Ultra-Early Machine Failure Sign & QA AE Logging System

Early Observer MEL-E

AE SYSTEM SUPPORT TOOL

User's Manual

JCC Co., Ltd.

History

Software

Version No.	Revision Date	Description
Ver. 0.1.6	10, Jun., 2024	1st edition Japanese document FNF 0040 14D

User's Manual

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Contents

1. SUMMARY 1
2. TRADEMARKS 1
3. ABOUT AE SYSTEM SUPPORT TOOL 1
4. AE MEASUREMENT FUNCTION 2
5. SYSTEM REQUIREMENTS 3
6. CONNECTING WITH EARLY OBSERVER MEL-E 3
7. INSTALLING THE SOFTWARE 4
7-1. Installing a USB Driver 4
7-2. Installing the Software 4
8. OPERATING AE TOOL 5
8-1. Main Screen 6
8-1-1. Graph Drawing 7
8-1-2. Status Display 7
8-1-3. Elapsed Time Display 7
8-1-4. Gain Value Selection 8
8-1-5. HPF Value Selection 8
8-1-6. Counts Mode Selection 8
8-1-7. Amplitude Threshold Value Settings 9
8-1-8. Transmission Interval Selection 9
8-1-9. Apportioned Value Settings 9
8-1-10. Axis Number Settings 10
8-1-11. Measurement Start/Stop 10
8-1-12. Menu 11
8-2. Settings Screen 12
8-2-1. Connection Settings 12
8-2-2. Graph Settings 13
8-2-3. Measurement Data Max Value Settings 13
8-2-4. Communication Log 13
8-2-5. Time Settings 14
8-2-6. Communication Settings 1 (MEL-E side) 15
8-2-7. Communication Settings 2 (MEL-E and PC side) 16
8-2-8. Sensor Signal Check 17
8-2-9. Measurement Data Save Settings 18
8-2-10. Saving and Reading Measurement Data 18
8-2-11. Closing 18

9. SAVING MEASUREMENT DATA FILES 19
9-1. File Save Location 19
9-2. Format for Saved File Name 19
9-3. Saved Data 20
10. HOW TO AVOID POINT OPEN FAILURE ERROR 22

1. SUMMARY

This User's Manual describes the method to use the AE SYSTEM SUPPORT TOOL software for Early Observer MEL-E (hereinafter, "MEL-E").

Please note that the described specifications or functions may be changed without notice for technological improvement.

2. TRADEMARKS

- Microsoft Windows is a registered trademark of Microsoft Corporation in the United States and/or other countries.
- Microsoft and Excel are registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.
- Other product names and company names shown in this document are registered trademarks or trademarks of each company.

3. ABOUT AE SYSTEM SUPPORT TOOL

AE SYSTEM SUPPORT TOOL (hereinafter, "AE TOOL") converts signals that have undergone advanced analysis processing in real-time by MEL-E into data that can be analyzed and evaluated for easy visualization.

With the AE TOOL, the phenomenon generated by acoustic emission (hereinafter, "AE") can be caught quickly without any one being missed.

The AE TOOL can display two types of graphs at the same time out of the following four types of measurement data.

• Amplitude-MAX	[mV]	: Maximum amplitude value
• Energy	[dBs]	: Energy value (integrated value of Amplitude-MAX)
• RMS	[mV]	: Effective value
• Counts	[pieces]	: 0 V or number of intersection points of set threshold value

[Cautions on AE measurement by PC]

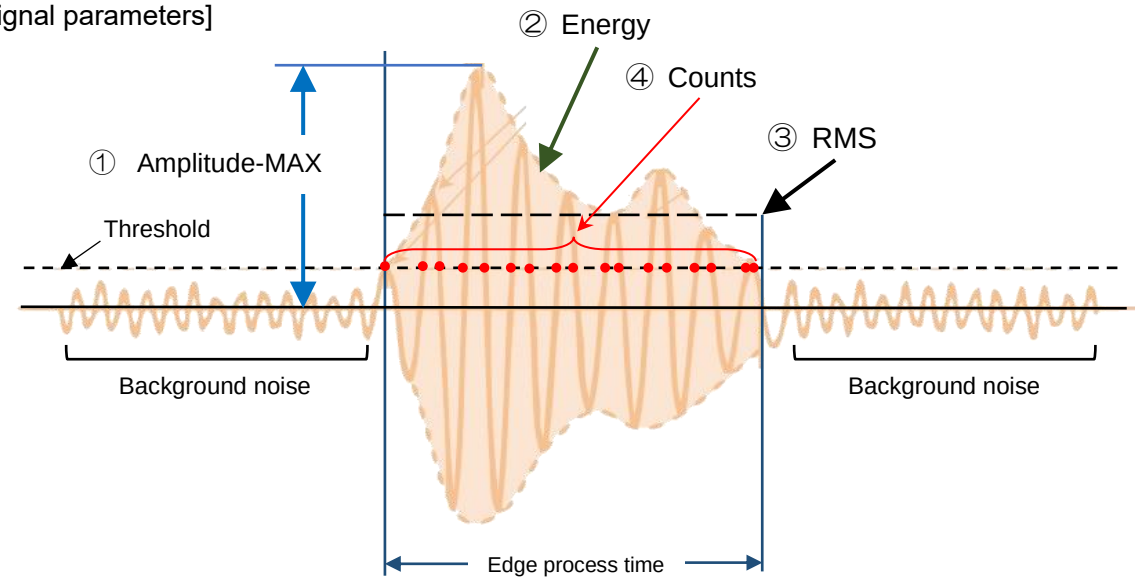
-If the AE measurement is performed by connecting the USB port of PC with a "cable for connecting PC", the Ethernet communication between MEL-E and the programable controller will be blocked.
To restart the Ethernet communication between MEL-E and the programable controller, turn off and on the power supply of MEL-E.

-AE measurement on a PC depends on the performance of the PC.
AE measurement on a PC should be done within 1 hour.
If AE measurement will take more than 1 hour, please use a PLC.

4. AE MEASUREMENT FUNCTION

The AE signal is converted into four parameters and measured.

[AE signal parameters]



① Amplitude-MAX = Max. amplitude value: Value of AE waveform within “edge process time”

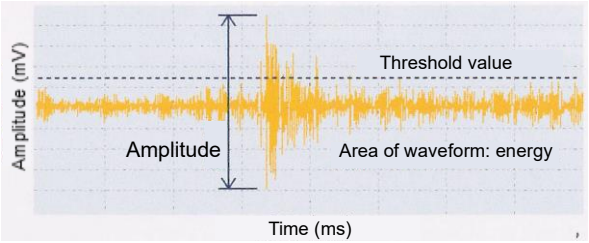
② Energy = Energy value: Integrated value of AE waveform within “edge process time”

③ RMS = Effective value: Value of AE signal acquired for each unit of “edge process time”

④ Counts = Count value: No. of intersections with 0 V or set threshold within "edge process time”

[AE waveform and measurement points]

Sudden type



Source of occurrence: Crack growth, material transformation, etc.

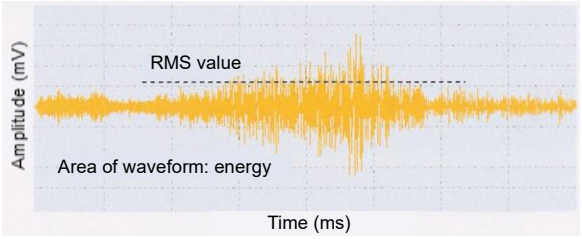
Waveform shape: Steep rise

RMS (effective value): Correlation with crack growth distance

Energy: Correlation with crack growth distance

Frequency: Different characteristics for each object/material

Continuous type



Source of occurrence: Friction, wear, etc.

Waveform shape: Continuous signal

RMS (effective value): Correlation with frictional force and coefficient of friction

Energy: Correlation with friction volume

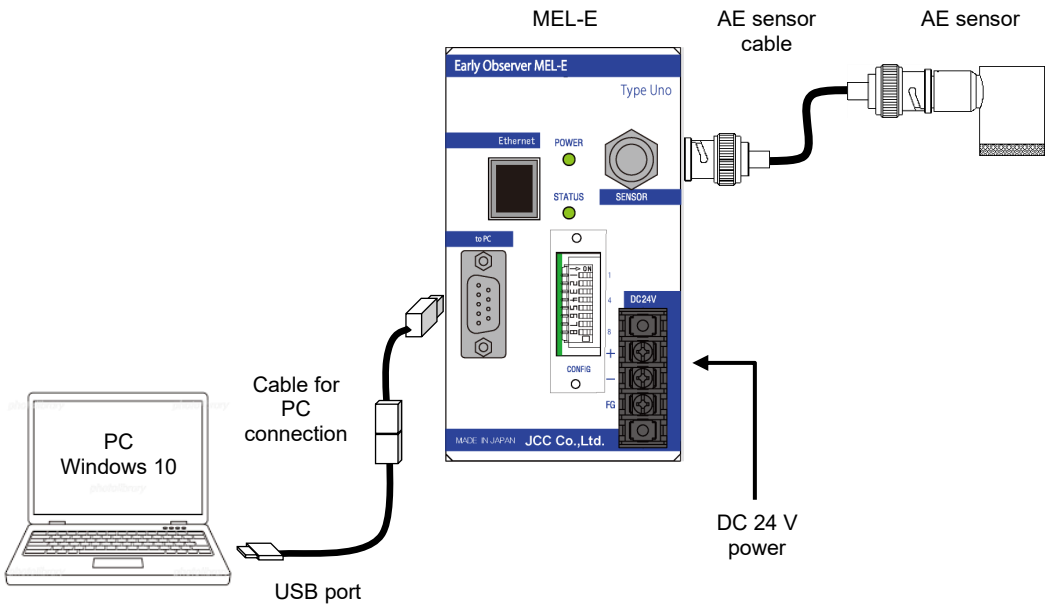
Frequency: Different characteristics for each object/material

5. SYSTEM REQUIREMENTS

The system with the following requirements is required to use the AE TOOL. (Recommended system)

- Microsoft Windows 10 (64-bit) or later
- 1 USB port
  * To connect with MEL-E, we recommend using the PC connection cable (EO-232C/USB2).
- Intel CORE i5 CPU or higher (8th generation CPU or later recommended)
- 8 GB memory or higher
- Hard disk with 10 MB of empty space or more
  Note: Approx. 4 MB of space is needed to save 10 minutes of measurement data.

6. CONNECTING WITH EARLY OBSERVER MEL-E



Connect each device to the MEL-E as shown in the image above.

Turn off the power to the MEL-E before connecting with the PC.

- Connect the PC and the MEL-E using the PC connection cable.
- Connect the AE sensor with the SENSOR connector.
- Connect the power to the power terminal.
- Turn off all CONFIG switches.

7. INSTALLING THE SOFTWARE

7-1. Installing a USB Driver

Install the USB driver of the PC connection cable.

Connect the PC connection cable to the PC while connected to the Internet. The USB driver of the PC connection cable is automatically installed.

* If the USB driver cannot be installed, download the driver from the website shown below, and then install it.
  https://www.buffalo.jp/download/software/
  Model: BSUSRC06SV

● Steps to install the driver downloaded from the website (example for Windows 10)

1. Connect the PC connection cable to the USB port of the PC.
2. On the PC, go to [Control Panel] and [System] and open [Device Manager].
3. Right-click [USB SERIAL CONVERTER] and select “Update driver.”
   * The name of [USB SERIAL CONVERTER] may be slightly different.
4. Select “Browse my computer for driver software.”
5. Browse to the folder containing the “CDM v2.12.28 WHQL Certified” driver file and click OK to update [USB SERIAL CONVERTER].
6. Open [Device Manager] again. Right-click [USB Serial Port] and update it in the same way.
   * The name of [USB Serial Port] may be slightly different.

This completes the driver installation.

∗It is necessary to install the USB driver only when connecting the PC connection cable for the first time. For the second connection, it is not necessary to install for the USB driver.

7-2. Installing the Software

Double-click AE SYSTEM SUPPORT TOOL.exe to start the software.

* It is not necessary to install the software.

A port open failure error may occur when starting the software.

In that case, refer to “10. HOW TO AVOID PORT OPEN FAILURE ERROR.”

[Precautions when conducting AE measurements on the PC]

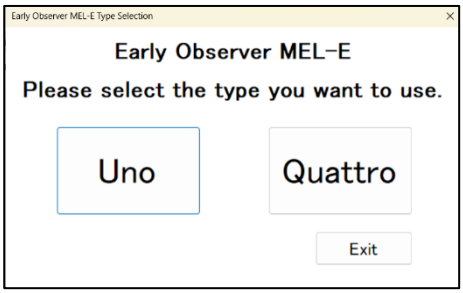
If the AE measurements is performed by connecting the USB port of PC with the PC connection cable, the Ethernet communication between the MEL-E and the programmable controller may be disrupted.
To restart the Ethernet communication between the MEL-E and the programmable controller, turn off and on the power of the MEL-E.

8. OPERATING AE TOOL

Double-click AE SYSTEM SUPPORT TOOL to start the software.



Select the Early Observer type that you are going to use.

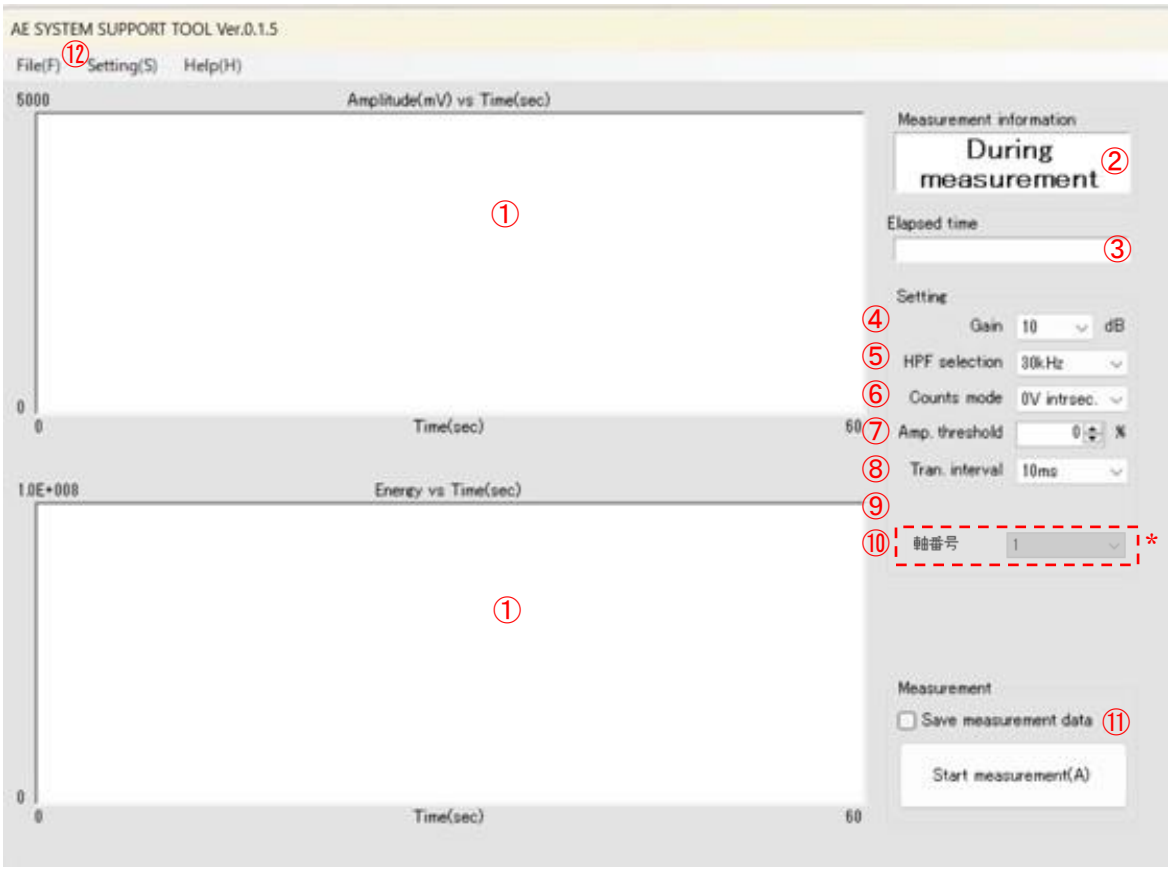


【Note】

Depending on the PC you are using, a virus warning may appear at the start.

In such a case, run “Windows Update” on the PC to update Windows to the latest state.

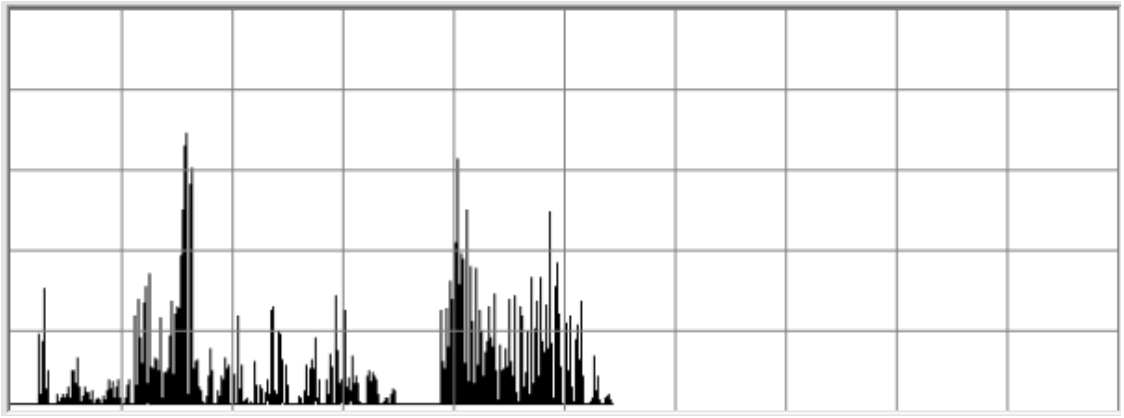
8-1. Main Screen



① Graph drawing
② Status display
③ Elapsed time display
④ Gain value selection
⑤ HPF selection
⑥ Counts mode selection
⑦ Amplitude threshold value
⑧ Transmission interval
⑨ Apportioned value (Uno SERIAL No.**214 or later)
⑩ Axis number *Only for Quattro
⑪ Measurement start/stop
⑫ Menu

8-1-1. Graph Drawing

This draws graphs of the measurement data selected on the settings screen.
The items to be displayed and the maximum values for both the top and bottom graphs can be selected in [Settings].



8-1-2. Status Display

This displays the current status of the AE TOOL.



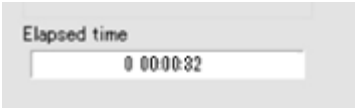
AE measurement not performed



AE measurement in progress

8-1-3. Elapsed Time Display

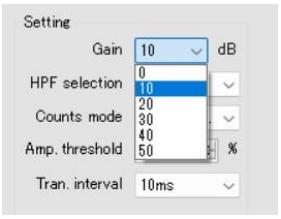
This displays the elapsed time since the start of the measurement.



Displayed in the format of “Day Hour : Minute : Second” from the left

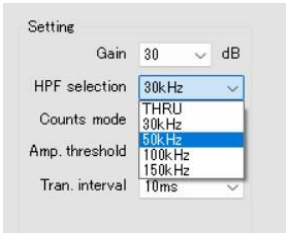
8-1-4. Gain Value Selection

This is used to select the gain value.



8-1-5. HPF Value Selection

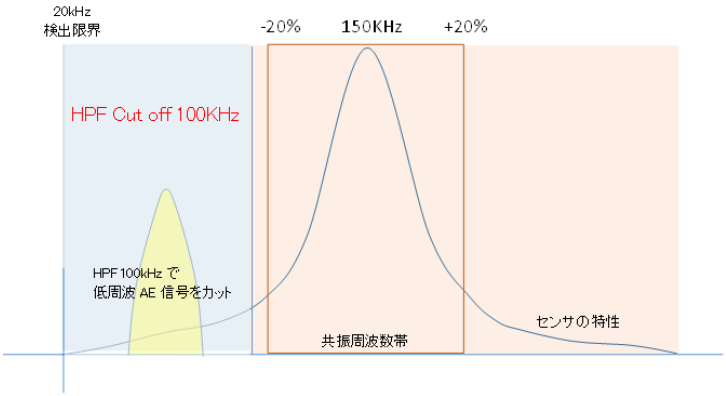
This is used to select the high pass filter (HPF) value.



■ Image of HPF

The frequency band not required for AE measurement is to be cut.

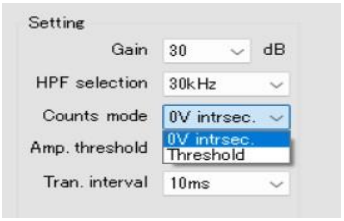
HPF: High Pass Filter

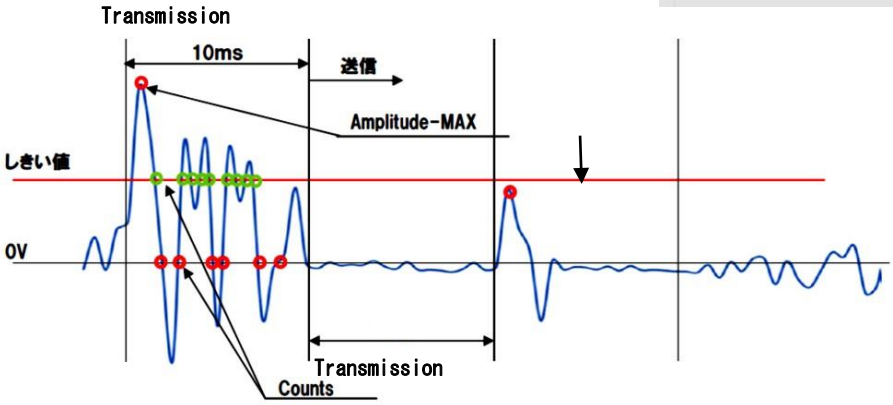


8-1-6. Counts Mode Selection

This selects the measurement level for the counts.

The measurement level and the number of intersections selected here are output as “Counts.”





8-1-7. Amplitude Threshold Value Settings

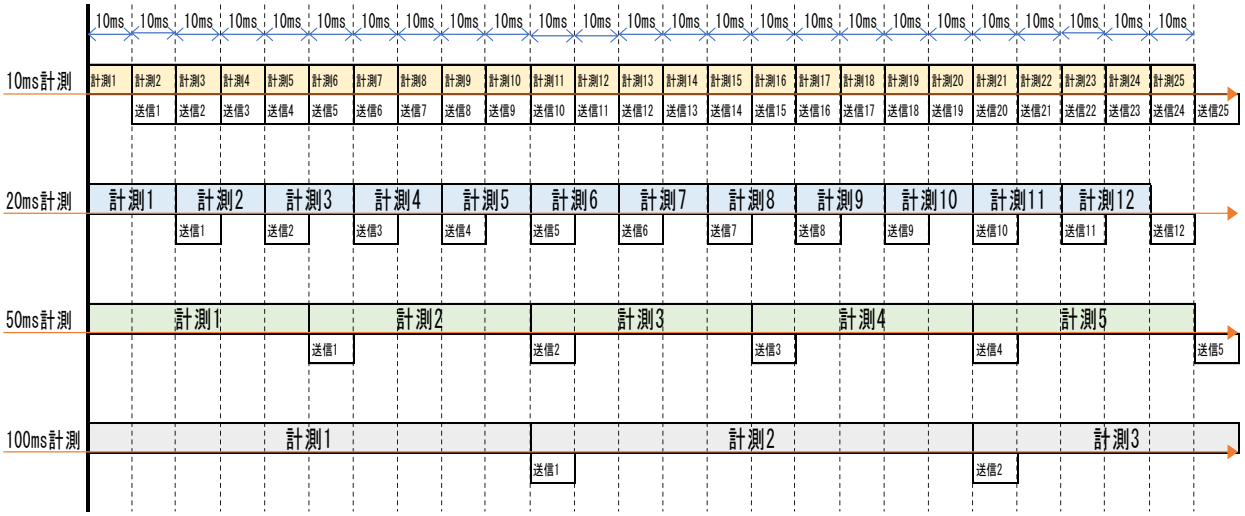
This sets the threshold value when [Threshold value] is selected in Counts mode.
The threshold value should be set from 0% to 99% based on the amplitude voltage range (0 to 5,000 mV).

8-1-8. Transmission Interval Selection

Select the transmission interval from 10ms, 20ms, 50ms, 100ms, 1000ms and 2000ms.

* 1,000 or 2,000 ms is applicable only for Uno serial No.**214 or later.

[Image of transmission interval]



8-1-9. Apportioned Value Settings

If a large value is selected as the transmission interval, the energy value may become large. In such a case, setting an apportioned value outputs the energy value after apportion measurement.

Energy Value = Energy ÷ Factor of 10 of the apportioned value

Example: Energy value when the energy is 80,162,573,654 with apportioned value

Apportioned value	Energy value
0	80,162,573,654
1	8,016,257,365
2	801,625,737
3	80,162,574
4	8,016,257
5	801,626
6	80,162
7	8,016
8	802
9	80

8-1-10. Axis Number Settings

When connecting Quattro, select the measurement axis for the AE data.
The AE measurement data is recorded in the folder of the selected axis number.

Important The measurement axis is switched using the I/O signal of the “axis switch I/O connector.”
(The axis cannot be switched using the AE SYSTEM SUPPORT TOOL dedicated software.)

8-1-11. Measurement Start/Stop

This is used to start or stop the AE measurement.

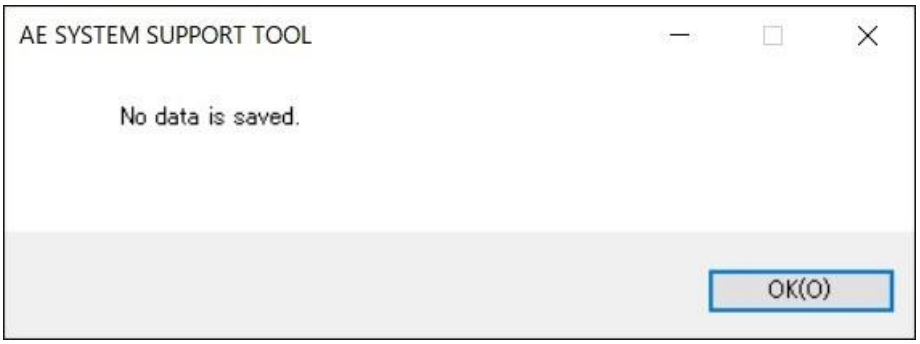


• Start Measurement (A)
This is used to start the AE measurement.



If you click the button when [Stop Measurement (A)] is displayed, the measurement will stop.

• Select the “Save measurement data” checkbox and click [Start Measurement (A)] to save the measured data in a file.
(For details on the saved data, refer to “8. Saved Measurement Data File.”)
If [Start Measurement (A)] is clicked without selecting the checkbox, a message indicating that the data will not be saved appears.
* You cannot enable “Save measurement data” while AE measurement is in progress.



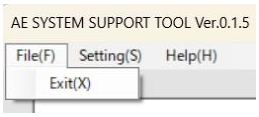
8-1-12. Menu

This is used to close the AE TOOL and perform other various settings.
This cannot be used while AE measurement is in progress.



• File (F)

Click [Exit (X)] to close the AE TOOL.

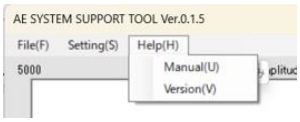


• Settings (S)

The settings screen appears. Details will be described later.

• Help (H)

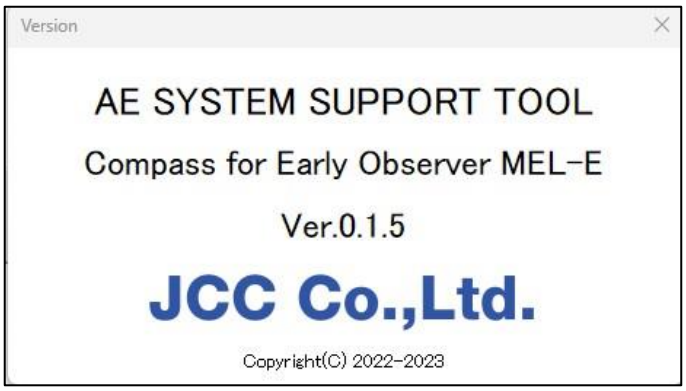
This displays the User's Manual (this document) or the version screen.



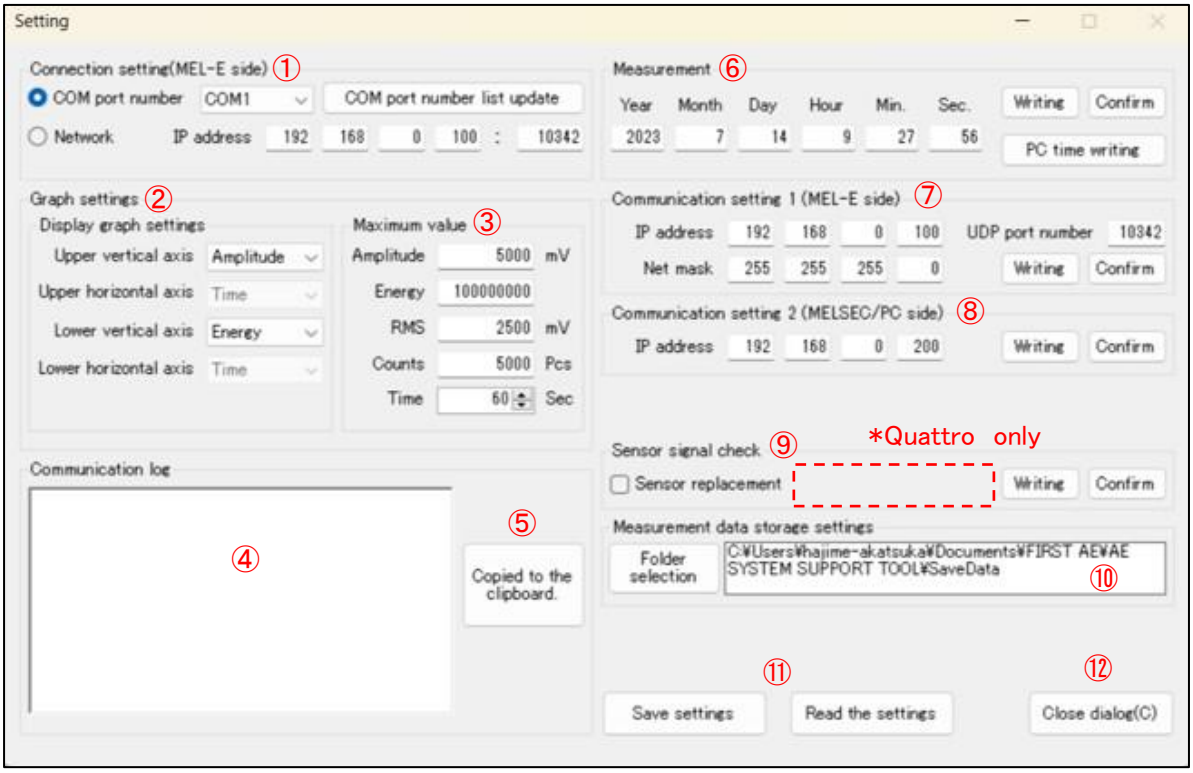
A separate software to view pdf* files needs to be installed on the PC in order to view the User's Manual.

* pdf: Portable Document Format

[Version screen]



8-2. Settings Screen



① Connection settings
② Graph settings
③ Max value settings for graphs
④ Communication log
⑤ Copy to clipboard
⑥ Time settings
⑦ Communication settings 1 (MEL-E side)
⑧ Communication settings 2 (MEL-E and PC side)
⑨ Sensor signal check
⑩ Measurement data storage settings
⑪ Saving and reading measurement data
⑫ Close

8-2-1. Connection Settings

This sets the communication environment to communicate with MEL-E.

When connecting via the PC connection cable, select “COM port.”

The COM port that can be connected to the PC is automatically selected.

* If the PC connection cable is connected after starting the AE tool, click the [COM port number list update] button before selecting a COM port number.

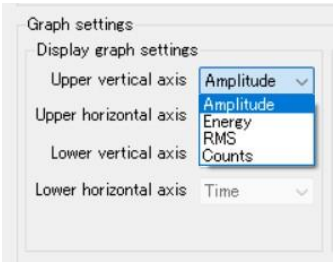


8-2-2. Graph Settings

This configures the measurement data displayed on the graph on the main screen.

Two types of graphs, top and bottom, can be shown.

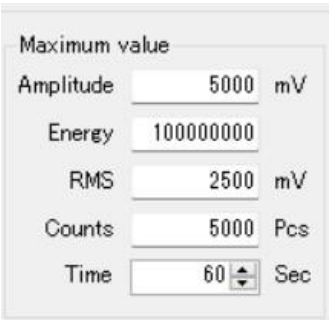
The horizontal axis represents the time (fixed).



8-2-3. Measurement Data Max Value Settings

This sets the upper limit values for each graph.

Time: Sets the time on the horizontal axis of the graph.



8-2-4. Communication Log

The received response data is displayed.

[Communication response example]



The displayed contents can be copied by pressing the [Copied to the clipboard] button.

8-2-5. Time Settings

This sets the time for MEL-E.



- Writing

  The configured time is set as the time for MEL-E. (Year, Month, Day, Hour, Minute, Second)

- Confirm

  This receives and displays the MEL-E time.

[Display example]



- PC time writing

  This sets the PC time as the time for MEL-E.

8-2-6. Communication Settings 1 (MEL-E side)

This configures the IP address, netmask, and UDP port number of MEL-E.
The following shows the initial values.

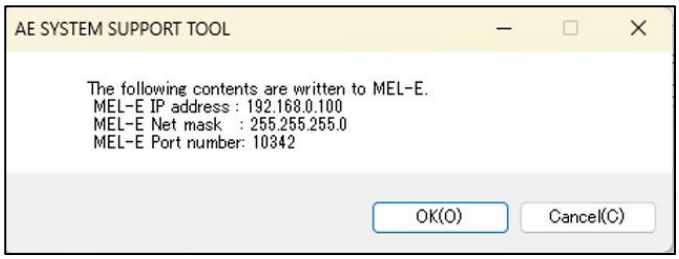


• Writing

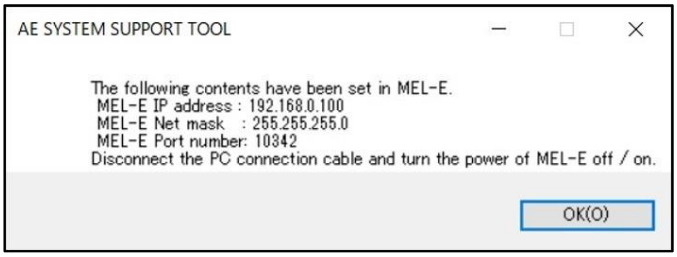
The configured values are set for MEL-E.

[Writing procedure]

1. Enter the setting values and click the [Writing] button.
2. The writing confirmation dialog appears. Click [OK].



3. The writing completed dialog appears. Click [OK].



4. Disconnect the PC connection cable and turn on the power of MEL-E again.

• Confirm

The current communication settings information is shown on the Communication Log screen.

8-2-7. Communication Settings 2 (MEL-E and PC side)

This sets the IP address of the target for MEL-E to connect to (programmable controller or PC). The initial value is 192.168.0.200.

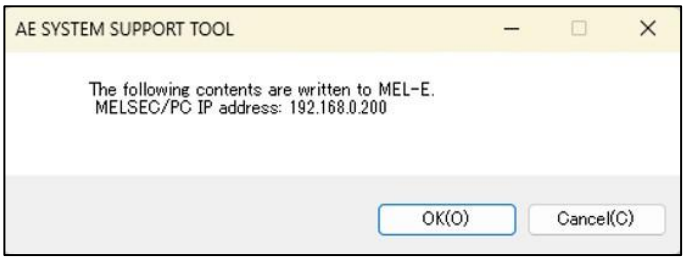


• Writing

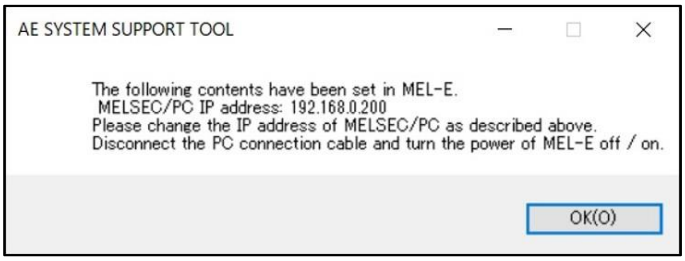
The configured values are set for MEL-E.

[Writing procedure]

1. Enter the setting values and click the [Writing] button.
2. The writing confirmation dialog box appears. Click [OK].



3. The writing completed dialog box appears. Click [OK].



4. Disconnect the PC connection cable and turn on the power of MEL-E again.

• Confirm

The current communication settings information is shown on the Communication Log screen.

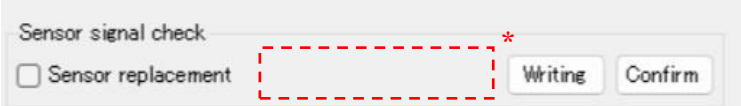
* If Ethernet communication fails, initialize the settings with the following steps:

1. Turn off the power of MEL-E.
2. Turn on the “Bit 1” CONFIG switch of MEL-E.
3. Turn on the power of MEL-E.
4. Once the program has started (POWER: lit in green), turn off the power of MEL-E.
5. Turn off the “Bit 1” CONFIG switch of MEL-E.

These steps return the settings to the initial values and enable Ethernet communication to be performed with the above initial values.

8-2-8. Sensor Signal Check

This checks the sensor signals.



• Axis number (only for Quattro)

When connecting Quattro, select the measurement axis for the sensor signal check.

The sensor signal check data is recorded separately for each of the four axes.

Important The measurement axis is switched using the I/O signal of the “axis switch I/O connector.”

(The axis cannot be switched using the AE SYSTEM SUPPORT TOOL dedicated software.)

• Writing

Measure the AE sensor signal and record it in “History 1.” The standard value and the past ten measurement values of the AE sensor signal are also displayed.

If the “Sensor replacement” checkbox is selected, the measurement value is written to the standard value.

[Sensor signal check execution example]



* History 01 shows the latest data.

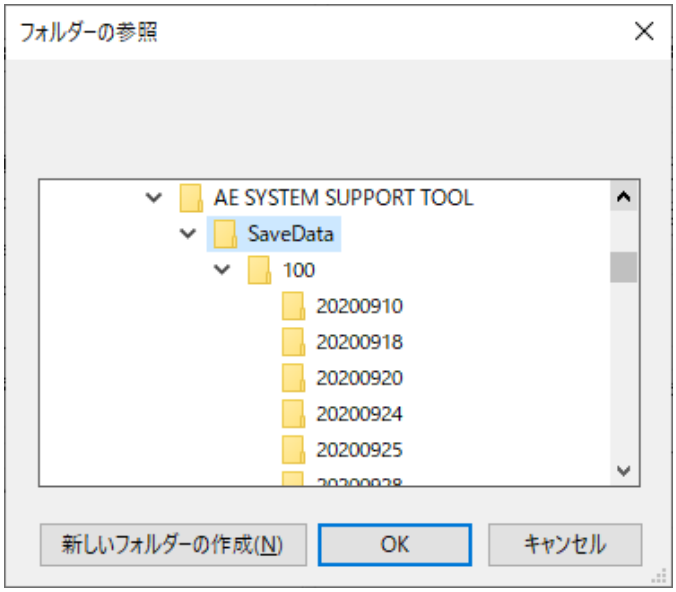
• Confirm

The standard value and the past ten measurement values of the AE sensor signal are displayed.

AE sensor signals are not measured and written here.

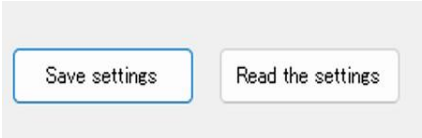
8-2-9. Measurement Data Save Settings

This sets the folder to save the measurement data file.



8-2-10. Saving and Reading Measurement Data

This is used to save and read the setting details.



- Save settings

  This is used to save the settings on the settings screen and the main screen.

  In the initial state, the settings are saved in the following file. Rewrite this file to change the settings when starting the software.

  <Documents>\FIRST AE\AE SYSTEM SUPPORT TOOL\ defaultsettings.csv

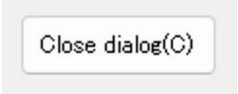
- Read settings

  This is used to read the settings on the settings screen and the main screen.

  To switch among multiple settings, read the configuration file using this button.

8-2-11. Closing

This closes the settings screen and returns to the main screen.



9. SAVING MEASUREMENT DATA FILES

If you select the “Save measurement data” checkbox on the main screen before performing a measurement, the measured data is saved in a file.
The saved file can be analyzed using Excel or other applications.

9-1. File Save Location

The files are saved in the folder specified in “Measurement data storage settings” on the settings screen. The initial value is set for the following folder.
<Documents>\FIRST AE\AE SYSTEM SUPPORT TOOL\SaveData

- Data measured with the PC connection cable connected is saved in the “000” folder. In addition, a folder for each measurement date is created in the “000” folder, and a sub-folder is created for each axis number.

  Example: Folder for axis number 1 for measurement date of Sep. 28, 2020
  <Specified folder>\000\20200928\1\

9-2. Format for Saved File Name

A file is saved in comma-separated values (CSV) format.
Its file name is created according to the following naming conventions.

Example. 1-20200928-131629-635_00001.csv

“1”	: Axis number (No.1)
“**20200928**”	: Measurement date (2020/09/28)
“**131629**”	: Measurement time (13:16:29)
“**635**”	: Measurement time in milliseconds
“**00001**”	: Serial number of the file

60,000 rows of data are saved in one file.
If there are more than 60,000 rows, the data is saved with a new name for which its serial number is incremented by one.

■ Measurement time with 60,000 rows of data

Transmission interval	Measurement time
10 ms	10 min
20 ms	20 min
50 ms	50 min
100 ms	100 min

9-3. Saved Data

Files are saved in CSV format.

■ Software of Ver. 0.1.4 or earlier

	A	B	C	D	E	F	G	H	I	J	K	L
1	Time(h:mm:ss.000)	Amplitude(mV)	Energy	RMS(mV)	Amplitude(dB)	Counts	Interval(ms)	Wire	Power	GAIN&HPF	Threshold	Version
2	13:38:37.840	48	198209	4	59	12128	10	0x00	0x00	0x03	0x80	0x10
3	13:38:37.850	46	192606	4	59	12368	10	0x00	0x00	0x03	0x80	0x10
4	13:38:37.860	44	200811	4	58	12424	10	0x00	0x00	0x03	0x80	0x10
5	13:38:37.870	51	186657	4	60	12505	10	0x00	0x00	0x03	0x80	0x10
6	13:38:37.880	47	181094	4	59	12720	10	0x00	0x00	0x03	0x80	0x10
7	13:38:37.890	49	204475	4	59	12264	10	0x00	0x00	0x03	0x80	0x10
8	13:38:37.900	51	193217	4	60	12416	10	0x00	0x00	0x03	0x80	0x10
9	13:38:37.910	50	183658	4	60	12746	10	0x00	0x00	0x03	0x80	0x10
10	13:38:37.920	50	197061	4	60	12031	10	0x00	0x00	0x03	0x80	0x10
11	13:38:37.930	50	199653	4	60	12136	10	0x00	0x00	0x03	0x80	0x10
12	13:38:37.940	62	181050	4	61	12560	10	0x00	0x00	0x03	0x80	0x10

Data is saved as follows.

Row A: Time (h:mm:ss.000) : Measurement time (h:mm:ss.000)

To show milliseconds on Excel, set the display format to “h:mm:ss.000” in the user definition.

Row B: Amplitude (mV) : Maximum amplitude value

Row C: Energy : Energy value

Row D: RMS (mV) : Effective value

Row E: Amplitude (dB) : Decibel equivalent of the maximum amplitude value

Amplitude (dB) 100 = Amplitude (mV) 5,000

Row F: Counts : 0 V or number of intersection points of set threshold value

Row G: Interval (ms) : Transmission interval (ms)

Row H: Wire : Sensor cable information (0x00 = Normal)

Row I: Power : Power information (0x00 = Normal)

Row J: GAIN&HPF : Gain and HPF values

HPF values	0 x _*	Gain values	0 x *_
THRU	0*	0 dB	*0
30 kHz	1*	10 dB	*1
50 kHz	2*	20 dB	*2
100 kHz	3*	30 dB	*3
150 kHz	4*	40 dB	*4
—	—	50 dB	*5

Row K: Threshold : Threshold 0x80 to 0xFF (hexadecimal digit)

Recorded value (HEX)	80	8C	9A	A6	B3	C0	CD	DA	E6	F3	FF
Setting value (%)	0	10	20	30	40	50	60	70	80	90	99

Use the following formula to convert the recorded value to the setting value.
Recorded value (HEX) — 128 ÷ 1.28 = Setting value (DEC)%
Example: C0 (hexadecimal digit) = 192 (decimal digit), 192 - 128 ÷ 1.28 = 50 (%)

Row L: Version : Version information

■ Software of Ver. 0.1.5 or later

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Time(h:mm:ss.000)	Amplitude(mV)	Energy	RMS(mV)	Amplitude(dB)	Counts	Interval(ms)	Wire	Power	Gain(dB)	HPF(kHz)	Threshold(%)	Apportion	Version
2	22:35.8	92	239241	6	65	7774	10	OK	OK	30	30	0	0	12
3	22:35.8	92	235396	6	65	7917	10	OK	OK	30	30	0	0	12
4	22:35.8	88	243986	6	64	7982	10	OK	OK	30	30	0	0	12
5	22:35.8	92	237583	6	65	7912	10	OK	OK	30	30	0	0	12
6	22:35.9	94	231784	6	65	7910	10	OK	OK	30	30	0	0	12
7	22:35.9	92	244084	6	65	8016	10	OK	OK	30	30	0	0	12
8	22:35.9	98	242875	6	65	7959	10	OK	OK	30	30	0	0	12
9	22:35.9	93	243070	6	65	7896	10	OK	OK	30	30	0	0	12
10	22:35.9	93	243023	6	65	7942	10	OK	OK	30	30	0	0	12
11	22:35.9	93	239349	6	65	7896	10	OK	OK	30	30	0	0	12
12	22:35.9	96	239233	6	65	7871	10	OK	OK	30	30	0	0	12

Data is saved as follows.

Row A: Time (h:mm:ss.000) : Measurement time (h:mm:ss.000)

To show milliseconds on Excel, set the display format to “h:mm:ss.000” in the user definition.

Row B: Amplitude (mV) : Maximum amplitude value

Row C: Energy : Energy value

Row D: RMS (mV) : Effective value

Row E: Amplitude (dB) : Decibel equivalent of the maximum amplitude value

Amplitude (dB) 100 = Amplitude (mV) 5,000

Row F: Counts : 0 V or number of intersection points of set threshold value

Row G: Interval (ms) : Transmission interval (ms)

Row H: Wire : Sensor cable information (OK: Normal/NG: Error)

Row I: Power : Power information (OK: Normal/NG: Error)

Row J: Gain(dB) : Gain value

Row K: HPF (kHz) : HPF value

Row L: Threshold (%) : Threshold

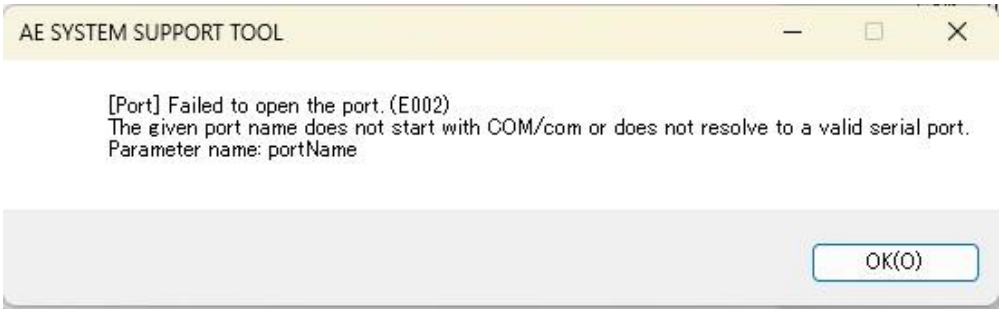
Row M: Apportion : Apportioned value

Row N: Version : Version information

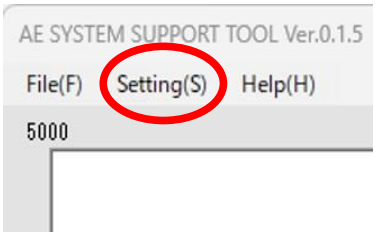
10. HOW TO AVOID POINT OPEN FAILURE ERROR

This section describes the method to avoid the port open failure error that may occur when starting the software (AE SYSTEM SUPPORT TOOL).

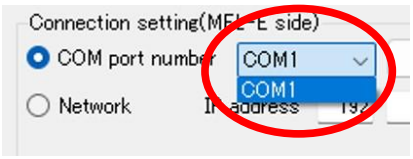
1. Start AE SYSTEM SUPPORT TOOL.exe.
   The following dialog appears if you have not set a COM port. Click [OK] to close the dialog.



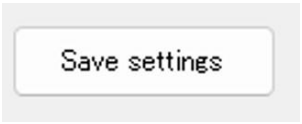
2. Click [Settings] on the menu to open the settings screen.



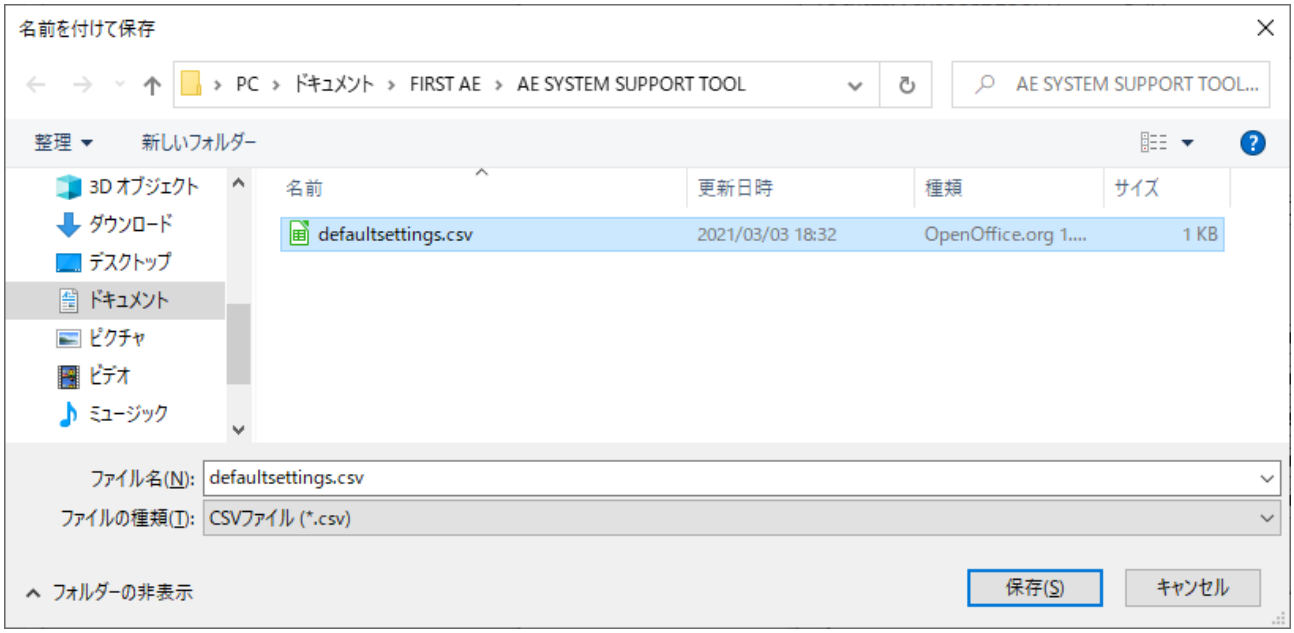
3. Select the COM port that you want to use.
   (The COM port number that can be used with the connected Early Observer MEL-E is shown.)



4. Click [Save settings].



5. Save (overwrite) the file as “defaultsettings.csv” in the “FIRST AE\AE SYSTEM SUPPORT TOOL” folder of the “Documents” folder.



6. Click [Close] on the settings screen to return to the main screen.

7. Close AE SYSTEM SUPPORT TOOL.exe.

8. Start AE SYSTEM SUPPORT TOOL.exe again.
   The error dialog does not appear if the COM port is recognized successfully.

[Notes]

If you change the USB port of the PC, you may encounter the port open failure error again. In such a case, configure the COM port to connect to by following the steps above.



∗This product is a data logging system adopting the AE sensor as a key technology, which does not guarantee machine failure sign diagnosis result or quality control.

■ **Contact**

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