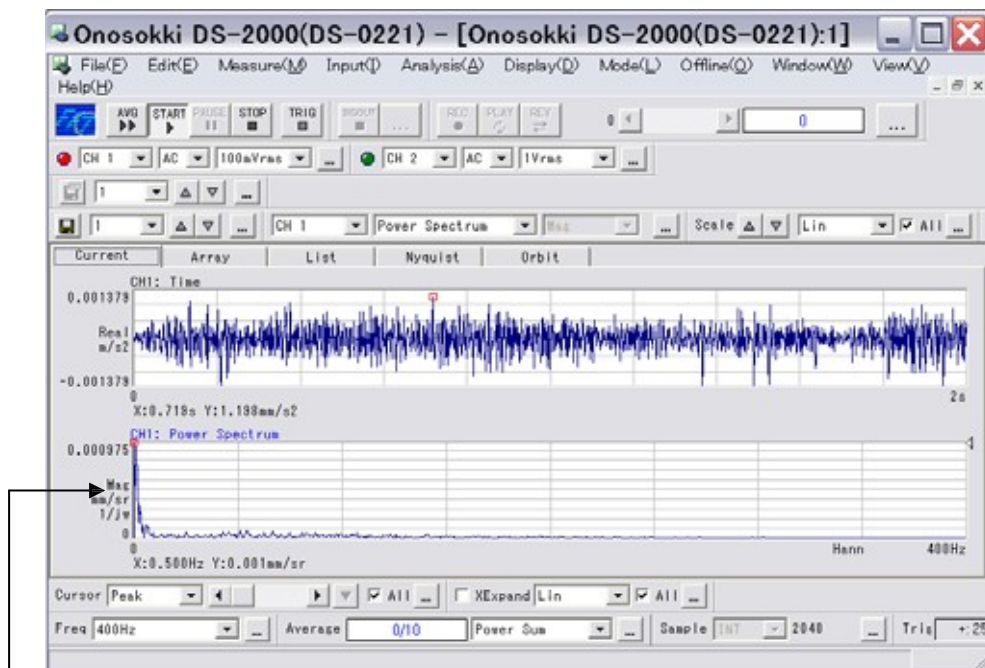
1/jw Unit: mm/s

1/jw<sup>2</sup> Unit: um

Displacement → Velocity  
 Displacement → Acceleration  
 Acceleration → Velocity  
 Acceleration → Displacement

Select an engineering unit.

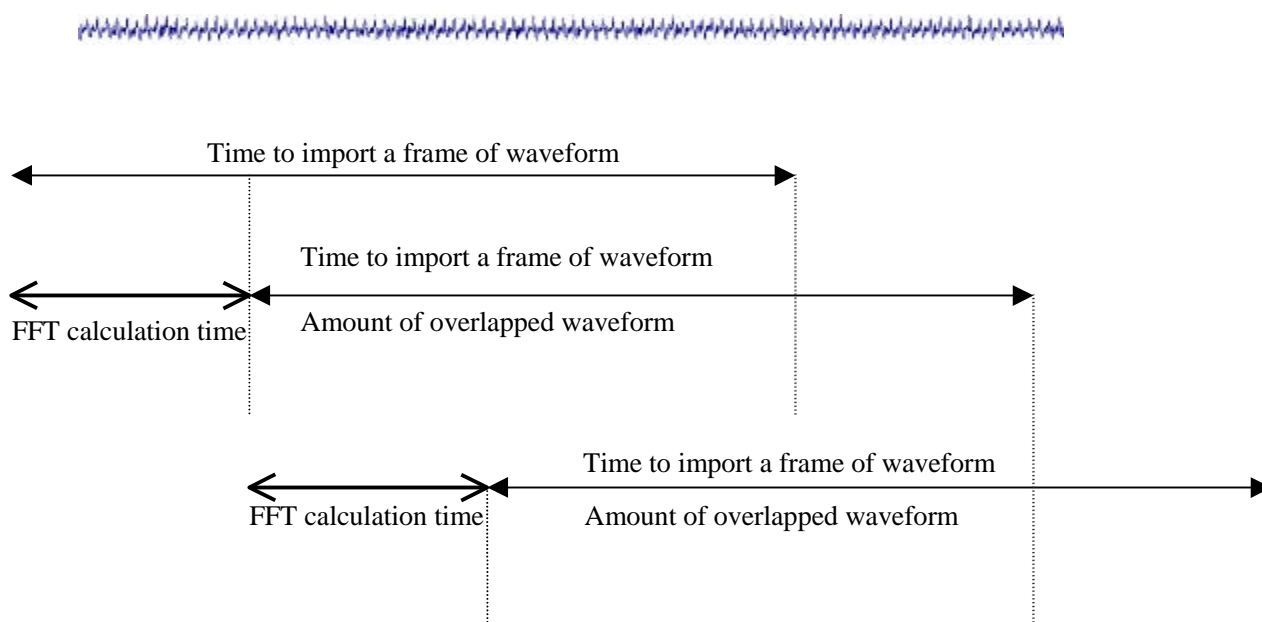
ALL



## 5. Processing and Saving Data

### 5-1 Averaging

Averaging is performed in order to improve data accuracy. Here, summation averaging of a general power spectrum is performed. At the time of averaging, it is necessary to perform overlap processing according to the frequency range. Overlap of data occurs if the signal capture time is longer than the FFT operation time. The lower the frequency range, the longer becomes the capture time and the more remarkable becomes overlap. With the DS-2000, overlap occurs except in the MAX range (40kHz) in the case of a 4-Ch system.



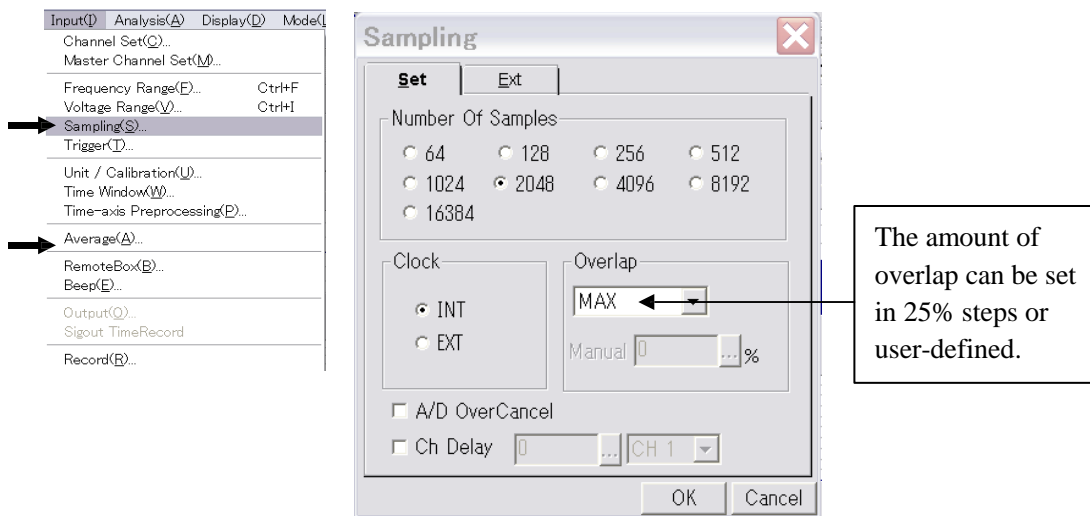
\* In the above waveform,

(  $\longleftrightarrow$  ) Sampling time that is necessary for the FFT analysis

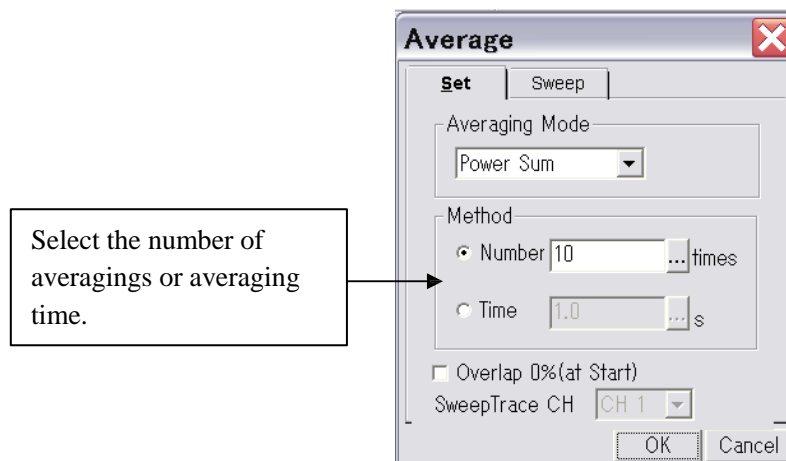
(  $\longleftrightarrow$  ) Time for a single FFT calculation

Therefore, the overlap amount is after deducting the FFT calculation time from the FFT capture time. The same data is arithmetically averaged while overlapping.

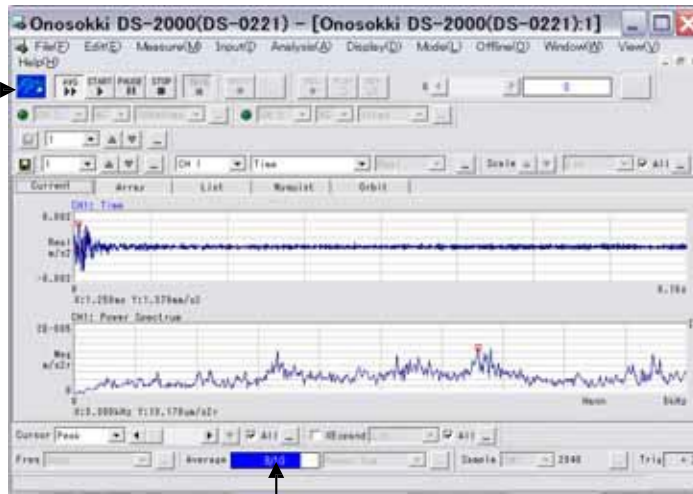
Select Sampling from the Input menu.



\* When the amount of overlap is set to 0%, new data is averaged. However, if the frequency range is very low, processing takes long time. In this case, the number of averaging can be increased or average time can be set. Select Average from the Input menu.



Perform averaging using tool buttons.



Performs summation averaging 10 times after overlap processing.

## 5-2 Saving Data

Save measurement results. All data currently displayed on the screen can be saved simultaneously, or only specified data can be saved. Procedures for saving specified data are shown below.

Select Save Data (Select) from the Input menu.

The screenshot shows the 'Save Select Data' dialog box. On the left, a portion of the 'Input' menu is visible, with 'Save Data (Select)' highlighted. The main dialog box has a title bar 'Save Select Data' and a file explorer view showing the directory 'DS021'. Below the file explorer, there is a dropdown menu for 'ファイルの種類' (File type) set to 'CFStyleDataFile (\*.dat)'. There are '保存' (Save) and 'キャンセル' (Cancel) buttons. Below these, there are buttons for 'Add...', 'Edit...', 'Delete', 'AllSame', and 'No'. A table lists the data to be saved:

Display	FileName	Comment	CH	Kind	Length
1	File1001.dat	CH1: Power Spe...	CH-1	Power Spectrum	1000

At the bottom right, there is a 'TextSave' checkbox and a 'No' button. Callouts provide instructions: 'Specify a location for saving data.' points to the file explorer; 'Specify data format (binary or text).' points to the file type dropdown; 'Press the Save button to execute.' points to the '保存' button; 'Specify the number to be set to the data.' points to the 'No' button; 'The specified data are listed.' points to the table; and 'Select the Add button to select specified data.' points to the 'Add...' button.

\* .dat denotes the binary format and .txt the text format.

\* When you click the Add button, the dialog shown at right appears.

The 'Select Save data' dialog box is shown with the following callouts:

- Select specified data.** Points to the list of analysis options, where 'Power Spectrum' is selected.
- Specify a channel in relation to data to be saved.** Points to the 'Channel' dropdown menu, which is set to 'CH 1'.
- Set a file name.** Points to the 'File Name' text input field, which contains 'File2'.
- Click OK to apply the settings.** Points to the 'OK' button at the bottom of the dialog.

### 5-3 Copy Function

Measurement data can be temporarily put in the clipboard. The data in the clipboard can be easily pasted to other applications without saving.

Select Copy Setup from the Edit menu.

The 'COPY' dialog box is shown with the following callouts:

- Select Bitmap or Text using the option buttons.** Points to the radio button options for 'Bitmap' and 'Text', where 'Text' is selected.
- Click OK to apply the settings.** Points to the 'OK' button at the bottom of the dialog.

Additional details visible in the dialog include:

- Condition:** A checked 'ON/OFF' checkbox and a 'DS-Format' dropdown menu.
- Data:** Radio button options for 'OFF', 'X-Axis Only', 'Y-Axis Only', and 'XY-Axis', with 'XY-Axis' selected.

After determining the data format with Copy Setup, select Copy from the Edit menu.

CAUTION:

1. The copyright of this procedure manual is reserved by Ono Sokki Co., Ltd.
2. Duplication without prior permission is prohibited.
3. This procedure manual explains general measurement procedures. Ono Sokki assumes no responsibility for data obtained through a specific operation performed by the customer.