EN

E-CON3 Application

for ClassPad II
fx-CG500

User's Guide

CASIO Education website URL

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CASIO®

Using the E-CON3 Application

The E-CON3 application makes it possible for you to control a Data Logger from a connected calculator. It allows you to perform the following operations from the calculator unit.

- Configuring Data Logger sampling parameters
- Starting and ending a Data Logger sampling operation
- Saving sample data
- Analysis and graphing of sample data

Important!

- All explanations in this section assume that you are fully familiar with all calculator and Data Logger (CMA CLAB* or CASIO EA-200) precautions, terminology, and operational procedures.
- The E-CON3 application is designed to get the most out of the measurement functions of the CASIO EA-200 Data Logger. Though it can run on a CMA CLAB Data Logger, CLAB does not have a SONIC port, microphone, or speaker as is equipped on the EA-200. While a calculator is connected to a CLAB Data Logger, attempting to configure E-CON3 application settings and perform measurement using parameters that are not supported by CLAB will cause an error.

* For information about CMA and the CLAB Data Logger, visit http://cma-science.nl/.

Contents

1 E-CON3 Application Overview

This chapter describes the configuration of the E-CON3 application screen, and provides basic information about its menus and commands.

Starting Up the E-CON3 Application

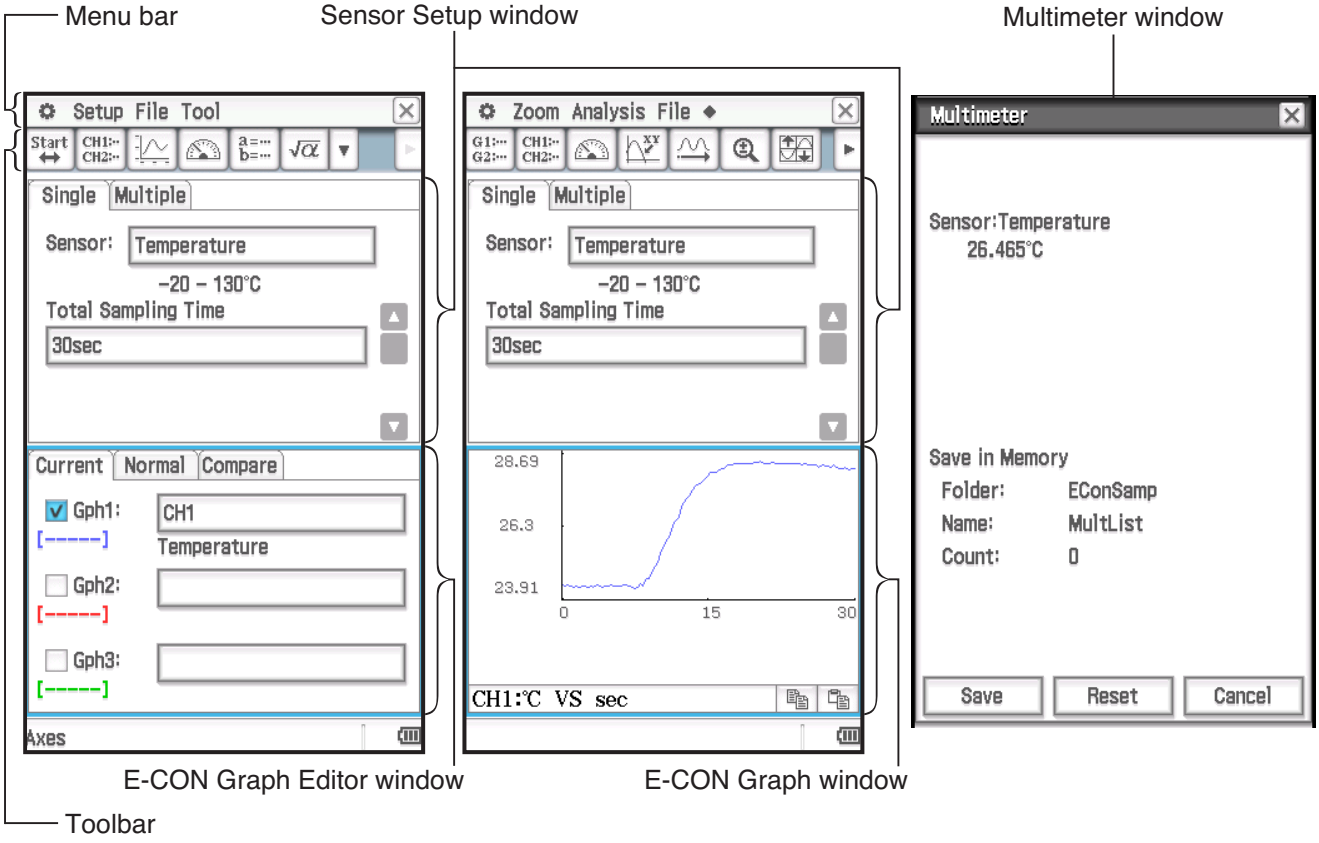
• Calculator Operation

(1) Tap Menu on the icon panel to display the application menu. Next, swipe the screen to the left to display page two of the application menu.

(2) Tap E-CON3.
This starts up the E-CON3 application and displays a Sensor Setup window.

E-CON3 Application Windows

The E-CON3 application has three windows: a Sensor Setup window, an E-CON Graph Editor window, and an E-CON Graph window. Only the Sensor Setup window is visible when you start up the E-CON3 application. You can have any two of the three windows (Sensor Setup, E-CON Graph Editor, E-CON Graph) displayed at the same time.
In addition to the three windows described above, there is also a Multimeter window, which appears on the screen during certain operations.



■ Sensor Setup Window

This window is for selecting a sensor for each of the Data Logger channels to be used for sampling, and for configuring sampling parameters. The Sensor Setup window has two tabs.

Use this tab:	When you want to do this:
Single	Configure sampling parameters for a single probe
Multiple	Configure parameters for simultaneous sampling with up to three probes

■ E-CON Graph Editor Window

This window displays the “current data”, which is data that is stored temporarily for each channel following a sampling operation. The E-CON Graph Editor window has three tabs.

Use this tab:	When you want to do this:
Current	View current data
Normal	Recall saved sample data without losing the current data
Compare	

You can configure separate graph settings for each of the above tabs. After selecting one of the tabs, you can then change to the E-CON Graph window and graph its data.

■ E-CON Graph Window

The E-CON Graph window graphs sampled data in accordance with the settings configured with the E-CON Graph Editor window. You can use the E-CON Graph window to analyze a graph be zooming it, by performing Fourier series expansion, by obtaining a periodic frequency, and more. You can also save the data for a specific range of the graph as list data or matrix data.

■ Multimeter Window

The Multimeter window provides real-time display of all channel measurement values during sampling. Displaying this window while the [Single] tab is active on the Sensor Setup window displays the measurement values of the CH1 or SONIC channel.
When the [Multiple] tab is active, this window shows individual values for all channels that are being used for sampling.

E-CON3 Application Menus and Buttons

This section provides an overview of E-CON3 application menu commands and toolbar buttons.

■ Menu Commands and Toolbar Buttons Common to All Windows

Menu/Command			Button	Functions
⚙	Variable Manager			See the section about the ⚙ Menu in the calculator User's Guide.
	View Window		—	
	Basic Format		—	
	Graph Format		—	
	Geometry Format		—	
	Advanced Format		—	
	Financial Format		—	
	Default Setup		—	
	Keyboard		—	
	Window	Sensor Setup		Makes the Sensor Setup window active.
		E-CON Graph Editor		Makes the E-CON Graph Editor window active.
		E-CON Graph		Makes the E-CON Graph window active.
		Graph Editor		Displays the calculator Graph Editor window. For details, see the section about the Graph & Table application in the calculator User's Guide.
		Graph		Displays the calculator Graph window. For details, see the section about the Graph & Table application in the calculator User's Guide.
		Stat Editor		Displays the calculator Stat Editor window. For details, see the section about the Statistics application in the calculator User's Guide.
		Main		Displays the calculator Main application work area window. For details, see the section about the Main application in the calculator User's Guide.
	Close		—	Closes the currently active window. Note, however, that this command does not close the Sensor Setup window.
—				Displays the Multimeter window.

Tip

- The button for the currently active window is not displayed on the toolbar. If the Sensor Setup window is active, for example, the button is not on the toolbar.

■ Sensor Setup Window Menus

Menu/Command			Functions
Setup			Displays the [Sample] tab of the Setup dialog box. The Setup dialog box has a [Sample] tab for advanced sampling parameters, a [Trigger] tab for advanced trigger parameters, and a [Graph] tab for graph settings.
File	Open Setup Memory		Recalls saved settings to the Sensor Setup window.
	Save Setup Memory		Saves the settings on the Sensor Setup window under a file name for later recall. Saved data includes [Single] tab and [Multiple] tab sensor selections, Setup dialog box parameter settings, and E-CON Graph Editor window settings.
Tool	Custom Probe	New Custom Probe	Displays a dialog box for configuring a new custom probe.
		Edit Custom Probe	Displays a dialog box for editing the settings of an existing custom probe.
		Edit CMA Sensor	Displays a dialog box for creating a new custom probe based on the settings of a CMA sensor.
		Edit Vernier Sensor	Displays a dialog box for creating a new custom probe based on the settings of a Vernier sensor.
	Clear All		Returns the sensor selections on the [Single] tab and [Multiple] tab, and all the settings on the Setup dialog box and E-CON Graph window to their initial defaults.
	Version		Displays the version dialog box.

■ E-CON Graph Editor Window Menus

Menu/Command		Functions
Setup		Displays the [Graph] tab of the Setup dialog box. Only [Graph] tab settings can be configured when you open the Setup dialog box from this menu.
File	Open Setup Memory	Recalls saved settings to the Sensor Setup window.
	Save Setup Memory	Saves the settings on the Sensor Setup window under a file name for later recall. Saved data includes [Single] tab and [Multiple] tab sensor selections, Setup dialog box parameter settings, and E-CON Graph Editor window settings.
Tool	Clear All	Returns the sensor selections on the [Single] tab and [Multiple] tab, and all the settings on the Setup dialog box and E-CON Graph window to their initial defaults.
	Version	Displays the version dialog box.

■ E-CON Graph Window Menus and Buttons

Menu/Command		Button	Functions
Zoom	All Zoom		Zooms all currently displayed graphs.
	Auto	—	Resizes the y-axis so the entire graph fits in the screen. The x-axis is adjusted automatically in accordance with the number of samples.
	y Auto		Resizes the graph so all of it fits in the screen along the y-axis, without changing the x-axis.
	Full	—	Resizes the graph so all of it fits in the screen.
	Original	—	Resizes the y-axis in accordance with the sampling range of the sensor being used for sampling, and resizes the x-axis to a size that allows display of all data on the same screen.
Analysis	Trace		Displays a cross-shaped trace cursor. The cursor keys can be used to move the trace cursor along the graph and obtain coordinate readings.
	Period		Calculates the periodic frequency for a range specified on a graph.
	Fourier	—	Uses Fourier series expansion to convert a displayed waveform graph to a function.
File	Save List	All	Stores all of the sample data of the currently displayed graph as list data.
		Select	Stores the sample data in the range selected on the currently displayed graph as list data.
	Save Matrix	All	Displays all sample data as matrix data.
		Select	Displays the currently selected range of sample data as matrix data.

■ E-CON Graph Window Menus and Buttons (Continued)

Menu/Command		Functions
◆	Open Picture	Saves the currently displayed graph as a graphic image (Save Picture). You can recall a saved graph image and overlay it on another graph to compare them (Open Picture). You can clear background image (Clear Picture). You can adjust the lightness of the background image (Fade I/O). For details, see the section about the Graph & Table application in the calculator User's Guide.
	Save Picture	
	Clear Picture	
	Fade I/O	
	1Move	Starts a process for moving one of the multiple graphs on the display.
	1Zoom	Starts a process for zooming one of the multiple graphs on the display.
	Speaker Output	Outputs a specific range of the displayed graph through the speaker.
	Change Axes	When drawing multiple graphs, selecting this command changes the currently displayed source data name and axes to those of the next graph.
	Change Unit	Changes the unit of the axes that are displayed when the E-CON Axes item on the [Graph] tab of the Setup dialog box is turned on.
	Cls	Clears the analysis element (for example: trace pointer).

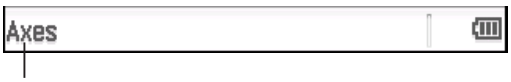
E-CON3 Application Status Bar

The following shows how the status bar appears for each of the E-CON3 application windows.

■ Sensor Setup Window Status Bar

This item shows the currently selected sampling mode (Normal, Real-Time, Fast, Extended, or Period). For more information, see “Modes” on page 3-3.

■ E-CON Graph Editor Window Status Bar



This item shows “Axes” when the E-CON Axes option is turned on, and nothing when E-CON Axes is turned off. For details about the E-CON Axes option, see “Configuring Graph Window Options” on page 3-11.

■ E-CON Graph Window Status Bar

- As with calculator applications, tapping anywhere on the E-CON graph screen with the stylus displays the coordinates of the tapped location in the status bar.
- As operations are performed on the graph screen, the status bar also displays guidance about the next operation.

2 Basic Steps for Configuring Sampling Parameters

This chapter explains the basic operations you need to perform when configuring Data Logger sampling parameters from the E-CON3 application. Before performing any of the procedures in this chapter, be sure to connect the Data Logger to your calculator.

Configuring Parameters for Sampling with a Single Sensor

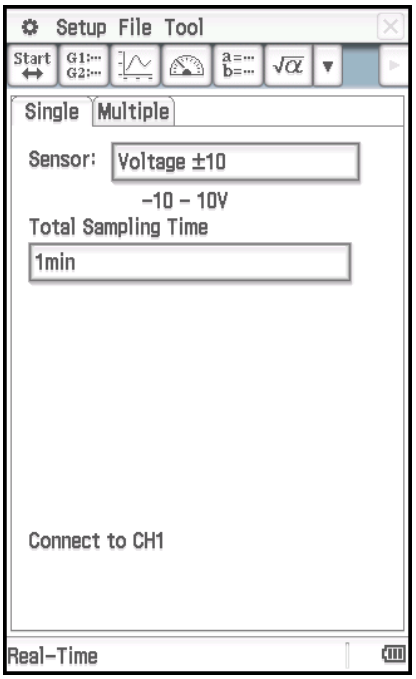
Use the [Single] tab of the Sensor Setup window to configure the parameters for a single sensor.

- The procedure for configuring sampling settings on the [Single] tab is similar to a Windows Setup Wizard. As you select a sensor and input setting values on the [Single] tab, settings are adjusted automatically in order to make it possible to perform sampling properly. Even if you are configuring settings for a single sensor, you should use the [Multiple] tab when you want to configure all of the detailed settings yourself.

● To configure parameters for sampling with a single sensor

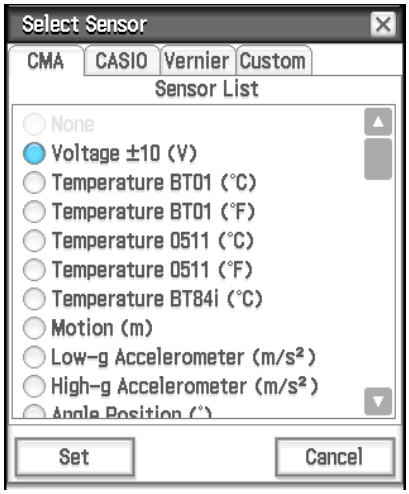
(1) Start up the E-CON3 application.

- This displays the [Single] tab of the Sensor Setup window.
- If the E-CON3 application is already running and another window (besides the Sensor Setup window) is displayed, tap CH1: CH2: to change to the Sensor Setup window.



(2) Tap the [Sensor] box.

- This displays a Select Sensor dialog box like the one shown to the right.

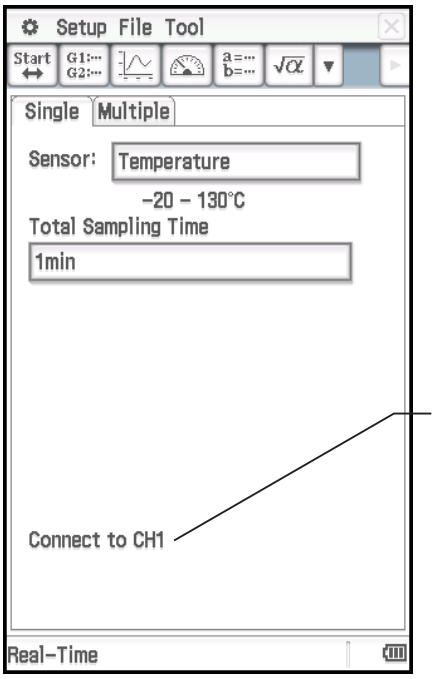


(3) Select the sensor you will use for sampling.

- Tap one of the tabs ([CMA], [CASIO], [Vernier], [Custom]), and then tap the option button next to the name of the sensor you want to select. For details about each of the selectable sensors, see the “10 Sensor List”.
- Tapping the [Custom] tab displays a sheet for configuring the parameters of a user-defined custom probe. For more information, see “Using a Custom Probe” on page 3-12.

(4) After selecting a sensor, tap [Set].

- This closes the Select Sensor dialog box. The Sensor Setup window now shows the name of the sensor you selected, along with boxes for the sample range and total elapsed sampling time (Total Sampling Time).
- The example screen below shows what would appear if when the CASIO Temperature (°C) sensor is selected.



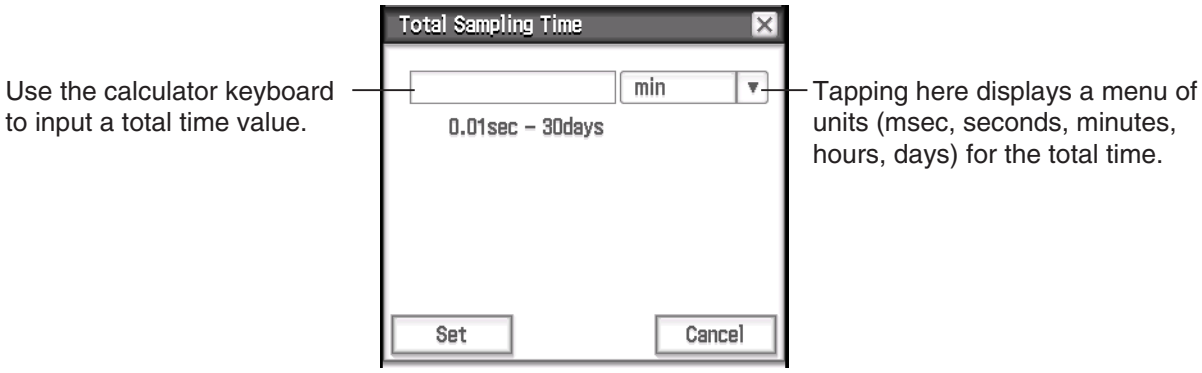
- Selecting some sensors will cause different parameters from those shown above to appear. The following table explains you should go for more information about such these sensors.

For this type of sensor:	Go here for more details:
[CASIO] tab, [Microphone-FFT]	See “Microphone-FFT Parameters” on page 2-4 for more information.
[CMA] tab, [Photogate] or [Photogate (Pulley)]	See “Photogate Sensor Parameters” on page 2-5 for more information.
[Vernier] tab, [Photogate] or [Photogate (Pulley)]	

- The [Setup] menu is unavailable while [Speaker (Sample Data)] is selected on the [CASIO] tab of the Select Sensor dialog box.
- When [Speaker ($y = f(x)$)] is selected on the [CASIO] tab of the Select Sensor dialog box, sampling is not performed by a sensor. Instead, the sound of the waveform of a function input on the calculator is output from the EA-200’s speaker. See “6 Outputting a Function to the Speaker” for more information.

(5) Tap the [Total Sampling Time] box.

- This displays the Total Sampling Time dialog box.



- If you specify a total sampling time value in the range of 10 seconds to 1 day, starting the sampling operation will automatically enter the Real-Time mode and perform real-time graphing during sampling.

(6) To apply the current settings on the Total Sampling Time dialog box, tap [Set].

- This closes the Total Sampling Time dialog box, and displays the recalculated total sampling time in the Total Sampling Time box on the Sensor Setup window. See the “Tip” on the next page for information about how recalculation is performed.

(7) At this point you could configure advanced setup parameters, if you want.

- See “3 Setup” for more information.

(8) You can start sampling immediately or you can save the setup in memory for later recall.

- To start sampling immediately, tap Start. For more information, see “5 Executing a Sampling Operation”.
- To store the setup in memory, tap [File] on the menu bar, and then tap [Save Setup Memory]. See “4 Using Setup Memory” for more information.

Tip

- When you use the above procedure to configure sampling parameters for a single sensor, the sampling mode is selected automatically in accordance with the specified total sampling time. In this case, the parameters of the Setup dialog box's [Sample] tab and [Trigger] tab are also configured automatically. The current sampling mode is indicated in the status bar.
  For information about the mode indication in the status bar, see "E-CON3 Application Status Bar" on page 1-7. For information about the Setup dialog box's [Sample] tab and [Trigger] tab, see "3 Setup".
- Tapping [Set] on the Total Sampling Time dialog box automatically configures the sampling interval in accordance with the total sampling time that you input on the dialog box. The number of samples value is calculate and rounded to the nearest integer. The number of samples integer value is used to recalculate the total sampling time ({Number of Samples} × {Sampling Interval}), and displays the result in the Total Sampling Time box on the Sensor Setup window. All of this means that the value you input on the Total Sampling Time dialog box may not necessarily the value that appears on the Sensor Setup window.

■ Microphone-FFT Parameters (EA-200 only)

The [CASIO] - [Microphone-FFT] sensor option selects the EA-200's built-in microphone for sampling sound.
In step (3) of the procedure under "To configure parameters for sampling with a single sensor" on page 2-1, select [Microphone-FFT] on the [CASIO] tab for the sensor. This causes the parameters described below to appear on the Sensor Setup window that appears in step (4).

Parameter	Initial Default	Description
Frequency Pitch	10	Specify the step in Hertz that should be used for sampling.
Frequency Max	4000	Specify the maximum frequency for sampling (minimum is always 0 Hz).

Tip

- The menu bar's [Setup] button is unavailable while [Microphone-FFT] is selected.

■ Photogate Sensor Parameters

Connection of a CMA or Vernier Photogate to the Data Logger requires configuration of parameters that are different from those for other types of sensors.

• To configure a setup for Photogate alone

In step (3) of the procedure under “To configure parameters for sampling with a single sensor” on page 2-1, select [Photogate] on the [CMA] or [Vernier] tab for the sensor. This causes the parameters described below to appear on the Sensor Setup window that appears in step (4).

Parameter		Initial Default	Description
(Channel)		CMA: CH1 Vernier: SONIC	CH1: Select this option when the Photogate sensor is connected to CH1. SONIC: Select this option when the Photogate sensor is connected to SONIC. (Not available on the CMA Photogate)
Gate Status		Open-Open	Open-Open: Timing starts when the gate opens, and continues until it closes and then opens again. Open-Close: Timing starts when the gate opens, and continues until it closes. Close-Open: Timing starts when the gate closes, and continues until it opens. Close-Close: Timing starts when the gate closes, continues until it opens, and then closes again.
Number of Samples		10	Input an integer in the range of 1 to 1000 to specify the number of samples.
Save List Data	Folder	EConSamp	Specify the variable folder for storage of interval data and count data.
	Interval	Interval	Input a variable name up to eight characters long for storage of interval data.
	Count	Count	Input a variable name up to eight characters long for storage of count data.

• To configure a setup for Photogate and Smart Pulley

In step (3) of the procedure under “To configure parameters for sampling with a single sensor” on page 2-1, select [Photogate (Pulley)] on the [CMA] or [Vernier] tab for the sensor. This causes the parameters described below to appear on the Sensor Setup window that appears in step (4).

Parameter		Initial Default	Description
(Channel)		CMA: CH1 Vernier: SONIC	CH1: Select this option when the Photogate (Pulley) sensor is connected to CH1. SONIC: Select this option when the Photogate (Pulley) sensor is connected to SONIC. (Not available on the CMA Photogate (Pulley))
Distance		1m	Input a value in the range of 0.1 to 4 to specify the distance in meters.
Save List Data	Folder	EConSamp	Specify the variable folder for storage of time, distance, velocity, and acceleration data.
	Time	Time	Input a variable name up to eight characters long for storage of time data.
	Distance	Distanc	Input a variable name up to eight characters long for storage of distance data.
	Velocity	Velocity	Input a variable name up to eight characters long for storage of velocity data.
	Accel	Accel	Input a variable name up to eight characters long for storage of acceleration data.

Tip

- The menu bar’s [Setup] button is unavailable while [Photogate] or [Photogate (Pulley)] is selected.

Configuring Parameters for Sampling with Multiple Sensors

Use the [Multiple] tab to configure parameters for simultaneous sampling with multiple sensors. The [Multiple] tab lets you select up to three channels for sampling, from among the Data Logger's CH1, CH2, CH3, and SONIC* channels.
* EA-200 only

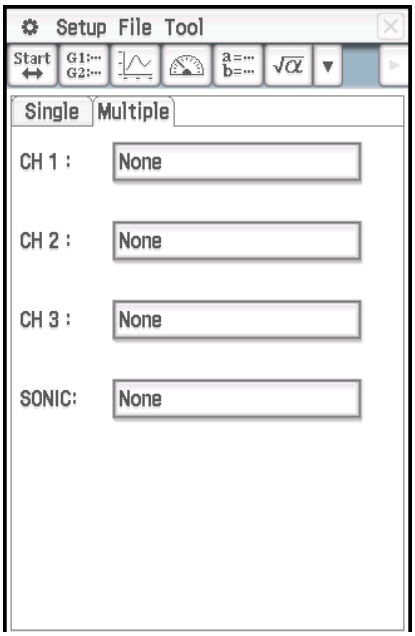
• To configure parameters for sampling with multiple sensors

(1) Start up the E-CON3 application.

- This displays the [Single] tab of the Sensor Setup window.
- If the E-CON3 application is already running and another window (besides the Sensor Setup window) is displayed, tap CH1: CH2: to change to the Sensor Setup window.

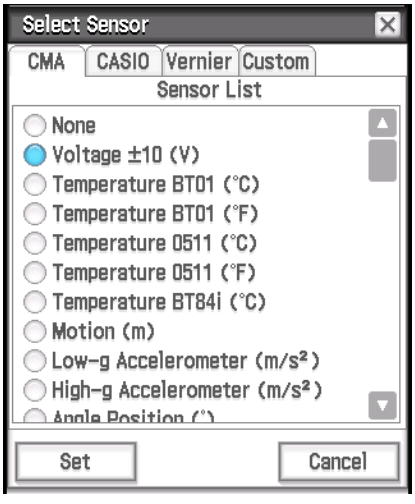
(2) Tap the [Multiple] tab.

- This displays the [Multiple] tab, which appears as shown to the right.



(3) Tap inside the box of one of the sensors you want to select ([CH1], [CH2], [CH3], [SONIC]).

- This causes a Select Sensor dialog box like the one shown to the right to appear. The dialog box shown here is for CH1, CH2, and CH3.



(4) Select the sensors you will use for sampling.

- Depending on the sensors you have connected to each channel, select the [CMA], [CASIO], [Vernier], or [Custom] tab and then tap the option button for the applicable sensor name. For details about the sensors that can be selected for each channel, see the “10 Sensor List”.
- Tapping the [Custom] tab displays a sheet for configuring the parameters of a user-defined custom probe. For more information, see “Using a Custom Probe” on page 3-12.
- If you do not want to use a particular channel for sampling, select the [None] option on the Select Sensor dialog box.

(5) After selecting a sensor, tap [Set].

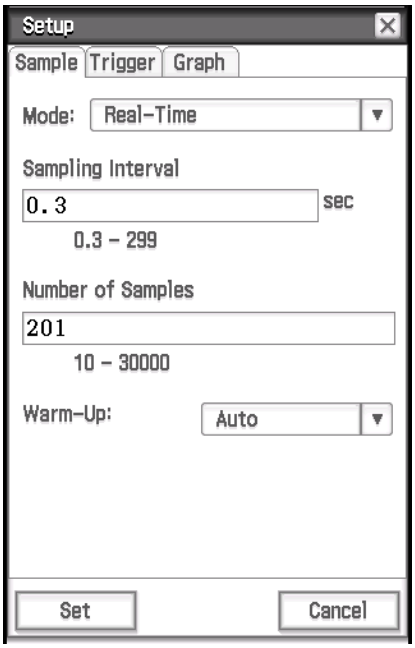
- This closes the Select Sensor dialog box and displays the [Multiple] tab again (step (2)), with the name of the sensor you selected next to the channel name.

(6) Repeat steps (3) through (5) for all of the channels you want to use for sampling.

- You can select sensors for up to three channels at one time.
- If you select sensors for four channels, an error occurs when you start sampling. To correct the problem, display the Select Sensor dialog box for one of the channels, and then select the [None] option button to deselect it.

(7) On the menu bar, tap [Setup].

- This displays the [Sample] tab of the Setup dialog box.



(8) Use the [Mode] box to select the mode you want.

- For more information about modes, see “Modes” on page 3-3.
- This causes the applicable parameters for the mode to appear on the [Sample] and [Trigger] tabs of the Setup dialog box.

(9) Use the [Sample] and [Trigger] tabs of the Setup dialog box to configure the required parameters.

- For details about the required parameters in each mode, see “Mode Parameters” on page 3-5.

(10) To apply the current settings on the Setup dialog box, tap [Set].

- This closes the Setup dialog box.

(11) You can start sampling immediately or you can save the setup in memory for later recall.

- To start sampling immediately, tap Start.
  See “5 Executing a Sampling Operation” for more information.
- To store the setup in memory, tap [File] on the menu bar, and then tap [Save Setup Memory]. See “4 Using Setup Memory” for more information.

3 Setup

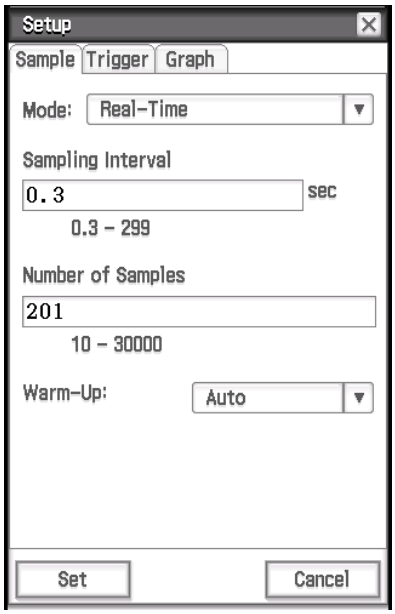
This chapter explains the various parameters you can configure with the Setup dialog box.

Important!

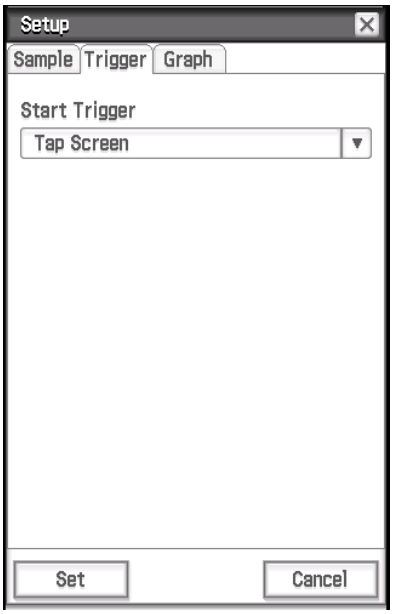
- Configuring advanced setup parameters is optional in the case of single-sensor sampling. See “To configure advanced parameters for a single sensor” on page 3-2.
- With multiple-sensor sampling, advanced setup parameters are part of the normal configuration procedure. See steps (7) through (10) under “To configure parameters for sampling with multiple sensors” on page 2-7.

Setup Overview

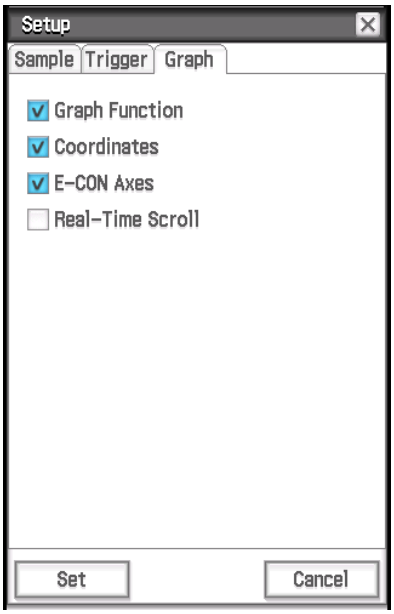
Tapping [Setup] on the Sensor Setup window menu bar displays the Setup dialog box. The Setup dialog box has the three tabs shown below.



[Sample] Tab



[Trigger] Tab



[Graph] Tab

The following describes each of the tabs in detail.

[Sample] Tab and [Trigger] Tab

These tabs let you configure advanced parameters for the tab ([Single] or [Multiple]) that is currently open on the Sensor Setup window. The [Sample] tab has parameters that control how sampling is performed, while the [Trigger] tab has parameters that control the event that triggers sampling. See “Configuring Advanced Sampling Parameters” on page 3-2 for more information.

[Graph] Tab

This tab is for selecting options that control how sampled data is graphed. See “Configuring Graph Window Options” on page 3-11 for more information.

Configuring Advanced Sampling Parameters

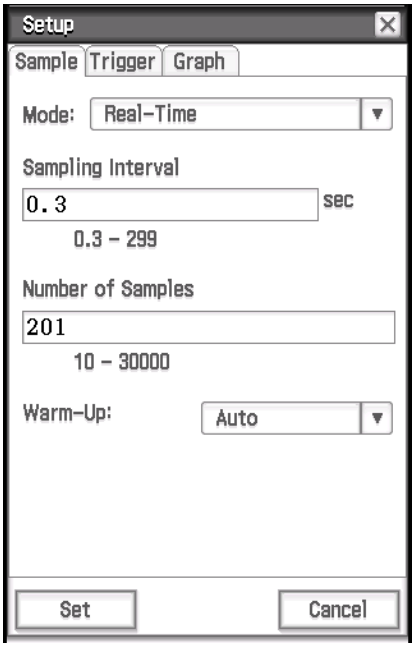
This section explains how to configure advanced sampling parameters on the [Sample] and [Trigger] tabs of the Setup dialog box.

• To configure advanced parameters for a single sensor

(1) Perform steps (1) through (6) under “To configure parameters for sampling with a single sensor” on page 2-1.

(2) On the menu bar, tap [Setup].

- This displays the [Sample] tab of the Setup dialog box.



- The initial [Mode] setting is the mode that matches the sensor that was selected on the [Single] tab.

(3) Use the [Mode] box to select the mode you want.

- For more information about modes, see “Modes” on page 3-3.
- Selecting a mode causes the applicable parameters to appear on the [Sample] and [Trigger] tabs.

(4) Use the [Sample] and [Trigger] tabs of the Setup dialog box to configure the required parameters.

- For details about the required parameters in each mode, see “Mode Parameters” on page 3-5.

(5) After everything is the way you want, tap [Set].

- This applies your settings and closes the Setup dialog box.

(6) You can now start sampling immediately or you can save the setup in memory for later recall.

- To start sampling immediately, tap Start.
  See “5 Executing a Sampling Operation” for more information.
- To store the setup in memory, tap [File] on the menu bar, and then tap [Save Setup Memory]. See “4 Using Setup Memory” for more information.

Modes

The [Mode] box at the top of the [Sample] tab of the Setup dialog box controls the current mode setting.
There is a selection of five modes, depending on the type of data being sampled and the sampling method: Normal, Real-Time, Fast, Extended, and Period. The Normal, Real-Time, Fast, and Extended modes are normally available, while the Period mode is available in special cases only.

■ Normal Mode

This general-purpose mode can be used for a wide range of sampling applications. The Normal Mode is used for relatively short sampling. When the Normal Mode is selected, you need to specify the sampling interval, the number of samples, and the timing of the start trigger.

■ Real-Time Mode

Basically, the Real-Time Mode is the same as the Normal Mode, except that it produces a real-time graph of data as it is sampled. Use this mode when you need to graphically monitor changes in sampled values as they are being sampled.

■ Fast Mode

Use this mode when sampling a sound waveform or when other very fast sampling is required. This mode can be selected only when CH1 or MIC is being used for sampling. This mode is selected automatically whenever sampling is performed using the microphone. In this mode, the sampling interval can be set to a very short interval in the range of 20 μsec to 500 μsec.

■ Extended Mode

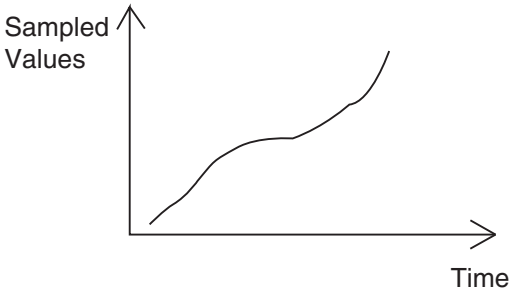
The Extended Mode is the opposite of the Fast Mode in that it allows setting of a long sampling interval. In this mode, the sampling interval can be set in a range of 5 to 240 minutes. This mode is best for sampling data like temperature or humidity over a long period. While performing measurements with the Extended mode, the Data Logger will enter a power off sleep state while standing by.

Note

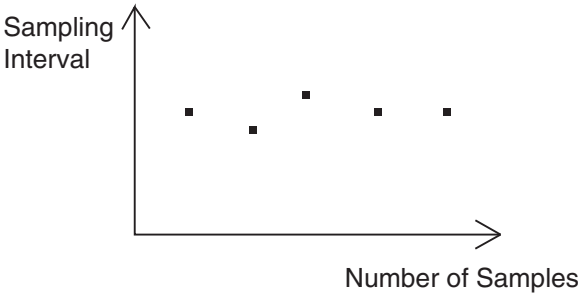
- If you plan to use CLAB for long term measurement, it is recommended that you connect it to a power outlet using the USB power adapter or to a computer using the USB cable (which will supply power to CLAB from your computer) before starting measurement.

■ Period Mode

The Period Mode is for sampling data that changes periodically. Samples recorded by the Period Mode differ from the samples recorded in other modes as shown below.



Other Modes



Period Mode

Unlike the other modes that record time and sampled values, the Period Mode records the number of samples (1st sample, 2nd sample, and so on) and the intervals between samples. For details, see “Period Mode Parameters” on page 3-7.

Tip

- If you display the Setup dialog box from the [Multiple] tab of the Sensor Setup window, the [Mode] box will allow selection of the Normal, Real-Time, or Extended mode only.
- Note that the availability of modes depends on the sensor being used for sampling. Certain sensors allow selection of particular modes only.
- The currently selected mode is shown in the status bar of the Sensor Setup window.

Mode Parameters

This section explains the parameters that can be configured on the [Sample] tab and [Trigger] tab of the Setup dialog box, in accordance with the mode selected on the [Sample] tab.

■ Parameters Common to All Modes

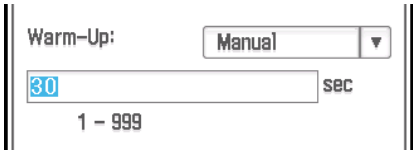
The following explains the parameters that normally appear, regardless of the currently selected mode.

Sampling Interval: Specify a value for the sampling interval. If you specify an interval of one second, for example, a sample will be taken every second.

Number of Samples: Specify the number of samples that should be taken. The total sampling time is calculated in accordance with the specified interval and number of samples, and displayed on the [Single] tab of the Sensor Setup window.

Warm-Up: Specify the warm-up time for the sensor. You can select from among the following options for this setting.

- Auto: Automatically sets a preset value for each sensor.
- Manual: Selecting this option displays a dialog box like the one shown below. Specify a warm-up time in the range of 1 to 999 seconds, and then tap [Set].



Start Trigger: Specify the event that triggers the start of sampling. You can select from among the following options for this setting.

- Tap Screen: This option specifies that sampling should start when [OK] is tapped on the screen.
- Count Down: This option specifies that sampling should start when the end of a countdown is reached.
- CH1: This option specifies that sampling should start when CH1 channel input reaches a certain value.
- SONIC: This option specifies that sampling should start when SONIC channel input reaches a certain value (EA-200 only).
- Microphone: This option specifies that sampling should start when the microphone detects a sound (EA-200 only).

■ Normal Mode Parameters

Tab	Parameter	Initial Default	Range
[Sample]	Sampling Interval	0.05 sec	0.0005 to 299 sec*
	Number of Samples	100	10 to 30000
	Warm-Up	Auto	Auto, Manual (1 to 999)
[Trigger]	Start Trigger	Tap Screen	Tap Screen, Count Down, CH1, SONIC, Microphone

* When one of the motion sensors is selected for the sensor, the setting range becomes 0.02 to 299 seconds.

- For details about each parameter, see “Parameters Common to All Modes” on page 3-5.
- Except for the [Tap Screen] item, all of the other start trigger options require specification of additional parameters. For details, see “Additional Start Trigger Parameters” on page 3-9.

■ Real-Time Mode Parameters

Tab	Parameter	Initial Default	Range
[Sample]	Sampling Interval	0.3 sec	0.3 to 299 sec
	Number of Samples	201	10 to 30000
	Warm-Up	Auto	Auto, Manual (1 to 999)
[Trigger]	Start Trigger	Tap Screen	Tap Screen, Count Down

- For details about each parameter, see “Parameters Common to All Modes” on page 3-5.
- Except for the [Tap Screen] item, all of the other start trigger options require specification of additional parameters. For details, see “Additional Start Trigger Parameters” on page 3-9.

■ Fast Mode Parameters

Tab	Parameter	Initial Default	Range
[Sample]	Sampling Interval	20 μsec	20 μsec to 500 μsec
	Number of Samples	5000	10 to 30000*2
	Warm-Up	Auto	Auto, Manual (1 to 999)
	FFT Graph	*1	On, Off
[Trigger]	Start Trigger	Tap Screen	Tap Screen, Count Down, CH1, SONIC, Microphone

*1 See “FFT Graph” on page 3-7 for details.
*2 When FFT Graph is turned on, the setting range become 10 through 8192.

- For details about parameters other than FFT graph, see “Parameters Common to All Modes” on page 3-5.
- Except for the [Tap Screen] item, all of the other start trigger options require specification of additional parameters. For details, see “Additional Start Trigger Parameters” on page 3-9.

FFT Graph

The [FFT Graph] parameter is available only when [Microphone] is selected as the sensor. You can turn post-sampling FFT Graph (frequency characteristics graph) graphing on or off.

When [CASIO] - [Microphone] is the sensor:
In this case, the initial setting for the FFT graph is off.
Turning on the FFT graph causes [Frequency Pitch] and [Frequency Max] values to be calculated. Note that these calculated values area applied automatically, and cannot be changed.
Also, the [Warm-Up] parameter cannot be configured.

When [CASIO] - [Microphone-FFT] is the sensor:
When [CASIO] - [Microphone-FFT] is selected, the Setup dialog box cannot be displayed, but the FFT Graph setting is always on. In this case, the settings of the [Frequency Pitch] and [Frequency Max] parameters can be changed on the Sensor Setup window.
See “Microphone-FFT Parameters” on page 2-4 for more information.

■ Extended Mode Parameters

Tab	Parameter	Initial Default	Range
[Sample]	Sampling Interval	5 min	5 to 240 min
	Number of Samples	100	10 to 30000
[Trigger]	Start Trigger	Tap Screen (fixed)	—

• For details about each parameter, see “Parameters Common to All Modes” on page 3-5.

■ Period Mode Parameters

Tab	Parameter	Initial Default	Range
[Sample]	Number of Samples	100	1 to 1000
	Warm-Up	Auto	Auto, Manual (1 to 999)
[Trigger]	Start Trigger	CH1 (fixed)	—
	Trigger Threshold	1 V[*1]	−10 to 10 V[*1]
	Trigger Edge	Rising To Rising	Rising to Rising Falling to Falling Rising to Falling Falling to Rising

[*1] The initial default value and setting range depends on the CH1 sensor. The above shows the initial value and setting range when [CASIO] - [Voltage] is selected.

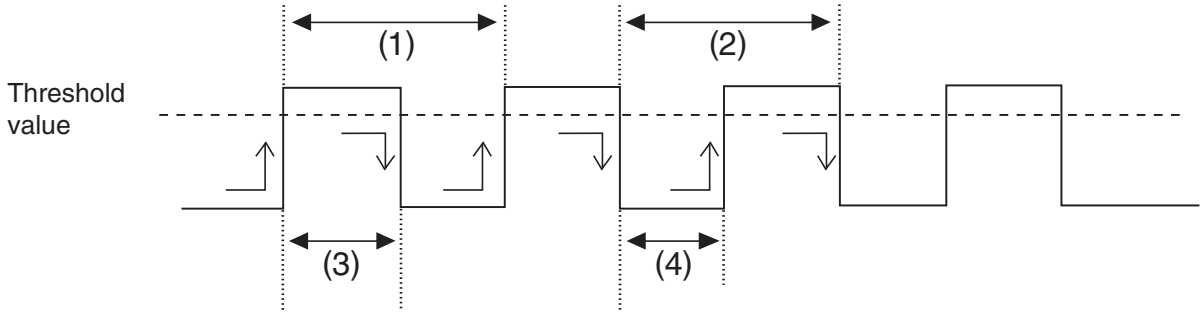
Number of Samples: Specify the number of samples that should be collected. Sampling continues until the specified number of samples is collected, regardless of the sampling time.

Warm-Up: See “Parameters Common to All Modes” on page 3-5.

Start Trigger: CH1 is always the start trigger. Sampling is triggered in accordance with the input value of the sensor connected to the CH1 channel. The timing of the trigger is controlled in accordance with the following two parameters.

Trigger Threshold: Specify a threshold value to specify when sampling is triggered.

Trigger Edge: Specify the interval during which sampling is performed once a change in the sampled value causes the Trigger Threshold to be crossed. You can select any one of the following options.
(1) Rising to Rising, (2) Falling to Falling, (3) Rising to Falling,
(4) Falling to Rising



- The parameters shown below can also be configured when the Period Mode is selected. These parameters appears on the Sensor Setup window, not on the Setup dialog box.

Parameter		Initial Default	Range
Save List Data	Folder	EConSamp	Any folder
	Interval	Interval	Any name (up to 8 characters)
	Count	Count	Any name (up to 8 characters)

Save List Data:
Folder: Specify a folder for storage of the interval and count list variables.
Interval: Specify a list variable name, up to eight characters long, for storage of the interval time that is specified in accordance with the Trigger Threshold and Trigger Edge.
Count: Specify a list variable name, up to eight characters long, for storage of the current sample count.

Tip

- When specifying the Trigger Threshold, be sure to specify a value that represents a relatively significant change for the current or normally measured value. A threshold value that is too close to the current or normally measured value can cause problems with triggering.

■ Additional Start Trigger Parameters

The following are the parameters that need to be configured for the Count Down, CH1, SONIC, and Microphone start triggers when Normal, Real-Time, or Fast is selected as the mode.

- If you specify CH1, SONIC, or Microphone for the [Start Trigger] parameter, you should also use the [Trigger] tab of the Setup dialog box to specify an appropriate start trigger for the selected sensor. Failure to specify an appropriate start trigger for the selected sensor will cause an error to occur.

Count Down Start Trigger

Additional Parameter	Initial Default	Range
Timer	5 sec	1 to 10 sec

Timer: With this start trigger, performing the sampling operation starts a countdown*, and actual sampling begins when the end of the countdown is reached. The countdown start value can be specified in the range of 1 to 10 seconds.

* While a countdown is in progress, a countdown tone sounds from the Data Logger and a Count Down dialog box remains on the calculator display. If you cancel the countdown while this dialog box is displayed, the countdown tone will continue to sound until the end of the preset Timer time is reached.

CH1 Start Trigger

Additional Parameter	Initial Default	Range
Sensor	—	—
Trigger Threshold	Depends on connected sensor	Depends on connected sensor
Trigger Edge	Rising	Rising, Falling

Sensor: This parameter shows the sensor that is currently connected to the CH1 channel. This parameter cannot be changed manually. Sampling is triggered in accordance with the input value of the sensor connected to the CH1 channel. The timing of the trigger is controlled in accordance with the following two parameters.

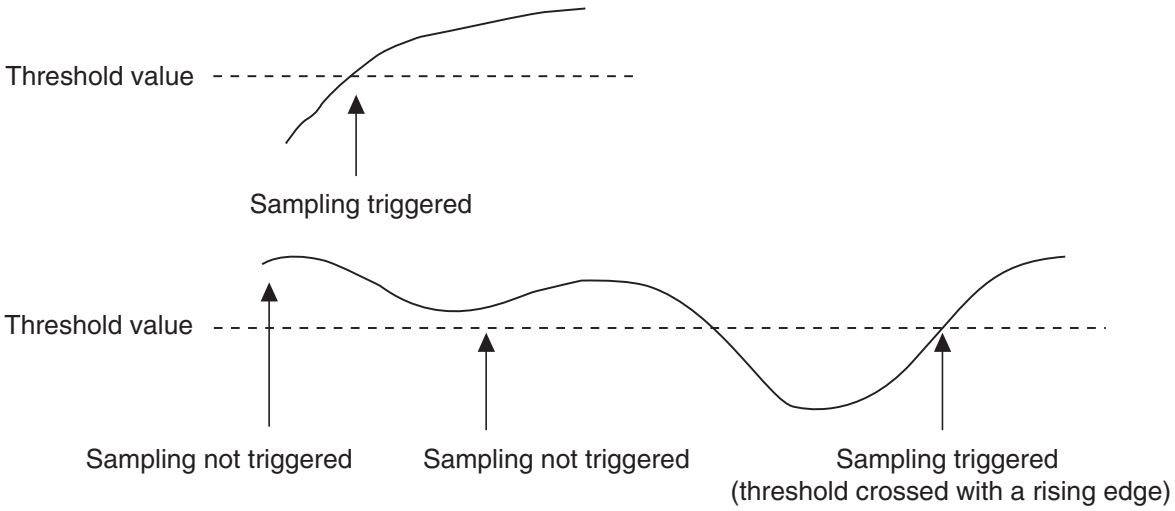
Trigger Threshold: Specify a threshold value to specify when sampling is triggered.

Trigger Edge: Select either [Rising] (reaching the [Trigger Threshold] value from a value less than it) or [Falling] (reaching the [Trigger Threshold] value from a value greater than it) for this parameter.

Tip

- With this start trigger, executing a sampling operation initially enters the standby state, and sampling does not start until sampled values cross the threshold in the specified direction (rising or falling). When [Rising] is specified for [Trigger Edge], for example, sampling will not start if the input value is already greater than the specified threshold value when the sampling operation is executed. This is because the threshold has not been crossed after execution of the sampling operation.
- When specifying the Trigger Threshold, be sure to specify a value that represents a relatively significant change for the current or normally measured value. A threshold value that is too close to the current or normally measured value can cause problems with triggering.

The graphs below show when sampling is triggered while [Rising] is specified for [Trigger Edge]. The graphs show changes in sampled values over time, and the left end of the graph is when the sampling operation is executed.



SONIC Start Trigger

Additional Parameter	Initial Default	Range
Sensor	Motion (fixed)	—
Trigger Threshold*	1 Meter	0 to 8 Meters
Trigger Level	Above	Above, Below

* When [Motion (Feet)] is selected for the sensor, the initial default setting becomes 1 foot and the setting range becomes 0 to 26 feet.

Sensor: The sensor is always [Motion] for this start trigger. Sampling is triggered in accordance with the input value of the motion sensor connected to the SONIC channel. The timing of the trigger is controlled in accordance with the following two parameters.

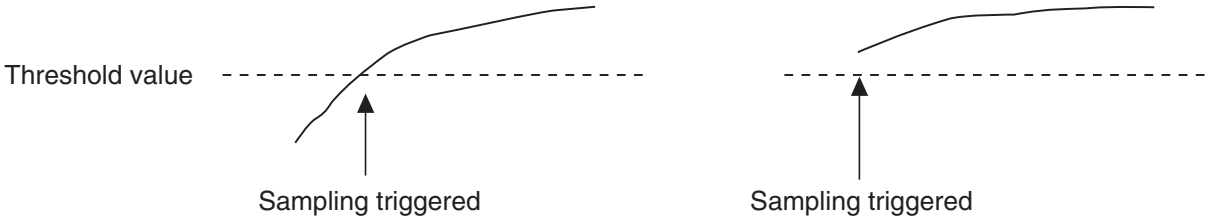
Trigger Threshold: Specify a threshold value to specify when sampling is triggered.

Trigger Level: Select either [Above] (any value above the [Trigger Threshold] value) or [Below] (any value below the [Trigger Threshold] value) for this parameter.

Tip

- With this start trigger, sample triggering depends solely on whether the current input value is greater than or less than the trigger value. When [Above] is specified for [Trigger Level], for example, sampling will start immediately if the input value is already greater than the specified threshold value when the sampling operation is executed.
- When specifying the Trigger Threshold, be sure to specify a value that represents a relatively significant change for the current or normally measured value. A threshold value that is too close to the current or normally measured value can cause problems with triggering.

The graphs below show when sampling is triggered while [Above] is specified for [Trigger Level]. The graphs show changes in sampled values over time, and the left end of the graph is when the sampling operation is executed.



Microphone Start Trigger

Additional Parameter	Initial Default	Range
Sensitivity	High	Low, Medium, High

Sensitivity: Specify one of three sensitivity levels for the EA-200's microphone.

Configuring Graph Window Options

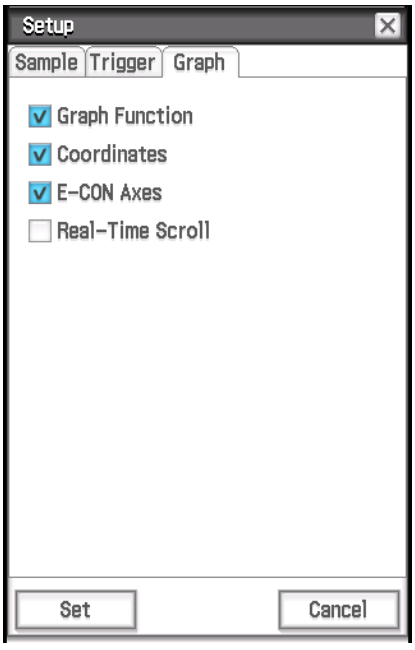
This section explains how to configure the settings of the [Graph] tab of the Setup dialog box.

• To configure graph window options

(1) On the Sensor Setup window menu bar, tap [Setup].

- This displays the [Sample] tab of the Setup dialog box.

(2) Tap the [Graph] tab.



(3) Select the check boxes of the options you want to turn on, and clear the check boxes of the options you want to turn off.

- The check boxes next to the options that are turned on have check marks in them.

(4) After everything is the way you want, tap [Set].

- This applies your settings and closes the Setup dialog box.

■ Graph Options

The following provides detailed explanations of the options that are available on the [Graph] tab of the Setup dialog box.

Option	Description	Initial Default Setting
Graph Function	Turns display of the source data name (current data channel name or sampling memory data name) on the E-CON Graph window on (selected) and off (cleared).	On
Coordinates	Turns display of coordinates on (selected) and off (cleared) when a trace operation is being performed on the E-CON Graph window.	On
E-CON Axes	Turns display of E-CON Graph window axes on (selected) and off (cleared).	On
Real-Time Scroll	Turns real-time scrolling of the E-CON Graph window in the Real-Time sampling mode on (selected) and off (cleared).	Off

Using a Custom Probe

This section explains how to configure a custom probe.
In addition to the CMA, CASIO and Vernier sensors that are preset in the E-CON3 application (see “10 Sensor List”), you can also configure your own “custom probes” for use during sampling.
Once you configure a custom probe, it is available on the [Custom] tab of the Select Sensor dialog box, which you can access from the Sensor Setup window.

Important!

- A sensor with an output voltage in the range of 0 to 5 volts can be configured with E-CON3 as a custom probe. Use of sensors with an output voltage outside of this range is not supported.

■ Configuring Custom Probes

To configure a custom probe, you must input values for the constants of the fixed linear interpolation formula ($ax + b$). The required constants are slope (a) and intercept (b). x in the above expression ($ax + b$) is the sampled voltage value (sampling range: 0 to 5 volts).

• To configure a new custom probe

(1) On the Sensor Setup window [Tool] menu, tap [Custom Probe] and then tap [New Custom Probe].

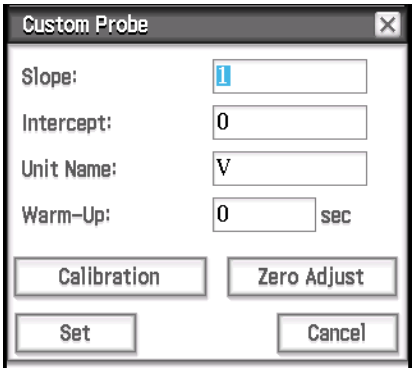
- This displays the New Custom Probe dialog box.

(2) On the dialog box, tap the [Folder] down arrow button and then select the destination folder from the list that appears.

(3) In the [Name] box, input up to eight characters for the custom probe name.

(4) When the name is the way you want, tap [OK].

- This displays the Custom Probe dialog box.



(5) Configure the following parameters on the Custom Probe dialog box.

Parameter	Description
Slope	Input the slope for the linear interpolation formula.
Intercept	Input the intercept for the linear interpolation formula.
Unit Name	Input up to eight characters for the unit name.
Warm-Up	Specify the warm-up time for the sensor in seconds, from 0 to 999.

(6) After all of the parameters are the way you want, tap [Set] to save the custom probe and close the Custom Probe dialog box.

- This saves the custom probe data in calculator memory as a variable with the name you specified in step (3). The custom probe data is locked, which means that it cannot be edited using another application on the calculator. Keep the custom probe data locked. For more information about locked variables, see the calculator User's Guide (Using Variable Manager).

• To edit an existing custom probe

(1) On the Sensor Setup window, make sure that the custom probe you want to edit is not selected.

- If the name of the custom probe you want to edit is displayed in the [Sensor] box on the [Single] tab of the Sensor Setup window, or in the [CH1], [CH2], [CH3], or [SONIC] box of the [Multiple] tab, tap the applicable box and then change its setting to something other than the probe you want to edit. Otherwise, an error will occur when you tap [OK] in step (5), below.

(2) On the Sensor Setup window [Tool] menu, tap [Custom Probe] and then tap [Edit Custom Probe].

- This displays the Edit Custom Probe dialog box.

(3) Tap the [Folder] down arrow button and then select the folder that contains the custom probe data from the list that appears.

(4) Tap the [Name] down arrow button, and then tap the name of the custom probe you want to edit.

(5) Tap [OK].

- This displays the Custom Probe dialog box, which shows the current [Slope], [Intercept], [Unit Name], and [Warm-Up] settings of the custom probe you selected in step (3).

(6) Change the settings.

(7) After all of the parameters are the way you want, tap [Set] to save the custom probe and close the Custom Probe dialog box.

- This saves the custom probe data in calculator memory as a variable with the name you specified in step (4). The custom probe data is locked, which means that it cannot be edited using another application on the calculator. Keep the custom probe data locked. For more information about locked variables, see the calculator User's Guide (Using Variable Manager).

• To configure new custom probe settings based on CMA or Vernier sensor settings

Use the following procedure to recall CMA or Vernier sensor settings that you have already registered with the E-CON3 application and use them to configure a new custom probe.

(1) On the Sensor Setup window [Tool] menu, tap [Custom Probe] and then tap [Edit CMA Sensor] or [Edit Vernier Sensor].
- This displays the Select Sensor dialog box.
  In this case, the Select Sensor dialog box has only a [CMA] tab or [Vernier] tab.

(2) Tap the sensor whose settings you want to use, and then tap [Set].
- This displays the New Custom Probe dialog box.

(3) Tap the [Folder] down arrow button and then select the destination folder from the list that appears.

(4) In the [Name] box, input up to eight characters for the custom probe name.

(5) Tap [OK].
- This displays the Custom Probe dialog box, which shows the current [Slope], [Intercept], [Unit Name], and [Warm-Up] settings of the sensor you selected in step (2).

(6) Change the settings.

(7) After all of the parameters are the way you want, tap [Set] to save the custom probe and close the Custom Probe dialog box.
- This saves the custom probe data in calculator memory as a variable with the name you specified in step (4). The custom probe data is locked, which means that it cannot be edited using another application on the calculator. Keep the custom probe data locked. For more information about locked variables, see the calculator User's Guide (Using Variable Manager).

• To delete an existing custom probe

Use the calculator Variable Manager to delete an existing custom probe. For details, see the section about the Variable Manager in the calculator User's Guide.

• To calibrate a custom probe

Note

- Perform the following procedure to calibrate a custom probe after you newly configure it or after you edit its settings.
- This procedure calibrates slope and intercept values based on two actual samples using the applicable custom probe.
- Before performing the procedure below, you should prepare two conditions whose measurement values are known.
- When inputting reference value in step (5) of the procedure below, input the exact known measurement value of the condition you will sample in step (4). When inputting reference value in step (7) of the procedure below, input the exact known measurement value of the condition you will sample in step (6).

(1) Connect the Data Logger to your calculator, and connect the custom probe you want to calibrate to the Data Logger's CH1 channel.

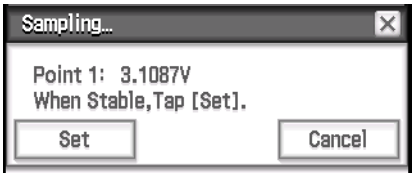
(2) What you should do next depends on whether you are calibrating a new custom probe or an existing custom probe whose settings have been edited.

When calibrating a new custom probe:
- Perform steps (1) through (5) under "To configure a new custom probe" on page 3-12.
- You can skip step (2), if you want.

When calibrating an existing custom probe:
- Perform steps (1) through (6) under "To edit an existing custom probe" on page 3-14.

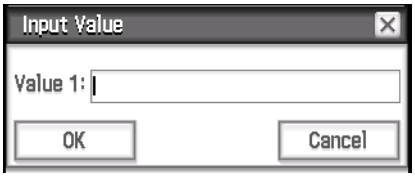
(3) Tap [Calibration].

- This starts sampling by the sensor connected to the CH1 channel and displays a Sampling... dialog box like the one shown to the right. This is how the dialog box appears during standby prior to the first sample.
- If this dialog box is left on the display, sampling will terminate and the dialog box will close automatically after about five hours.



(4) Tap [Set] when you are ready to take the first sample.

- This causes the Sampling... dialog box to change as shown to the right.

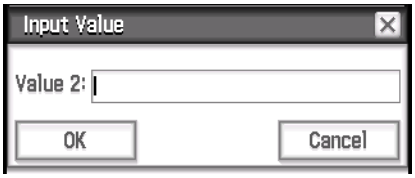


(5) In the [Value 1] box, input the reference value for the first sample, and then tap [OK].

- This restarts sampling by the sensor connected to the CH1 channel and displays a Sampling... dialog box like the one shown to the right. This is how the dialog box appears during standby prior to the second sample.
- If this dialog box is left on the display, sampling will terminate and the dialog box will close automatically after about five hours.

(6) Tap [Set] when you are ready to take the second sample.

- This causes the Sampling... dialog box to change as shown to the right.



(7) In the [Value 2] box, input the reference value for the second sample, and then tap [OK].

- This closes the Input Value dialog box and returns to the Custom Probe dialog box.
- The Data Logger calculates the slope and the intercept for the linear interpolation formula from the first set of values (reference and sampled), and the second set of values, and automatically inputs them into the [Slope] and [Intercept] values of the custom probe.
- After you are finished, tap [Set] to save the custom probe and close the Custom Probe dialog box.

Tip

- An error occurs if the reference values you input in steps (4) and (6) are not correct. If this happens, repeat the procedure from step (3).

• To zero adjust a custom probe

This procedure zero adjusts a custom probe and sets its intercept value based on an actual sample using the applicable custom probe.

(1) Connect the Data Logger to your calculator, and connect the custom probe you want to zero adjust to the Data Logger's CH1 channel.

(2) What you should do next depends on whether you are calibrating a new custom probe or an existing custom probe whose settings have been edited.

When calibrating a new custom probe:
- Perform steps (1) through (5) under "To configure a new custom probe" on page 3-12.
- You can skip step (2), if you want.

When calibrating an existing custom probe:
- Perform steps (1) through (6) under "To edit an existing custom probe" on page 3-14.

(3) Tap [Zero Adjust].

- This starts sampling by the sensor connected to the CH1 channel and displays a Sampling... dialog box like the one shown to the right. This is how the dialog box appears during standby prior to the sample.
- If this dialog box is left on the display, sampling will terminate and the dialog box will close automatically after about five hours.

(4) Tap [Set] when you are ready to take the sample.

- This closes the Sampling... dialog box and returns to the Custom Probe dialog box.
- The value produced by the sample is entered automatically for [Intercept].

(5) After you are finished, tap [Set] to save the custom probe and close the Custom Probe dialog box.

Tip

- An error occurs if the sample value in step (4) is not correct. If this happens, repeat the procedure from step (3).

4 Using Setup Memory

Setup memory lets you save the parameters on the Sensor Setup window in a file for later recall when you need them. This means you can instantly setup for a particular sensor simply by recalling a setup.

Setup Memory Data File Contents

Saving Sensor Setup window parameters saves the following data in setup memory.

- Sensor selection and setup on the [Single] tab
- Sensor selection on the [Multiple] tab
- Setup dialog box parameters
- E-CON Graph Editor window parameters

Saving and Recalling Setup Data

Use the procedures in this section to save data to setup memory and to recall data when you need it.

• To save setup data

(1) On the Sensor Setup window, configure the settings you want.

- For details about settings, see the following: “2 Basic Steps for Configuring Sampling Parameters”, “Configuring Advanced Sampling Parameters” on page 3-2, and “Configuring Graph Window Options” on page 3-11.

(2) On the [File] menu, tap [Save Setup Memory].

- This displays the Save Data dialog box.

(3) On the dialog box, tap the [Folder] down arrow button and then select the destination folder from the list that appears.

(4) In the [Name] box, input up to eight characters for the file name.

(5) Tap [OK].

- This saves the setup memory data in calculator memory as a variable with the name you specified in step (4), and closes the dialog box. The setup memory data is locked, which means that it cannot be edited using another application on the calculator. Keep the setup memory data locked.
  For more information about locked variables, see the calculator User’s Guide (Using Variable Manager).

• To recall setup data

Important!

• Performing the following procedure will replace the current settings of the Sensor Setup window parameters (see “Setup Memory Data File Contents” on page 4-1) with the setup data you recall.

(1) Display the Sensor Setup window active.

  • It makes no difference whether the [Single] tab or [Multiple] tab is displayed.

(2) On the [File] menu, tap [Open Setup Memory].

  • This displays the Open Data dialog box.

(3) Tap the [Folder] down arrow button, and then tap the name of folder that contains the setup you want to recall.

(4) Tap the [Name] down arrow button, and then tap the name of the setup you want to recall.

(5) Tap [OK].

  • This closes the Open Data dialog box and recalls the setup you selected.

• To delete setup data

Use the calculator Variable Manager to delete a setup file. For details, see the section about the Variable Manager in the calculator User’s Guide.

5 Executing a Sampling Operation

This chapter explains the procedure for executing a Data Logger sampling operation in accordance with E-CON3 application settings. It also explains how to store sample data collected with the Data Logger.

Note (EA-200 only)

- For information about operation when [CASIO] - [Speaker ($y = f(x)$)] is selected as the sensor on the Sensor Setup window, see "6 Outputting a Function to the Speaker". When [CASIO] - [Speaker ($y = f(x)$)] is selected, sampling is not performed. Instead, the sound of the waveform of a function input on the calculator is output from the EA-200's speaker.

• To get ready for sampling

(1) Connect the Data Logger to your calculator.

(2) Turn on the Data Logger.

(3) Connect the required sensor(s) in accordance with the setup you will be using for the sampling operation.

(4) Set up the sampling environment with the material to be sampled, required equipment, etc.

Starting the Sampling Operation

This section explains how to start the sampling operation, and describes the entire sampling procedure right up to the end.

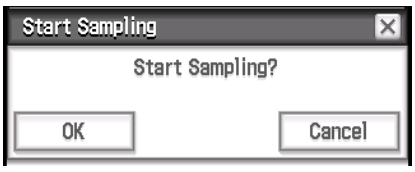
• To start a sampling operation

(1) On the Sensor Setup window, select either the [Single] tab or the [Multiple] tab, in accordance with the type of sampling you want to perform.

- You can also recall previously saved setup data (page 4-2).

(2) To start sampling, tap [Start].

- This displays a dialog box like the one shown below.



If the warm-up time setting is anything other than "0 sec", this dialog box appears after warm-up is complete.

- Tapping [OK] on this dialog box starts sending the setup data on the currently displayed Sensor Setup window tab ([Single] or [Multiple]) to the Data Logger.
- You can cancel the sampling operation by tapping [Cancel].

(3) Depending on the setup you are using, either a standby dialog box appears or sampling starts right away after configuration of the Data Logger settings is complete.

- What happens next depends on the sampling mode, trigger settings, and other setup data sent to the Data Logger. For details, see “Operations Performed during Sampling” below.
- After sampling is complete, the sampled data is stored temporarily as “current data”. You can view the current data on the [Current] tab of the E-CON Graph Editor window. You can also save the current data to a file, if you want. See “Saving Sample Data” on page 5-5 for more information.

Operations Performed during Sampling

The following is the general flow of operations that are performed during sampling.

Setup data is sent from the E-CON3 (calculator) to the Data Logger.

↓

Sampling operation is triggered.
Sampling operation is started by a manual trigger (tapping the screen) or by one of a number of automatic triggers.

↓

Sampling ends.
Sampling ends automatically when the number of samples reaches a preset level.

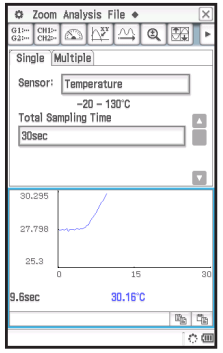
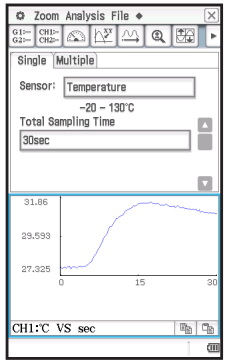
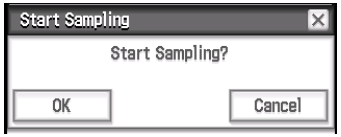
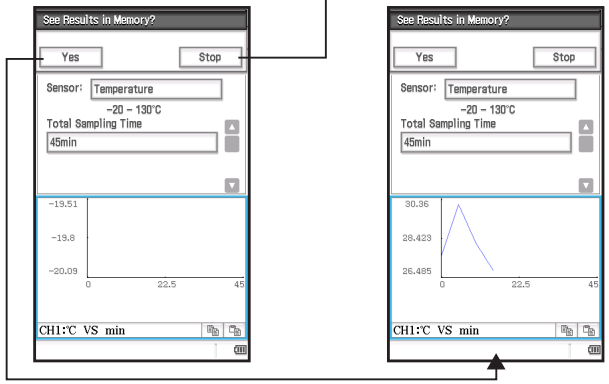
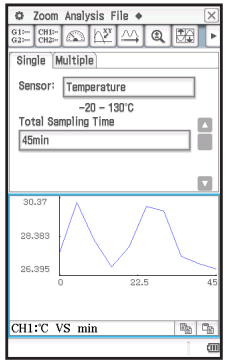
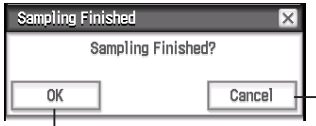
↓

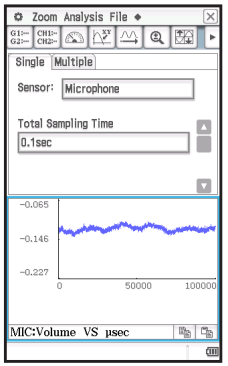
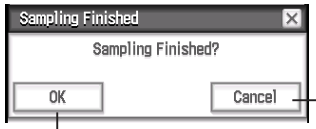
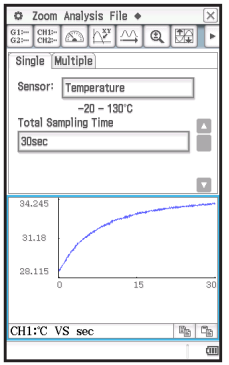
Setup data is sent from the Data Logger to the E-CON3 (calculator).
In the Real-Time Mode, data transfer starts at the same time sampling starts.

↓

Graph the sampled data.

The table on the next page provides shows the various screens that appear during the above flow. Note that the actual flow and the screens that appear depend on the mode, trigger setting, etc.

Mode	1. Start Standby	2. Sampling operation is triggered (and data is graphed).	3. Sampling ends (and data is graphed).
Real-Time		 Data is graphed in real-time, as it is sampled.	 Graphing ends when data sampling does. The Message Box shows the name of the channel used for sampling, and the label names for the graph's vertical and horizontal axes.
Extended		 The graph is drawn using the data from the beginning of the sampling operation, up to the present.	Sampling ends.  Graphing ends when data sampling does. The Message Box shows the name of the channel used for sampling, and the label names for the graph's vertical and horizontal axes.
Period		 Cancels sampling (and discards sampled data).	 This dialog box appears when sampling is finished. Sampled data is stored in a specified memory area, and can be viewed with the Main application or Stat Editor.

Mode	1. Start Standby	2. Sampling operation is triggered (and data is graphed).	3. Sampling ends (and data is graphed).
Fast		The elapsed sampling time is counted on the display during sampling. 	 Fast Mode graphing example
Normal		The screen shown below appears when CH1, SONIC or Microphone is used as the Start Trigger.  Cancels sampling (and discards sampled data).	 Normal Mode graphing example

Saving Sample Data

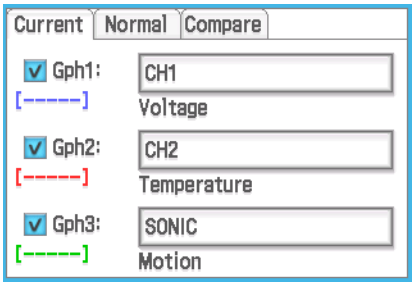
The data produced by a Data Logger sampling operation controlled from the E-CON3 application is stored temporarily in the calculator's [EConSamp] folder. This temporary data is called the "current data".

- Current data is saved using one or more variables, one for each of the channels that was used for sampling. Variable names are assigned automatically in accordance with the channel and sensor used for sampling.

Variable Name	Channel and Sensor Used for Sampling
CH1	CH1
CH2	CH2
CH3	CH3
SONIC	SONIC
MIC	EA-200's built-in microphone Current data is saved under this variable whenever either of the following sensor settings is selected. • [CASIO] - [Microphone] • [CASIO] - [Speaker (Sample Data)]
FFTdat	EA-200's built-in microphone Current data is saved under this variable whenever either of the following sensor settings is selected. • [CASIO] - [Microphone-FFT] • [CASIO] - [Microphone], with the [FFT Graph] setting turned on • [Vernier] - [Microphone], with the [FFT Graph] setting turned on

Performing a sampling operation when [CASIO] - [Microphone] is selected on the Sensor Setup window and the [FFT Graph] setting is turned on simultaneously creates two sets of current data with variable names "MIC" and "FFTdat".

- The current data is displayed on the [Current] tab of the E-CON Graph Editor window in the format <variable name>.



Sample Display

You can use the [Current] tab to graph the current data after sampling is complete. For information about graphing, see “8 Graphing Data”.

- Whenever you perform a new sampling operation, the current data of the channel you are using is overwritten with the new data. If you want to keep a copy of sampled data, you need to save the current data under a different name.

• To save the current data under a different name

Use the calculator Variable Manager to save the current data in the [EConSamp] folder under a different name. For details, see the section about the Variable Manager in the calculator User’s Guide.

• To delete saved sample data

Use the calculator Variable Manager to delete saved sample data. For details, see the section about the Variable Manager in the calculator User’s Guide.

• To recall saved sample data

You can use the E-CON Graph Editor window to recall saved sample data or the current data and graph it. For more information, see “8 Graphing Data”.

6 Outputting a Function to the Speaker (EA-200 only)

When [Speaker ($y = f(x)$)] is selected on the [CASIO] tab of the Select Sensor dialog box, sampling is not performed by a sensor. Instead, the sound of the waveform of a function input on the calculator is output from the EA-200's speaker.

• To output the waveform of a function through the speaker

(1) Connect the EA-200 to the calculator, and turn on the EA-200.

(2) Turn on the calculator, and start up the E-CON3 application.

(3) Tap ⚙ and then [Window] - [Graph Editor] (or tap Y1:··· Y2:···) to display the calculator Graph Editor window.

(4) On the Graph Editor window, input the function (for example: $y1 = \sin(440 \cdot 2 \cdot \pi \cdot x)$) that will be output from the speaker into any of the available lines ($y1$ to $y20$).

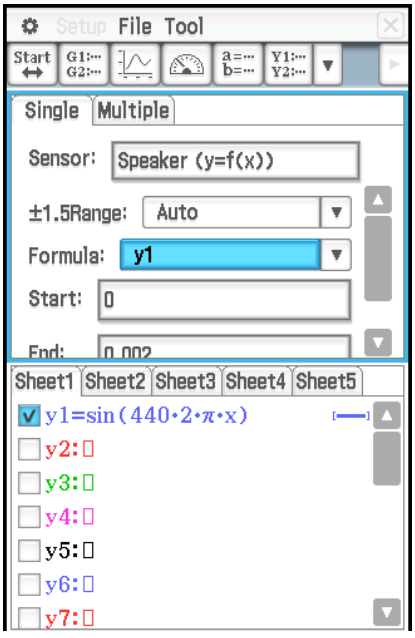
- When inputting a function, specify arguments (for sin, etc.) using radian units. This function treats all arguments as radian values, regardless of the calculator's angle unit setting.
- For details about how to input expressions into the Graph Editor window, see the section about the Graph & Table application in the calculator User's Guide.

(5) Tap the Sensor Setup window to make it active.

(6) Tap the [Sensor] box to display the Select Sensor dialog box.

(7) On the [CASIO] tab, select [Speaker ($y = f(x)$)] and then tap [Set].

- This closes the Select Sensor dialog box and returns to the Sensor Setup window, which now appears as shown to the right.



(8) Tap the [±1.5Range] down arrow button, and then select [Auto] or [Manual] as required.

- Selecting [Auto] optimizes the function and output range during graphing of the function on the calculator Graph window (not the E-CON Graph window) so the y-axis range is from –1.5 to 1.5 (maximum allowable range for speaker output). This is the setting you should normally use.

- When [Manual] is selected, the optimization performed by the [Auto] setting is not performed. Because of this, you need to input a function and specify an output range (x-value) that makes the y-axis range –1.5 to 1.5. An error occurs whenever the y-axis is outside the range of –1.5 to 1.5.

(9) Tap the [Formula] down arrow button. On the menu that appears, select the line ($y1$ to $y20$) that contains the function you input in step (4).

(10) Specify the function output range (x-value).

- Tap the [Start] and input the start value in the input dialog box that appears. Tap the [End] box and then input an end value.

(11) Tap Start.

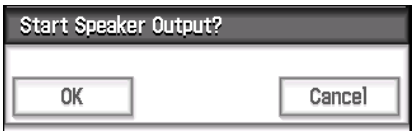
- This displays the Output Frequency dialog box.

(12) Specify the output frequency on the dialog box.

- Input a percent value for the output frequency value you want. To output the original sound as-is, specify 100%. To raise the original sound by one octave, input a value of 200%. To lower the original sound by one octave, input a value of 50%.

(13) Tap [OK].

- This displays a dialog box like the one shown to the right.



(14) Tap [OK].

- This outputs the range specified by the function as a sound through the EA-200's built-in speaker.
- To terminate sound output, press the EA-200 [START/STOP] key.

Tip

- To store the setup you configured in steps (1) through (10) in memory, tap [File] on the menu bar, and then tap [Save Setup Memory].
  See "4 Using Setup Memory" for more information.
- The [Setup] menu is unavailable while [Speaker ($y=f(x)$)] is selected on the [CASIO] tab of the Select Sensor dialog box.

7 Using the Multimeter Window

The Multimeter window shows the sample values of all channels in real-time. You can also use the Multimeter window to manually store sample data at any point.

Viewing Sample Data on the Multimeter Window

This section explains how to view sample data in real-time on the Multimeter window.

Tip

- Before performing the procedures described here, perform the preparation steps under “To get ready for sampling” on page 5-1.
- Warm-up is not performed while you are using the Multimeter window for sampling.
- If the Multimeter window left on the display, sampling will terminate and the window will close automatically after about five hours.
- Note that use of the Multimeter window is not supported when any of the following sensors is in use.
  - [CMA] - [Photogate]
  - [CMA] - [Photogate (Pulley)]
  - [CASIO] - [Microphone]
  - [CASIO] - [Microphone-FFT]
  - [CASIO] - [Speaker (Sample Data)]
  - [CASIO] - [Speaker ($y = f(x)$)]
  - [Vernier] - [Photogate]
  - [Vernier] - [Photogate (Pulley)]
  - [Vernier] - [Microphone]

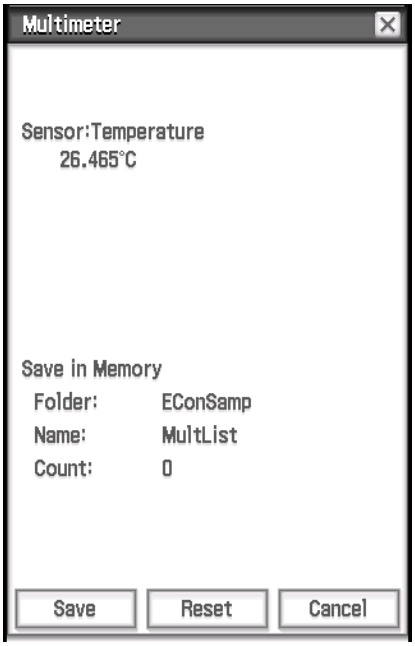
• To view real-time sample data during sampling configured with the [Single] tab

(1) On the Sensor Setup window, display the [Single] tab and configure the settings you want.

- You can also recall previously saved setup data (page 4-2).

(2) Tap .

- This displays the Multimeter window and starts sampling with the sensor connected to the channel specified on the [Single] tab. Sampled data is displayed in real-time on the Multimeter window.



(3) To close the Multimeter window, tap [Cancel].

Tip

- Tapping the [Save] button on the Multimeter window saves the current sample to a specified list variable (EConSamp\MultList). See “Saving Sample Data from the Multimeter Window” on page 7-4 for more information.

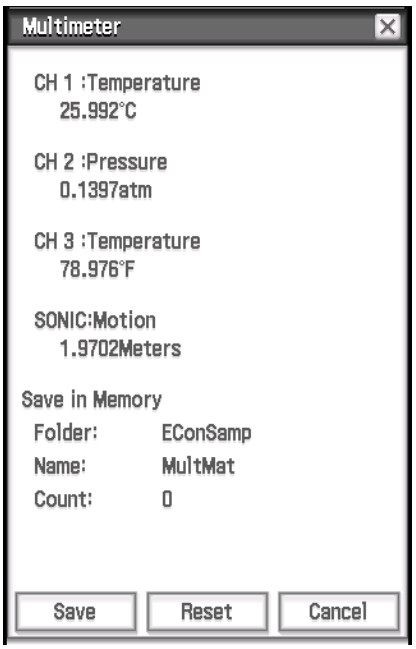
• To view real-time sample data during sampling configured with the [Multiple] tab

(1) On the Sensor Setup window, display the [Multiple] tab and configure the settings you want.

- You can also recall previously saved setup data (page 4-2).

(2) Tap .

- This displays the Multimeter window and starts sampling with the sensors connected to the channels specified on the [Multiple] tab. Sampled data is displayed in real-time on the Multimeter window.



Shows sampled values in real-time for the channels specified on the [Multiple] tab. Nothing is shown for unused channels.

(3) To close the Multimeter window, tap [Cancel].

Tip

- Tapping the [Save] button on the Multimeter window saves the current sample to a specified matrix variable (EConSamp\MultMat). See “Saving Sample Data from the Multimeter Window” on page 7-4 for more information.

Saving Sample Data from the Multimeter Window

You can use the procedures below to save sample data while the Multimeter window is displayed.
Executing sample data save from the Multimeter window saves the current sample data only.

• To save sample data from the Multimeter window during sampling configured with the [Single] tab

(1) Perform steps (1) and (2) of the procedure under “To view real-time sample data during sampling configured with the [Single] tab” on page 7-2.

(2) When you want to store sample data, tap the [Save] button on the Multimeter window.

- This causes the count value on the window to change from 0 to 1. A list variable with the name “MultList” is created in the [EConSamp] folder, and current sample data value is stored there.

(3) You can tap the [Save] button whenever you want to store the current data value.

- Each tap of the [Save] button increases the count value by one.
- Saved samples are stored in the “MultList” list variable as shown below (when CH1 is the channel being used for sampling).

Count	1	2	3	...
CH1	(Sample 1)	(Sample 2)	(Sample 3)	...

- The shaded parts of the above table shows the data assigned to the variables. The count values and channel name are not stored.
- Tapping the [Reset] button on the Multimeter window resets the count value to zero and deletes EConSamp\MultList. After that, you can store another set of data by returning to step (2), above.

(4) To close the Multimeter window, tap [Cancel].

- If you want to retain the sample data stored in the “MultList” list variable, use the calculator Variable Manager to save it under a different name. For details, see the section about the Variable Manager in the calculator User’s Guide.

• To save sample data from the Multimeter window during sampling configured with the [Multiple] tab

(1) Perform steps (1) and (2) of the procedure under “To view real-time sample data during sampling configured with the [Multiple] tab” on page 7-3.

(2) When you want to store sample data, tap the [Save] button on the Multimeter window.

- This causes the count value on the window to change from 0 to 1. A matrix variable with the name “MultMat” is created in the [EConSamp] folder, and current sample data value is stored there.

(3) You can tap the [Save] button whenever you want to store the current data value.

- Each tap of the [Save] button increases the count value by one.
- Saved samples are stored in the “MultMat” matrix variable as shown below.

Count	CH1	CH2	CH3	SONIC
1	(Sample 1)	(Sample 1)	(Sample 1)	(Sample 1)
2	(Sample 2)	(Sample 2)	(Sample 2)	(Sample 2)
3	(Sample 3)	(Sample 3)	(Sample 3)	(Sample 3)
⋮	⋮	⋮	⋮	⋮

- The shaded parts of the above table shows the data assigned to the variables. The count values and channel name are not stored.
- If you do not have four channels selected for sampling, data is not saved for the unused channel(s). Data is saved in columns only for the channels being used for sampling, and blank columns are not included in the matrix for the unused channel(s). The example below shows how data is stored when only CH1 and CH3 are used for sampling.

Count	CH1	CH3
1	(Sample 1)	(Sample 1)
2	(Sample 2)	(Sample 2)
⋮	⋮	⋮

- Tapping the [Reset] button on the Multimeter window resets the count value to zero and deletes EConSamp\MultMat. After that, you can store another set of data by returning to step (2), above.

(4) To close the Multimeter window, tap [Cancel].

- If you want to retain the sample data stored in the “MultMat” matrix variable, use the calculator Variable Manager to save it under a different name. For details, see the section about the Variable Manager in the calculator User’s Guide.

Tip

- The Multimeter window count is reset to zero by either of the following.
  - When the Multimeter window is displayed by tapping
  - Tapping the [Reset] button on the Multimeter window
  - When calculator Variable Manager was used to delete “MultMat” or “MultList” variable from the [EConSamp] folder, or by changing “MultMat” or “MultList” to a different variable type.

8 Graphing Data

This chapter explains how to configure graph parameters on the E-CON Graph Editor window, and how to draw a graph on the E-CON Graph window.

E-CON Graph Editor Window

To graph sample data, you first need to tap the button and display the E-CON Graph Editor window, where you can select the sample data you want to graph.
The E-CON Graph Editor window has three tabs: [Current], [Normal], and [Compare].
Each of the tabs is described in detail below.

Tip

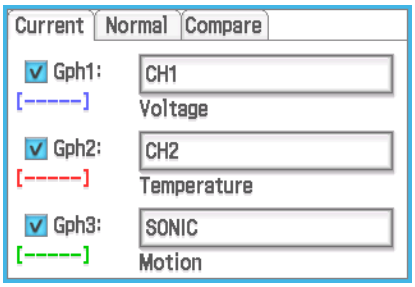
- Note that each time you perform a sampling operation, all of the current data on the [Current] tab (or the sampled data you recalled for each graph) is cleared and replaced with the newly sampled data. A sampling operation does not have any affect on the [Normal] tab and [Compare] tab.

■ [Current] Tab

The [Current] tab shows the current data (page 5-5). Use this tab when you want to draw a graph of the current data following a sampling operation.
The [Current] tab can be either of the two styles shown below.

Gph1, Gph2, Gph3 Style

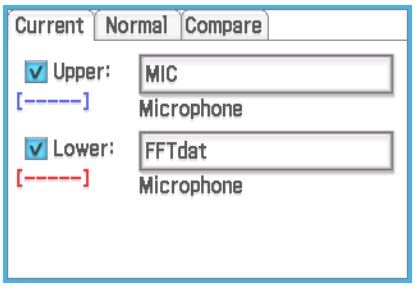
This is the same style as the [Normal] tab (see page 8-3).



This is the style that is displayed following sampling with most sensors. This style also appears if you have not performed a sampling operation to produce current data, and following the Clear All operation (page 8-10).
Except for the fact that the [Current] tab Gph1, Gph2, and Gph3 graph data is replaced by the latest sampling operation, the operations for this tab style are identical to those for the [Normal] tab.

Upper/Lower Style

This is the same style as the [Compare] tab (see page 8-4).



This style appears in the following cases only.

- When sampling is performed with [CASIO] - [Speaker (Sample Data)] specified as the sensor
- When sampling is performed with [CASIO]- [Microphone] specified as the sensor, with the [FFT Graph] setting turned on.
- When sampling is performed with [Vernier]-[Microphone] specified as the sensor, with the [FFT Graph] setting turned on.

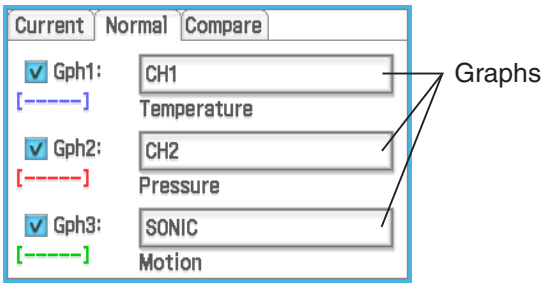
Except for the fact that the [Current] tab Upper and Lower graph data is replaced by the latest sampling operation using the above sensors, the operations for this tab style are identical to those for the [Compare] tab.

Tip

- The following explains how data is allocated to the [Upper] and [Lower] graphs in accordance with the sensor used for sampling.
  [CASIO] - [Speaker (Sample Data)] Sensor
  Upper: MIC (current data)
  Lower: Sound (Conversion data based on Upper current data)
  [CASIO] - [Microphone] Sensor, [FFT Graph] Turned On
  Upper: MIC (current data)
  Lower: FFTdat (current data)
  [Vernier] - [Microphone] Sensor, [FFT Graph] Turned On
  Upper: CH1 (current data)
  Lower: FFTdat (current data)
  For information about [Sound], see “[Compare] Tab” on page 8-4.

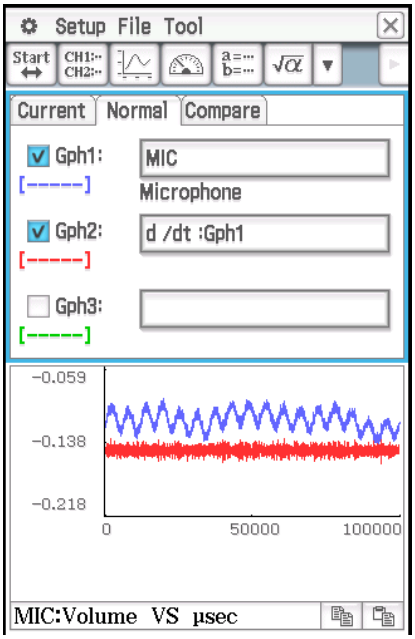
■ [Normal] Tab

The [Normal] tab is for recalling previously saved sampled data (or current data) for graphing. You can draw up to three graphs at the same time using this tab.



You can draw the following types of graphs using the [Normal] tab.

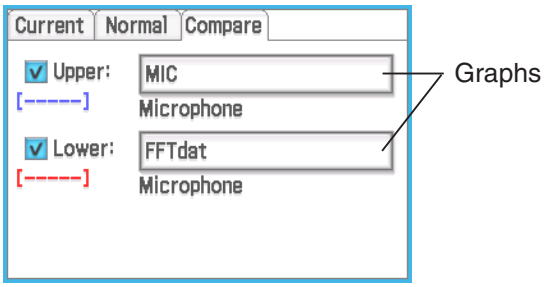
- Different sampled data can be recalled and assigned to each of the graphs (Gph1, Gph2, Gph3) and graphed at the same time.
- You can use this tab to draw a single graph, or to draw two or three graphs at the same time.
- For Gph2 and Gph3, you can assign Gph1 first derivative (d/dt) or second derivative (d^2/dt^2) data. The assigned differential data can be graphed at the same time with the sample data assigned to Gph1.



Example of graph using [Normal] tab settings

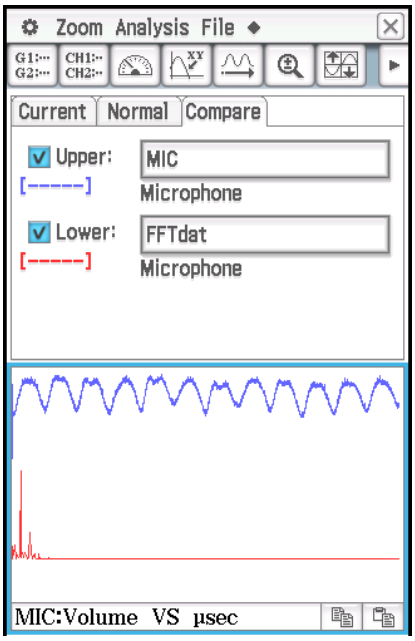
■ [Compare] Tab

Like the [Normal] tab, the [Compare] tab lets you for recall previously saved sampled data (or current data) for graphing. You can draw up to two graphs at the same time using this tab.



You can draw the following types of graphs using the [Compare] tab.

- Different sampled data can be recalled and assigned to each of the graphs (Upper and Lower) and graphed at the same time.
- You can use this tab to draw a single graph or to draw two graphs at the same time.
- For the Lower graph, you can assign Upper data first derivative (d/dt) or second derivative (d^2/dt^2) data, or waveform (Sound) data converted from the Upper graph data so it can be output from the speaker. The assigned data can be graphed at the same time with the Upper data.
- Sound can be assigned to the Lower graph only when the sampled data assigned to the Upper graph is MIC data (data sampled using the EA-200's built-in microphone).



Example of graph using [Compare] tab settings

Drawing a Graph

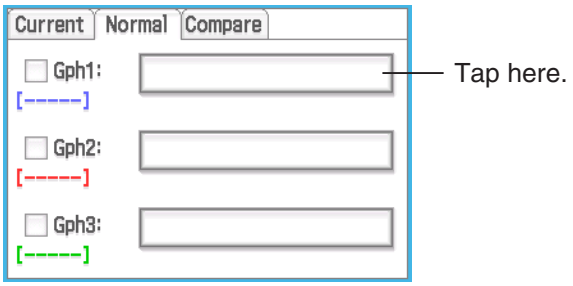
The following procedures explain how to actually draw a graph by configuring setups on each of the E-CON Graph Editor window tabs.

• To draw a graph using [Normal] tab settings

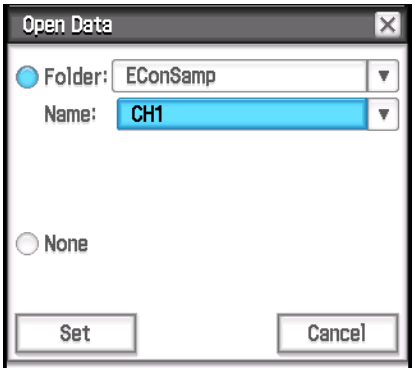
(1) Tap G1:··· G2:··· to display the E-CON Graph Editor window.

(2) Tap the [Normal] tab.

(3) First, recall the data you want to assign to [Gph1]. Tap the [Gph1] box.



- This displays a Open Data dialog box like the one shown below.



(4) Tap the [Folder] option button.

(5) Tap the [Folder] down arrow button, and then tap the name of folder that contains the sample you want to recall.

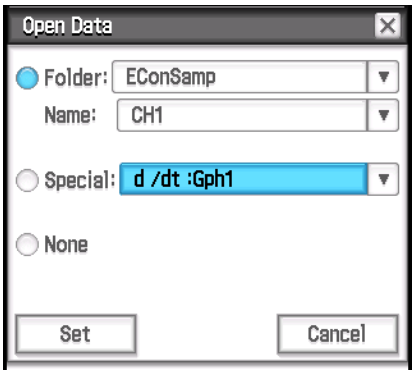
(6) Tap the [Name] down arrow button, and then tap the name of the sample data you want to recall.

(7) Tap [Set].

- This closes the Open Data dialog box and assigns the selected sample data to [Gph1].

(8) Assign sample data to [Gph2] and [Gph3].

- If you want to recall and assign different data, repeat steps (3) through (7) above for [Gph2] and/or [Gph3].
- If you want to perform first derivative or second derivative on [Gph1] and assign the results to [Gph2] or [Gph3], perform the following steps. Note, however, that you will be able to perform these steps only if you have data assigned to [Gph1]. The [Special] option button is unavailable if you do not have any data assigned to [Gph1].



① On the Open Data dialog box, tap the [Special] option button.

② Tap the [Special] down arrow button, and then select [d/dt] (first derivative) or [d^2/dt^2] (second derivative).

③ Tap [Set].

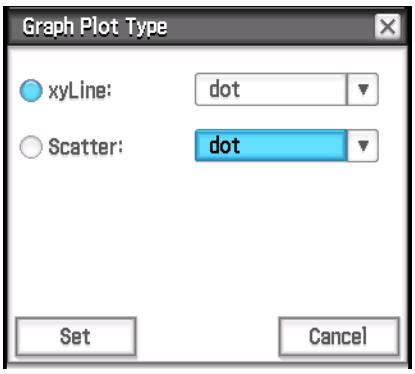
- If you do not want to assign any data, tap the [None] button on the Open Data dialog box, and then tap [Set].

(9) On the [Normal] tab, turn on graphing for each of the graphs that you want to draw.

- Select the check box next to the name of each of the graphs that you want to draw. Clear the check box next to the name of each graph that you do not want to draw.

(10) Specify the graph plot type for each of the graphs you will draw. Tap the [-----] button to the right of the graph.

- This displays a Graph Plot Type dialog box like the one shown below.



(11) Tap the option button next to the plot type you want to specify for the graph.
[xyLine]: Plot points connected by lines
[Scatter]: Plot points only

(12) Tapping the [*xy*Line] or [Scatter] down arrow button displays a list of the plot point types.

- The following shows the type of graph produced by each possible setting available on the Graph Plot Type dialog box.

	*xy*Line	Scatter
dot		
large dot		
square		
cross		

(13) Tap [Set].

- This closes the Graph Plot Type dialog box. The current plots settings are indicated under each of the graph names (Gph1, Gph2, Gph3) on the E-CON Graph Editor window.
- Repeat steps (10) and (12) for the other graphs, if you want.

(14) To start actual drawing of the graph, tap  .

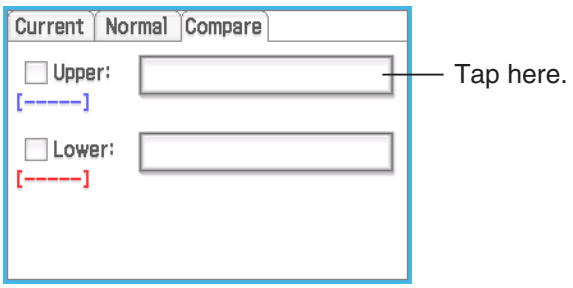
- This displays the E-CON Graph window and draws the graph in accordance with the settings of the [Normal] tab.
- For details about the operations you can perform on the E-CON Graph window, see “9 E-CON Graph Window Operations”.

• To draw a graph using [Compare] tab settings

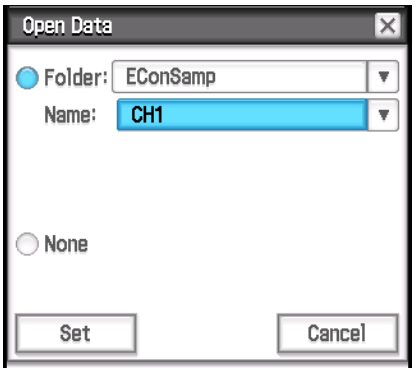
(1) Tap G1: G2: to display the E-CON Graph Editor window.

(2) Tap the [Compare] tab.

(3) First, recall the data you want to assign to [Upper]. Tap the [Upper] box.



- This displays a Open Data dialog box like the one shown below.



(4) Tap the [Folder] option button.

(5) Tap the [Folder] down arrow button, and then tap the name of folder that contains the sample you want to recall.

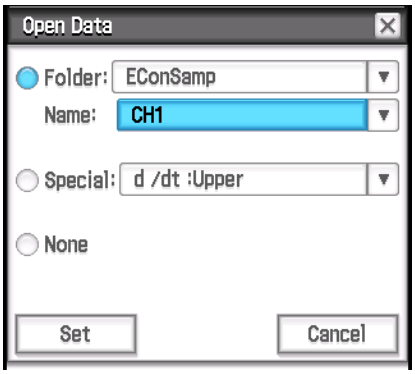
(6) Tap the [Name] down arrow button, and then tap the name of the sample data you want to recall.

(7) Tap [Set].

- This closes the Open Data dialog box and assigns the selected sample data to [Upper].

(8) Assign sample data to [Lower].

- If you want to recall and assign different data, repeat steps (3) through (7) above for [Lower].
- If you want to assign [Upper] first derivative data or second derivative data, or [Upper] data converted to a format for output through the speaker, perform the following steps. Note, however, that you will be able to perform these steps only if you have data assigned to [Upper]. The [Special] option button is unavailable if you do not have any data assigned to [Upper].



① On the Open Data dialog box, tap the [Special] option button.

② Tap the [Special] down arrow button, and then select [d/dt] (first derivative) or [d^2/dt^2] (second derivative).
If you assigned data sampled with [Microphone] to the [Upper] graph, the [Special] list will also include a [Sound] option. Selecting [Sound] converts the [Upper] data to a waveform data that can be output from the speaker, and then assigns that data to [Lower].

③ Tap [Set].

- If you do not want to assign any data, tap the [None] button on the Open Data dialog box, and then tap [Set].

(9) Now perform the steps starting from step (9) under “To draw a graph using [Normal] tab settings” on page 8-5 to complete the procedure.

• To draw a graph using [Current] tab settings

- In either of the following cases, perform the same steps as those under “To draw a graph using [Compare] tab settings” on page 8-8.
  - When sampling is performed with [CASIO] - [Speaker (Sample Data)] specified as the sensor
  - When sampling is performed with [CASIO] - [Microphone] specified as the sensor, with the [FFT Graph] setting turned on.
  - When sampling is performed with [Vernier] - [Microphone] specified as the sensor, with the [FFT Graph] setting turned on.

  Note, however, that steps (3) through (8) of the above procedure can be skipped when graphing current data.
- In cases other than those described above, perform the same steps as those under “To draw a graph using [Normal] tab settings” on page 8-5.
  Note, however, that steps (3) through (13) of the procedure can be skipped when graphing current data.

• To clear all E-CON Graph Editor window settings

Note

- The following procedure clears all of the parameters (data assignments and graph settings) on all three of the tabs of the E-CON Graph Editor window.

(1) Displays the E-CON Graph Editor window.

(2) On the menu bar, tap [Tool] and then [Clear All].

(3) In response to the confirmation message that appears, tap [OK] to clear all the data, or [Cancel] to cancel.

9 E-CON Graph Window Operations

This chapter explains how to perform zoom, scroll, and other operations while a graph is on the E-CON Graph window. It also explains how to use various analytical tools.

Note

The E-CON Graph window appears and a data is graphed after either of the following two events.

- After a sampling operation (except when sampling is performed in the Period mode, or when [CMA] - [Photogate], [CMA] - [Photogate (Pulley)], [Vernier] - [Photogate] or [Vernier] - [Photogate (Pulley)] is selected as the sensor)
- After performing the procedure under “Drawing a Graph” on page 8-5

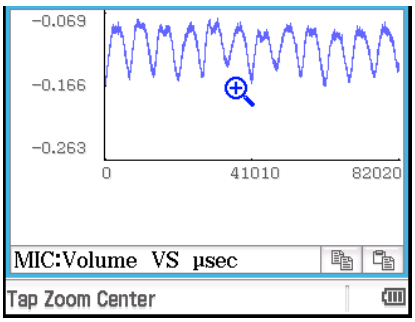
Zooming a Graph

You can use the following procedure to enlarge or reduce the size of a graph on the E-CON Graph window. You can also select an option that resizes the graph to fit the screen.

• To zoom all displayed graphs

(1) On the E-CON Graph window [Zoom] menu tap [All Zoom], or tap the button.

- This causes the message “Tap Zoom Center” to appear in the status bar.

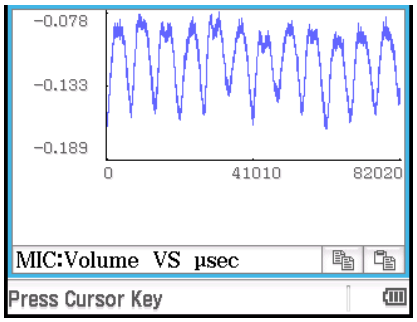


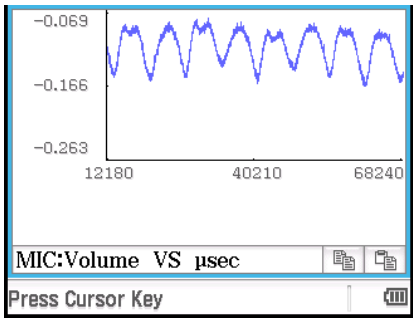
(2) Use the stylus to tap the location on the screen that you want at the center of the enlarged or reduced image.

- This enters the zoom mode.
- Instead of tapping the screen with the stylus, you could use the cursor keys to move the zoom cursor to the location you want, and then press [EXE] to enter the zoom mode.

(3) The cursor keys perform the following operations in the zoom mode.

- Right and Left Cursor Keys: Enlarges or reduces the graph to the right or left.
- Up and Down Cursor Keys: Enlarges or reduces the graph upwards or downwards.





(4) To exit the zoom mode, tap Esc on the calculator icon panel, or press the calculator [Clear] key.

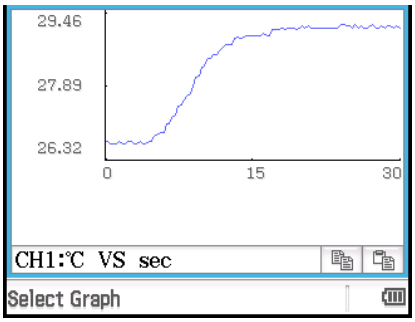
• To zoom a particular graph

Note

- Use this procedure to zoom a particular graph while there are multiple graphs on the E-CON Graph window.
- You will not be able to zoom a graph drawn by assigning data to [Gph2], [Gph3], or [Lower] with the [Special] option on the Open Data dialog box. See pages 8-6 and 8-9 for more information.

(1) On the E-CON Graph window ◆ menu tap [1Zoom].

- This changes to a display of only one of the graphs that is currently on the E-CON Graph window. The displayed graph is the one that is selected for zooming.



(2) Use the up and down cursor keys to cycle through the graphs until the one you want is displayed, and then press [EXE].

- Continue from step (2) of the procedure under “To zoom all displayed graphs” on page 9-1.

• To resize the graph so it fills the screen

There are two methods you can use to resize the graph to fill the screen: by simply zooming it (Full) or by automatically adjusting graph properties to fit.

- To use zoom to fit the graph to the screen, tap the E-CON Graph window [Zoom] menu, and then tap [Full].
- To automatically adjust the graph properties so it fits the screen, tap the E-CON Graph window [Zoom] menu and then tap [Auto].
  [Auto] resizes the y-axis so the entire graph fits in the screen. The x-axis is adjusted automatically in accordance with the number of samples.

• To display a graph by adjusting its y-axis only

On the E-CON Graph window [Zoom] menu, tap [y Auto], or tap [].
There is no corresponding function for adjusting the x-axis.

• To resize the y-axis to match the sensor sampling range

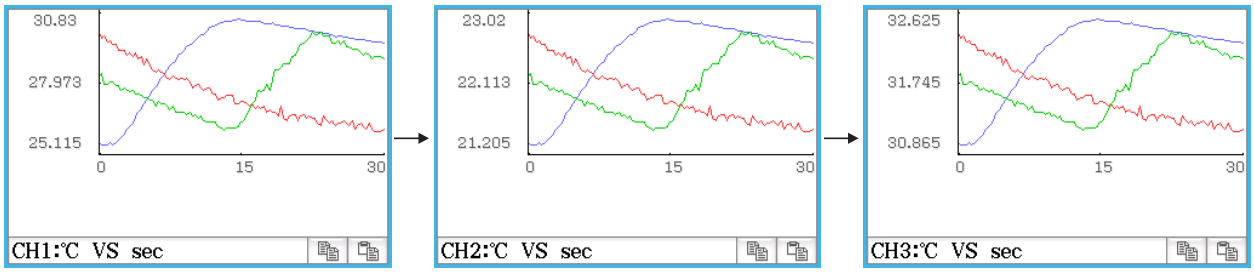
On the E-CON Graph window [Zoom] menu, tap [Original].
This resizes the y-axis in accordance with the measurement range of the sensor being used for measurement. The x-axis is resized to allow display of all data on the same screen.

Displaying and Hiding Graph Display Components

When there are multiple graphs on the E-CON Graph window, you can display or hide the graph axes, the source data name, and the axis labels.

• To hide and display the source data name and axes

When you have multiple graphs on the display, the source data name and axes of the first graph appear first.
You can select the source data name and axes for another graph by tapping the E-CON Graph window ◆ menu and then tapping [Change Axes]. Each tap of [Change Axes] cycles through the applicable graphs in the sequence Gph1 → Gph2 → Gph3.



Tip

- The source data name is displayed on the E-CON Graph window when the [Graph Function] option on the [Graph] tab of the Setup dialog box is turned on. The axes are displayed when the [E-CON Axes] option is turned on. See “Configuring Graph Window Options” on page 3-11 for more information.
- Note that you will not be able display the source data name and axes for a graph drawn by assigning data to [Gph2], [Gph3], or [Lower] with the [Special] option on the Open Data dialog box. See pages 8-6 and 8-9 for more information.

• To display and hide E-CON Graph window axis units

On the E-CON Graph Window ◆ menu, tap [Change Unit]. On the sub-menu that appears, select the unit you want.

The following is a list of units that can be selected.
Auto: Auto selection
μsec: microseconds
msec: milliseconds
sec: seconds
min: minutes
hour: hours
day: days

Scrolling a Graph

You can select one of the graphs displayed on the E-CON Graph window and scroll it.

- Note that you will not be able to scroll a graph drawn by assigning data to [Gph2], [Gph3], or [Lower] with the [Special] option on the Open Data dialog box. See pages 8-6 and 8-9 for more information.

• To scroll a particular graph

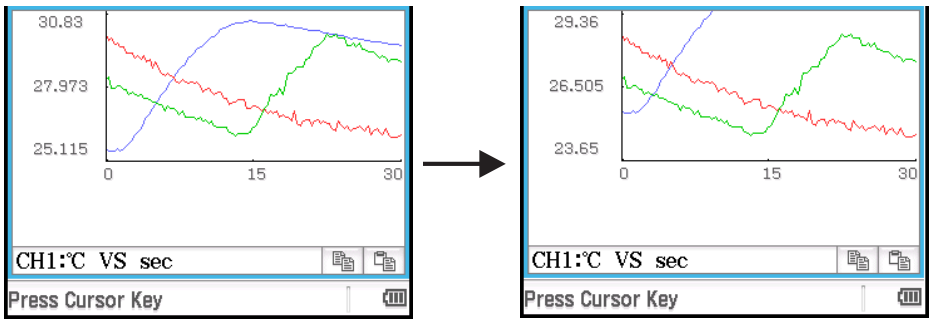
(1) On the E-CON Graph window ◆ menu, tap [1Move].

- If there are multiple graphs on the display, the above operation causes all of them except the one currently selected for scrolling to disappear. If there is only one graph, step (2) and advance directly to step (3).

(2) Use the up and down cursor keys to cycle through the graphs until the one you want is displayed, and then press [EXE].

- This redisplays all of the graphs, with the one you selected in the scroll mode.

(3) Use the cursor keys to scroll the selected graph.



(4) To exit the scroll mode, tap Esc on the calculator icon panel, or press the calculator [Clear] key.

Using Trace

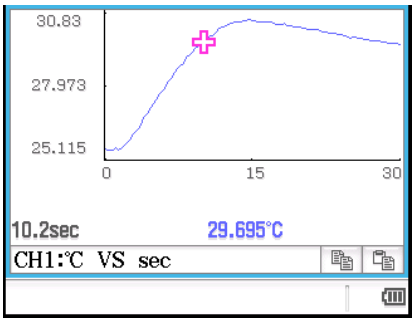
Trace displays a cross pointer on the displayed graph along with the coordinates of the current cursor position. You can use the cursor keys to move the pointer along the graph.

- Note that you will not be able to perform the trace operation cannot on a graph drawn by assigning data to [Gph2], [Gph3], or [Lower] with the [Special] option on the Open Data dialog box. See pages 8-6 and 8-9 for more information.

• To use Trace to read coordinates along a graph

(1) On the E-CON Graph window [Analysis] menu, tap [Trace], or tap the button.

- This causes the trace pointer to appear on the graph. The coordinates of the current trace pointer location are also shown on the display.



(2) Use the left and right cursor keys to move the trace pointer along the graph to the location you want.

- You can also move the trace pointer by tapping the display at location to which you want to move.
- The coordinate values change in accordance with the trace pointer movement.
- If there are multiple graphs on the screen, you can use the up and down cursor keys to move the trace cursor jump between them.

(3) To exit the trace operation, tap Esc on the calculator icon panel, or press the calculator [Clear] key.

- This causes both the trace pointer and the coordinates to disappear from the screen.

Calculating the Periodic Frequency

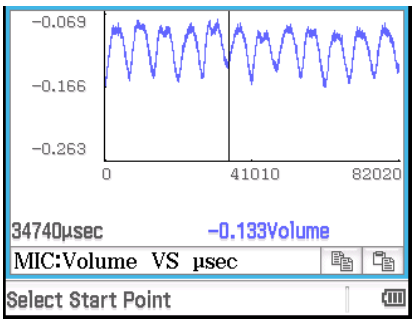
You can use the following procedure to determine the periodic frequency for a specific range on a graph.

- Note that you will not be able to calculate the periodic frequency for a graph drawn by assigning data to [Gph2], [Gph3], or [Lower] with the [Special] option on the Open Data dialog box. See pages 8-6 and 8-9 for more information.

• To calculate the periodic frequency for a specific range on a graph

(1) On the E-CON Graph window [Analysis] menu, tap [Period], or tap the button.

- If there are multiple graphs on the screen, you can use the up and down cursor keys to move between them. When the graph whose periodic frequency you want to calculate is displayed, press the EXE key.

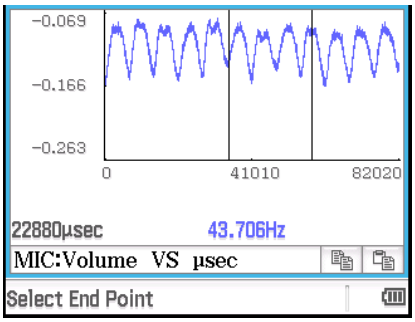


(2) Use the left and right cursor keys to move the vertical line to the start point of the range whose periodic frequency you want to obtain, and then press EXE.

- Alternatively, you could tap the start point of the range with the stylus.

(3) Use the left and right cursor keys to move the vertical line to the end point of the range whose periodic frequency you want to obtain.

- Alternatively, you could tap the end point of the range with the stylus.
- This causes the period and periodic frequency value at the start point you selected in step (2) to appear along the bottom of the screen.



(4) To exit the operation, tap Esc on the calculator icon panel, or press the calculator Clear key.

- This causes both the vertical line and the periodic frequency to disappear from the screen.

Analyzing a Graph Using Fourier Series Expansion

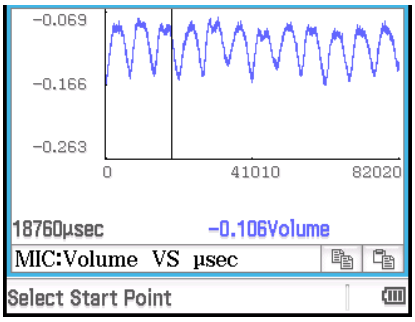
Fourier series expansion is effective for studying sounds by expressing them as functions. The procedure below assumes that there is a graph of sampled sound data already on the graph screen.

- Fourier series expansion is possible only with data sampled using the EA-200's built-in microphone. Attempting the following procedure with any other type of data causes an error.
- The angle unit for a function obtained using Fourier series expansion is always radians, regardless of the calculator's angle unit setting.

• To use Fourier series expansion to convert a waveform graph to a function

(1) On the E-CON Graph window [Analysis] menu, tap [Fourier].

- If there are multiple graphs on the screen, you can use the up and down cursor keys to move between them. When the graph you want is displayed, press the [EXE] key.

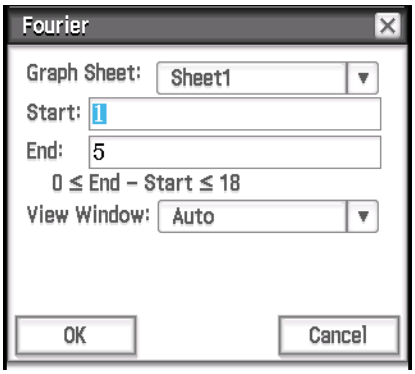


(2) Use the left and right cursor keys to move the vertical line to the start point of the range for which you want to perform Fourier series expansion, and then press [EXE].

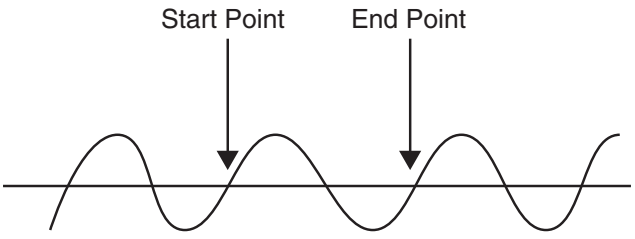
- Alternatively, you could tap the start point of the range with the stylus.

(3) Use the left and right cursor keys to move the vertical line to the end point of the range for which you want to perform Fourier series expansion.

- Alternatively, you could tap the end point of the range with the stylus.
- This displays a dialog box like the one shown to the right.

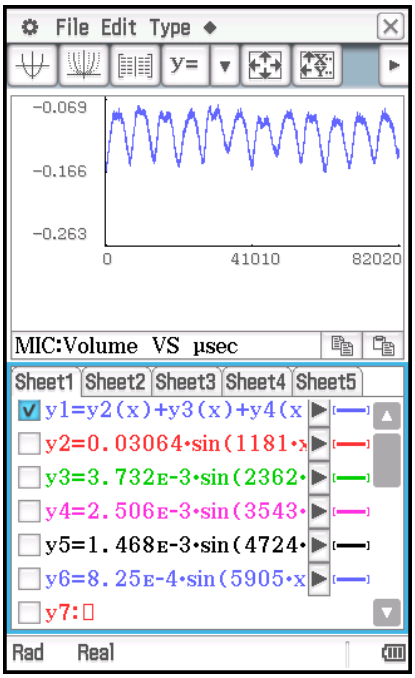


(4) On the dialog box, configure the settings as required.

Parameter	Description
Graph Sheet	Specify a Graph Editor window sheet from Sheet 1 to Sheet 5 for storage of the numeric expression that results from Fourier series expansion. Note that any function expressions input on the sheet you specify here are overwritten.
Start	Specify a value from 1 to 99 for the Fourier series expansion start degree.
End	Specify a value from 1 to 99 for the Fourier series expansion end degree. You can specify a start degree and end degree in the range of 0≦End – Start≦18. Specifying values outside of this range causes an error.
View Window	The E-CON3 application uses View Window settings that are independent of the View Window settings (⚙ - [View Window]) for the calculator Graph window. This parameter specifies whether or not View Window settings of the E-CON Graph Window (source graph) should also be applied to the calculator's View Window (result graph). The following explains the two settings that are possible for this parameter. Auto: This option overwrites the View Window settings of the calculator with the View Window settings of the E-CON Graph Window. This setting makes it possible to apply the View Window settings used to draw the source graph with Fourier series expansion on the E-CON Graph window to draw a result graph on the calculator Graph window using the function obtained by Fourier series expansion. Manual: Selecting this option causes the current calculator View Window settings to remain unchanged. In order to obtain a result graph that resembles the source graph, make sure that the start point and end point that you specify for the source graph is one period of the graph. 

(5) After all the settings are the way you want, tap [OK].

- This starts calculation. The Graph Editor window containing the numeric expression obtained as a result of the Fourier series expansion appears in the lower half of the screen when calculation is complete. At this time, the Graph Editor window is active.



(6) On the toolbar, tap [graph] to graph the expression obtained as the result of the Fourier series expansion on the Graph window.

- Now you can compare the original graph on the E-CON Graph window and the graph of the expanded expression on the calculator Graph window to find out if they are the same.

Saving Sample Data

You can use E-CON Graph window operations to save the sampled data of a particular graph to a list type variable or a matrix type variable. You can save all of the data for the graph, or only the data in a specific range.
The data saved to a variable can be recalled by other calculator operations.

• To save all of a graph's data to a list type variable

(1) On the E-CON Graph window [File] menu tap [Save List] and then [All].

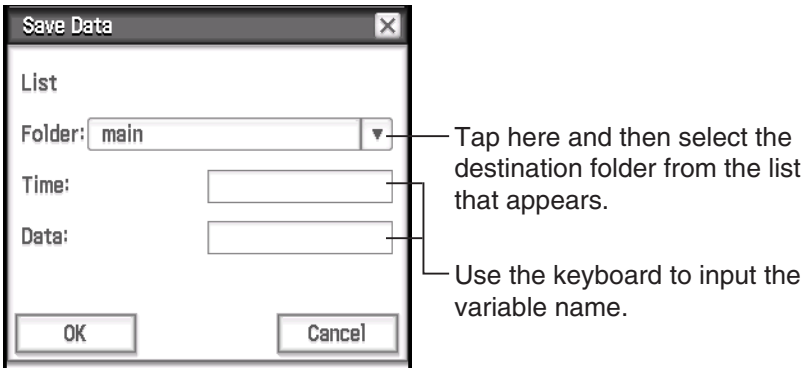
- When there are multiple graphs, the above step changes the display to show only one. The displayed graph is the one that is selected for data save. Use the up and down cursor keys to cycle through the graphs until the one you want is displayed.
- If there is only one graph, the above step displays the Save Data dialog box. In such a case, skip to step (3) of this procedure.

(2) Use the up and down cursor keys to cycle through the graphs until the one you want is displayed, and then press [EXE].

- This displays the Save Data dialog box.

(3) On the Save Data dialog box, specify the name of the folder where the list variable is stored and the list name.

- Time and data are stored in different lists. Specify a list name for each.
- The time value is always stored as seconds.



(4) After the settings are configured in the way you want, tap [OK].

Tip

- When the displayed graph is an FFT graph, a [Freq] (Frequency) parameter appears on the Save Data dialog box in place of the [Time] parameter.
- Note that you will not be able to save data of a graph drawn by assigning data to [Gph2], [Gph3], or [Lower] with the [Special] option on the Open Data dialog box. See pages 8-6 and 8-9 for more information.

• To save the data in a specific range of the graph to a list type variable

(1) On the E-CON Graph window [File] menu, tap [Save List] and then [Select].

- When there are multiple graphs, the above step changes the display to show only one. The displayed graph is the one that is selected for data save. Use the up and down cursor keys to cycle through the graphs until the one you want is displayed.
- If there is only one graph, the above step causes the vertical line to appear on the graph. In such a case, skip to step (3) of this procedure.

(2) Use the up and down cursor keys to cycle through the graphs until the one you want is displayed, and then press [EXE].

- This causes the vertical line to appear on the graph.

(3) Use the left and right cursor keys to move the vertical line to the start point of the range of data you want to save, and then press [EXE].

- Alternatively, you could tap the start point of the range with the stylus.

(4) Use the left and right cursor keys to move the vertical line to the end point of the range of data you want to save, and then press [EXE].

- Alternatively, you could tap the end point of the range with the stylus.
- This displays the Save Data dialog box.
- Now you can perform the steps starting from step (3) under “To save all of a graph’s data to a list type variable” on page 9-9.

Tip

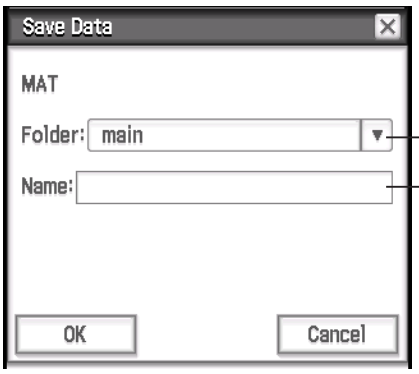
- Note that you will not be able to save data of a graph drawn by assigning data to [Gph2], [Gph3], or [Lower] with the [Special] option on the Open Data dialog box. See pages 8-6 and 8-9 for more information.

• To save all of a graph's data to a matrix type variable

(1) On the E-CON Graph window [File] menu, tap [Save Matrix] and then [All].

- This displays the Save Data dialog box.

(2) On the Save Data dialog box, specify the name of the folder where the matrix variable is stored and the matrix name.



(3) After the settings are configured is the way you want, tap [OK].

• To save the data in a specific range of the graph to a matrix type variable

(1) On the E-CON Graph window [File] menu, tap [Save Matrix] and then [Select].

- This causes the vertical line to appear on the graph.

(2) Use the left and right cursor keys to move the vertical line to the start point of the range of data you want to save, and then press [EXE].

- Alternatively, you could tap the start point of the range with the stylus.

(3) Use the left and right cursor keys to move the vertical line to the end point of the range of data you want to save, and then press [EXE].

- Alternatively, you could tap the end point of the range with the stylus.
- This displays the Save Data dialog box.
- Now you can perform the steps starting from step (2) under "To save all of a graph's data to a matrix type variable".

• Saved Matrix Data

Saving graph data to a matrix type variable saves it to a variable that has n lines and up to 6 columns, where n is the total number of samples in the saved data.

- If the maximum number of graphs are not on the display (less than three in the case of Gph1, Gph2, Gph3; less than 2 in the case of Upper and Lower), data is not saved for the unused graph(s). Data is saved in columns only for the displayed graph(s), and blank columns are not included in the matrix for the unused graph(s).
- When the number of samples for Gph1, Gph2 and Gph3 (or Upper and Lower) are not the same, matrix data is created in accordance with graph that has the greatest number of samples. Unused cells for graphs that have fewer samples than the graph with the greatest number of samples are filled with the data "Undef" (Undefined).

The following example shows how data is stored when there is data for Gph1 and Gph3 only, and Gph1 has n number of samples.

Column / Data / Row Data	Gph1 x-axis Value	Gph1 y-axis Value	Gph3 x-axis Value	Gph3 y-axis Value
Sample 1	Value	Value	Value	Value
Sample 2	Value	Value	Value	Value
⋮	⋮	⋮	⋮	⋮
Sample n–1	Value	Value	Undef	Undef
Sample n	Value	Value	Undef	Undef

Tip

- The time value is always stored as seconds.
- The storage capacity of the [Save Matrix] command is limited. If an error occurs, use [Save Matrix] - [Select] to decrease the size of the range, or use [File] - [Save List] to store the data as a list.

Outputting a Graph as a Sound from the Speaker (EA-200 only)

You can specify a range on a graph and output it from the speaker.

Note

- The following operation is possible only with data sampled using the EA-200's built-in microphone. Attempting the following procedure with any other type of data, including that sampled with [CASIO] - [Microphone-FFT] causes an error. The allowable output range is 200 to 4000 Hz.

• To output a specific range of a graph from the speaker

(1) On the E-CON Graph window ✥ menu, tap [Speaker Output].

- When there are multiple graphs, the above step changes the display to show only one. The displayed graph is the one that is selected for speaker output. Use the up and down cursor keys to cycle through the graphs until the one you want is displayed.
- If there is only one graph, skip to step (3).

(2) Use the up and down cursor keys to cycle through the graphs until the one you want is displayed, and then press [EXE].

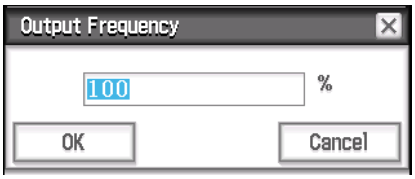
- This causes the vertical line to appear on the graph.

(3) Use the left and right cursor keys to move the vertical line to the start point of the range of data you want to output from the speaker, and then press [EXE].

- Alternatively, you could tap the start point of the range with the stylus.
- This registers the start point.

(4) Use the left and right cursor keys to move the vertical line to the end point of the range of data you want to output from the speaker, and then press [EXE].

- Alternatively, you could tap the end point of the range with the stylus.
- After you specify the start point and end point, an Output Frequency dialog box appears.

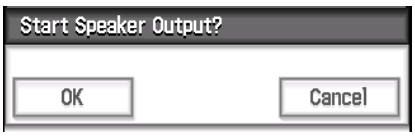


(5) Specify the output frequency on the dialog box.

- Input a percent value for the output frequency value you want. To output the original sound as-is, specify 100%. To raise the original sound by one octave, input a value of 200%. To lower the original sound by one octave, input a value of 50%.

(6) After the settings are configured is the way you want, tap [OK].

- This displays a dialog box like the one shown to the right.



(7) Tap [OK].

- This outputs the waveform between the start point and end point from the EA-200's speaker.
- An error will result if the sound you configured cannot be output for some reason. Note that the supported output range is 200 to 4000 Hz. If an error occurs, tap [OK] and then perform the procedure from the beginning.

(8) To terminate sound output, press the EA-200 [START/STOP] key.

E-CON Graph Window Operations when Speaker (Sample Data) is Selected (EA-200 only)

After a sampling operation while [CASIO] - [Speaker (Sample Data)] is selected as the sensor, the calculator automatically graphs the sampled data on the E-CON Graph window. This E-CON Graph window includes buttons that only appear when [Speaker (Sample Data)] is selected: [🔊], [⇦], and [⇨]. These buttons can be used to horizontally stretch or compress the graph, and to output sampled data to the speaker.

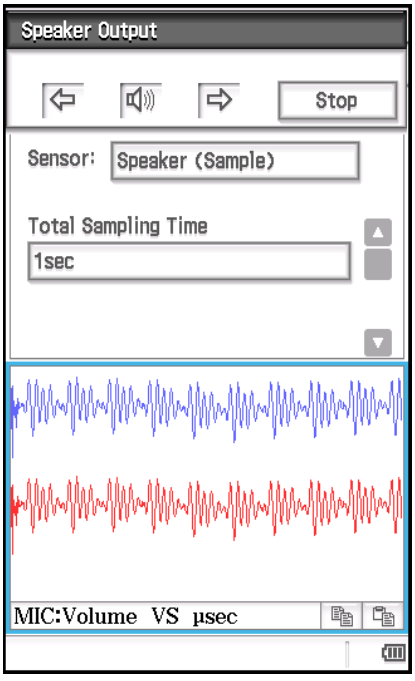
Tip

For details about [Speaker (Sample Data)] sampling parameters, see "2 Basic Steps for Configuring Sampling Parameters".

• To output from the speaker after sampling

(1) Select [CASIO] - [Speaker (Sample Data)] as the sensor, and then perform sampling.

- The Speaker Output window shown to the right appears after the sampling operation is complete. The sampling results are graphed in the bottom of the window.
- On this screen, tapping [⇨] stretches the graph while tapping [⇦] compresses it. Tapping the [Stop] button returns to the E-CON Graph window.



(2) Tap [🔊].

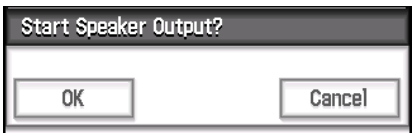
- This displays the Output Frequency dialog box.

(3) Specify the output frequency on the dialog box.

- Input a percent value for the output frequency value you want. To output the original sound as-is, specify 100%. To raise the original sound by one octave, input a value of 200%. To lower the original sound by one octave, input a value of 50%.

(4) After the settings are configured is the way you want, tap [OK].

- This displays a dialog box like the one shown to the right.



(5) Tap [OK].

- This outputs the sampled sound from the EA-200's speaker.

(6) To terminate sound output, press the EA-200 [START/STOP] key.

(7) Tap [OK]. This returns to the Speaker Output window of step (1).

- To return to the E-CON Graph window, tap the [Stop] button.

Dropping E-CON Graph Window Data into a Calculator Built-in Application

You can drag data from the E-CON Graph window and drop it into the Main application work area, the Stat Editor window, or the Graph Editor window.
The following explains the type of data that can be copied using drag and drop.

■ Selecting a Specific Graph on the E-CON Graph Window and Dragging It to the Main Application Work Area

Regardless of which graph is selected, the above operation creates a matrix (n lines × up to 6 columns; n = total number of samples) in the Main application work area, into which is placed all of the graphs in the E-CON Graph window.

- If the maximum number of graphs are not on the display (less than three in the case of Gph1, Gph2, Gph3; less than 2 in the case of Upper and Lower), data is not saved for the unused graph(s). Data is saved in columns only for the displayed graph(s), and blank columns are not included in the matrix for the unused graph(s).
- When the number of samples for Gph1, Gph2 and Gph3 (or Upper and Lower) are not the same, matrix data is created in accordance with graph that has the greatest number of samples. Unused cells for graphs that have fewer samples than the graph with the greatest number of samples are filled with the data "Undef" (Undefined).

The following example shows how data is stored when there is data for Gph1 and Gph3 only, and Gph1 has n number of samples.

Column / Data / Row Data	Gph1 x-axis Value	Gph1 y-axis Value	Gph3 x-axis Value	Gph3 y-axis Value
Sample 1	Value	Value	Value	Value
Sample 2	Value	Value	Value	Value
⋮	⋮	⋮	⋮	⋮
Sample n–1	Value	Value	Undef	Undef
Sample n	Value	Value	Undef	Undef

Tip

- The time value is always stored as seconds.
- The storage capacity of the above data storage operation is limited. If an error occurs, use [File] - [Save List] to store the data as a list.

■ Selecting a Specific Graph on the E-CON Graph Window and Dragging It to the Stat Editor Window

Regardless of which graph is selected, the above operation creates six lists (list1 through list6) in the Stat Editor window, into which is placed the data of all of the graphs in the E-CON Graph window.

- If the maximum number of graphs are not on the display (less than three in the case of Gph1, Gph2, Gph3; less than 2 in the case of Upper and Lower), data is not saved for the unused graph(s). Data is saved in columns only for the displayed graph(s), and blank columns are not included in the matrix for the unused graph(s).
- When the number of samples for Gph1, Gph2 and Gph3 (or Upper and Lower) are not the same, list data is created in accordance with graph that has the greatest number of samples. Unused cells for graphs that have fewer samples than the graph with the greatest number of samples are filled with the data "Undef" (Undefined).

The following example shows how data is stored in lists 1 through 6 when there is data for Gph1 and Gph3 only, and Gph1 has n number of samples.

	Gph1 x-axis Value	Gph1 y-axis Value	Gph3 x-axis Value	Gph3 y-axis Value
List	List1	List2	List3	List4
Sample 1	Value	Value	Value	Value
Sample 2	Value	Value	Value	Value
⋮	⋮	⋮	⋮	⋮
Sample n–1	Value	Value	Undef	Undef
Sample n	Value	Value	Undef	Undef

Tip

- The time value is always stored as seconds.
- The storage capacity of the above data storage operation is limited. If an error occurs, use [File] - [Save List] to store the data as a list.

■ Dragging E-CON Graph Window Message Box Contents to the Main Application Work Area or Graph Editor Window

In this case, the Message Box contents (connected sensor name, vertical axis name, horizontal axis name) are input as text into the location where they are dropped.
The drag and drop operation is identical to that for standard calculator applications.

10 Sensor List

The following is a list of sensors that can be selected on the Sensor Setup window. The "○" symbol indicates sensors that can be selected for the applicable tab ([Single] or [Multiple]) and channel.

Manufacturer	Sensor Name	[Single] Tab	[Multiple] Tab	
		CH1	CH1, CH2, CH3	SONIC
CMA*1	Voltage ±10 (V)	○	○	
	Temperature BT01 (°C)	○	○	
	Temperature BT01 (°F)	○	○	
	Temperature 0511 (°C)	○	○	
	Temperature 0511 (°F)	○	○	
	Temperature BT84i (°C)	○	○	
	Motion (m)	○	○	
	Low-g Accelerometer (m/s^2)	○	○	
	High-g Accelerometer (m/s^2)	○	○	
	Angle Position (°)	○	○	
	Baro Sensor (mbar)	○	○	
	Blood Pressure (mmHg)	○	○	
	Charge ±5 (nC)	○	○	
	Charge ±20 (nC)	○	○	
	Charge ±97 (nC)	○	○	
	CO_2 Gas 5000 (ppm)	○	○	
	CO_2 Gas 100000 (ppm)	○	○	
	Colorimeter (%T)	○	○	
	Conductivity 200 (μS/cm)	○	○	
	Conductivity 2000 (μS/cm)	○	○	
	Conductivity 20000 (μS/cm)	○	○	
	Current ±500 (mA)	○	○	
	Current ±5 (A)	○	○	
	Diff Voltage ±500 (mV)	○	○	
	Diff Voltage ±10 (V)	○	○	
	Dissolved Oxygen (mg/L)	○	○	
	ECG (mV)	○	○	
	Exercise Heart Rate (V)	○	○	
	Flow Rate (m/s)	○	○	
	Force ±5 (N)	○	○	

Manufacturer	Sensor Name	[Single] Tab	[Multiple] Tab	
		CH1	CH1, CH2, CH3	SONIC
CMA*[1]	Force ±50 (N)	○	○	
	Force Plate 800 (N)	○	○	
	Force Plate 3500 (N)	○	○	
	Gas Pressure (kPa)	○	○	
	Heart Rate (%)	○	○	
	Light 10 (W/m^2)	○	○	
	Light 10 (lx)	○	○	
	Light 200 (lx)	○	○	
	Light 150 (klx)	○	○	
	Magnetic Field 50 (mT)	○	○	
	Magnetic Field 500 (mT)	○	○	
	ORP (mV)	○	○	
	Oxygen Gas (%)	○	○	
	pH (pH)	○	○	
	Photogate	○		
	Photogate (Pulley)	○		
	Pressure 023i (kPa)	○	○	
	Pressure BT66i 130 (kPa)	○	○	
	Pressure BT66i 700 (kPa)	○	○	
	Relative Humidity (%)	○	○	
	Salinity (ppt)	○	○	
	Sound (Pa)	○	○	
	Spirometer (L/s)	○	○	
	Thermocouple 110 (°C)	○	○	
	Thermocouple 1300 (°C)	○	○	
	Turbidity (NTU)	○	○	
	UVA (mW/m^2)	○	○	
	UVB (mW/m^2)	○	○	
CASIO	Voltage (V)	○	○	
	Temperature (°C)	○	○	
	Temperature (°F)	○	○	
	Optical (Lum Int)	○	○	
	Motion (Meters)	(SONIC)		○
	Motion (Feet)	(SONIC)		○

Manufacturer	Sensor Name	[Single] Tab	[Multiple] Tab	
		CH1	CH1, CH2, CH3	SONIC
CASIO	Microphone	*2		
	Microphone-FFT	*2		
	Speaker (Sample Data)	*2		
	Speaker ($y = f(x)$)	*3		
Vernier*4	Low-g Accel H (m/s^2)	○	○	
	Low-g Accel V (m/s^2)	○	○	
	25-g Accel H (m/s^2)	○	○	
	25-g Accel V (m/s^2)	○	○	
	Barometer (atm)	○	○	
	Barometer (inHg)	○	○	
	Barometer (mbar)	○	○	
	Barometer (mmHg)	○	○	
	Conductivity 100 (mg/L)	○	○	
	Conductivity 1000 (mg/L)	○	○	
	Conductivity 10000 (mg/L)	○	○	
	Conductivity 200 (μS/cm)	○	○	
	Conductivity 2000 (μS/cm)	○	○	
	Conductivity 20000 (μS/cm)	○	○	
	Current (A)	○	○	
	Diff Voltage (V)	○	○	
	Dual-Range Force 10 (N)	○	○	
	Dual-Range Force 50 (N)	○	○	
	EKG (Volume)	○	○	
	Gas Pressure (atm)	○	○	
	Gas Pressure (inHg)	○	○	
	Gas Pressure (kPa)	○	○	
	Gas Pressure (mbar)	○	○	
	Gas Pressure (mmHg)	○	○	
	Gas Pressure (psi)	○	○	
	Heart Rate (Volume)	○	○	
	Humidity (%)	○	○	
	Microphone	○		
	Motion (Meters)	(SONIC)		○
	Motion (Feet)	(SONIC)		○

Manufacturer	Sensor Name	[Single] Tab	[Multiple] Tab	
		CH1	CH1, CH2, CH3	SONIC
Vernier	Photogate	○(SONIC)		
	Photogate (Pulley)	○(SONIC)		
	pH (pH)	○	○	
	Pressure (atm)	○	○	
	Pressure (kPa)	○	○	
	Pressure (mmHg)	○	○	
	Pressure (psi)	○	○	
	Thermocouple (°C)	○	○	
Custom	User-assigned name and unit	○	○	

*1 Centre for Microcomputer Applications
*2 EA-200 built-in microphone used as sensor.
*3 Sound output from EA-200 built-in speaker in accordance with specified function.
*4 Vernier Software & Technology

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