E-CON2

All of the explanations provided here assume that you are already familiar with the operating precautions, terminology, and operational procedures of the calculator and the EA-200.
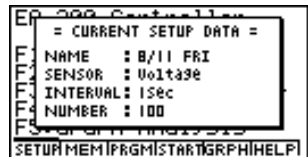
1 E-CON2 Overview

• From the Main Menu, select E-CON2 to enter the E-CON2 Mode.

```
EA-200 Controller

F1:Setup EA-200
F2:Setup Memory
F3:Program Converter
F4:Start Sampling
F5:Graph Analysis
SETUP MEM PRGM START GRPH HELP
```
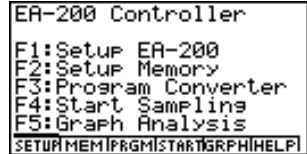
E-CON2 Main Menu

• "The E-CON2 Mode" provides the functions listed below for simple and more efficient data sampling using the CASIO EA-200.

   • F1 (SETUP) ... Displays a screen for setting up the EA-200.

   • F2 (MEM) .... Displays a screen for saving EA-200 setup data under a file name.

   • F3 (PRGM) ..... Performs program conversion.

      • This function converts EA-200 setup data configured by E-CON2 to a program.

      • It can also be used to convert data to a program that can be run on a CFX-9850 Series/fx-7400 Series calculator, and to transfer the data to the calculator.

   • F4 (START) .... Starts data collection.

   • F5 (GRPH) ..... Graphs data sampled by the EA-200, and provides tools for analyzing graphs. Graph Analysis tools include calculation of periodic frequency, various types of regression, Fourier series calculation, and more.

   • F6 (HELP) ...... Displays E-CON2 help.

• Pressing the OPTN key (Setup Preview) or a cursor key while the E-CON2 main menu is on the screen displays a preview dialog box that shows the contents of the setup in the current setup memory area.

```
EA 200 Controller
= CURRENT SETUP DATA =
NAME    : 8/11 FRI
SENSOR  : Voltage
INTERVAL: 1sec
NUMBER  : 100
SETUP MEM PRGM START GRPH HELP
```

To close the preview dialog box, press ESC.

About online help

Pressing the F6 (HELP) key displays online help about the E-CON2 Mode.

---

2 Using the Setup Wizard

This section explains how to use the Setup Wizard to configure the EA-200 setup quickly and easily simply by replying to questions as they appear.

If you need more control over specific sampling parameters, you should consider using the Advanced Setup procedure on page 3-1.

■ Setup Wizard Parameters

Setup Wizard lets you make changes to the following three EA-200 basic sampling parameters using an interactive wizard format.

- Sensor (Select Sensor):
  Specify a CASIO or VERNIER* sensor from a menu of choices.
  *Vernier Software & Technology
- Total Sampling Time:
  Specify a value within the range of 0.01 second to 30 days.
- Sampling Time Unit (Select Unit):
  Specify seconds (sec), minutes (min), hours (hour), or days (day) as the time unit of the value you input for the total sampling time (Total Sampling Time).

Sensor-specific settings

The type of sensor you select with "Select Sensor" settings affects the settings of the Setup Wizard as described below.

Selecting this with "Select Sensor":	Affects Setup Wizard settings like this:
[CASIO] - [Mic]	• The sampling time unit (Select Unit) becomes "sec" and cannot be changed.
[CASIO] - [SPEAKR] - [Sample]	• The sampling time unit (Select Unit) becomes "sec" and cannot be changed.
[VERN] - [P-Gate] - [None]	• You must specify the sampling timing (Gate - Status) and number of samples (Number of Samples). • For details, see "Using Setup Wizard to Configure a PhotoGate Setup" on page 2-3.
[VERN] - [P-Gate] - [Pulley]	• You must specify the distance (Distance) only. • For details, see "Using Setup Wizard to Configure a PhotoGate Setup" on page 2-3.
[CASIO] - [SPEAKR] - [Y=f(x)]	• Requires sampling that is completely different from that performed with a sensor. • For details, see "Outputting the Waveform of a Function through the Speaker" on page 2-4.

Setup Wizard Rules

Note the following rules whenever you use the Setup Wizard.

- The EA-200 sampling channel is CH1 or SONIC.
- The trigger for a Setup Wizard setup is always the [EXE] key.

● **To configure an EA-200 setup using Setup Wizard**

Before getting started...

• Before starting the procedure below, make sure you first decide if you want to start sampling immediately using the setup you configure with Setup Wizard, or if you want to store the setup for later sampling.

• See sections 6-1, 7-1, and 8-1 of this manual for information about procedures required to start sampling and to store a setup. We recommend that you read through the entire procedure first, referencing the other sections and pages as noted, before actually trying to perform it.

• To terminate Setup Wizard part way through and cancel the setup, press [SHIFT] [ESC] (QUIT).

1. Display the E-CON2 main menu (page 1-1).

2. Press [F1] (Setup EA-200). This displays the "Setup EA-200" submenu.

3. Press [1] (Wizard). This displays the "Select Sensor" screen.

4. Press [F1] to specify a CASIO sensor, or [F2] to specify a Vernier sensor. Select the sensor you want from the menu of sensors that appears.

   • Selecting a sensor (page 2-1) causes a screen for specifying the total sampling time to appear.
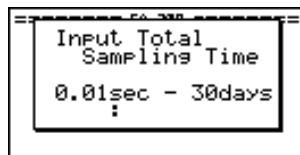
5. Use the number input keys to input the total sampling time. Just input a value. You will be able to specify the unit (sec, min, hour, day) of the value you input here in step 7 of this procedure (see "Sensor-specific settings" on page 2-1).

   Note

   • If you specify a total sampling time value in the range of 10 seconds to 23 hours, 59 minutes, 59 seconds, real-time graphing will be performed during sampling. This is the same as selecting the Realtime Mode on the "Advanced Setup" screen.

6. After inputting total sampling time value you want, press [EXE]. This displays the "Select Unit" screen.

7. Use number keys ⒈ through ⒌ to specify the unit for the value you specified in step 5.

   • When you select a unit, the Final Setup Wizard screen appears on the display.
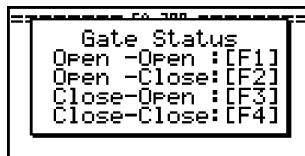
```
=====  SETUP WIZARD  =====
          Complete!

1:Start Setup
2:Save Setup-MEM
3:Convert Program
```

Final Setup Wizard Screen

8. Press number keys described below to specify what you want to do with the setup you have configured.

   ⒈ (Start Setup) .... Starts sampling using the setup (page 8-1)

   ⒉ (Save Setup-MEM) ...... Saves the setup (page 6-2)

   ⒊ (Convert Program) .... Converts the setup to a program (page 7-1)

■ Using Setup Wizard to Configure a PhotoGate Setup

Connection of a Vernier PhotoGate requires configuration of setup parameters that are slightly different from parameters for other types of sensors.
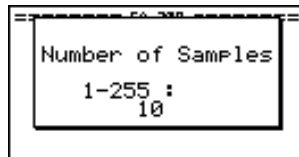
• To configure a setup for PhotoGate alone

1. Perform the first three steps of the procedure under "To configure an EA-200 setup using Setup Wizard" on page 2-2.

2. On the "Select Sensor" screen, select [VERN] - [P-Gate] - [None].

   • This causes a "Gate Status" screen to appear.

```
======  EA-200  ======
       Gate Status
Open -Open :[F1]
Open -Close:[F2]
Close-Open :[F3]
Close-Close:[F4]
```

   • "Open" means the photo path is not blocked, while "Close" means the photo path is blocked.

   • The gate status defines what PhotoGate status should cause timing to start, and what status should cause timing to stop.

   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 and then opens again.

   Close-Close ...... Timing starts when the gate closes, and continues until it opens and then closes again.

3. Use function keys [F1] through [F4] to select a Gate Status setting.

   • Selecting a gate status causes a screen for specifying the number of samples to appear.

========= EA-200 =========

Number of Samples

1-255 :
         10

4. Input an integer in the range of 1 to 255 to specify the number of samples.

5. Perform step 8 under "To configure an EA-200 setup using Setup Wizard" on page 2-2 to finalize the procedure.

● **To configure a setup for PhotoGate and Smart Pulley**

1. Perform the first three steps of the procedure under "To configure an EA-200 setup using Setup Wizard" on page 2-2.

2. On the "Select Sensor" screen, select [VERN] - [P-Gate] - [Pulley].

   • This causes an "Input Distance(m)" screen to appear.

======== EA-200 ========

Input Distance(m)

0.1m-4m :
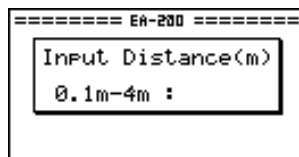
   • The distance you specify here is the distance the weight travels after it is released.

   • Input a value in the range of 0.1 to 4 to specify the distance in meters.

3. Perform step 8 under "To configure an EA-200 setup using Setup Wizard" on page 2-2 to finalize the procedure.


■ **Outputting the Waveform of a Function through the Speaker**

Normally, the Setup Wizard helps you configure setups for sensors connected to the EA-200. If you select [CASIO] - [SPEAKR] - [Y=f(x)] on the "Select Sensor" screen, however, it configures the EA-200 to output the sound that corresponds to a function that you input and graph on the calculator.

● **To configure a setup for speaker output**

1. Connect the data communication cable (SB-62) to the communication port of the calculator and the MASTER port of the EA-200.

2. Display the E-CON main menu (page 1-1), and then press [F1] (Setup EA-200).

   • This displays the "Setup EA-200" submenu.

3. Press [1] (Wizard). This displays the Setup Wizard initial screen.

4. Select [CASIO] - $\boxed{5}$ (SPEAKR) - $\boxed{2}$ (Y=f(x)).
   This displays a screen like the one shown below.

```
=== Caution ===

Y-Range:±1.5
Y1=f(x) only
Angle:Radian
```
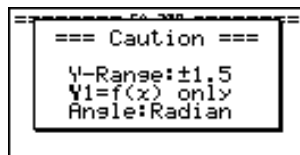
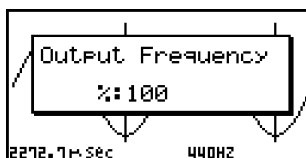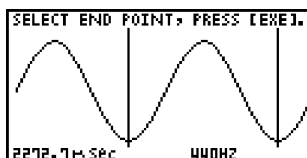5. Press $\boxed{\text{EXE}}$ to advance to the View Window setting screen.

   • The following settings are configured automatically: Ymin = –1.5 and Ymax = 1.5. Do not change these settings.

6. Press $\boxed{\text{EXE}}$ or $\boxed{\text{ESC}}$ to advance to the graph function list.

7. In line "Y1", input the function of the waveform for the sound you want to input.

```
Graph Func  :Y=
Y1:sin (440×2πXX)
Y2:
Y3:
Y4:
Y5:
Y6:
SEL DEL Yn          DRAW
```

   • Note that the angle unit is always radians.

   • Input a function where the value of "Y" is within the range of –1.5 to +1.5.

8. Press $\boxed{\text{F6}}$ (DRAW) to graph the function.

   • This graphs the function and displays a vertical cursor line as shown below. Use the graph to specify the range that you want to output to the speaker.

```
SELECT START POINT, PRESS [EXE]
```
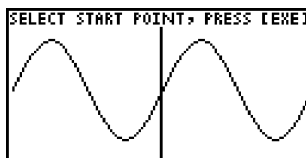
9. Use the $\bigcirc\!\!\blacktriangleleft$ and $\blacktriangleright\!\!\bigcirc$ cursor keys to move the cursor to the start point of the output, and then press $\boxed{\text{EXE}}$ to register it.

10. Use the $\bigcirc\!\!\blacktriangleleft$ and $\blacktriangleright\!\!\bigcirc$ cursor keys to move the cursor to the end point of the output, and then press $\boxed{\text{EXE}}$ to register it.

   • After you specify the start point and end point, a dialog box like the one shown below appears on the display.

```
SELECT END POINT, PRESS [EXE].



2272.7μSec      440HZ
```

→

```
Output Frequency

%:100

2272.7μSec      440HZ
```

11. 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%.

12. After inputting an output frequency value, press [EXE].

   • This outputs the waveform between the start point and end point from the EA-200 speaker.

   • If the sound you configured cannot be output for some reason, the message "Range Error" will appear. Note that the supported output range is 200 to 4000Hz. If this happens, press [ESC] to scroll back through the previous setting screens and change the setup as required.

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

   • Pressing [EXE] after terminating sound output returns to the output frequency dialog box in step 11.

3 Using Advanced Setup

Advanced Setup provides you with total control over a number of parameters that you can adjust to configure the EA-200 setup that suits your particular needs.

The procedures in this section provide the general steps you should perform when using Advanced Setup to configure an EA-200 setup, and to returns setup settings to their initial default values. You can find details about individual settings and the options that are available with each setting are provided by the explanations that start on page 3-2.

■ Advanced Setup Operations

● To configure an EA-200 setup using Advanced Setup

The following procedure describes the general steps for using Advanced Setup. Refer to the pages as noted for more information.

1. Display the E-CON2 main menu (page 1-1).

2. Press [F1] (SETUP). This displays the "Setup EA-200" submenu.

3. Press [2] (Advan). This displays the Advanced Setup menu.

Advanced Setup Menu

4. If you want to configure a custom probe at this point, press [5] (Custom Probe). Next, follow the steps under "To configure a custom probe setup" on page 4-1.

   • You can also configure a custom probe during the procedure under "To configure Channel Setup settings" on page 3-2.

   • Custom probe configurations you have stored in memory can be selected using Channel in step 5, below.

5. Use the Advanced Setup function keys described below to set other parameters.

   • [1] (Channel) .... Displays a screen that shows the sensors that are currently assigned to each channel (CH1, CH2, CH3, SONIC, Mic). You can also use this dialog to change sensor assignments. See "Channel Setup" on page 3-2 for more information.

   • [2] (Sample) ..... Displays a screen for selecting the sampling mode, and for specifying the sampling interval, the number of samples, and the warm-up mode. When "Fast" is selected for "Mode", this dialog box also displays a setting for turning FFT (frequency characteristics) graphing on and off. See "Sample Setup" on page 3-4 for more information.

- 3 (Trigger) ...... Displays a screen for configuring sampling start (trigger) conditions. See "Trigger Setup" on page 3-6 for more information.
- 4 (Graph) .... Displays a screen for configuring graph settings. See "Graph Setup" on page 3-8 for more information.
- You can return the settings on the above setup screens (1 through 4) using the procedure described under "To return setup parameters to their initial defaults".

6. After you configure a setup, you can use the function key operations described below to start sampling or perform other operations.

- F1 (START) .... Starts sampling using the setup (page 8-1).
- F2 (MULT) ...... Starts MULTIMETER Mode sampling using the setup (page 5-1).
- F3 (MEM) .... Saves the setup (page 6-1).
- F4 (PRGM) ..... Converts the setup to a program (page 7-1).
- F5 (GRPH) ..... Graphs data sampled by the EA-200, and provides tools for analyzing graphs (page 10-1).
- F6 (ABOUT) ... Displays version information about the EA-200 unit that is currently connected to the calculator.

● To return setup parameters to their initial defaults

Perform the following procedure when you want to return the parameters of the setup in the current setup memory area to their initial defaults.

1. While the Advanced Setup menu (page 3-1) is on the display, press 6 (Initialize).

```
Advanced Setup      RT
   Initialize
   Current Setup?

   Yes:[EXE]
   No :[ESC]

START MULTI MEM PRGM GRPH ABOUT
```

2. In response to the confirmation message that appears, press EXE to initialize the setup.

- To clear the confirmation message without initializing the setup, press ESC.

■ Channel Setup

The Channel Setup screen shows the sensors that are currently assigned to each channel (CH1, CH2, CH3, SONIC, Mic).

● To configure Channel Setup settings

1. While the Advanced Setup menu (page 3-1) is on the display, press 1 (Channel).

- This displays the Channel Setup screen.

Currently selected channel

```
Channel Setup
 CH 1  :Voltage
 CH 2  :Temperature
 CH 3  :Optical
 SONIC :
 Mic   :
 Range:-20~130°C
CASIO VERN CSTM None
```

Channel Setup Screen

2. Use the ⊙ and ⊙ cursor keys to move the highlighting to the channel whose setting you want to change.

3. What you need to do next depends on the currently selected channel.

• CH1, CH2, or CH3

Press a function key to display a menu of sensors that can be assigned to the selected channel.

[F1] (CASIO) ...... Displays a menu of CASIO sensors.

[F2] (VERN) .... Displays a menu of Vernier sensors.

[F3] (CSTM) .... Displays a menu of custom probes.

[F4] (None) .... Press this key when you want leave the channel without any sensor assigned to it.

• SONIC Channel

For this channel, the sensor is automatically set to Motion Sensor (EA-2). However, you need to configure the settings described below.

[F1] (Meters) ...... Specifies meters as the measurement unit.

[F2] (Feet) .... Specifies feet as the measurement unit.

[OPTN] .... Press to toggle smoothing (correction of erroneous samples) on ("-Smooth" displayed) and off ("-Smooth" not displayed).

[F4] (None) .... Select this option to disable the SONIC channel.

• Mic Channel

For this channel, the sensor is automatically set to Built-in (External) Microphone. However, you need to configure the settings described below.

[F1] (Active) .... Select this option to enable the Mic channel.

[F4] (None) .... Select this option to disable the Mic channel.

4. Repeat steps 2 and 3 as many times as necessary to configure all the channels you want.

5. After all the settings are the way you want, press [EXE].

• This returns to the Advanced Setup menu.

Note

• When you select a channel on the Channel Setup screen, the sampling range of the selected channel appears in the bottom line of the screen.

```
Channel Setup
 CH 1  :Voltage
 CH 2  :Temperature
 CH 3  :Optical
 SONIC :
 Mic   :
Range:-20~130°C
CASIO VERN CSTM None
```
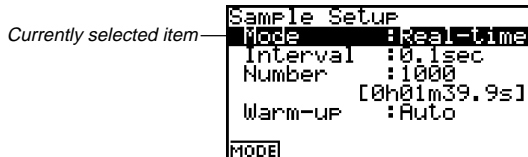
In this example, the range of the temperature sensor assigned to CH2 appears.

■ Sample Setup

The Sample Setup screen lets you configure a number of settings that control sampling.

● **To configure Sample Setup settings**

1. While the Advanced Setup menu (page 3-1) is on the display, press [2] (Sample).

   • This displays the Sample Setup screen.

   Currently selected item ——

   ```
   Sample Setup
   Mode     :Real-time
   Interval :0.1sec
   Number   :1000
            [0h01m39.9s]
   Warm-up  :Auto

   MODE
   ```

   Sample Setup Screen

2. To change the sampling mode setting, use the ⊙ and ⊙ cursor keys to move the highlighting to "Mode". Next, press [F1] (MODE) to display a mode selection menu.

   • Note that the mode you select also determines the channel(s) you can use.

To do this:	Select this mode:	Selectable Channel(s)
Graph data in real-time as it is sampled	Realtime	CH1-3, SONIC
Perform sampling of high-speed phenomena (sound, etc.)	Fast	CH1, Mic
Perform sampling over a long time (weather, etc.) • The EA-200 enters a power off sleep state while standing by.	Extended	CH1-3, SONIC
Perform periodic sampling, from a start trigger event to an end trigger event	Period	CH1
Output from the speaker sound sampled with the microphone	Sound	Mic
Record the time of the occurrence of a particular trigger event as an absolute value starting from 0, which is the sampling start time	Clock	CH1
Perform sampling other than that described above	Normal	CH1-3, SONIC

3. To change the sampling interval setting, move the highlighting to "Sampling Interval". Next, press [F1] to display a dialog box for specifying the sampling interval.

   • The range of values you can select depends on the current sampling mode setting.

If this sampling mode is selected:	This is the allowable setting range:
Realtime	0.3 second to 299sec
Fast	20usec to 500usec
Extended	5 minutes to 4hours
Period	"=Trigger" only (no value input required)
Sound	20usec to 27usec
Clock	"=Trigger" only (no value input required)
Normal	500usec to 299sec

4. To change the number of samples setting, move the highlighting to "Number". Next, press F1 to display a dialog box for specifying the number of samples.

Important!

• When all of the following conditions exist, a "Distance" setting appears in place of the "Number" setting. See "To configure the Distance setting" below for information about configuring the "Distance" setting.

    • Channel Setup (page 3-2): [VERN] - [P-Gate]- [Pulley]

    • Sampling Mode (page 3-4): Clock

• You can specify a value in the range of 10 to 30,000.

• The total sampling time shown at the bottom of the dialog box is calculated by multiplying the "Sampling Interval" value you specified in step 3 by the number of samples you specify here.

5. To change the warm-up time setting, move the highlighting to "Warm-up". Next, perform one of the function key operations described below.

Note

• The "Warm-up" setting will not be displayed on the Sample Setup screen if "Fast" or "Sound" is currently selected as the sampling mode.

To do this:	Press this key:
Have the warm-up time for each sensor set automatically	F1 (Auto)
Input a warm-up time, in seconds, manually	F2 (Manual)
Disable the warm-up time	F3 (None)

Important!

• When the following condition exists, an "FFT Graph" setting appears in place of the "Warm-up" setting. See "To configure the FFT Graph setting" below for information about configuring the "FFT Graph" setting.

    • Sampling Mode (page 3-4): Fast

6. After all the settings are the way you want, press EXE.

• This returns to the Advanced Setup menu.

● **To configure the Distance setting**

In place of step 3 of the procedure under "To configure Sample Setup settings", press F1 to display a dialog box for specifying the distance the weight travels in meters.

• Specify a value in the range of 0.1 to 4 meters.

● **To configure the FFT Graph setting**

In place of step 5 of the procedure under "To configure Sample Setup settings", press F1 to display a dialog box for turning frequency characteristic graphing (FFT Graph) on and off.

To do this:	Press this key:
Turn on graphing of frequency characteristics after sampling	F1 (On)
Turn off graphing of frequency characteristics after sampling	F2 (Off)

■ Trigger Setup

Use the Trigger Setup screen to configure measurement start (trigger) conditions.

• To configure Trigger Setup settings

1. While the Advanced Setup menu (page 3-1) is on the display, press ③ (Trigger).

   • This displays the Trigger Setup screen.

   Currently selected item —

   ```
   Trigger Setup
   Source   :CountDown
   Timer    :5sec



   [EXE]COUNT CH1 SONIC Mic
   ```
   Trigger Setup Screen

2. To change the trigger source setting, use the ⊛ and ⊙ cursor keys to move the highlighting to "Trigger Source". Next, press F1 ([EXE]) to display a trigger source selection menu.

   • Note that selecting trigger source setting displays other settings that need to be configured for the selected trigger source.

To select this trigger source:	Press this key:
EXE key operation	F1 ([EXE])
Completion of a countdown timer operation	F2 (Count)
Attainment of a threshold value by CH1 input	F3 (CH1)
Surpassing of a threshold value by SONIC input	F4 (SONIC)
Pickup of sound by the EA-200 built-in microphone	F5 (Mic)

3. What you need to do next depends on what trigger source you selected in step 2.

If you selected this trigger source:	Do this next:
F1 ([EXE])	Press EXE to finalize Trigger Setup and return to the Advanced Setup menu.
F2 (Count)	Specify the countdown start time (page 3-6).
F3 (CH1)	Specify the trigger threshold value and trigger edge direction (page 3-7).
F4 (SONIC)	Specify the trigger threshold value and trigger edge type (page 3-7).
F5 (Mic)	Specify microphone sensitivity (page 3-7).

• To specify the countdown start time

1. Move the highlighting to "Timer".

2. Press F1 (TIMER) to display a dialog box for specifying the countdown start time.

3. Input a value in seconds from 1 to 10.

4. Press EXE to finalize Trigger Setup and return to the Advanced Setup menu.

• **To specify microphone sensitivity**

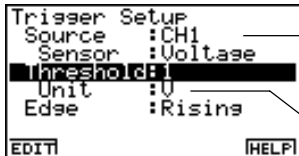1. Move the highlighting to "Sense" and then press one of the function keys describe below.

To select this level of microphone sensitivity:	Press this key:
Low	F1(Low)
Medium	F2(Mid)
High	F3(High)

2. Press EXE to finalize Trigger Setup and return to the Advanced Setup menu (page 3-1).

• **To specify the trigger threshold value and trigger edge type**

Perform the following steps when "Fast", "Normal", or "Clock" is specified as the sampling mode (page 3-4).

1. Move the highlighting to "Threshold".
2. Press F1(EDIT) to display a dialog box for specifying the threshold trigger value, which is value that data needs to attain before sampling starts.

```
Trigger Setup
 Source   :CH1
 Sensor   :Voltage
 Threshold:1
 Unit     :V
 Edge     :Rising

EDIT              HELP
```

Sensor assigned to CH1 or SONIC by Channel Setup (page 3-3)

Measurement unit supported by assigned sensor

3. Input the value you want.
4. Move the highlighting to "Edge".
5. Press one of the function keys described below.

To select this type of edge:	Press this key:
Falling	F1(Fall)
Rising	F2(Rise)

6. Press EXE to finalize Trigger Setup and return to the Advanced Setup menu (page 3-1).

• **To configure trigger threshold, trigger start edge, and trigger end edge settings**

Perform the following steps when "Period" is specified as the sampling mode (page 3-4).

1. Move the highlighting to "Threshold".
2. Press F1(EDIT) to display a dialog box for specifying the threshold trigger value, which is value that data needs to attain before sampling starts.
3. Input the value you want.
4. Move the highlighting to "Start to".

To select this type of edge:	Press this key:
Falling	F1(Fall)
Rising	F2(Rise)

5. Press one of the function keys described below.
6. Move the highlighting to "End Edge".

7. Press one of the function keys described below.

To select this type of edge:	Press this key:
Falling	F1 (Fall)
Rising	F2 (Rise)

8. Press EXE to finalize Trigger Setup and return to the Advanced Setup menu (page 3-1).

• To configure PhotoGate trigger start and end settings

Perform the following steps when CH1 is selected as a Photogate trigger source.

1. Move the highlighting to "Start to".
2. Press one of the function keys described below.

To specify this PhotoGate status:	Press this key:
PhotoGate closed	F1 (Closed)
PhotoGate open	F2 (Open)

3. Move the highlighting to "End Gate".
4. Press one of the function keys described below.

To specify this PhotoGate status:	Press this key:
PhotoGate closed	F1 (Closed)
PhotoGate open	F2 (Open)

5. Press EXE to finalize Trigger Setup and return to the Advanced Setup menu (page 3-1).

■ Graph Setup

Use the Graph Setup screen to configure settings for the graph produced after sampling is complete. You use the Sample Setup settings (page 3-4) to turn graphing on or off.

• To configure Graph Setup settings

1. While the Advanced Setup menu (page 3-1) is on the display, press 4 (Graph).

   • This displays the Graph Setup screen.

Currently selected item —

```
Graph Setup
Graph Func  :On
Coord       :On
Econ Axes   :On
Real Scroll :Off


On Off
```
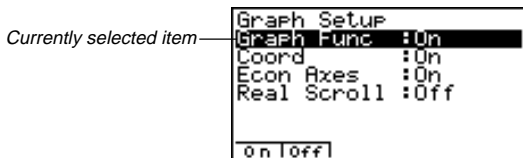
Graph Setup Screen

2. To change the graph source data name display setting, use the ⊕ and ⊙ cursor keys to move the highlighting to "Graph Func". Next, press one of the function keys described below.

To specify this graph source data name display setting:	Press this key:
Display source data name	F1(On)
Hide source data name	F2(Off)

• When the graph data is stored in a sample data memory file, the file name appears as the source data name. When the graph data is stored in current data area, the channel name appears.

3. To change the trace operation coordinate display setting, use the ⊕ and ⊙ cursor keys to move the highlighting to "Coord". Next, press one of the function keys described below.

To specify this coordinate display setting for the trace operation:	Press this key:
Display trace coordinates	F1(On)
Hide trace coordinates	F2(Off)

4. To change the numeric axes display setting, use the ⊕ and ⊙ cursor keys to move the highlighting to "Econ Axes". Next, press one of the function keys described below.

To specify this axes display setting:	Press this key:
Display axes	F1(On)
Hide axes	F2(Off)

5. To change the real-time scroll setting, use the ⊕ and ⊙ cursor keys to move the highlighting to "RealScroll". Next, press one of the function keys described below.

To specify this real-time scrolling setting:	Press this key:
Real-time scrolling on	F1(On)
Real-time scrolling off	F2(Off)

6. Press EXE to finalize Graph Setup and return to the Advanced Setup menu.

   Note

   • For details about sample data memory and current data area, see "9 Using Sample Data Memory".

4 Using a Custom Probe

You can use the procedures in this section to configure a custom probe for use with the EA-200. The term "custom probe" means any sensor other than the CASIO or Vernier sensors specified as standard for the E-CON2 Mode.

■ Configuring a Custom Probe Setup

To configure a custom probe setup, 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 custom probe setup

1. From the E-CON2 main menu (page 1-1), press F1(SETUP) and then 2(Advan) to display the Advanced Setup menu.

   • See "3 Using Advanced Setup" for more information.

2. On the Advanced Setup menu (page 3-1), press 5(Custom Probe) to display the Custom Probe List.

   • The message "No Custom Probe" appears if the Custom Probe List is empty.

3. Press F2(NEW).

   • This displays the screen for inputting the name of the new custom probe.

4. Input up to 18 characters for the custom probe name, and then press EXE.

   • This displays the screen for configuring a new custom probe.

5. Use the function keys described below to configure the custom probe setup.

   • To change the setting of an item, first use the ▲ and ▼ cursor keys to move the highlighting to the item. Next, use the function keys to select the setting you want.

   (1) Slope
   Press F1(EDIT) to display a dialog box for inputting the slope for the linear interpolation formula.

   (2) Intercept
   Press F1(EDIT) to display a dialog box for inputting the intercept for the linear interpolation formula.

(3) Unit Name

Press [F1](EDIT) to display a dialog box for inputting up to eight characters for the unit name.

6. Press [EXE] and then input a memory number (1 to 99).

• This saves the custom probe setup and returns to the Custom Probe List, which should now contain the new custom probe setup you configured.

■ Auto Calibrating a Custom Probe

Auto calibration automatically corrects the slope and intercept values of a custom probe setup based on two actual samples.

Important!

• Before performing the procedure below, you should prepare two conditions whose measurement values are known.

• When inputting reference value in step 4 of the procedure below, input the exact known measurement value of the condition you will sample in step 5. When inputting reference value in step 6 of the procedure below, input the exact known measurement value of the condition you will sample in step 7.

● To auto calibrate a custom probe

1. Connect the calculator and EA-200, and connect the custom probe you want to auto calibrate to CH1 of the EA-200.

2. Perform steps 1 through 4 of the procedure under "To configure a custom probe setup" on page 4-1.

3. Press [F2](CALIB).

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

```
Input Slope
[    
== Reference Value ==
 :
■               
Unit Name:None
EDIT|CALIB        HELP
```

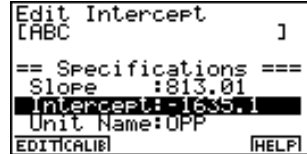4. Input a reference value for the first sample.

5. Press [EXE].

• This performs a sampling operation, and stores the value you input in step 4 and the sampled value. Next, the dialog box for inputting a reference value reappears.

6. Input a reference value for the second sample.

7. Press [EXE].

• This performs a sampling operation, and stores the value you input in step 6 and the sampled value.

• Next, the EA-200 calculates liner interpolation for the first set of values (reference and sampled), and the second set of values, and automatically inputs them for the slope and intercept values of the custom probe. The Edit Slope screen appears on the display with the new values.

```
Edit Intercept
[ABC          ]

== Specifications ===
 Slope   :813.01
 Intercept:-1635.1
 Unit Name:OPP
EDIT CALIB        HELP
```

8. Use the ⓐ and ⓥ cursor keys to move the highlighting to "Unit Name", and then press
   F1 (Edit) to display a dialog box for inputting up to eight characters for the unit name.

9. Press EXE, and then input a memory number from 1 to 99.

   • This saves the custom probe setup and returns to the custom probe list, which should now contain the new custom probe.

■ Managing Custom Probe Setups

Use the procedures in this section to edit and delete existing custom probe setups.

• To edit a custom probe setup

1. Display the Custom Probe List.

2. Select the custom probe setup whose configuration you want to edit.

   • Use the ⓐ and ⓥ cursor keys to highlight the name of the custom probe you want.

3. Press F3 (EDIT).

   • This displays the screen for configuring a custom probe setup.

   • To edit the custom probe setup, perform the procedure starting from step 5 under "To configure a custom probe setup" on page 4-1.

• To delete a custom probe setup

1. Display the Custom Probe List.

2. Select the custom probe setup you want to delete.

   • Use the ⓐ and ⓥ cursor keys to highlight the name of the custom probe setup you want.

3. Press F4 (DEL).

4. In response to the confirmation message that appears, press EXE to delete the custom probe setup.

   • To clear the confirmation message without deleting anything, press ESC.

5 Using the MULTIMETER Mode

You can use the Channel Setup screen (page 3-2) to configure a channel so that EA200 MULTIMETER Mode sampling is triggered by a calculator operation.

• **To use the MULTIMETER Mode**

1. Connect the calculator and EA-200, and connect the sensors you want to the applicable EA-200 channels.

2. From the Advanced Setup menu (page 3-1), use the Channel Setup screen (page 3-2) to configure sensor setups for each channel you will be using.

3. After configuring the sensor setups, press EXE to return to the Advanced Setup menu (page 3-1), and then press F2 (MULT).

   • This starts sampling in the EA-200 MULTIMETER mode and displays a list of sample values for each channel.

```
======== EA-200 ========

CH 1 :1.76V
CH 2 :25.8°C
CH 3 :-50.4m/s²
SONIC:1.88Meter

      Cancel:[AC]
```

4. To end MULTIMETER mode sampling, press the AC key. After "Break" appears on the display, press ESC.

   • Displayed sample data is refreshed at 0.5-second intervals.

   • Do not connect sensors to any other channels except for those you specified in step 2.

   • You do not need to select "None" for the sensor selection setting of channels that you do not select in step 2.

   • Data sampled in the MULTIMETER mode is not saved in memory.

6 Using Setup Memory

You can use setup memory to save EA-200 setups you configure using Setup Wizard or Advanced Setup in calculator memory for later recall when you need them.

■ Saving a Setup

A setup can be saved when any one of the following conditions exist.

• After configuring a new setup with Setup Wizard
  See step 8 under "To configure an EA-200 setup using Setup Wizard" on page 2-2.

• After configuring a new setup with Advanced Setup
  See step 6 under "To configure an EA-200 setup using Advanced Setup" on page 3-1 for more information.

• While the E-CON2 main menu (page 1-1) is on the display
  Performing the setup save operation while the E-CON2 main menu is on the display saves the contents of the current setup memory area (which were configured using Setup Wizard or Advanced Setup).

Details on saving a setup are listed below.

● To save a setup

1. Start the save operation by performing one of the function key operations described below.

   • If the Advanced Setup menu (page 3-1) is on the display, press [F3] (MEM).

   • If the E-CON2 main menu (page 1-1) is on the display, press [F2] (MEM).

   • Performing any one of the above operations causes the setup memory list to appear.

   • The message "No Setup-MEM" appears if setup memory is empty.

2. Press [F2] (SAVE).

   • If the final Setup Wizard screen (page 2-3) is on the display, press [2] (Save Setup-MEM).

   • This displays the screen for inputting the setup name.

   ```
   Setup-MEM Name
   [                    ]
   ```

3. Input up to 18 characters for the setup name.

4. Press [EXE] and then input a memory number (1 to 99).

   • If you start from the final Setup Wizard screen (page 2-3), this saves the setup and the message "Complete!" appears. Press [EXE] to return to the final Setup Wizard screen (page 2-3).

   • If you start from the Advanced Setup menu (page 3-1) or the E-CON2 main menu (page 1-1), this saves the setup and returns to the setup memory list which includes the name you assigned it.

   Important!

   • Since you assign both a setup name and a file number to each setup, you can assign the same name to multiple setups, if you want.

■ Using and Managing Setups in Setup Memory

All of the setups you save are shown in the setup memory list. After selecting a setup in the list, you can use it to sample data or you can edit it.

• To preview saved setup data

You can use the following procedure to check the contents of a setup before you use it for sampling.

1. On the E-CON2 main menu (page 1-1), press [F2] (MEM) to display the setup memory list.

2. Use the ⊙ and ⊙ cursor keys to highlight the name of the setup you want.

3. Press [OPTN] (Setup Preview).

   • This displays the preview dialog box.

   ```
   Setup-MEM List
         = SETUP-MEM =
   NAME    : REALTIME M
   SENSOR  : SONIC
   INTERVAL: 0.52Sec
   NUMBER  : 100
   STARTISAVE REN  DEL LOADIHELP
   ```

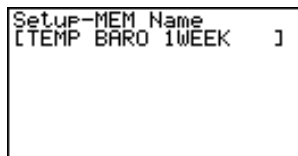4. To close the preview dialog box, press [ESC].

● **To recall a setup and use it for sampling**

Be sure to perform the following steps before starting sampling with the EA-200.

1. Connect the calculator to the EA-200.

2. Turn on EA-200 power.

3. In accordance with the setup you plan to use, connect the proper sensor to the appropriate EA-200 channel.

4. Prepare the item whose data is to be sampled.

5. On the E-CON2 main menu (page 1-1), press [F2] (MEM) to display the setup memory list.

6. Use the ⊕ and ⊙ cursor keys to highlight the name of the setup you want.

7. Press [F1] (START).

8. In response to the confirmation message that appears, press [EXE].

   • Pressing [EXE] sets up the EA-200 and then starts sampling.

   • To clear the confirmation message without sampling, press [ESC].

● **To change the name of setup data**

1. On the E-CON2 main menu (page 1-1), press [F2] (MEM) to display the setup memory list.

2. Use the ⊕ and ⊙ cursor keys to highlight the name of the setup you want.

3. Press [F3] (REN).

   • This displays the screen for inputting the setup name.

```
Setup-MEM Name
[TEMP BARO 1WEEK    ]
```

4. Input up to 18 characters for the setup name, and then press [EXE].

   • This changes the setup name and returns to the setup memory list.

   Note

   • See "Operations during a sampling operation" on page 8-2 for information about operations you can perform while a sampling operation is in progress.

● **To delete setup data**

1. On the E-CON2 main menu (page 1-1), press [F2] (MEM) to display the setup memory list.

2. Use the ⊙ and ⊙ cursor keys to highlight the name of the setup you want.

3. Press [F4] (DEL).

4. In response to the confirmation message that appears, press [EXE] to delete the setup.

   • To clear the confirmation message without deleting anything, press [ESC].

● **To recall setup data**

Recalling setup data stores it in the current setup memory area. You can then use Advanced Setup to edit the setup. This capability comes in handy when you need to perform a setup that is slightly different from one you have stored in memory.

1. On the E-CON2 main menu (page 1-1), press [F2] (MEM) to display the setup memory list.

2. Use the ⊙ and ⊙ cursor keys to highlight the name of the setup you want.

3. Press [F5] (LOAD).

4. In response to the confirmation message that appears, press [EXE] to recall the setup.

   • To clear the confirmation message without recalling the setup, press [ESC].

   Note

   • Recalling setup data replaces any other data currently in the current setup memory area.

7 Using Program Converter

Program Converter converts an EA-200 setup you configured using Setup Wizard or Advanced Setup to a program that can run on the calculator. You can also use Program Converter to convert a setup to a CFX-9850 Series/fx-7400 Series-compatible program and transfer it to a calculator.[*1][*2]

[*1] See the documentation that came with your scientific calculator or EA-200 for information about how to use a converted program.

[*2] See online help (PROGRAM CONVERTER HELP) for information about supported CFX-9850 Series and fx-7400 Series models.

■ Converting a Setup to a Program

A setup can be converted to a program when any one of the following conditions exists.

• After configuring a new setup with Setup Wizard
  See step 8 under "To configure an EA-200 setup using Setup Wizard" on page 2-2.

• After configuring a new setup with Advanced Setup
  See step 6 under "To configure an EA-200 setup using Advanced Setup" on page 3-1 for more information.

• While the E-CON2 main menu (page 1-1) is on the display
  Performing the program converter operation while the E-CON2 main menu is on the display converts the contents of the current setup memory area (which were configured using Setup Wizard or Advanced Setup).

The program converter procedure is identical in all of the above cases.

● To convert a setup to a program

1. Start the converter operation by performing one of the function key operations described below.

   • If the final Setup Wizard screen (page 2-3) is on the display, press ③ (Convert Program).

   • If the Advanced Setup menu (page 3-1) is on the display, press F4 (PRGM).

   • If the E-CON2 main menu (page 1-1) is on the display, press F3 (PRGM).

   • This displays the program name input screen.

```
Input Program Name
[          ]


F1:Transmit Program
   to CFX-9850/7400
TRNS        →O SYBL HELP
```

2. Input the name you want to assign to the program.

3. Press EXE.

   • This starts conversion of the setup data to a program.

   • The message "Complete!" appears when conversion is complete.

20021201

● **To convert setup data to a program and transfer it to a CFX-9850 Series/ fx-7400 Series calculator**

1. Connect the scientific calculator (CFX-9850 Series or fx-7400 Series) to the ALGEBRA-FX Series calculator.

   • Perform the necessary procedure on the scientific calculator to set it up to receive data.

2. Perform steps 1 and 2 of the procedure under "To convert a setup to a program" on page 7-1.

3. Press [F1] (TRNS). On the submenu that appears, specify the type of scientific calculator ([1]: FX9850 or [2]: fx7400) for which you want to configure a program.

   • Program conversion and transfer starts as soon as you specify a calculator model.

   • The message "Complete!" appears when conversion is complete.

   Important!

   • A program configured using Program converter makes it possible to perform sampling that is identical to that performed using the original setup. This is true except when you convert to a CFX-9850 Series or fx-7400 Series calculator program.

   Note

   • When you convent setup data to a CFX-9850 Series or fx-7400 Series program, any sample value storage list number greater than 5 is changed to 5.

   • CFX-9850 Series or fx-7400 Series calculators support up to six lists only.

   • List 6 is used for EA-200 setup.

8 Starting a Sampling Operation

The section describes how to use a setup configured using the E-CON2 Mode to start an EA-200 sampling operation.

■ Before getting started...

Be sure to perform the following steps before starting sampling with the EA-200.

1. Connect the calculator to the EA-200.

2. Turn on EA-200 power.

3. In accordance with the setup you plan to use, connect the proper sensor to the appropriate EA-200 channel.

4. Prepare the item whose data is to be sampled.

■ Starting a Sampling Operation

A sampling operation can be started when any one of the following conditions exist.

• After configuring a new setup with Setup Wizard
 See step 8 under "To configure an EA-200 setup using Setup Wizard" on page 2-2.

• After configuring a new setup with Advanced Setup
 See step 6 under "To configure an EA-200 setup using Advanced Setup" on page 3-1.

• While the E-CON2 main menu (page 1-1) is on the display
 Starting a sampling operation while the E-CON2 main menu is on the display performs sampling using the contents of the current setup memory area (which were configured using Setup Wizard or Advanced Setup).

• While the setup memory list is on the display
 You can select the setup you want on the setup memory list and then start sampling.

The following procedures explain the first three conditions described above. See "To recall a setup and use it for sampling" on page 6-3 for information about starting sampling from the setup memory list.

• **To start sampling**

1. Start the sampling operation by performing one of the function key operations described below.

   • If the final Setup Wizard screen (page 2-3) is on the display, press 1 (Start Setup).

   • If the Advanced Setup menu (page 3-1) is on the display, press F1 (START).

   • If the E-CON2 main menu (page 1-1) is on the display, press F4 (START).

   • This sets up the EA-200 using the setup data in the current setup memory area.

   • To interrupt a setup while the above screen is on the display, press AC.

   ```
   ======== EA-200 ========
        Setting EA-200...

          Cancel:[AC]
   ```
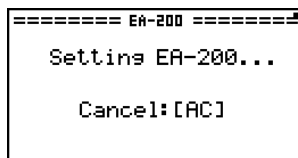
2. The sampling start dialog box appears after setup of the EA-200 is complete.

   • The content of the sampling start dialog box depends on the settings contained in the setup. See "Operations during a sampling operation" below for information about this dialog box and other display screens.

• **Operations during a sampling operation**

Sending a sample start command from the calculator to the EA-200 causes the following sequence to be performed.

> Setup Data Transfer → Sampling Start → Sampling End →
> Transfer of Sample Data from the EA-200 to the Calculator

The table on the next page shows how the trigger conditions and sensor type specified in the setup data affects the above sequence.

Starts Sampling

Mode	1. EA-200 Setup	2. Start Standby	3. Sampling	4. Graphing
Real-time	========= EA-200 ========= Setting EA-200... Cancel:[AC]	========= EA-200 ========= Start Sampling? Press:[EXE]		Sampled values are saved as Current Sample Data.
Fast			========= EA-200 ========= Sampling.... Cancel:[AC] • The screen shown below appears when CH1, SONIC, or Mic is used as the trigger. When sampling is done •press [EXE] key.	• **When Mode = Sound** Graph screen does not show all sampled values, but only a partial preview. Displayed the next sampled values.
Normal				Try Again? Yes:[EXE] No :[ESC] PREVIEW : ONE MOMENT PLEASE
Sound				Input values. Output Frequency? ?: Outputting through speaker PREVIEW : ONE MOMENT PLEASE SPEAKER OUTPUT PRESS [ESC] PREVIEW : ONE MOMENT PLEASE
Extended			Pressing [EXE] advances to 4. Graphing. Pressing [EXE] during sampling returns to 3. Sampling. Sampling... View:[EXE] Stop:[ESC]	
Period			When sampling is done •press [EXE] key.	• **When Number of Samples = 1** The following three graph types can be produced when Photo-Gate-Pulley is being used. 1. Time and distance graph 2. Time and velocity graph 3. Time and acceleration graph
Clock				• **When Number of Samples > 1** Sample values is stored as List data only.

20021201

9 Using Sample Data Memory

Performing an EA-200 sampling operation from the E-CON2 Mode causes sampled results to be stored in the "current data area" of E-CON2 memory. Separate data is saved for each channel, and the data for a particular channel in the current data area is called that channel's "current data".

Any time you perform a sampling operation, the current data of the channel(s) you use is replaced by the newly sampled data. If you want to save a set of current data and keep it from being replaced by a new sampling operation, save the data in sample data memory under a different file name.

■ Managing Sample Data Files

● To save current sample data to a file

1. On the E-CON2 main menu (page 1-1), press [F5] (GRPH).

   • This displays the Graph Mode screen.
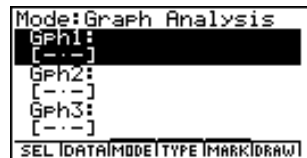
   ```
   Mode:Graph Analysis
   Gph1:
   [-.-]
   Gph2:
   [-.-]
   Gph3:
   [-.-]
   SEL DATA MODE TYPE MARK DRAW
   ```
   Graph Mode Screen

   • For details about the Graph Mode screen, see "10 Using the Graph Analysis Tools to Graph Data".

2. Press [F2] (DATA).

   • This displays the Sampling Data List screen.

   List of current data files

   "cd" stands for "current data". The text on the right side of the colon indicates the channel name.

   ```
   Sample Data List
   cd:CH1
   cd:CH2
   cd:SONIC
   ASIGN SAVE REN DEL        HELP
   ```
   Sampling Data List Screen

3. Use the ⊙ and ⊙ cursor keys to move the highlighting to the current data file you want to save, and then press [F2] (SAVE).

   • This displays the screen for inputting a data name.

   ```
   Sample Data Name
   CH 1 Current Data:
   [                    ]
   ```
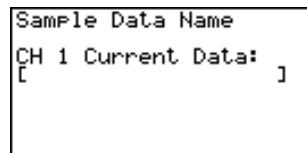
4. Enter up to eight characters for the data file name, and then press EXE.

   • This displays a dialog box for inputting a memory number.

5. Enter a memory number in the range of 1 to 99, and then press EXE.

   • This saves the sample data at the location specified by the memory number you input.

The sample data file you save is indicated on the display using the format:
<memory number>:<file name>.

```
Sample Data List
1:COIL
cd:CH1
cd:CH2
cd:SONIC

ASIGN SAVE REN DEL        HELP
```

   • If you specify a memory number that is already being used to store a data file, a confirmation message appears asking if you want to replace the existing file with the new data file. Press EXE to replace the existing data file, or ESC to return to the memory number input dialog box in Step 4.

6. To return to the E-CON2 main menu (page 1-1), press ESC twice.

   Note

   • You could select another data file besides a current data file in step 3 of the above procedure and save it under a different memory number. You do not need to change the file's name as long as you use a different file number.

● **To rename an existing sample data file**

   Note

   • You cannot use this procedure to rename a current data file name.

1. On the E-CON2 main menu (page 1-1), press F5 (GRPH).

   • This displays the Graph Mode screen.

2. Press F2 (DATA).

   • This displays the Sampling Data List screen.

3. Use the ▲ and ▼ cursor keys to move the highlighting to the data file you want to rename, and then press F3 (REN).

   • This displays the screen for inputting a file name.

4. Enter up to 18 characters for the new data file name, and then tap EXE.

   • This returns to the Sampling Data List screen.

5. To return to the E-CON2 main menu (page 1-1), press ESC twice.

● **To delete a sample data file**

1. On the E-CON2 main menu (page 1-1), press F5 (GRPH).

   • This displays the Graph Mode screen.

2. Press F2 (DATA).

   • This displays the Sampling Data List screen.

3. Use the ▲ and ▼ cursor keys to move the highlighting to the data file you want to delete, and then press [F4] (DEL).

4. In response to the confirmation message that appears, press [EXE] to delete the data file.
   • To clear the confirmation message without deleting the data file, press [ESC].
   • This returns to the Sampling Data List screen.

5. To return to the E-CON2 main menu (page 1-1), press [ESC] twice.

10 Using the Graph Analysis Tools to Graph Data

Graph Analysis tools make it possible to analyze graphs drawn from sampled data.

■ Accessing Graph Analysis Tools

You can access Graph Analysis tools using either of the two methods described below.

- **Accessing Graph Analysis tools from the Graph Mode screen, which is displayed by pressing** F5 **(GRPH) on the E-CON2 main menu (page 1-1)**
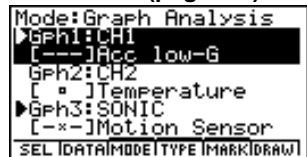
Graph Mode Screen

- The main menu appears after you perform a sampling operation. Press F5 (GRPH) at that time.

- When you access Graph Analysis tools using this method, you can select from among a variety of other Analysis modes. See "Selecting an Analysis Mode and Drawing a Graph" below for more information about the other Analysis modes.

- **Accessing Graph Analysis tools from the screen of a graph drawn after a sampling operation is executed from the Setup Wizard or from Advanced Setup (Realtime Mode)**
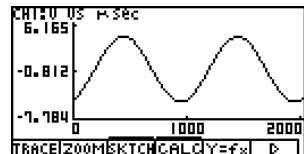
Graph Screen

- In this case, data is graphed after the sampling operation is complete, and the calculator accesses Graph Analysis tools automatically. See "Graph Screen Function Key Operations" on page 11-1.

■ Selecting an Analysis Mode and Drawing a Graph

This section contains a detailed procedure that covers all steps from selecting an analysis mode to drawing a graph.

Note

- Step 4 through step 6 are not essential and may be skipped, if you want. Skipping any step automatically applies the initial default values for its settings.

- If you skip step 2, the default analysis mode is the one whose name is displayed in the top line of the Graph Mode screen.

20021201

1. On the E-CON2 main menu (page 1-1), press [F5] (GRPH).
   • This displays the Graph Mode screen.

2. Press [F3] (MODE), and then select the analysis mode you want from the menu that appears.

To do this:	Perform this menu operation:	To select this mode:
Graph three sets of sampled data simultaneously	[Normal]	Graph Analysis
Graph sampled data along with its linear and quadratic differential graph	[Diff]	Differential
Display the graphs of different sampled data in upper and lower windows for comparison	[Compare]→[Graph]	Compare Graph
Output sampled data from the speaker, displaying graph of the raw data in the upper window and the output waveform in the lower window	[Compare]→[Sound]	Compare Sound
Display the graph of sampled data in the upper window and its first derivative graph in the lower window	[Compare]→[d/dt]	Compare d/dt
Display the graph of sampled data in the upper window and its second derivative graph in the lower window	[Compare]→[d²/dt²]	Compare d^2/dt^2

• The name of the currently selected mode appears in the top line of the Graph Mode screen.

Analysis mode name ⎯⎯

```
Mode:Graph Analysis
 Gph1:
 [-.-]
 Gph2:
 [-.-]
 Gph3:
 [-.-]
SEL DATA MODE TYPE MARK DRAW
```
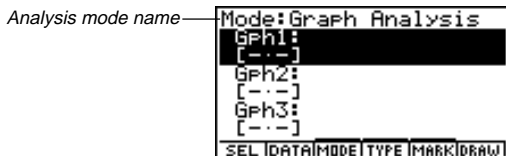
3. Specify the sampled data for graphing.

a. Use the ⊙ and ⊙ cursor keys to move the highlighting to the name of the sampled data file you want to select, and then press [EXE].
   • This returns to the Graph Mode screen, which shows the name of the sample data file you selected.

Graph on/off indicator ⎯⎯

```
Mode:Graph Analysis
▶Gph1:CH1
 [---]Acc low-G
 Gph2:
 [-.-]
 Gph3:
 [-.-]
SEL DATA MODE TYPE MARK DRAW
```

⎯ *Sample data file name*

⎯ *Name of sensor used for sampling*

Graph Mode Screen
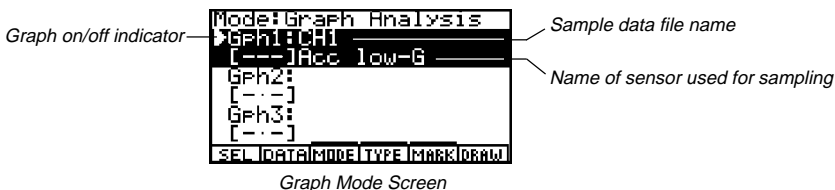
b. Repeat step a above to specify sample data files for other graphs, if there are any.
   • If you select "Graph Analysis" as the analysis mode in step 2, you must specify sample data files for three graphs. If you select "Compare Graph" as the analysis mode in step 2, you must specify sample data files for two graphs. With other modes, you need to specify only one sample data file.

• For details about Sampling Data List screen operations, see "9 Using Sample Data Memory".

4. Turn on graphing for each of the graphs listed on the Graph Mode screen.

a. On the Graph Mode screen, use the ⓐ and ⓥ cursor keys to select a graph, and then press F1(SEL) to toggle graphing on or off.

Graphing turned off.

Graphing turned on.

```
Mode:Graph Analysis
▶Gph1:CH1
 [---]Acc low-G
 Gph2:CH2
 [ • ]Temperature
▶Gph3:SONIC
 [-×-]Motion Sensor
SEL DATA MODE TYPE MARK DRAW
```
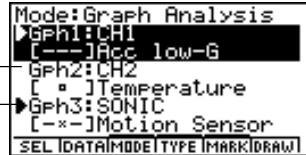
b. Repeat step a to turn each of the graphs listed on the Graph Mode screen on or off.

5. Select a type (scatter plot or xyLine) for each graph.

a. On the Graph Mode screen, use the ⓐ and ⓥ cursor keys to move the highlighting to the graph (Gph1, Gph2, etc.) whose type you want to specify, and then press F4(TYPE).

b. On the menu that appears, tap the graph type you want to select.

This part of the graph on/off indicator is the graph type indicator, which shows the graph type. Blank spaces indicate a scatter plot, while a hyphens (-) indicate an xyLine graph.

To select this graph type:	Select this option:	Which displays this graph type indicator:
Scatter plot	1(Scater)	Blank space
xyLine graph	2(xyLine)	Hyphen

c. Repeat a and b to specify the type for each of the graphs on the Graph Mode screen.

6. Specify a plot marker (dot, square, or cross) for each graph.

a. On the Graph Mode screen, use the ⓐ and ⓥ cursor keys to move the highlighting to the graph (Gph1, Gph2, etc.) whose plot marker you want to specify, and then press F5(MARK).

b. On the menu that appears, tap the plot marker you want to select.

This part of the graph on/off indicator is the marker type indicator.

To select this plot marker:	Select this option:	Which displays this marker type indicator:
Dot	1(Dot)	•
Square	2(Square)	□
Cross	3(Cross)	×

c. Repeat a and b to specify the marker type for each of the graphs on the Graph Mode screen.

7. On the Graph Mode screen, press [F6] (DRAW) or [EXE].

   • This draws the graph(s) in accordance with the settings you configured in step 2 through step 6.
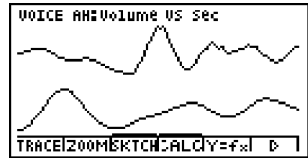
Graph Screen

   • When a Graph screen is on the display, the function keys provide you with zooming and other capabilities to aid in graph analysis.

     For details about Graph screen function key operations, see the following section.

11 Graph Analysis Tool Graph Screen Operations

This section explains the various operations you can perform on the graph screen after drawing a graph.

You can perform these operations on a graph screen produced by a sampling operation, or by the operation described under "Selecting an Analysis Mode and Drawing a Graph" on page 10-1.

■ Graph Screen Function Key Operations

When a graph screen is on the display, the function keys provide you with the following operations, which are indicated by the function menu along the bottom of the screen.

Press function key [F6] (▷) to toggle between Function Menu 1 and Function Menu 2.
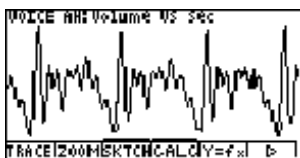
Function Menu 1   *Function Menu 2*

The following tables describe the functions that are available from each of the function menus.

Function Menu 1

Function Key	Description
[F1](TRACE)	Displays a trace pointer on the graph along with the coordinates of the current cursor location. Trace can also be used to obtain the periodic frequency of a specific range on the graph and assign it to a variable. See "Using Trace" on page 11-2.
[F2](ZOOM)	Starts a zoom operation, which you can use to enlarge or reduce the size of the graph along the x-axis or the y-axis. See "Using Zoom" on page 11-3.
[F3](SKTCH)	Displays a menu that contains the following commands: Cls, PlotOn, PlotOff, PlotChange, Text, Vert, and Horz. For details about each command, see "5-10 Changing the Appearance of a Graph" in the manual that comes with the ALGEBRA FX2.0/FX1.0 calculator.
[F4](CALC)	Displays a menu that lets you transform a sample result graph to a function using Fourier series expansion, and to perform regression to determine the tendency of a graph. See "Using Fourier Series Expansion to Transform a Waveform to a Function" on page 11-5, and "Performing Regression" on page 11-7.
[F5](Y=fx)	Displays the graph function list, which lets you select a Y=f(x) graph to overlay on the sampled result graph. See "Overlaying a Y=f(x) Graph on a Sampled Result Graph" on page 11-8.
[F6](▷)	Switches to Function Menu 2

Function Menu 2

Function Key	Description
F1 (PICT)	Saves the currently displayed graph as a graphic image. You can recall a saved graph image and overlay it on another graph to compare them. For details about these procedures, see "5-4 Storing a Graph in Picture Memory" in the manual that comes with the ALGEBRA FX2.0/FX1.0 calculator.
F2 (LMEM)	Displays a menu of functions for saving the sample values in a specific range of a graph to a list. See "Transforming Sampled Data to List Data" on page 11-4.
F3 (EDIT)	Displays a menu of functions for zooming and editing a particular graph when the graph screen contains multiple graphs. See "Working with Multiple Graphs" on page 11-9.
F4 (SPKR)	Starts an operation for outputting a specific range of a sound data waveform graph from the speaker. See "Outputting a Specific Range of a Graph from the Speaker" on page 11-11.
F6 (▷)	Switches to Function Menu 1

■ Scrolling the Graph Screen

Press the cursor keys while the graph screen is on the display scrolls the graph left, right, up, or down.

Note

• The cursor keys perform different operations besides scrolling while a trace or graph operation is in progress. To perform a graph screen scroll operation in this case, press ESC to cancel the trace or graph operation, and then press the cursor keys.

■ Using Trace

Trace displays a crosshair 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. You can also use trace to obtain the periodic frequency value for a particular range, and assign the range (time) and periodic frequency values in separate Alpha-Memory values.

● To use trace

1. On the graph screen, press F1 (TRACE).

   • This causes a trace pointer to appear on the graph. The coordinates of the current trace pointer location are also shown on the display.
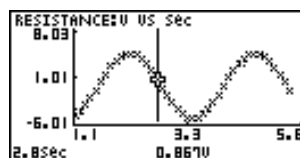
2. Use the ◀ and ▶ cursor keys to move the trace pointer along the graph to the location you want.

• The coordinate values change in accordance with the trace pointer movement.

• You can exit the trace pointer at any time by pressing [ESC].

● **To obtain the periodic frequency value**

1. Use the procedure under "To use trace" above to start a trace operation.

2. Move the trace pointer to the start point of the range whose periodic frequency you want to obtain, and then press [EXE].

3. Move the trace pointer to the end point of the range whose periodic frequency you want to obtain.

• This causes the period and periodic frequency value at the start point you selected in step 5 to appear along the bottom of the screen.
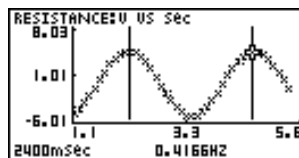
4. Press [EXE] to assign the period and periodic frequency values to Alpha-Memory variables.

• This displays a dialog box for specifying variable names for [Period] and [Frequency] values.

• The initial default variable name settings are "S" for the period and "H" for the periodic frequency. To change to another variable name, use the up and down cursor keys to move the highlighting to the item you want to change, and then press the applicable letter key.

5. After everything is the way you want, press [EXE].

• This stores the values and exits the trace operation.

• For details about using Alpha-Memory, see the manual that comes with the ALGEBRA FX2.0/FX1.0 calculator.

■ **Using Zoom**

Zoom lets you enlarge or reduce the size of the graph along the *x*-axis or the *y*-axis.

Note

• When there are multiple graphs on the screen, the procedure below zooms all of them. For information about zooming a particular graph when there are multiple graphs on the screen, see "Working with Multiple Graphs" on page 11-9.

• **To zoom the graph screen**

1. On the graph screen, press [F2](ZOOM).

   • This causes a magnifying glass cursor ( ) to appear in the center of the screen.

2. Use the cursor keys to move the magnifying glass cursor to the location on the screen that you want at the center of the enlarged or reduced screen.

3. Press [EXE].

   • This causes the magnifying glass to disappear and enters the zoom mode.

   • The cursor keys perform the following operations in the zoom mode.

To do this:	Press this cursor key:
Enlarge the graph image horizontally	▶
Reduce the size of the graph image horizontally	◀
Enlarge the graph image vertically	▲
Reduce the size of the graph image vertically	▼

4. To exit the zoom mode, press [ESC].

■ **Transforming Sampled Data to List Data**

Use the following procedure to transform the sampled data in a specific range of a graph into list data.

• **To transform sampled data to list data**

1. On the graph screen, press [F6](▷), and then [F2](LMEM).

   • This displays the [LMEM] menu.

2. Press [2](Select).

   • This displays the trace pointer for selecting the range on the graph.

3. Move the trace pointer to the start point of the range you want to convert to list data, and then press [EXE].

4. Move the trace pointer to the end point of the range you want to convert to list data, and then press [EXE].

• This displays a dialog box for specifying the lists where you want to store the time data and the sampled data.

→

• The initial default lists are List 1 for the time and List 2 for sample data. To change to another list (List 1 to List 20), use the up and down cursor keys to move the highlighting to the list you want to change, and then input the applicable list number.

5. After everything is the way you want, press [EXE].

• This returns to the graph screen.

• For details about using list data, see the manual that comes with the ALGEBRA FX2.0/ FX1.0 calculator.

Note

• Pressing [1] (ALL) in place of [2] (Select) in step 2 converts the entire graph to list data. In this case, the "Store Sample Data" dialog box appears as soon as you press [2] (ALL).

■ Using Fourier Series Expansion to Transform a Waveform to a Function

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.

• To perform Fourier series expansion

1. On the graph screen, press [F4] (CALC).

• This displays the [CALC] menu.

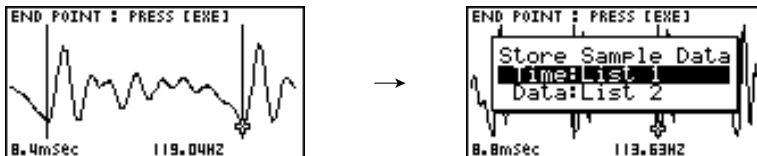2. Press [1] (Fourie).

• This displays the trace pointer for selecting the graph range.

3. Move the trace pointer to the start point of the range for which you want to perform Fourier series expansion, and then press [EXE].

4. Move the trace pointer to the end point of the range for which you want to perform Fourier series expansion, and then press [EXE].

    • This displays a dialog box for specifying the lists where you want to store the time data and the sampled data.

 →

    • The initial default lists are List 1 for the time and List 2 for sample data. To change to another list (List 1 to List 20), use the up and down cursor keys to move the highlighting to the list you want to change, and then input the applicable list number.

5. Press [EXE].

    • This saves the time and sampled values as list data, and displays a dialog box for inputting the degree of the Fourier series.

6. Input a value in the range of 1 to 10, and then press [EXE].

    • After a short while, the graph function list appears with the calculation result.

7. Pressing [F6] (DRAW) here graphs the function.

    • This lets you compare the expanded function graph and the original graph to see if they are the same.

■ Performing Regression

You can use the procedure below to perform regression for a range specified using the trace pointer. All of the following regression types are supported: 2VAR, Linear, Med-Med, Quadratic, Cubic, Quartic, Logarithmic, Exponential, Power, Sine, and Logistic.
For details about these regression types, see page 6-3-5 of the manual that comes with the ALGEBRA FX2.0/FX1.0 calculator.
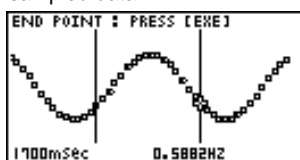The following procedure shows how to perform quadratic regression. The same general steps can also be used to perform the other types of regression.

• To perform quadratic regression

1. On the graph screen, press F4 (CALC).

   • This displays the [CALC] menu.

2. Press 5 (Quad).

   • This displays the trace pointer for selecting the range on the graph.

3. Move the trace pointer to the start point of the range for which you want to perform quadratic regression, and then press EXE.

4. Move the trace pointer to the end point of the range for which you want to perform quadratic regression, and then press EXE.

   • This displays a dialog box for specifying the lists where you want to store the time data and the sampled data.


   • The initial default lists are List 1 for the time and List 2 for sample data. To change to another list (List 1 to List 20), use the up and down cursor keys to move the highlighting to the list you want to change, and then input the applicable list number.

5. Press EXE.

   • This saves the time and sampled values as list data, and displays the quadratic regression calculation result screen.
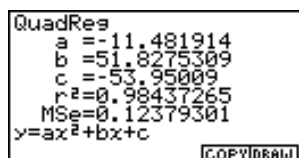
6. Press [F6] (DRAW).

   • This draws a quadratic regression graph and overlays it over the original graph.
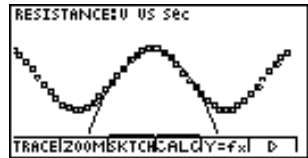
   • To delete the overlaid quadratic regression graph, press [F3] (SKTCH) and then [1] (Cls).

■ Overlaying a Y=f(x) Graph on a Sampled Result Graph

Use the following procedure when you want to overlay a Y=f(x) graph on the sampled result graph.

• To overlay a Y=f(x) graph on an existing graph

1. On the graph screen, press [F5] (Y=fx).

   • This displays the graph function list. Any functions you have previously input on the graph function list appear at this time.

2. Input the function you want to graph.

   • To input a function, use the ⊙ and ⊙ cursor keys to move the highlighting to the line where you want to input it, and then use the calculator keys for input. Press [EXE] to store the function.

3. On the graph function list, specify which functions you want to graph.

   • Graphing is turned on for any function whose "=" symbol is highlighted. To toggle graphing of a function on or off, use the ⊙ and ⊙ cursor keys to move the highlighting to the function, and then press [F1] (SEL).

4. After the graph function list settings are configured the way you want, press [F6] (DRAW).

   • This overlays graphs of all the functions for which graphing is turned on, over the graph that was originally on the graph screen.

    →

   Original Graph   *Overlaid with Y=f(x) Graph*

   • To delete the overlaid graph, press [F3] (SKTCH) and then [1] (Cls).

Important!

• The screenshot shown in step 4 above is of a function that was calculated and stored by performing regression on a graph that was drawn using sampled data. Note that overlaying a Y=f(x) graph on a sampled data graph does not automatically draw a regression graph based on sampled data.

■ Working with Multiple Graphs

The procedures in this section explain how you can zoom or move a particular graph when there are multiple graphs on the display.

● To zoom a particular graph on a multi-graph display

1. When the graph screen contains multiple graphs, press [F6] (▷), and then [F3] (EDIT).

   • This displays the [EDIT] menu.

2. Press [1] (1-Zoom).

   • This displays only one of the graphs that were originally on the graph screen.
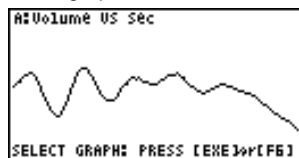
3. Use the ⊙ and ⊙ cursor keys to cycle through the graphs until the one you want is displayed, and then press [EXE].

   • This enters the zoom mode and causes all of the graphs to reappear, along with a magnifying glass cursor (⊛) in the center of the screen.


4. Use the cursor keys to move the magnifying glass cursor to the location on the screen that you want at the center of the enlarged or reduced screen.

   • This overlays graphs of all the functions for which graphing is turned on, over the graph that was originally on the graph screen.

5. Press EXE.

• This causes the magnifying glass to disappear and enters the zoom mode.

• The cursor keys perform the following operations in the zoom mode.

To do this:	Press this cursor key:
Enlarge the graph image horizontally	▶
Reduce the size of the graph image horizontally	◀
Enlarge the graph image vertically	▲
Reduce the size of the graph image vertically	▼
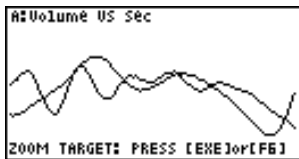
6. To exit the zoom mode, press ESC.

• To move a particular graph on a multi-graph display

1. When the graph screen contains multiple graphs, press F6 (▷), and then F3 (EDIT).

• This displays the [EDIT] menu.

2. Press 2 (1-Move).

• This displays only one of the graphs that were originally on the graph screen.

3. Use the ▲ and ▼ cursor keys to cycle through the graphs until the one you want is displayed, and then press EXE.

• This enters the move mode and causes all of the graphs to reappear.

4. Use the ◀ and ▶ cursor keys to move the graph left and right.
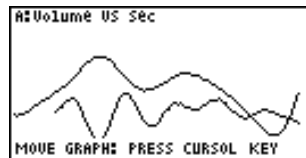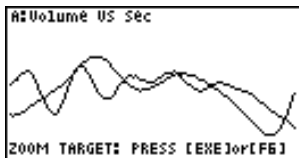
5. To exit the move mode, press ESC.

■ Outputting a Specific Range of a Graph from the Speaker

Use the following procedure to output a specific range of a sound data waveform graph from the speaker.

### ● To output a graph from the speaker

1. On the graph screen, press [F6] (▷), and then [F4] (SPKR).

   • This displays the trace pointer for selecting the range on the graph.

2. Move the trace pointer to the start point of the range you want to output from the speaker, and then press [EXE].

3. Move the trace pointer to the end point of the range you want to output from the speaker, and then press [EXE].

   • After you specify the start point and end point, a dialog box like the one shown below appears on the display.
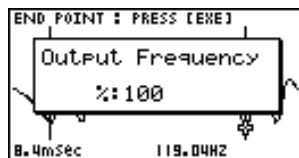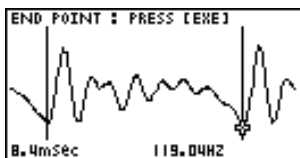
4. Input a percent value for the output frequency value you want.

   • The output frequency specification is a percent value. 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%.

5. After inputting an output frequency value, press [EXE].

   • This outputs the waveform between the start point and end point from the EA-200 speaker.

   • If the sound you configured cannot be output for some reason, the message "Range Error" will appear. Note that the supported output range is 200 to 4000Hz. If this happens, press [ESC] to scroll back through the previous setting screens and change the setup as required.

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

   • Pressing [EXE] after terminating sound output returns to the output frequency dialog box in step 3.

■ Configuring View Window Parameters

Pressing [SHIFT] [OPTN] (V-Window) while the graph screen is on the display displays a View Window function key menu along the bottom of the display.
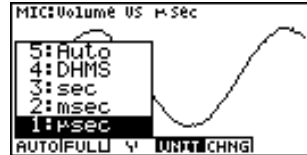
Press the function key that corresponds to the View Window parameter you want to configure.

Function Key	Description
[F1](AUTO)	Automatically applies the following View Window parameters. Y-axis Elements: In accordance with screen size X-axis Elements: In accordance with screen size when 1 data item equals 1 dot; 1 data equals 1 dot in other cases
[F2](FULL)	Resizes the graph so all of it fits in the screen.
[F3](Y)	Resizes the graph so all of it fits in the screen along the Y-axis, without changing the X-axis dimensions.
[F4](UNIT)	Specifies the unit of the numeric axis grid displayed by the Econ Axes setting of the graph setup screen (page 3-9). [1](μ sec): microseconds [2](msec): milliseconds [3](sec): seconds [4](DHMS):days, hours, minutes, seconds (1 day, 2 hours, 30 minutes, 5 seconds = 1d2h30m5s) [5](Auto):Auto selection
[F5](CHNG)	Toggles display of the source data on the graph screen on and off. To exit the View Window function key menu and return to the standard function key menu, press [ESC].