EM labs

OPERATION MANUAL

CP-MA permittivity measurement software

EM LABS INC.

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1. Product Overview

CP-MA Permittivity Measurement Software is a software to efficiently measure complex relative permittivity by the perturbation method using the CP series cavity resonator. It controls the Keysight Technologies network analyzer and automatically acquires the necessary parameters and outputs the complex relative permittivity.

2. System Requirements

This section describes the operating environment required to use the software.

OS
- Windows OS (Windows 10 /11)
- .NET Framework 4.5 or later
- Keysight IO Libraries

Usable analyzers
- Keysight ENA / ENA-L Series Network Analyzers
- Keysight PNA / PNA-L Series Network Analyzers
- Keysight Streamline Series USB Vector Network Analyzers

NOTE

PNA series with firmware A07.50.48 and later is fully supported.

3. Install and Uninstall

This section provides detailed steps on how to install and uninstall the software.
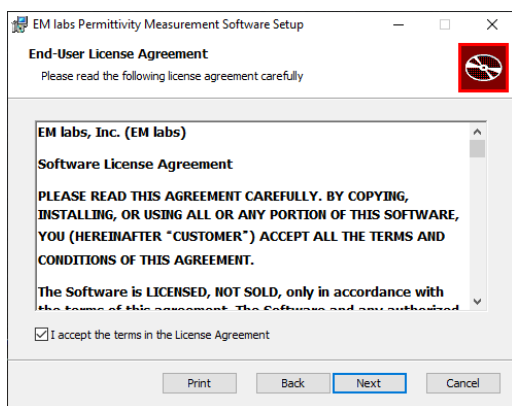
Installation

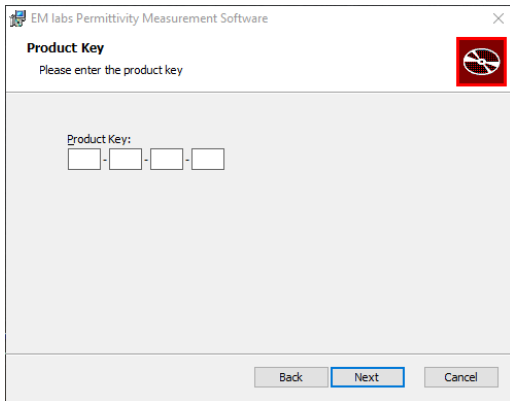Use the installer (EMlabsPMSetup.msi) and the 16-digit product key provided at the purchase.

1. Run EMlabsPMSetup.msi on a Windows PC and follow the on-screen instructions to proceed with the installation.
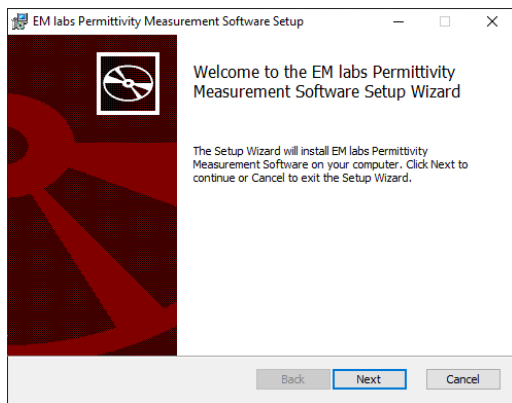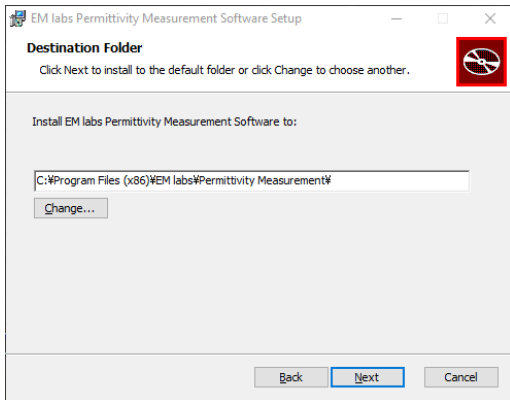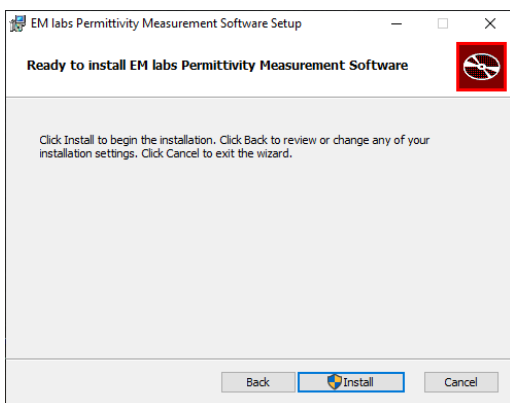

2. Accept the license agreement.
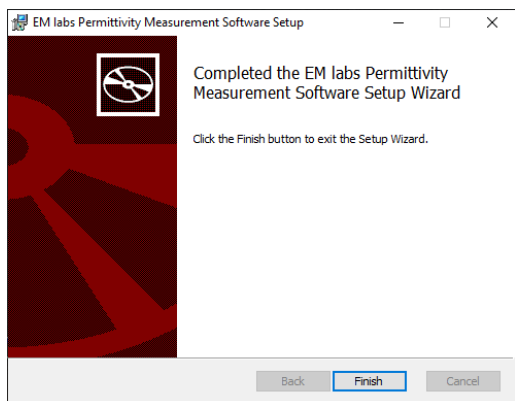
3. Enter the 16 digits product key.

4. Specify the installation destination. Use the default settings unless you need to change.

5. When ready, start the installation.

6.   Finish the wizard and complete the installation.

Uninstallation

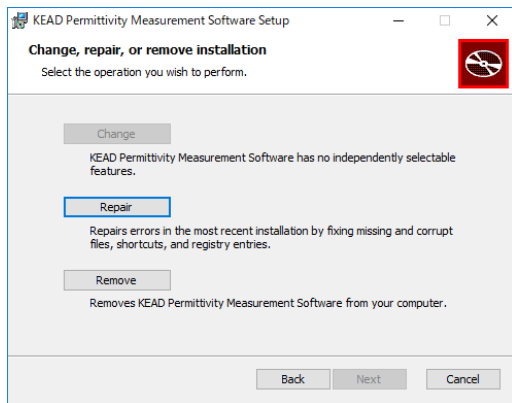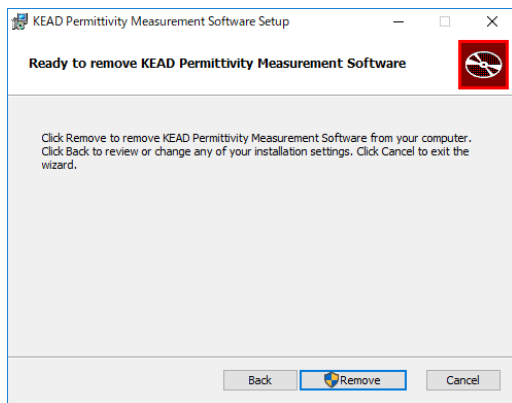Uninstallation also uses the installer (EMlabsPMSetup.msi).

1.   Run EMlabsPMSetup.msi on a Windows PC and follow the on-screen instructions to proceed with the uninstallation.
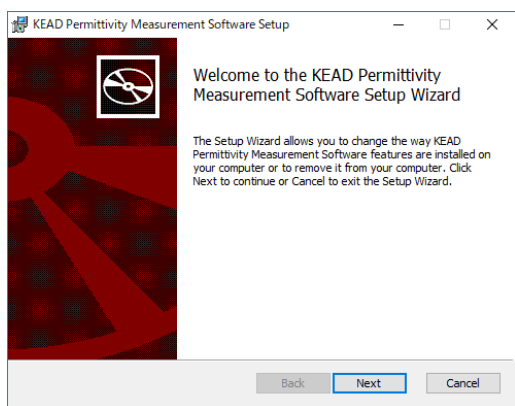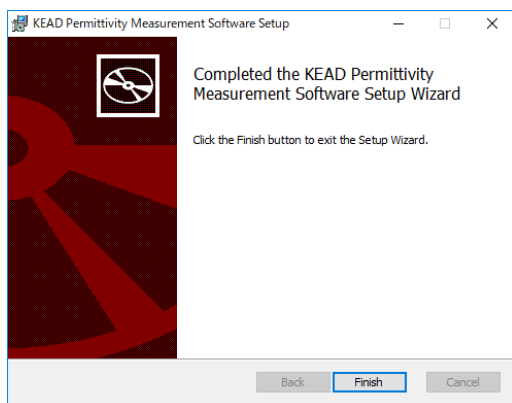
2. Select [Remove].

3. Execute [Remove].

4. Finish the wizard and complete uninstallation.

4. Measurement Procedure

This section will explain how to start the software and measure permittivity. An overall measurement flow will be followed by individual step explanations. Refer to the resonator manual for details about measurement sample preparation and hardware operation.

Measurement flow overview

You can proceed with the measurement as shown in the figure below following the software screen instructions.

There are some tips for efficient evaluation. [4. Sample registration] allows you to register information for multiple samples. You can prepare the data in CSV format and import the file later for measurements.

In [5. Measurement], you can measure the registered samples and display results. The results can be saved in CSV format. You can also select a part of the registered samples and measure. If you measure the same set of samples with several kinds of resonators, save the result after one set of measurements, and then use the [Back] button to return to [3. Select Resonator] to select another resonator. In that way, you can measure the registered samples with the selected resonator.


1. Start
↓
2. Select Analyzer
↓
3. Select Resonator
↓
4. Sample Registration
↓
5. Measurement
↓
6. Display/Save Results
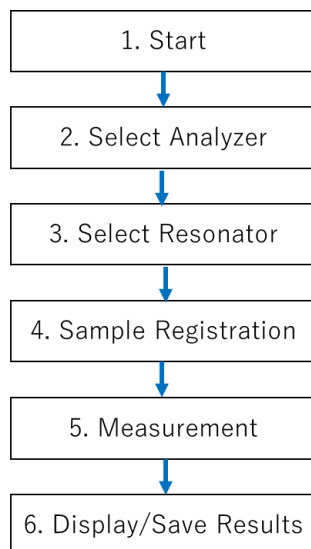
About each step

Following is the explanation on each step based on the display.

1. **Start testing**

Start the software by clicking the Windows start button and then [EMlabs] → [EMlabs permittivity measurement software]. The start screen is followed by the analyzer selection screen.
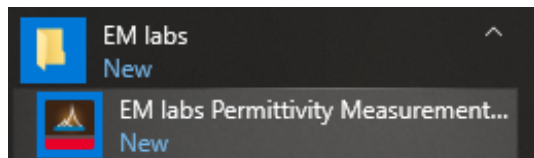
2. **Analyzer selection**

Click [Detect Analyzers] on the analyzer selection screen to display a list of available analyzers. Select the analyzer to use and click [Next].
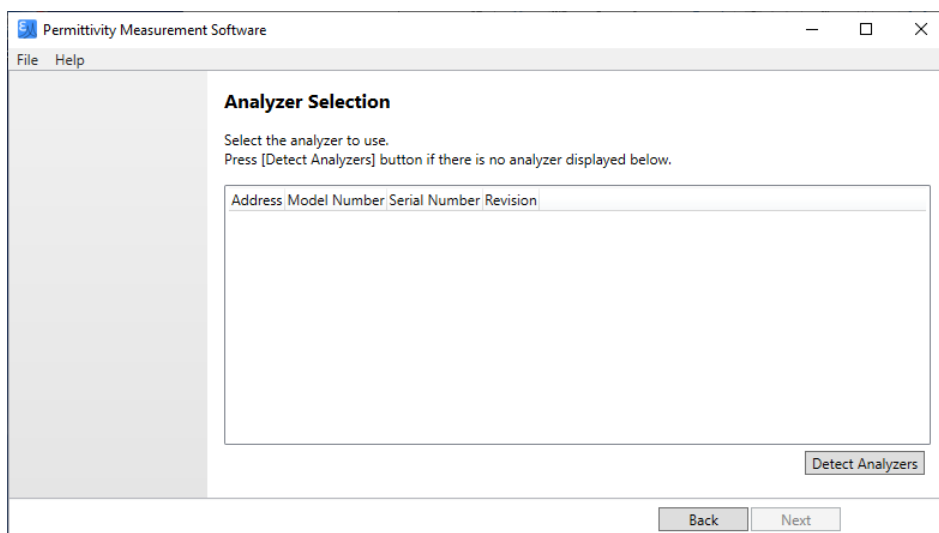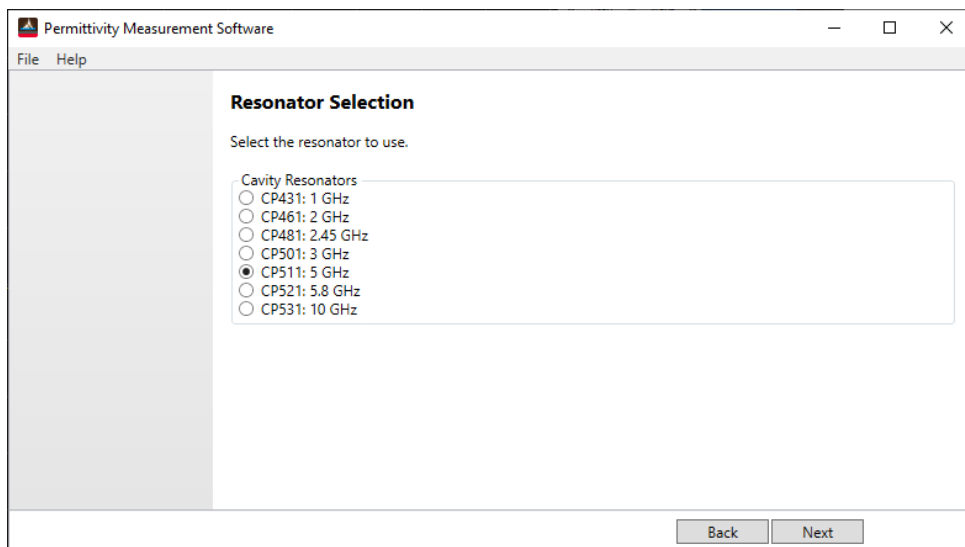

<div align="center">NOTE</div>

Even if the analyzer is physically connected to the PC via USB or LAN, it will not appear in the list unless it is recognized by the Keysight Connection Expert. If you do not see the analyzer you want to use, use the Connection Expert to connect and then perform [Detect Analyzers].
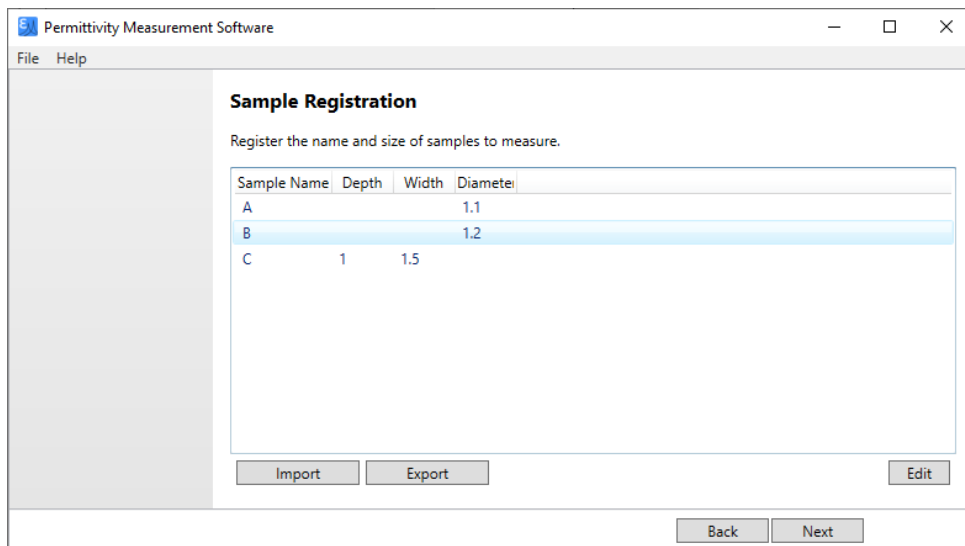
3. Resonator selection

Check the resonator to use and click [Next].

4. Sample registration

The currently registered samples are listed. Click [Next] to continue measurement of these samples. When registering or deleting a sample, click [Edit] to display the editing screen.

When registering a new sample on the sample edit screen, select the type of the sample to add under "Select type:", circular or rectangle, then click [Add]. Next, enter the sample name and size (diameter for circular samples and width and depth for rectangle one) in "Properties". When editing a sample that has already been registered, select it on the list on the left side, and edit "Properties". You can change the measurement order with the ⬇ button or delete

it with the ❌ button. When editing is completed, click [OK] to return to the sample registration screen.
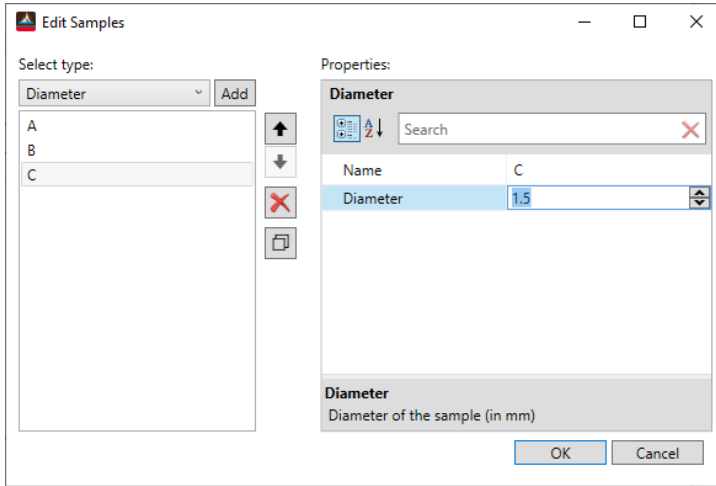
In the Sample Registration screen, [Import] and [Export] buttons are available to import and export the sample data using CSV files. When editing, use the following format and enter the size in mm.

5. Measurement

Connect the resonator to the network analyzer and start the measurement. You can measure all the registered samples one by one from the top by pressing [Measure All] button. If you select samples on the list and press [Measure Selected], you can measure selected samples from the top. (The figure shows an example where A and C are selected.)
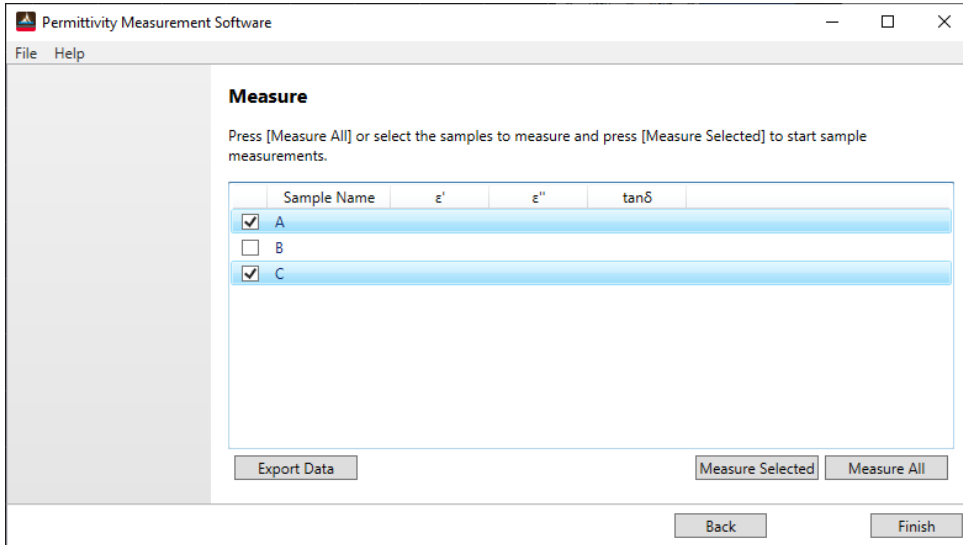
When the measurement is started, "empty measurement" (state where the sample is not inserted in the resonator) and "sample measurement" (state where the sample is inserted in the resonator) are repeated for all the samples to be measured. In each step, a confirmation
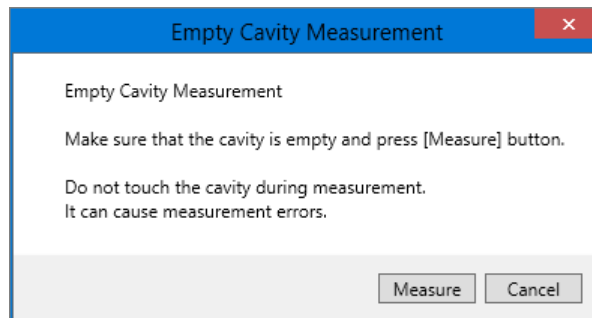

screen is displayed. Check that the resonator state is correct then press [Measure] button. The status bar disappears when measurement is completed, and results are displayed on the list. The result is displayed on the list for each measurement. (The figure shows an example of the empty cavity measurement screen.)

NOTE

One permittivity measurement result is calculated from the three measurements of "empty measurement" → "sample measurement" → "empty measurement". In case of cavity resonator measurement, the drift of the resonance frequency due to the temperature change may not be negligible. The effect can be reduced by taking the average of two empty measurements.

6. Display / save result

Click [Export Data] button to open the "Save As" dialog, and save the measurement results in CSV format. Note that frequency and measurement time date are saved in addition to the measured data displayed on the screen.
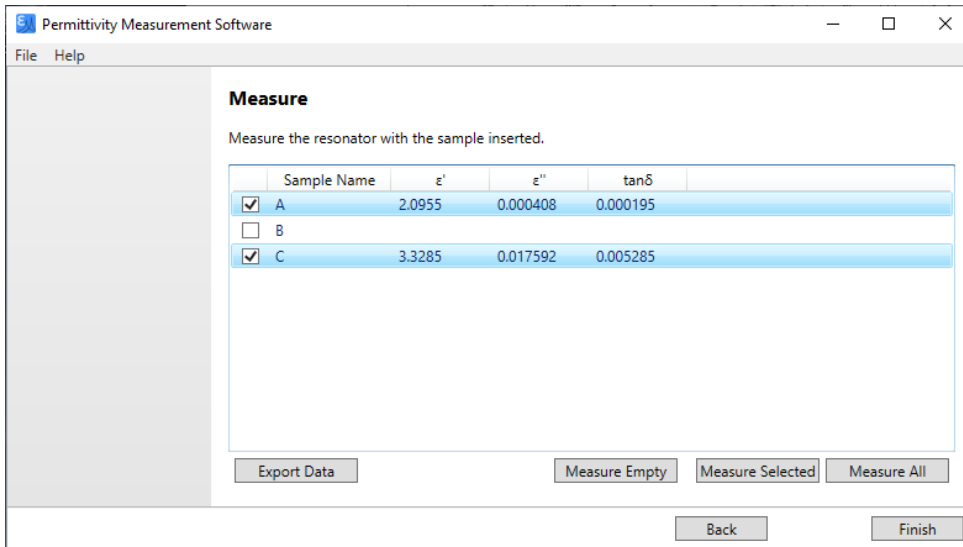
Click [Finish] button to exit the software.

If you continue to repeat the same measurement, or if you want to measure the same sample with a different resonator, you can use [Back] button to return to the appropriate step.

5. Simple Troubleshooting

When problems such as installation failure and software freeze occur, please contact us directly from our website for support.

https://www.emlabs.jp

For effective support, please provide the following information:

- This software version
- PC OS version
- Keysight IO Libraries version
- Network Analyzer model number and its firmware version