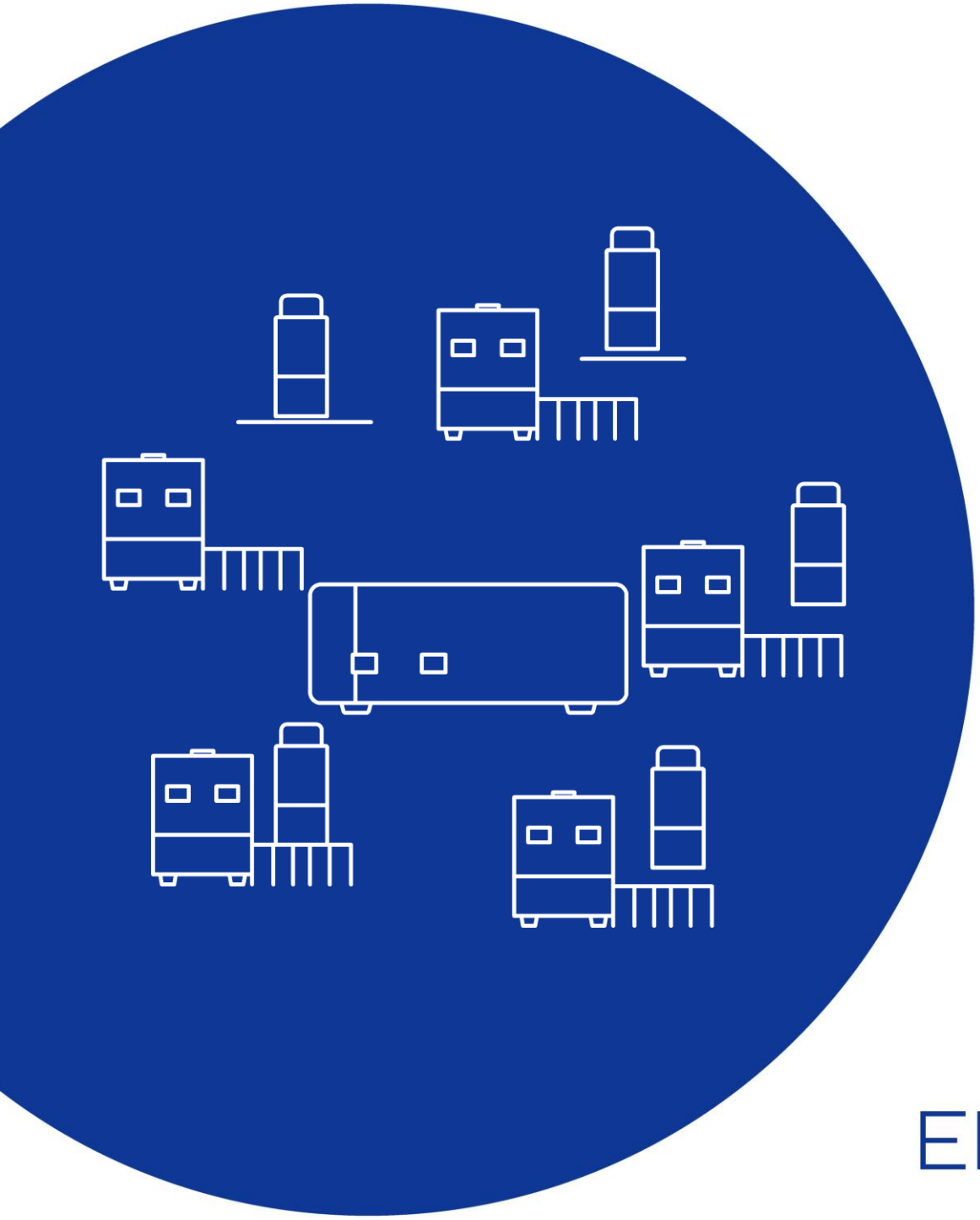
INSTRUCTION MANUAL

VIP Checker

HC-121



EKO

1. Index

2. Important User Information

Thank you for using EKO Products

Make sure to read this instruction manual thoroughly and to understand the contents before starting to operate the instrument. Keep this manual at safe and handy place for whenever it is needed.
For any questions, please contact us at one of the EKO offices given below:

2-1. Contact Information

EKO INSTRUMENTS CO., LTD.

Asia, Oceania Region

www.eko-instruments.com
info@eko-instruments.com

EKO INSTRUMENTS Co., Ltd.
1-21-8 Hatagaya, Shibuya-ku
Tokyo, 151-0072 Japan

Tel: +81 (3) 3469-6711
Fax: +81 (3) 3469-6719

Europe, Middle East, Africa, South America Region

www.eko-eu.com
sales-eu@eko-instruments.com

EKO INSTRUMENTS Europe B.V.
Lulofsstraat 55, Unit 28,
2521 AL, Den Haag, The Netherlands

Tel: +31 (0)70 3050117

North America Region

www.eko-usa.com
sales-usa@eko-instruments.com

EKO INSTRUMENTS USA Inc.
111 North Market Street, Suite 300
San Jose, CA 95113 USA

Tel: +1 408-977-7751
Fax: +1 408-977-7741

2-2. Warranty and Liability

For warranty terms and conditions, contact EKO or your distributor for further details.
EKO guarantees that the product delivered to customer has been verified, checked and tested to ensure that the product meets the appropriate specifications. The product warranty is valid only if the product has been installed and used according to the directives provided in this instruction manual.

In case of any manufacturing defect, the product will be repaired or replaced under warranty. However, the warranty does not apply if:

- Any modification or repair was done by any person or organization other than EKO service personnel.
- The damage or defect is caused by not respecting the instructions of use as given on the product brochure or the instruction manual.

2-3. About Instruction Manual

Copy Rights Reserved by EKO INSTRUMENTS CO., LTD. Making copies of whole or parts of this document without permission from EKO is prohibited.

This manual was issued: 2023/11/21

Version Number: 4

2-4. Environment

1. WEEE Directive 2002/96/EC (Waste Electrical and Electronic Equipment)

This product is not subjected to WEEE Directive 2002/96/EC however it should not be mixed with general household waste. For proper treatment, recovery and recycling, please take this product(s) to designated collection points.

Disposing of this product correctly will help save valuable resources and prevent any potential negative effects on human health and the environment, which could otherwise arise from inappropriate waste handling.

2. RoHS Directive 2002/95/EC

EKO Instruments has completed a comprehensive evaluation of its product range to ensure compliance with RoHS Directive 2002/95/EC regarding maximum concentration values for substances. As a result all products are manufactured using raw materials that do not contain any of the restricted substances referred to in the RoHS Directive 2002/95/EC at concentration levels in excess of those permitted under the RoHS Directive 2002/95/EC, or up to levels allowed in excess of these concentrations by the Annex to the RoHS Directive 2002/95/EC.

3. Safety Information

EKO Products are designed and manufactured with consideration for safety; however, please make sure to read and understand this instruction manual thoroughly to be able to operate the instrument safely in the correct manner.

WARNING CAUTION

Attention to user; pay attention to the instructions given on the instruction manual with this sign.

HIGH VOLTAGE WARNING

High voltage is used; pay special attention to instructions given on this instruction manual with this sign to prevent electric leakage and/or electric shocks.

HIGH TEMPERATURE WARNING

Touching or getting close to the devise may lead to burn.

3-1. WARNING/CAUTION

- Use and store this instrument in a room temperature with less humidity.
- When handling the sensors, display units, and barcode reader, handle with care. If any strong impacts are given to these instruments, the instruments are easily scratched or indented which may affect on measurements.
- Do not use Barcode Scanner in combination with devices other than HC-121. Failing to follow this instruction manual may lead to risk of being exposed to harmful laser beam. Do not repair the laser scanner in any circumstances. Do not look directly into the laser beam even when the scanner is not in operation. Do not look inside the scanner by opening the unit. There is a risk for harmful laser beam exposure, and will harm your eyes.

3-2. ELECTROSTATICS and NOISE WARNING

- If this instrument is used and setup in room where statics occur frequently, make sure the electrostatics countermeasures are taken thoroughly. See [5-2. Setup: Electrostatics & Noise Countermeasure] for detailed instruction.
- Please avoid setting this instrument near large machines and/or devices which uses high voltage. It will affect to the measurement due to noise.

4. Introduction

Inspection for vacuum leakages and insulation effectiveness for Vacuum Insulation Panel (it is made with polymer film with aluminum foil, which is vacuumed on a thermal resistance material; it is called as VIP in this text) used to be processed by heat-flow method for measuring the thermal conductivity; however, it is not so efficient for managing quality control for mass quantity of VIP production since it would take about 1~2 hours to measure just one VIP. The VIP (Vacuum Insulation Panel) Checker HC-121 is now possible to measure one VIP within 1 minute because it checks the VIP's by simplified method.

4-1. Main Functions

1. Quick Evaluation for VIP

HC-121 measures the loss of the heat which is cased from the difference in thermal conductivity of VIP to evaluate the VIP performance by OK/NG. This measurement method takes much shorter time for evaluation compared to the traditional method. HC-121 has sensor head, which is the heat source with detector that measures the heat loss. With a most common method, it usually takes more than 1 hour for evaluation; however with HC-121, it only takes approximately 1 minute and is applicable for quality control process.

2. Up to 5 Sensor Head Connection

VIP is a high performance insulator; however, if any vacuum leakage occurs, it will lose its performance. HC-121 is developed to check the VIP vacuum leakage, and the VIP are evaluated by comparing against the reference VIPs that are already known for each OK, n-NG, and NG conditions. Up to 5 units of sensor units can be connected, and each of these sensor head can be operated individually.

3. Calibration and Determining Evaluation Threshold

HC-121 can be used by calibrating per individual sensor by reference VIPs which are produced in the identical configuration with the VIPs to be evaluated.

If there are three samples of VIPs, which are in same size, made from same material and their thermal conductivities are already known but different, the thermal conductivity of same type of VIP values can be estimated from the standard graph by giving value to the sensor using calibration function. The calibration software is used for such calibrations.

4. Easiest Solution for VIP Quality Control

As mentioned above, since HC-121 takes only about 1 minute per one sample to evaluate VIPs compared to the common stable method, which takes more than 1 hour, it is best suited for VIP quality control in production line.

5. Barcode Reader (Option)

The control software controls the sensor and used for measurement data managements. In order to register and identify all the VIP samples, the barcode reader can be connected.

4-2. Package Contents

Check the package contents first; if any missing item or damage is noticed, please contact EKO immediately.

Table 4-1 Package Contents

Standard Items	Qty.	Remarks
Measuring Unit	1	With power supply cable, RS-232C cable
Display Unit	1 - 5	
Sensor Units	1 - 5 sets	1 - 5 sets of Weight and Sensor Head
Barcode Reader	1	Optional: with power adapter and RS-232C cable
CD-ROM	1	PC software & Instruction Manual
Inspection Report	1	Inspection results of sensor heads

5. Getting Started

5-1. Parts Name and Descriptions

Each part name and its main functions are described below.

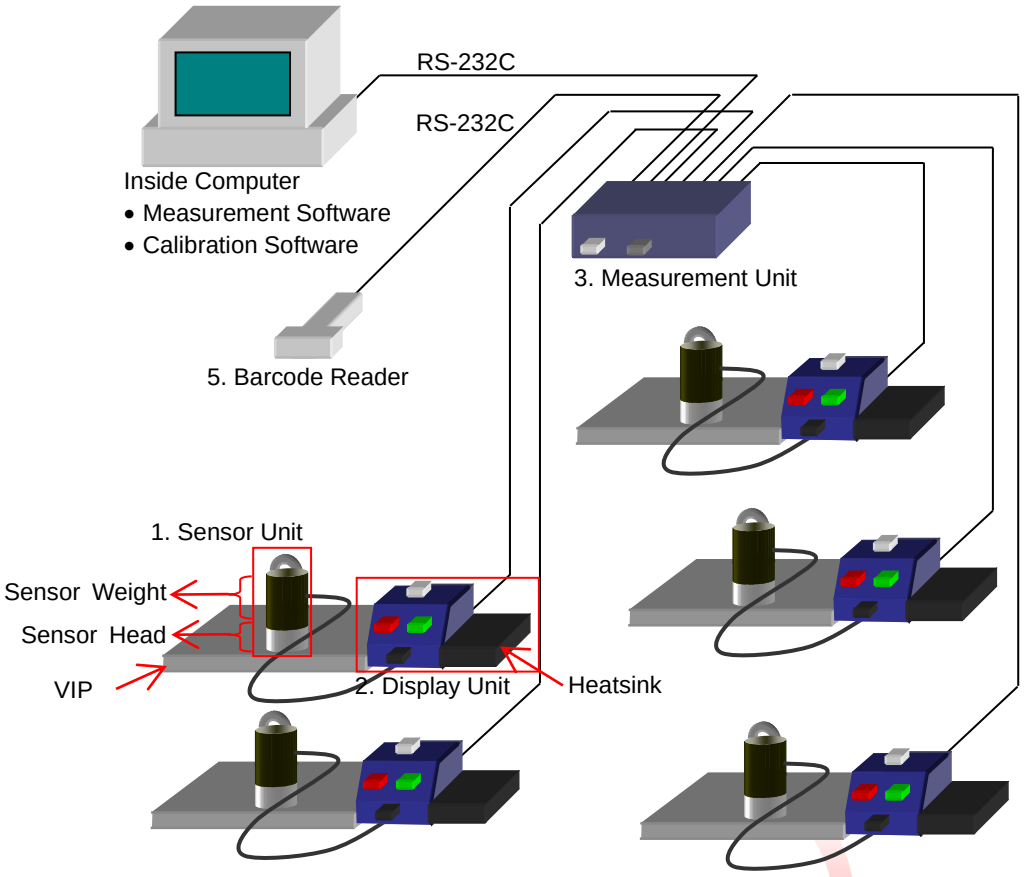


Figure 5-1 VIP Checker HC-121 System Configuration

1. Sensor Unit (Sensor)

This is the sensor part which measures the VIP.

It is constructed with heater which heats the VIP, differential thermocouple, thermal resistance metal and brass spindle weight.

It measures the temperature difference between the temperature of VIP surface which is heated with heater and inside the sensor which is insulated with thermal resistance material.

To compare the output value and the thermal conductivity, calibration needs to be performed. (See [6-2. Calibration Software] for details)

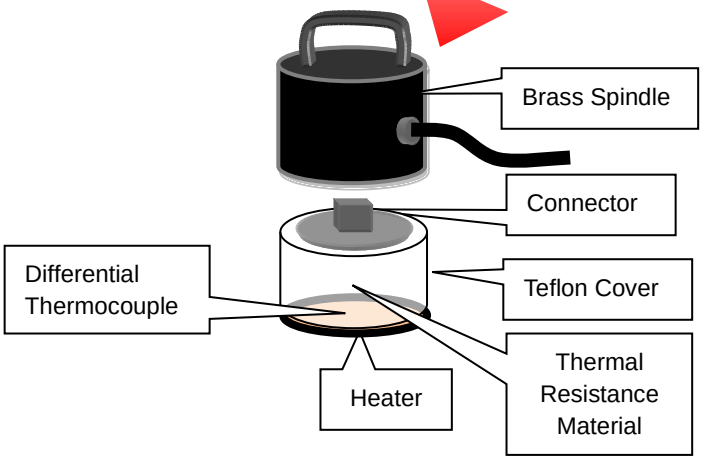


Figure 5-2. Sensor Unit Configuration

2. Display Unit

This is a unit that indicates the starting and statuses (Measuring, OK to measure, Finished, and Measurement result: OK/NG) of the measurements by lamps. This unit is combined with the heatsink for the Sensor Units and supports one Sensor Unit per unit. It is connected to the Measurement Unit and Sensor Unit by the attached cable for Display Unit. The Sensor Units are connected to the Display Unit by cable attached to the Sensor Weight.

After the evaluation is completed on PC side, the lamps on the Display Unit lights ON to indicate the OK/NG.

3. Measurement Unit

This is a unit that controls the indications on the Display Unit and sends the output information from the Sensor Unit to the computer. It is connected with Sensor Unit through Display Unit by a connector and with RS-232C cable to the computer.

Sensor disconnection detector function is integrated and it checks the sensor disconnection by installing the attached software on the computer.

Each of five channels has one circuit for Constant Current Power Source, which provides constant electric current of 160mV to the sensor heater. One Measurement Unit manages 5 Display Units and Sensor Units.

4. Computer

A computer will be used for displaying and saving the measurement results by installation of attached software. It controls the measurement sequences to the Measurement Unit and manages the output from the Sensor Units. As long as the PC is connected to LAN, multiple systems of this product can be managed by acquiring the data from host PC.

5. Barcode Reader

The Barcode Reader will read the barcodes which are serial numbers (up to 13 digits) of the VIP to be measured.

Barcode Reader is also connected via RS-232C cable.

Serial numbers can be entered also from keyboard on the computer when the Barcode Reader is not available.

5-2. Setup: Electrostatic and Noise Countermeasure

1. Electrostatic Countermeasure

HC-121 contains many semiconductor electric circuitry parts, thus it is definitely not strong with statics.

Generally said that when a human body electrostatic charge becomes more than approximately 3kV, it could generate electrical discharge that generated from an electrical shock could be felt on a human body.

In an environment which creates a lot of statics could cause the following symptoms:

- Unexpected malfunctions on Measurement Software
- Abnormal measurement values
- Controller malfunctions

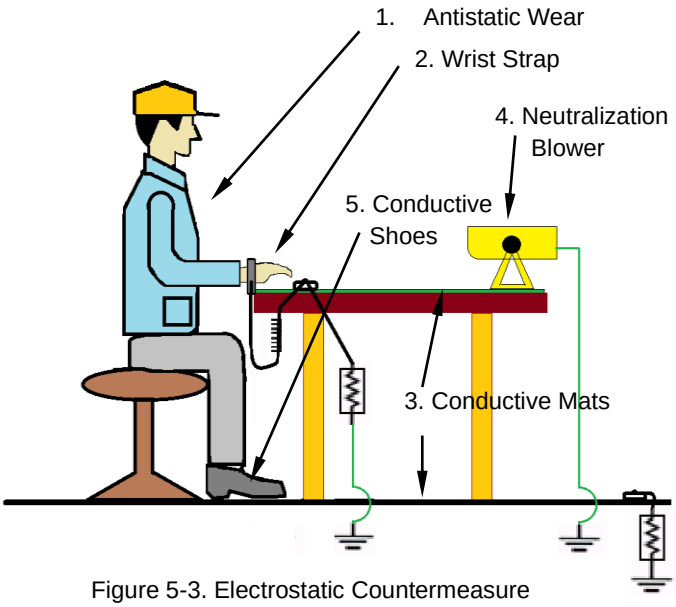


Figure 5-3. Electrostatic Countermeasure

If there are any statics which felt by human body in the working environment, it is required to take countermeasures for statics.

Here are some of the common countermeasure methods for statics, described below:

- **Prevent from humidity getting too low in the working environment.**
- **Make sure the ground cable is connected for the HC-121. (Connect from an AC plug that is grounded to the power of the Controller with 3-pin plug.)**
- Place conductive mats (specific resistance of the surface: 10^5~$10^8\Omega/cm^2$) on the operation table and the floor around it and make sure to connect to ground. (Figure 5-3, 3: Conductive mats)
- Anti-electrostatic charge suite, conductive shoes, and wrist strap (1MΩ±10%) should be properly worn or used by the operator. (Figure 5-3, 1: Anti-electrostatic charge suite, 2: Wrist Strap, 5: Conductive shoes)
- Setup neutralization apparatus on the operation table to operate the device in the ionic wind. Place conductive sheet, which is grounded, on the operation table. (Figure 5-3, 4: Anti-static blower)
- Connect the grounding for the computer earth and RF separately.
  When placing all sorts of electrical devices on the conductive mat on the operation table; do connect the grounding for the devices, but make sure to keep more than 1MΩ of resistance between the mat and the electrical device. (Keep the device body and the mat by taking measures such as putting rubber pieces on feet of the devices.)

2. Noise Countermeasure

If there is any large device or equipment operating with high voltage near the HC-121, and the power is supplied from the same electric transformer, there is a high possibility that some high voltage noise on the AC power line. If the AC power line is supplied with separate electric transformer, there should not be any problems. To prevent noise, use noise cut transformer; make sure the grounding cable for the noise cut transformer and HC-121 is surely connected as well.

5-3. Connecting Instruments

1) Connect PC and HC-121 Measurement Unit with attached RS-232C cable.
2) Connect Measurement Unit and Barcode Reader with RS-232C cable.
3) Connect Measurement Unit and Display Units.
   Plug in the connector for Display Units to the connector on back of Measurement Unit in order of the numbers indicated.
4) Connect the Display Units and the Sensor Units.
5) Place the Sensor Units on the heatsink per each channel
6) Turn ON the power.
   When the power is turned ON, all lamps on the Display Units are lit and buzzer sound should come on.
   *In this process the sensor disconnection is checked.

6. Software

HC-121 has two types of software: Calibration software (TCCal_V34xx.exe)* for calibrating the Sensor Unit and Measurement Software (TCDac_V74xx.exe)* for entering barcode information, viewing the measurement results and status information.

To calibrate the Sensor Units, use 3 (or 2) reference VIPs with different thermal conductivities that are primarily prepared and measure all reference VIPs with each of the 5 Sensor Units. The calibration software takes the relationships between the thermal conductivity and the voltage from the measurements and determines the approximation on a straight line, and then calculates the slope and intercept, which will be set as the calibration value for each Sensor Unit.

Measurement Software displays the measurement results from the Sensor Units and the test statuses of each Sensor Unit.
The measurement results are saved in a specified folder in text format.

* "xxxx" indicates the software version number.

6-1. Installation and Uninstallation

1. Software Installation

1) Turn on the PC power, and start up the Windows.
2) Once the Windows is started up, insert the installation disk in the CD drive.
3) There are two software: Calibration Software and Measurement Software, in the installation disk.
   Find the file [setup.exe] from [HC121_Software_Installer] → [Calibration Software Verxxxx] → [English], double click to start up.

   a. Once the [setup.exe] file is started up, the following window is displayed to start the installation preparation. Click Next > button to continue.

Figure 6-1. Installation Wizard: Welcome

b. Thoroughly read the “License Agreement” and click the radio button for “I accept the terms in the license agreement” then click Next > button to continue.

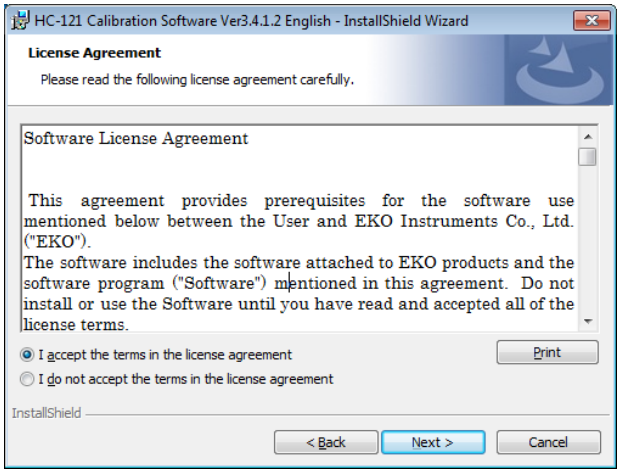


Figure 6-2. Installation Wizard: License Agreement

c. Select an installation folder. To select a folder, click Change… button and specify the installation folder. If a folder is not selected, it automatically creates a folder “C:¥EKO¥HC-121” and the software is installed under this folder.
Click Next > button to continue.

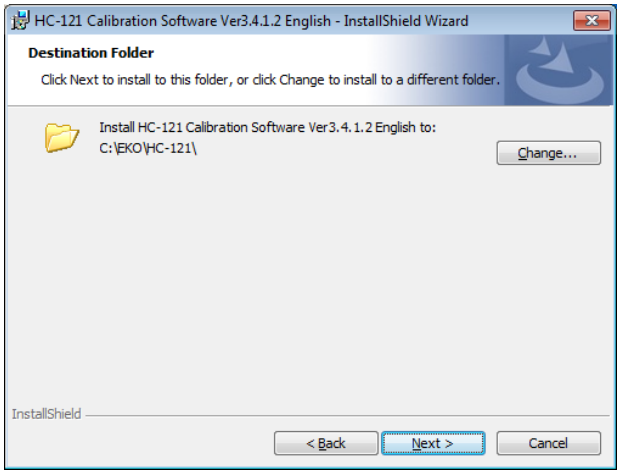


Figure 6-3. Installation Wizard: Select Folder

d. Confirm the installation folder; if the selected folder is correct, click Install button.

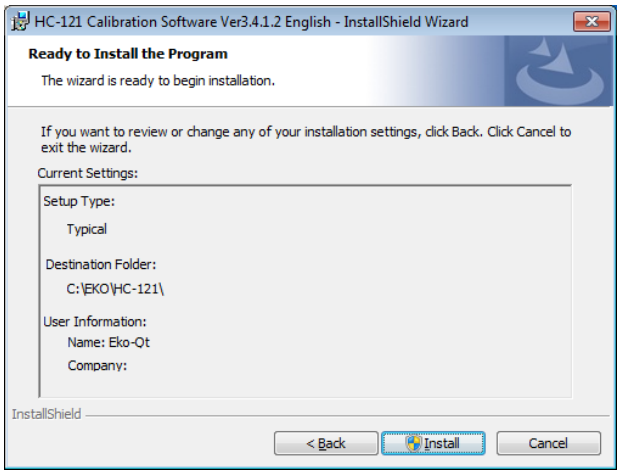


Figure 6-4. Installation Wizard: Folder Confirmation

e. In the case of installing the software on a computer with Windows Vista or newer for OS, the display will once get dark then warning message for user account control appears. Click Yes button.

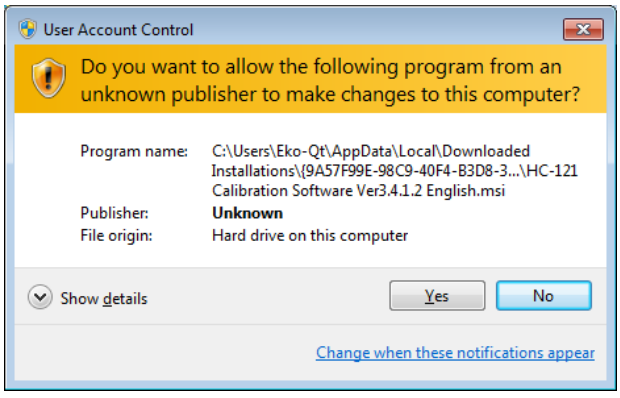


Figure 6-5. Installation Wizard: Warning Message

f. The software installation starts; after a while, the window changes to the “installation complete”. Click Finish button to complete the installation.

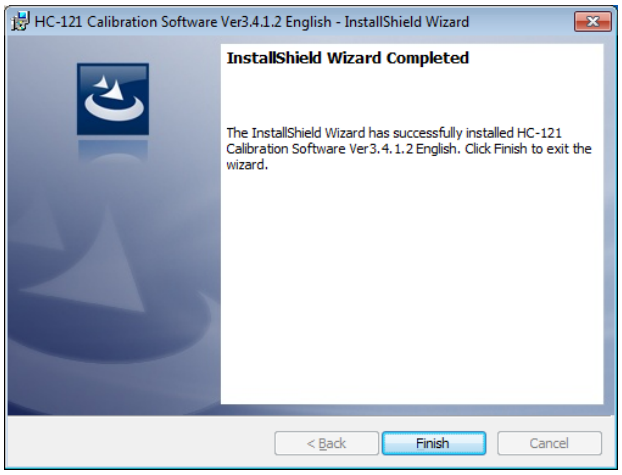


Figure 6-6. Installation Wizard: Installation Complete

To install the Measurement Software, start up the “setup.exe” by accessing the folders from [HC121_Software_Installer] → [Measurement Software Verxxxx] → [English].

The same installation wizard window as installing the Calibration Software will appear; follow the above instruction.

When the installation is completed, shortcut icons appear on the desktop.

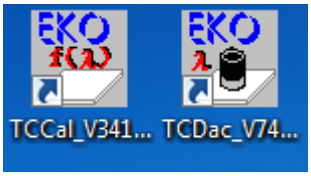


Figure 6-7. Shortcut Icons

2. Software Uninstallation

There are following 2 ways to uninstall the software.

1) Uninstalling from [Programs and Features]

Go to [Control Panel] → [Program] → [Programs and Features].

Select the program to be deleted; when the selected program is right-clicked with mouse, pop-up menu appears. Select “Uninstall”.

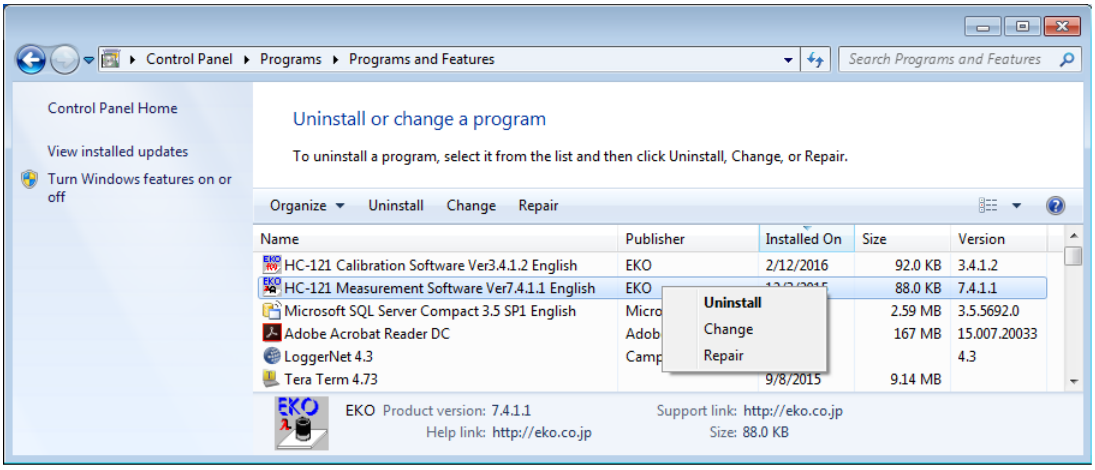


Figure 6-8. Uninstalling Method

Following message appears; if you really wish to uninstall, click Yes button. The program disappears from the list of [Programs and Features] which confirms that the program uninstallation has competed.

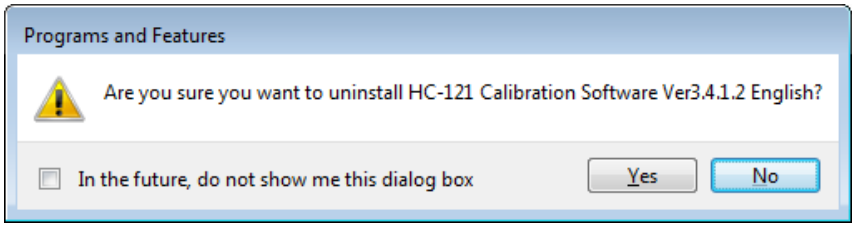


Figure 6-9. Confirmation Message

2) Uninstalling from Program Maintenance.

Just like when installing the software, double click and start up the “setup.exe” file.

Follow the instructions given on the appeared window; if the software is already installed, there will be a window displaying “Modify”, “Repair” and “Remove”.

Select “Remove” on this window and click Next > button.

Follow the instruction given then already installed software is uninstalled accordingly.

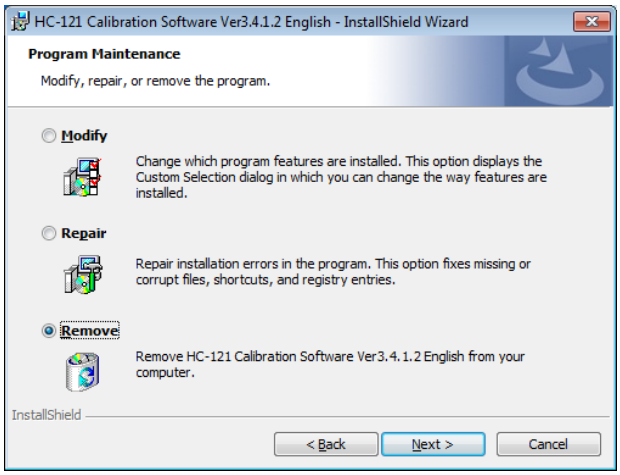


Figure 6-10. Uninstallation Wizard

3. COM Port Setting

Double click the icon for TCCal_Vxxxx.exe/TCDac_Vxxx.exe on the screen.

The “Communication Error” message appears (Figure 6-11) when starting the software for the very first time since the serial port is not yet selected. Once the [OK] button is clicked, the dialog box for “Select RS232C port” appears (Figure 6-12).

Select a COM port which is connected with the PC then click [OK].

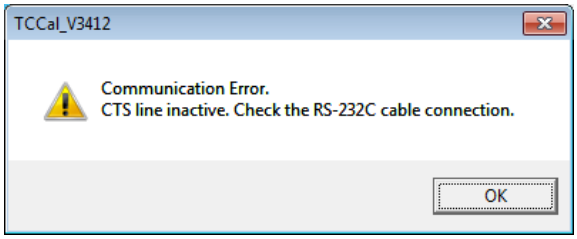


Figure 6-11. Select Serial Port Message

Once the COM port setting is completed, there will be a file named “TCCal.cfg” created in a folder where this software is installed.

Next time the PC is started, the settings are read from this file, thus this dialog box will not appear again for selecting COM port.

The COM ports that are unavailable will be shown in gray and cannot be selected. Also, when a COM port is already in use, it will also be shown in gray and cannot be used. (This is the same when the software is double started.)

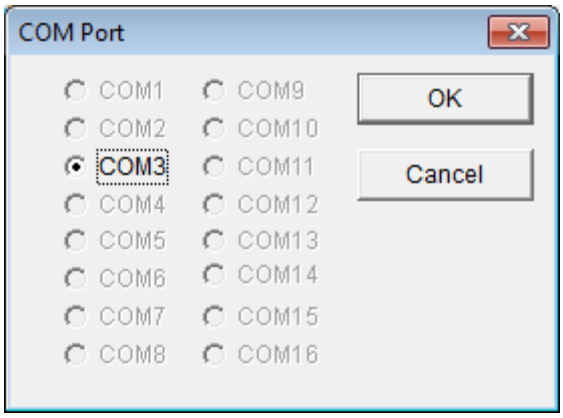


Figure 6-12. Select RS 232C Port

* Most of the PC has COM1 available, but sometimes other COM ports are available for use. This is same for a PC which has expanded COM ports. Also, most of the recent versions of PC do not possess COM ports. In such case, using RS232C/USB converter cable will allow to select COM ports. **HOWEVER, depending on the type of RS232C/USB converter cable used, it may not be compatible with this software.**

* If multiple applications which uses COM Ports are installed on the same PC, COM Port numbers from 1~8 may not be available for use. In such case, the software cannot be started up. To solve this issue, go to [Control Panel] → [System] → [Devise Manager]; right click the Port (COM and LPT), COMxx and select Property, Port Setting, Detail Setting, and COM port number. Select a COM Port number below 8 from the pull-down menu to forcibly change the COM Port assignment.

6-2. Calibration Software

1. Calibration Overview

HC-121 offers two types of measurement methods which user can select: One method approximates the relationship between the slope of differential thermocouple temperature difference from the sensor unit and the thermal conductivity by calibration curve then approximates the relationship between the output and thermal conductivity by straight line considering they are almost proportional within the narrow range of thermal conductivity, and another method approximates the thermal conductivity by exponential approximation. This value varies by each sensor unit, VIP type, size, thickness, and shape. Hence calibration procedure is necessary in order to evaluate the VIP. From the above reason, the sensors of the VIP Checker need to be calibrated before starting the VIP evaluation. From this calibration results, figure out the reference values for OK and NG VIP products.

To calibrate the Sensor Units, it is necessary to prepare three VIPs with same type but different thermal conductivities and take measurement with each Sensor Unit to determine the calibration curve in relationship between the output and thermal conductivity prior to the calibration. The points on calibration curve which will be the reference value for evaluating the OK (Good) and NG (Not Good) VIP can be determined from the thermal conductivity value

To calibrate the Sensor Units, 3 VIP samples need to be prepared preliminary, and calibrate in the range of a-b-c as shown on the Figure 6-13a. By figuring out the straight-line approximation for the relationship between the output voltage and thermal conductivity for the Sensor Unit, the thermal conductivity can be calculated from the sensor voltage within almost linear and narrow range. This value varies by each sensor. For samples d and e, it provides approximation way off from the actual thermal conductivity and output relationship curve. In other words, the accuracy varies significantly by which thermal conductivity sample is used for the calibration. It is important to determine the VIP sample by having some understanding of the relationship between the sample output and thermal conductivity of the measuring sample.

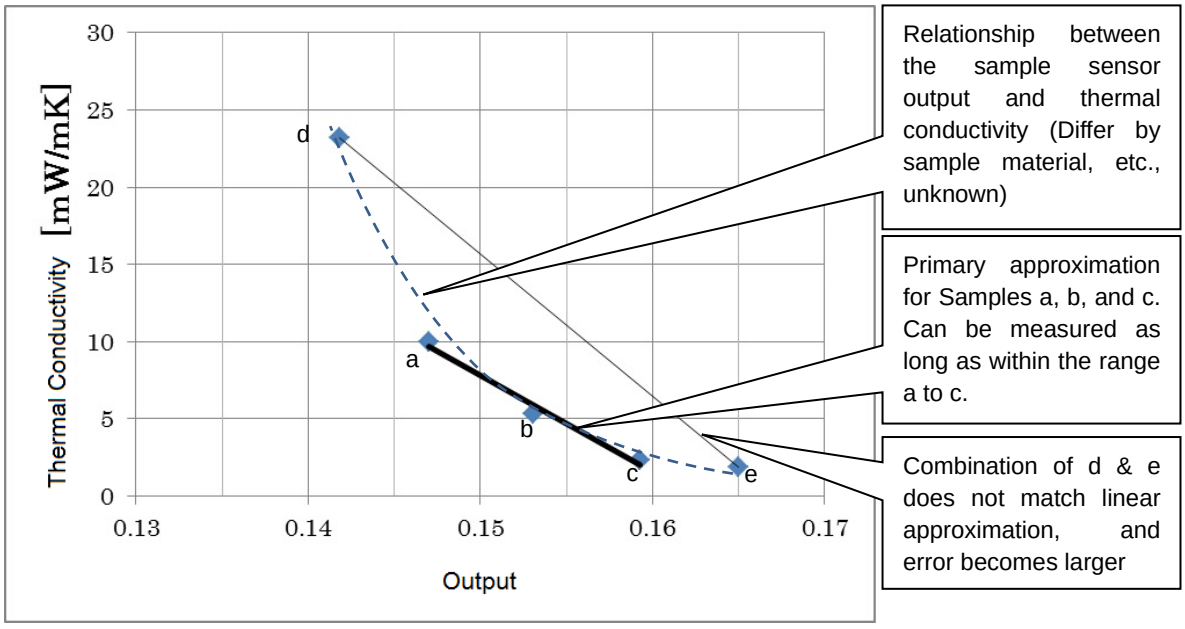


Figure 6-13a. Calibration Curve by Linear Approximation

As shown on Figure 6-13b for a measurement in wide range of thermal conductivity, exponential approximation can be used if the relationship of value between the thermal conductivity log and output log become almost straight.

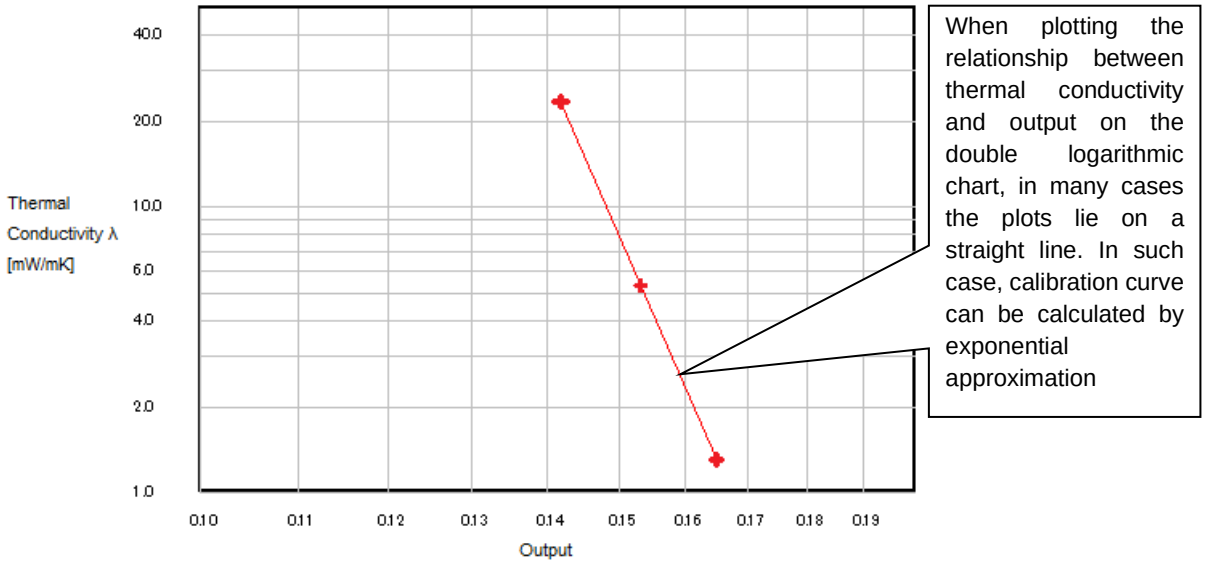


Figure 6-13b. Calibration Curve by Exponential Approximation

2. Preparing Reference VIPs

Prepare 3 types of VIP which have different thermal conductivities.

When exponential approximation is selected and for example preparing three thermal conductivities of 1.3mW/mK, 5.3mW/mK, and 23.2mW/mK, the measurement results are plotted on almost straight line in equal distances on double logarithm charge as shown on Figure 6-13b. If a measured plot is off from this straight line, either the measurement was unsuccessful or this method is not appropriate for this VIP. As you can see from above graph, VIP with far apart value can be accepted; however good calibration curve cannot be drawn when the thermal conductivity values are almost the same even if there are three VIPs

When VIP sample with wide range cannot be prepared, it is possible to measure very narrow range by selecting the linear approximation. In such case, there are some values goes off the calibration curve, so repeat the measurement again.

There are cases that calibrated samples vary by time, so following procedures are recommended:

- Perform calibration once per week at initial stage.
- Once confirm that there are no variation seen on the calibration result, perform the calibration once per month.

Also correlation of Sensor Unit outputs are lost if the VIP material and thicknesses vary, so **make sure to perform calibration using the same material, same size as the VIP which is evaluated.**

- Although the output higher than near-value but lower than reference value is indicated as nNG, and determined as “Not Good”, it is recommended to repeat the measurement. Less than near-value is indicated as NG and processed as “Not Good”.

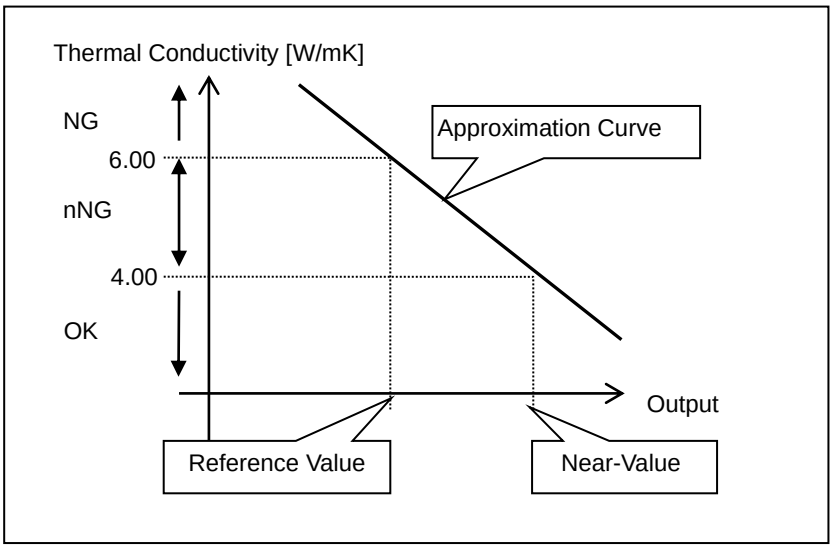


Figure 6-14. Evaluation Standard

3. Calibration Software Operation

1) Starting Calibration Software

According to the [6-1. Installation and Uninstallation], [3. COM Port Setting], set the COM port on PC. The COM port setting is saved once it is setup.

After the COM port is setup, the Calibration Software starts up and below window appears.

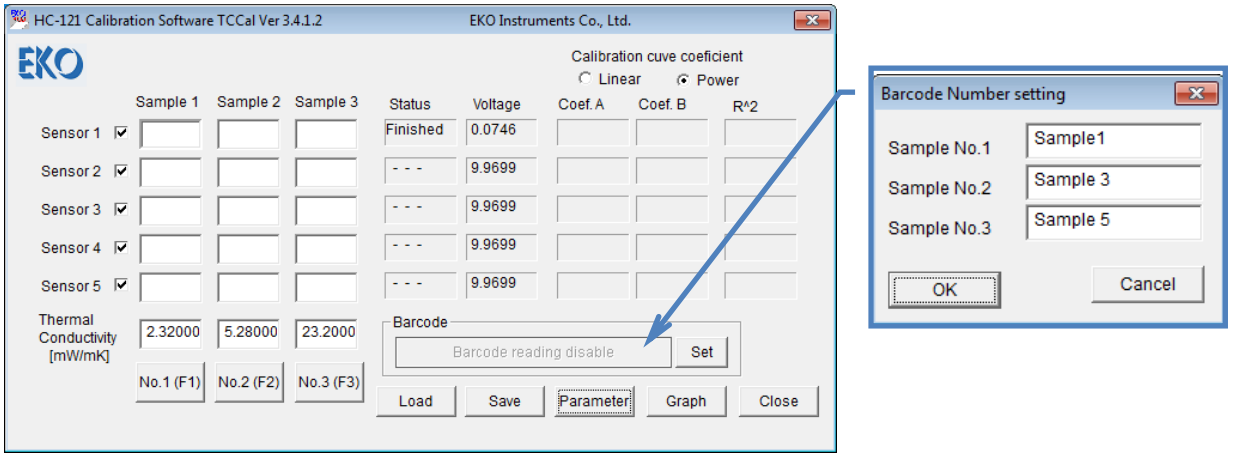


Figure 6-15. TCCal_Vxxx Start Up Window & Registering Barcode Numbers

2) Registering Barcode Number for Calibration VIP

Name the VIPs (reference VIPs) with appropriate name or number for calibration as Sample 1, 2, and 3, and register the barcode numbers (serial numbers). Click the Set button in the “Barcode” section on the window.

Registration dialog is displayed for barcode numbers. Enter the serial numbers in an order from the lower thermal conductivity. When finish entering the numbers, click OK.

When there is no barcode on the VIP, use 3 different numbers or names to identify each VIP.

3) Entering Thermal Conductivities

Enter the thermal conductivities for each Sample 1, 2, and 3 at the very bottom section of each sample items. Enter the values in [mW/mK].

4) Select Sensor Unit to be Used

Place checks in the checkbox provided on the right side of the sensor numbers, Sensor 1 to Sensor 5. Only the checked Sensor Unit(s) is(are) used. Checked (✓): use, unchecked (□): not use

5) Performing Calibration

1. When the software is stared, the start button on the Display Unit starts to blink. Once the start button is pressed, the status indication changes from “Finish” to “Cooling.”
2. When the cooling time is finished, the status will change to “OK to Measure” and the start button will light up. At this point, the indication of the left side button on the Barcode section in the window changes from “Barcode reading disable” to “Barcode reading enable”

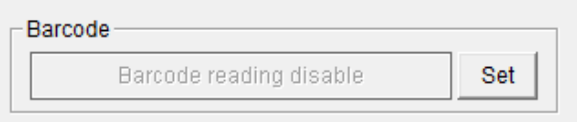


Figure 6-16a. Indication in Barcode Section 1

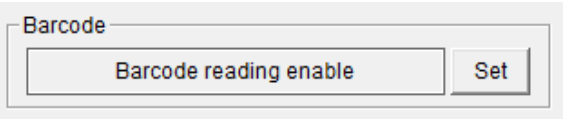


Figure 6-16b. Indication in Barcode Section 2

3. Select VIP. In order to select the VIPs, there are 3 ways described as below:
   a. Entering F1, F2, and F3 from keyboard.
      Each corresponds to Sample 1, Sample 2, and Sample 3.
   b. Click the [No.1 (F1)], [No.2 (F2)], and [No.3 (F3)] buttons on the software window using mouse.
   c. Read the barcode on the VIP with Barcode Reader.
      The registered serial numbers of VIP can be selected with above methods. When the barcode is selected, the serial number is displayed on the Barcode section of the window.

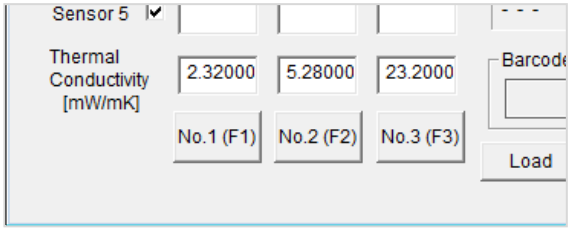


Figure 6-17. Select VIP Button

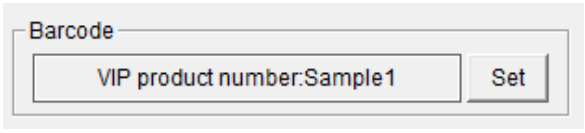


Figure 6-18. Indication in Barcode Section 3

4. Place the Sensor Unit on top of the sample, then push the start button on the Display Unit, the measurement for calibration starts.

   * Make sure to place the sensor on a center of VIP surface which is flat. If there are any uneven surfaces, it will cause larger variances.

   By repeating the steps 3 and 4, measurements for Samples 1~3 are started in order, and the status indication will change to “Measuring” in each channel.

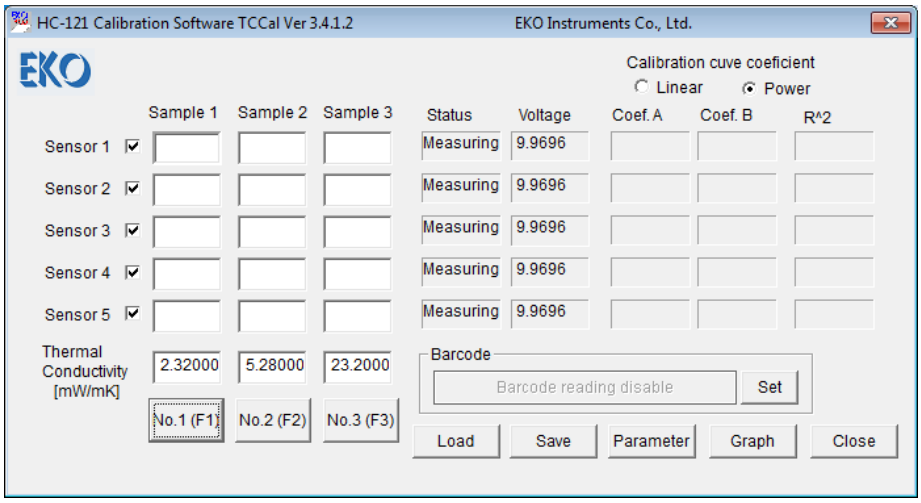


Figure 6-19. Start Measurement Window

5. After approximately 30 seconds, buzzer sounds and the start button starts to blink as the measurement is completed.
   The measured values are displayed in the specific section for the sensors and the 5x3 samples.

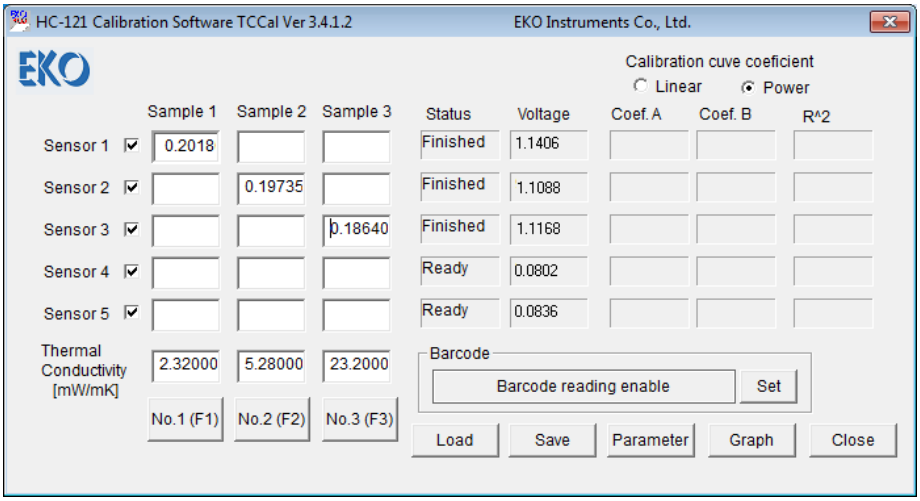


Figure 6-20. Finish Measurement Window

6. Return the Sensor Unit on the Heatsink and push the start button. Start button stops blinking and the status indication on the window changes to “Cooling”.

7. When the cooling time is over, the start button lights up. Wait for more than 1 minute, then repeat the steps 2~6.

   * If the sample itself gets warmed up by the heater on the Sensor Unit, the calibration cannot be performed well, thus wait for more than 1 minute till the Sensor Unit cools down.

8. When measurements are completed, the results, the measurement outputs are displayed in the sample boxes for each Sensor Unit.
Repeat the measurements by changing the combinations so that the boxes are all filled. Once all the measurements are completed, “slope” “intersection” and “R^2” are calculated and displayed.

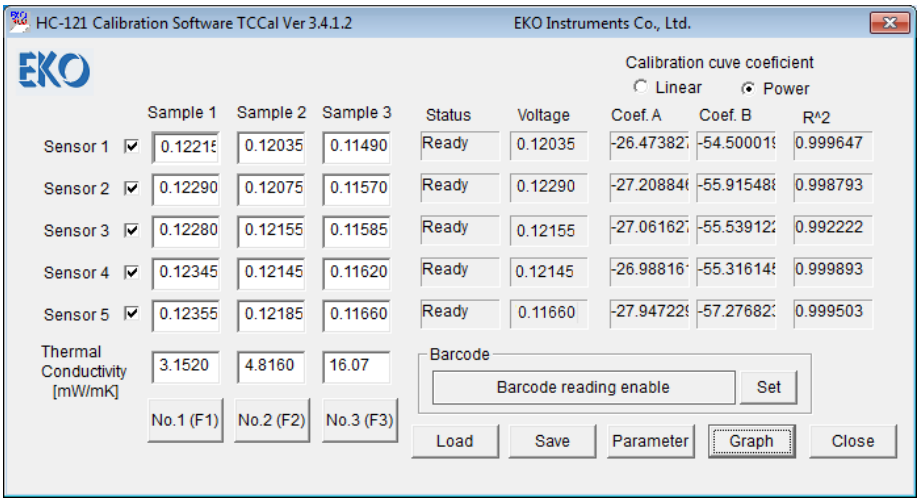


Figure 6-21. Window Completed All Measurement

The measurement result data up to this point are not saved yet; if the software is closed without saving, the measurement results are lost. Always click Save button to save with an appropriate file name, as often as possible. In case the computer shuts down due to some malfunction, the save data can be retrieved. (See step 11. Discontinuing and restarting calibration process)

* “Determination Coefficient (R^2)” indicates the relativity of the approximation value and the measurement values, which calculated from the “slope” and “intersection”; the relativity is higher as it is closer to 1, which means it is a good value as calibration.

9. Select the measurement method, Linear Approximation or Exponential Approximation by clicking the radio buttons provided on the Main Window.

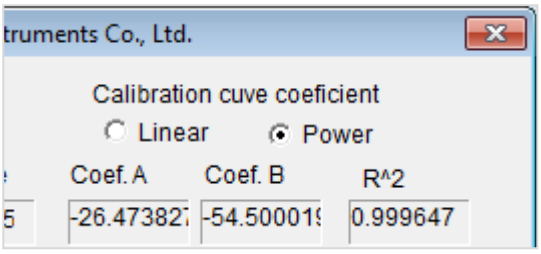


Figure 6-22. Select Linear Approximation or Exponential Approximation

10. The calibration results are displayed in graph by clicking the Graph button; the calibration results can be reviewed.

See Figure 23a. as an example of Linear Approximation graph, and Figure 23b. for Exponential Approximation graph. If there is a value plotted away from the straight line, this is a measurement error thus re-do the measurement on that specific point.

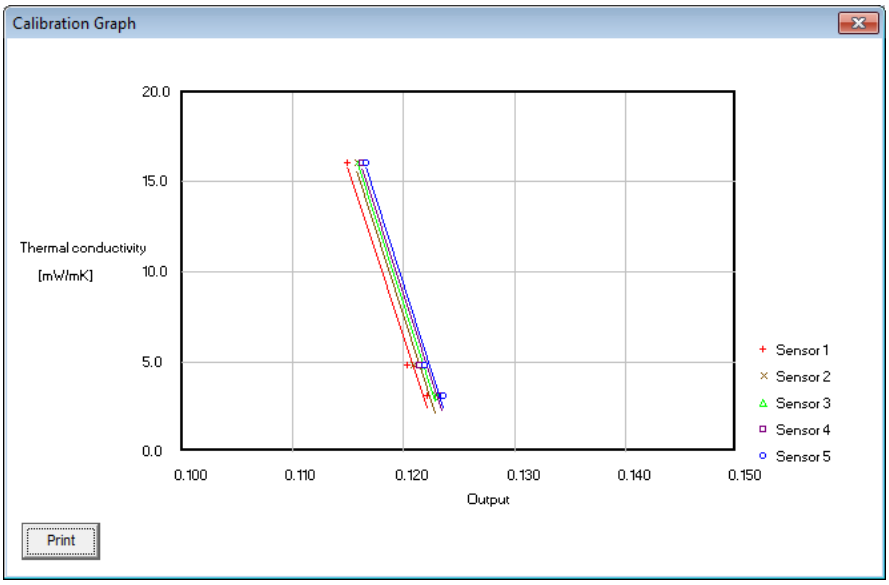


Figure 6-23a. Calibration Graph (Linear Approximation)

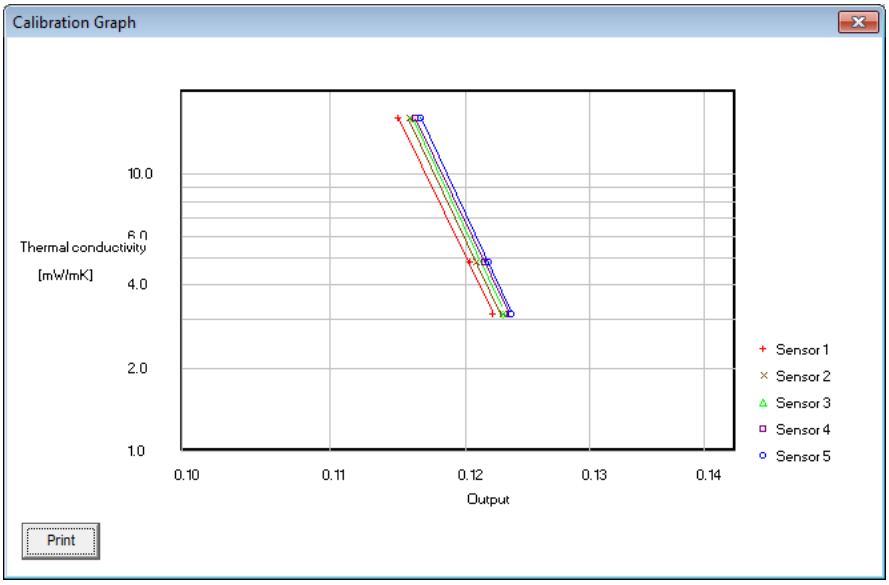


Figure 6-23b. Calibration Graph (Exponential Approximation)

11. Termination and Restarting the Calibration Procedure

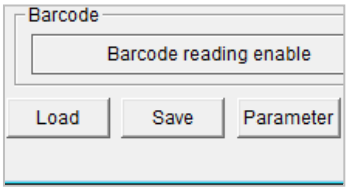


Figure 6-24. Discontinuing & Restarting

Calibration is a time-consuming task. If you wish to terminate the calibration, the measurement results acquired so far can be saved and later restart the calibration by retrieving the data.

To save the measurement results, click Save. Save dialog window appears; enter appropriate file name and click Save button. Extension "*.cal" is automatically added to the saved file name.

When restarting the calibration by opening the saved measurement result, calibration can be continued by retrieving this file again. To retrieve the file, click Open. Open dialog window appears; select a file name and click Open.

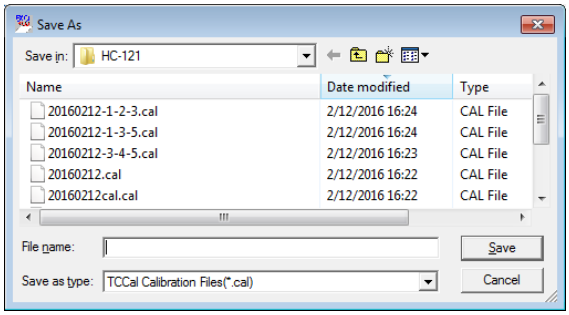


Figure 6-25. Saving Unfinished Calibration Data

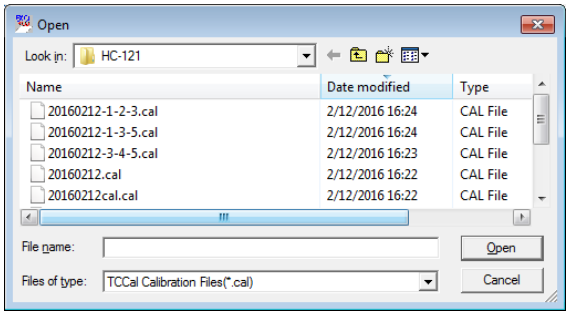


Figure 6-26. Retrieving Unfinished Calibration Data

12. When clicked on the Print button on the left bottom of the Calibration Graph Window, it prints out the calibration graph and the measurement results from the printer connected to the PC.

* There are variances in the “slope” and “intersection” of the thermal conductivity conversion coefficient, but there should not be any values that are far apart in each channel. If such value is shown, please check all the measurement conditions and re-do the calibration.

13. Clicking the Parameter button will display the dialog box for measurement setup. Enter the standard value and near-value in thermal conductivity. Clicking the Update button will display the “slope” and “intersection” that are calculated in last step by each channel, and the standard value and near-value for each channel are displayed in voltage.

Setup the time in the following manner:

1) Standby Time: [Standard 20sec.] (Can be changed, but minimum setting is 20 sec.)
2) Cooling Time: [Standard 30sec.] (Can be changed, but minimum setting is 30 sec.)
3) Heating Time: [Standard 10sec.] (Cannot be changed)

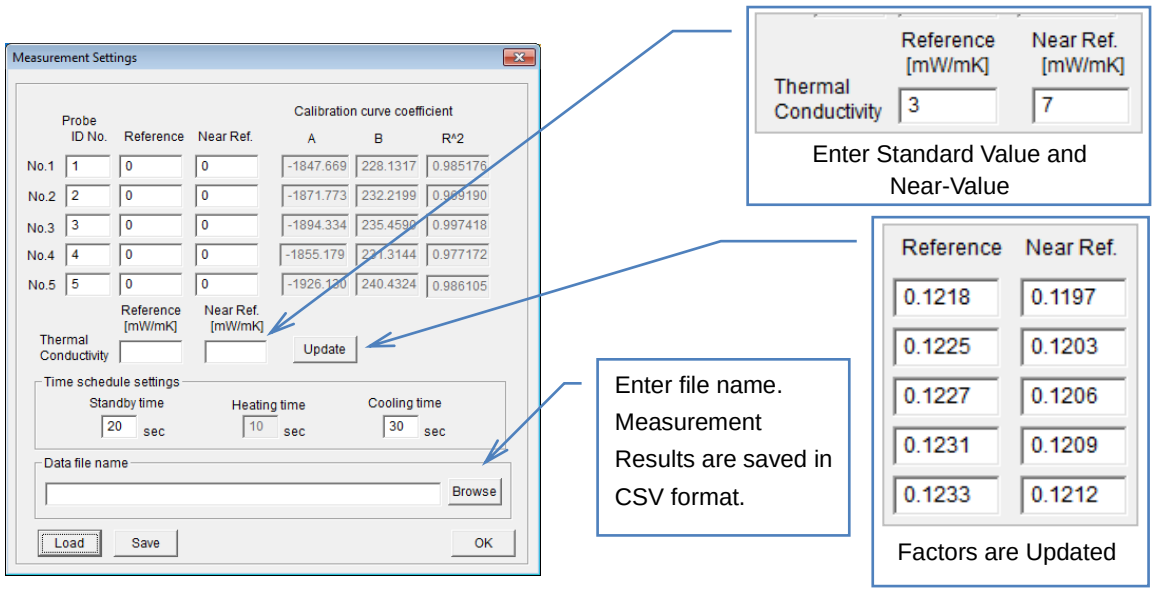


Figure 6-27. Measurement Setup

* **Standard value and the Near-value are important values for judging the OK/NG of measured sample; setup these values with well consideration.**

14. The probe ID, standard value, and near-value for each channel are changeable by entering values from the keyboard.

* **Do not change the values in “Stand-by” and “Cooling” in the “Time Setting” section.**

Enter a file name which saves the measurement result record in the “Data Saving File Name.” Click the Browse button, select a desired folder and enter the file name.
The extension of the data file is “*.csv” and recorded as CSV format text file, which can be viewed with such as Excel.

Click the Save button and save the setup contents in a parameter file (extension: *.tcd).
This parameter file will be called to measure in this Measurement Software.

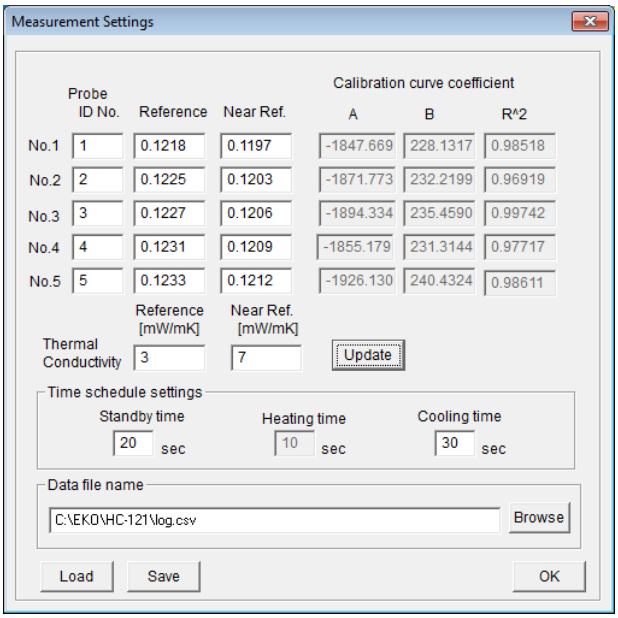


Figure 6-28. Saving Measurement Settings

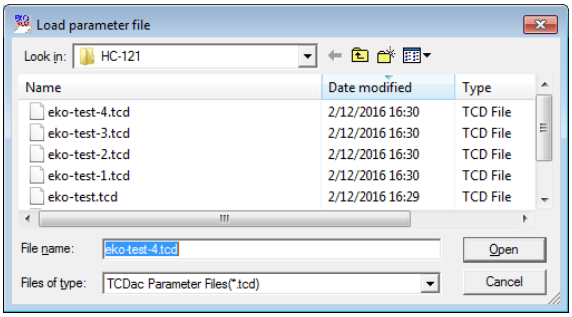


Figure 6-29. Loading Parameter File

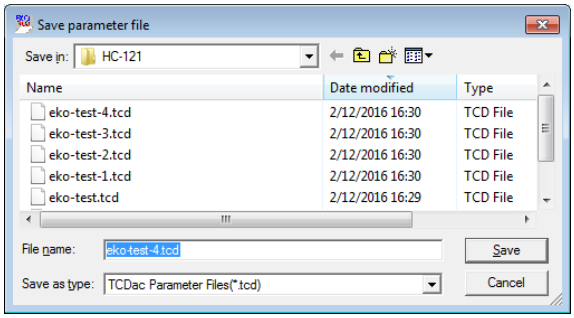


Figure 6-30. Saving Parameter File

* If a parameter file is already created, the parameter file can be read and modified. Click the Load button and readout the parameter file. If the standard value and/or near-value are changed, click Save button, specify a file name, and save.

15. Now the calibration process is completed.
Click Close button to finish the software.

6-3. Measurement Software

1. Display Contents

The contents of the main window for Measurement Software are described below:

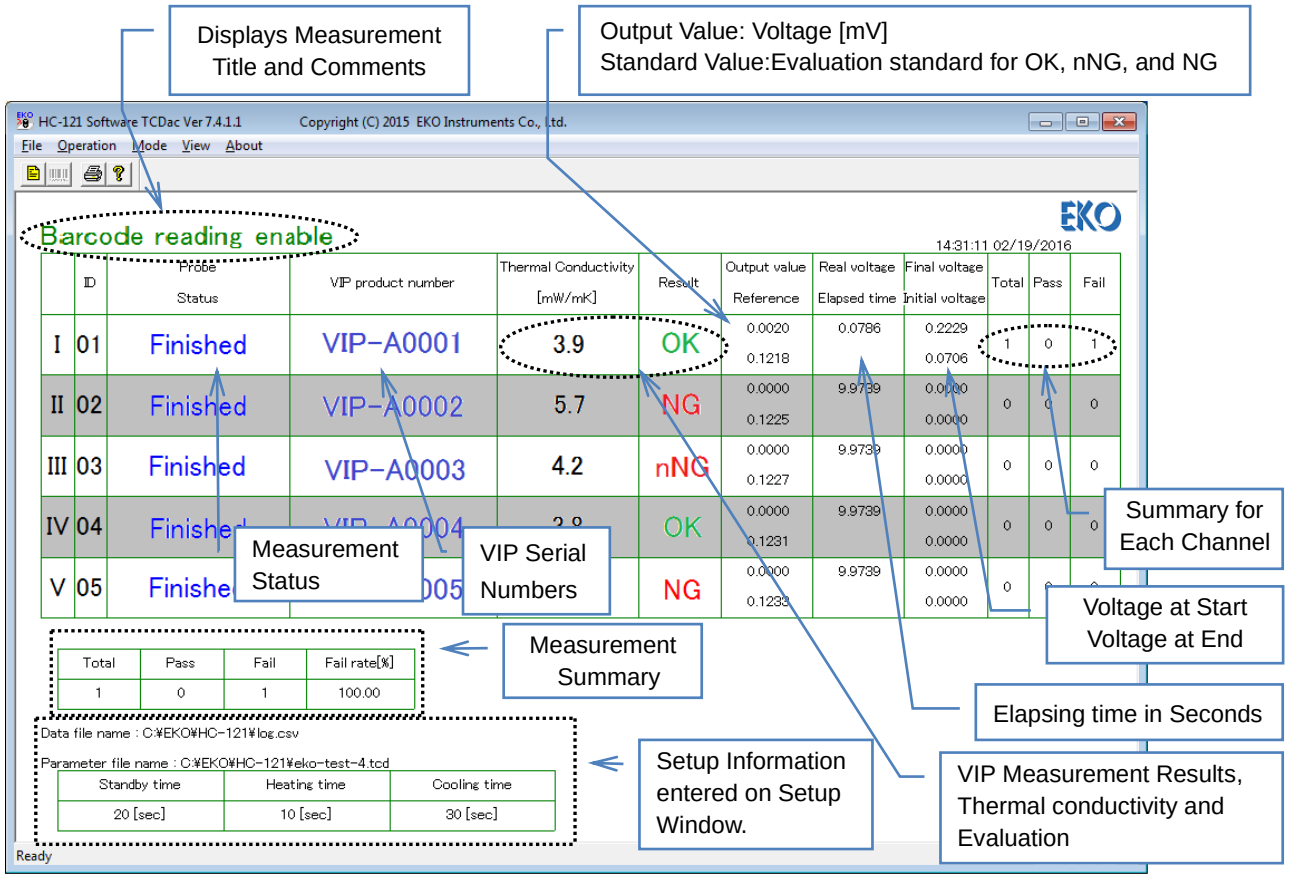


Figure 6-31. Display Contents of Measurement Software

[- - -] If there are any disconnections, display will be shown as below:

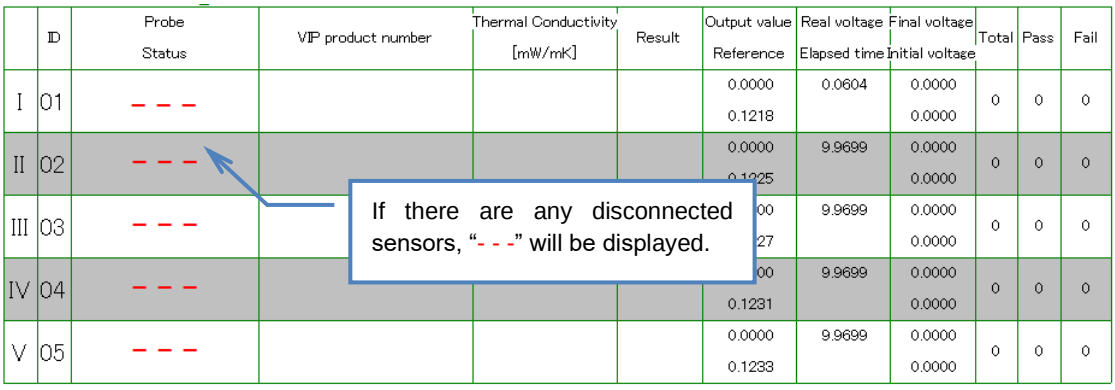


Figure 6-32. Display in Disconnected Status

If above indication appears, please check again for connections on the Sensors and Display Unites.

2. Starting Measurement Software

The Measurement Software starts up and the below window is displayed. (The initial Start UP Window is shown on Figure 6-31)

The “Measurement Setup” window appears on top of the Main window. Click the Load button to select the calibration file (*.tcd) created in the Calibration Software, then click OK button. The “Measurement Setup” window is closed.

※ If the calibration file is not selected, it will not go forward to the measurement step.

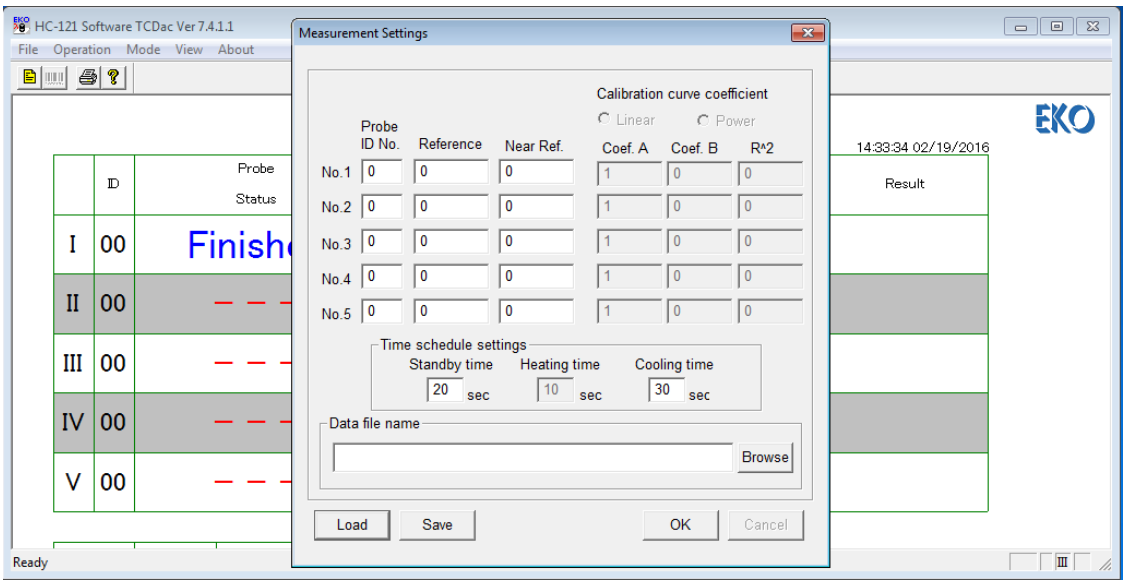
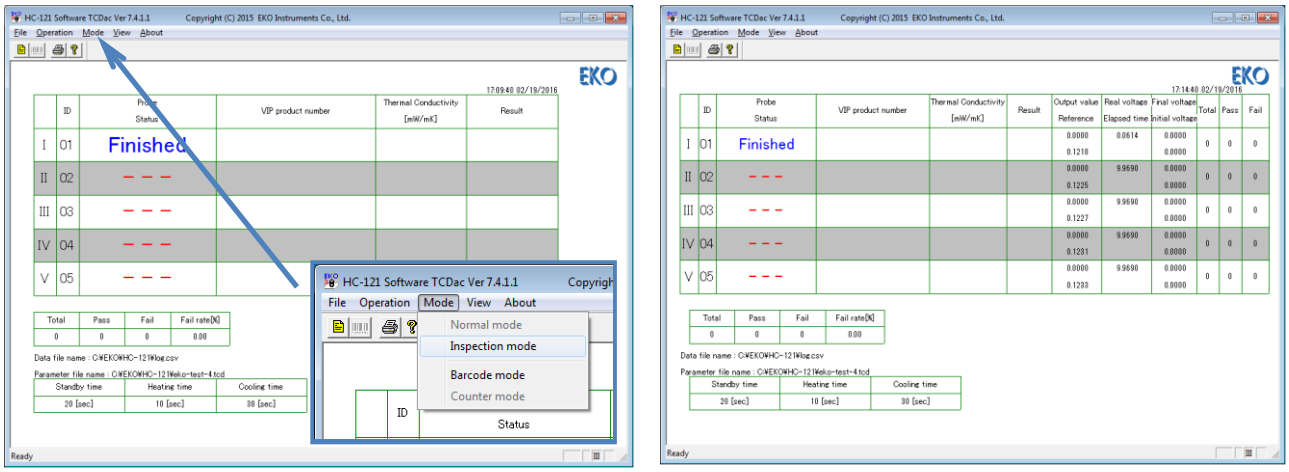


Figure 6-33. Initial Window (At Startup)



Normal Mode Inspection Mode

Figure 6-34. Initial Window & Mode Menu

When clicked on the “Mode” to “Inspection Mode” from the Menu Bar, the display will change to the Inspection Mode, and it shows more detailed contents.

Select a mode which is easy for you to see.

3. Operation Menu

By clicking on the “Operation” from the Menu Bar, the measurement settings window is shown.

1) VIP Product Number: When the Barcode Reader is not used, the serial number of VIP can be entered from keyboard or assigned by the Measurement Software automatically.

2) Set Time: The time on the Controller is adjusted to the PC time.

3) Measurement Settings: Setup the parameters, etc. which are necessary for the measurements. This is shown at starting up the software. Without setting this up, you cannot go to the measurement step.

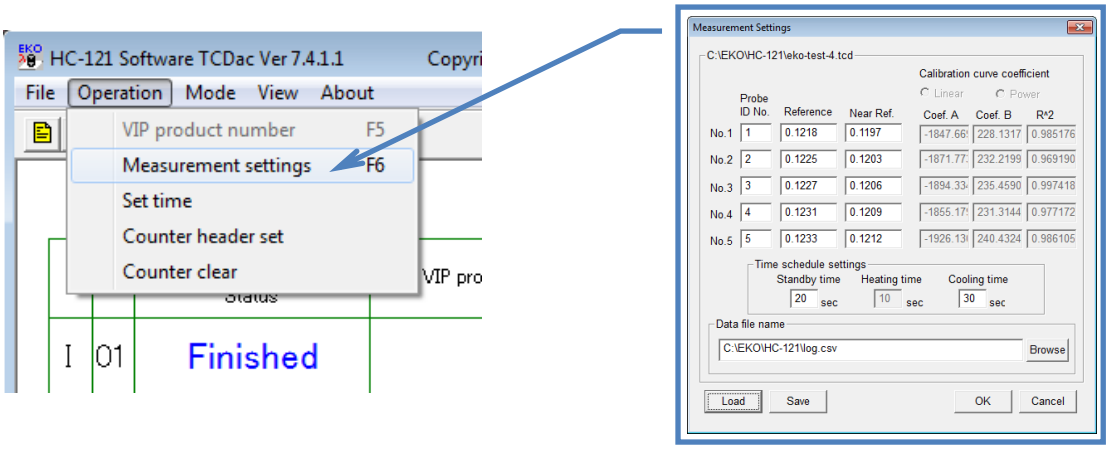


Figure 6-35. Operation Menu & Measurement Setup Display

Enter the following items on Figure 6-35 Measurement Setup Display.

[Standard Setup Example]

1) Standby Time: [Standard 20sec.] (Can be changed, but minimum setting is 20 sec.)

2) Cooling Time: [Standard 30sec.] (Can be changed, but minimum setting is 30 sec.)

3) Heating Time: [Standard 10sec.] (Cannot be changed)

[Items which require changing setup each time]

1) Thermal conductivity Conversion Factor:

This is the value of the slope and intersection of a straight line when the relationship of output voltage and thermal conductivity of sensor expressed in linearly, which resulted from the calibration using the same material and size reference VIP as the actually evaluated material.

Read out the parameter file (extension “*.tcd”) of the calibration results by clicking the Read out button.

2) Standard Value/Near Value:

It is the standard value which is used to determine the OK VIP and NG VIP into 2 levels.

Change if you want to adjust the evaluation levels into OK/nNG/NG.

3) Data Saving File Name:

When the measured result is saved, the directory and file name are assigned.

Click Browse button to assign the directory for data saving and set it up with an appropriate name.

After finished entering the settings, click OK button on Setup Tab.

※ The standard value is determined by calibration done in advance. (See [6-2. Calibration Software])

4. Measurement Procedure

1) When the power switch on Controller is turned ON, the lamp on the Display Unit will light and buzzer will sound in order from the Channel 1. Then all the lamps turn off.

※ When there is any lamp that does not light, please check the condition of connector on that channel. If the lamp does not light even after checking the connection, it is considered to be broken.

2) Start the Measurement Software TCDac.
When the TCDac is started, the Probe Status should be indicated as “Finish” as shown on the Figure 6-33. Initial Window. At this time, the Start button on the Display Unit is in Stand-by status.

3) Press the Start button which is blinking on the Display Unit. The blinking will stop after the button is pressed. The Probe Status on the Measurement Software display will change from “Finished” to “Cooling”.

	ID	Probe Status	VIP product number	Thermal Conductivity [mW/mK]	Result	Output value Reference	Real voltage Elapsed time	Final voltage Initial voltage	Total	Pass	Fail
I	01	Cooling				0.0000 0.1218	0.0709 3	0.0000 0.0000	0	0	0
II	02	Cooling				0.0000 0.1225	9.9693	0.0000 0.0000	0	0	0
III	03	Cooling				0.0000 0.1227	9.9693	0.0000 0.0000	0	0	0
IV	04	Cooling				0.0000 0.1231	9.9693	0.0000 0.0000	0	0	0
V	05	Cooling				0.0000 0.1233	9.9693	0.0000 0.0000	0	0	0

Figure 6-36. Start Measurement Display

4) After the cooling time, the Probe Status will change to “Measureable” and the Start button will light. At this moment, the display at the left top on the window is changed from “Barcode reading disable” to “Barcode reading enable”
When using Counter Mode, the indication will change to “Sensor setting enable”.

Barcode reading enable

	ID	Probe Status	VIP product number	Thermal Conductivity [mW/mK]	Result	Output value Reference	Real voltage Elapsed time	Final voltage Initial voltage	Total	Pass	Fail
I	01	Ready				0.0000 0.1218	0.0737	0.0000 0.0000	0	0	0
II	02	Ready				0.0000 0.1225	9.9690	0.0000 0.0000	0	0	0
III	03	Ready				0.0000 0.1227	9.9690	0.0000 0.0000	0	0	0
IV	04	Ready				0.0000 0.1231	9.9690	0.0000 0.0000	0	0	0
V	05	Ready				0.0000 0.1233	9.9690	0.0000 0.0000	0	0	0

Figure 6-37. Measureable Display

5) Entering serial numbers for VIP

There are three different methods to enter the serial numbers for VIP.

- Using Barcode Reader

  Read the serial number placed on the prepared VIP with Barcode Reader.

  Click the “Barcode mode” which is under “Mode” menu on the Menu Bar. The mode is changed to Barcode Reader mode.

  Read the barcode by placing the Barcode Reader closer to the barcode on the VIP.

  When the barcode is read successfully, a beep sound will come on and the barcode is displayed in the box for serial number.

- Assigning number automatically by Measurement Software

  This is a method assigning the number automatically by Measurement Software. (The number does not relate to the actual serial number)

  Setup the mode to Counter Mode, inclement the counter in the order that Start button is pressed for the channels to be measured; a random character + counter value are used as serial number of the VIP. When the same channel is used, the number increases by +1 (inclement). The operation is easier since the Barcode Reader is not used.

Click the “Counter mode” under “Mode” menu from Menu Bar.

When clicked on the “Counter mode” from the “Operation” menu, the setup dialog box appears.

Only five characters are can be registered on the Setup display for the random character. It can be setup individually for each channel, but the same letters cannot be used in each channel.

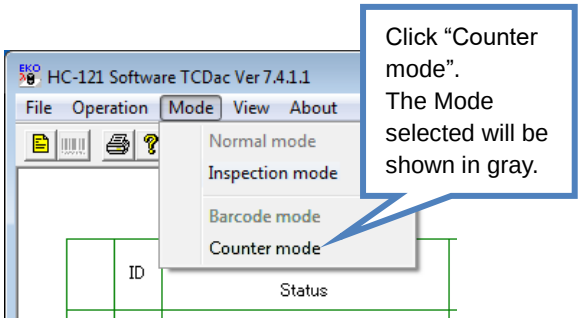


Figure 6-38. Mode Setup

Once the above setting is completed, the setup is recorded in the “TCDac.cfg” file, thus same setup is not required in the next time software is started.

Up to 5 random characters can be registered on header for each counter per sensor.

Example)

1ch : VIP_Axxxx

2ch : VIP_Bxxxx

3ch : VIP_Cxxxx

4ch : VIP_Dxxxx

5ch : VIP_Exxxx

* xxxx: Counter

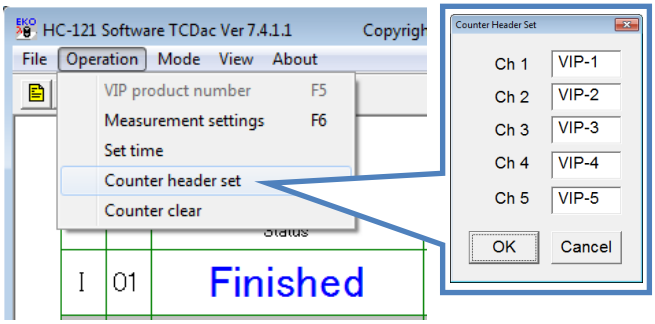


Figure 6-39. Counter Header Setup

The counter (xxxx) is made of 4 digit-numbers between 0 and 9999. When starting up the software, the counter is setup at “0000” and every time the Start button is pressed, the number inclement up to “9999.” The counter number will individually inclement for each channel. The counter will be cleared to the initial value of “0000” when clicking on the “Counter Clear” from the Operation menu.

- Entering from Keyboard

  This method is effective only when the mode is in the Barcode Reader mode.

  Click [F5] from the Keyboard. The dialog box for entering serial numbers on the display window. Enter the serial number from the keyboard and click OK. (Available up to 13 digits.)

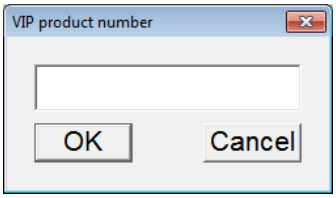


Figure 6-40. Enter Serial Number Dialog

6) Place the Sensor Unit of the measuring channel on top of the sample; when the Start button on the Display Unit of the same channel is pressed, the light turns off and starts the measurement. The indication of the Probe Status will change from “Measureable” to “Measuring”. The measurement time count starts and the display changes to below.

* Place the Sensor Unit on the center of the VIP which is flat.

	ID	Probe Status	VIP product number	Thermal Conductivity [mW/mK]	Result	Output value / Reference	Real voltage / Elapsed time	Final voltage / Initial voltage	Total	Pass	Fail
I	01	Measuring	VIP-A0001			0.1218	0.0706 / 15		0	0	0
II	02	Measuring	VIP-A0002			0.0000 / 0.1225	9.9683	0.0000 / 0.0000	0	0	0
III	03	Measuring	VIP-A0003			0.0000 / 0.1227	9.9683	0.0000 / 0.0000	0	0	0
IV	04	Measuring	VIP-A0004			0.0000 / 0.1231	9.9683	0.0000 / 0.0000	0	0	0
V	05	Measuring	VIP-A0005			0.0000 / 0.1233	9.9683	0.0000 / 0.0000	0	0	0

Figure 6-41. Measuring Display

After 30 seconds, buzzer will sound and Start button starts blinking then the measurement is completed. The Display Unit indicates “Finished” again then the thermal conductivity and the evaluation result will be displayed.

	ID	Probe Status	VIP product number	Thermal Conductivity [mW/mK]	Result	Output value / Reference	Real voltage / Elapsed time	Final voltage / Initial voltage	Total	Pass	Fail
I	01	Finished	VIP-A0001	3.9	OK	0.0020 / 0.1218	0.0786	0.2229 / 0.0706	1	0	1
II	02	Finished	VIP-A0002	5.7	NG	0.0000 / 0.1225	9.9739	0.0000 / 0.0000	0	0	0
III	03	Finished	VIP-A0003	4.2	nNG	0.0000 / 0.1227	9.9739	0.0000 / 0.0000	0	0	0
IV	04	Finished	VIP-A0004	3.8	OK	0.0000 / 0.1231	9.9739	0.0000 / 0.0000	0	0	0
V	05	Finished	VIP-A0005	5.7	NG	0.0000 / 0.1233	9.9739	0.0000 / 0.0000	0	0	0

Figure 6-42. Measurement Completed Display

7) Return the Sensor Unit back to the Heatsink.

Push Start button.

The blinking on the Start button stops and the status on the display becomes “Cooling”.

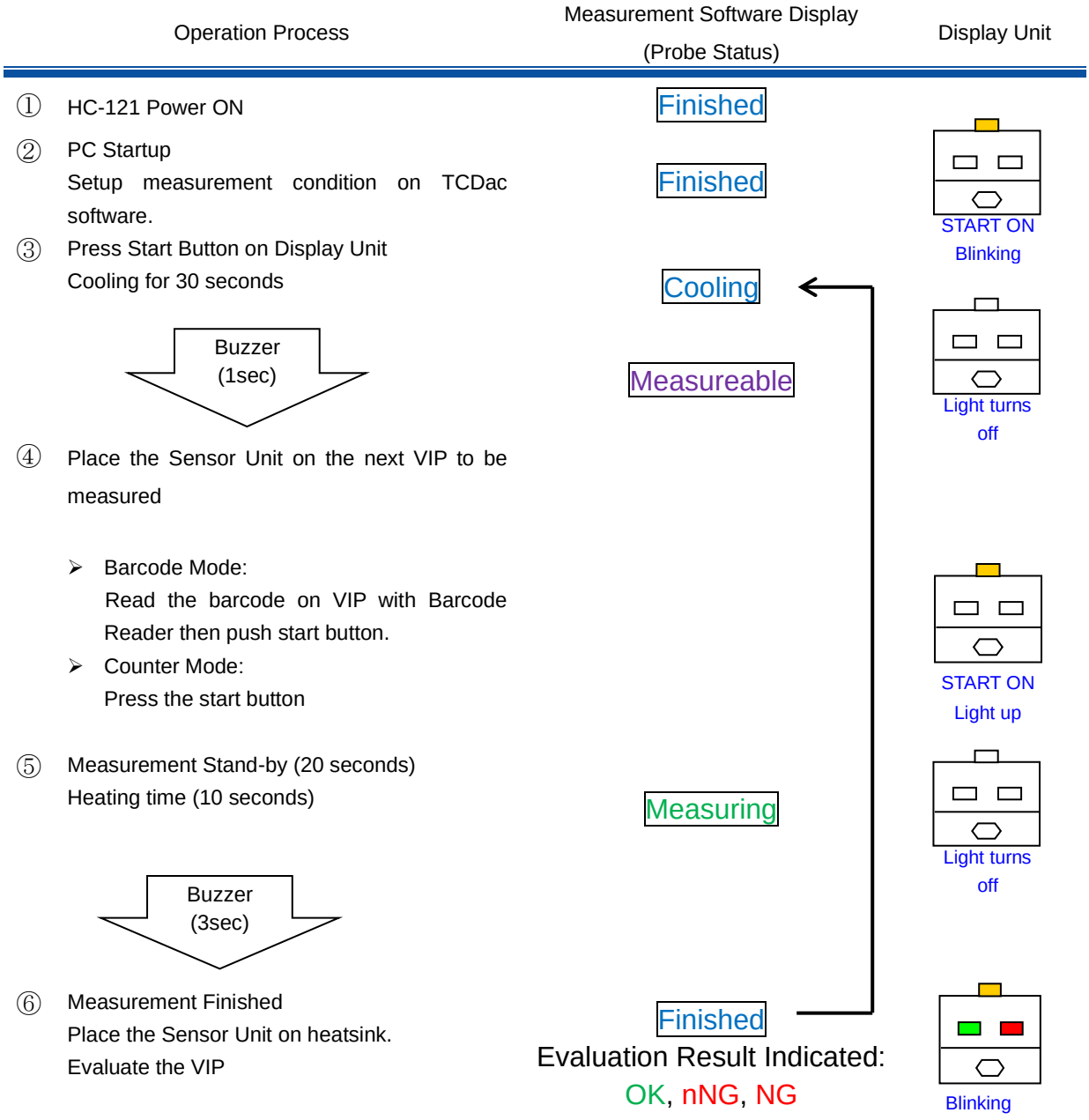
When the Cooling time is over, the Start button is light again.

Repeat the same process from 4) to 6) by sorting the next VIP.

Approximately within 1 minute, 5 VIP can be inspected.

* Please be careful that the indications of serial number, thermal conductivity, and evaluation result are cleared once the Start button is pressed. The saved data will not be erased.

5. Measurement Process Flow



When the start button is blinking, place the Sensor Unit on the heatsink and press the start button; the process will go back to the step ③ to start cooling and the measurement can be continued repeatedly.

- Definition of start button indications
  - ① Blinking: Place the Sensor Unit on heatsink and press the start button.
  - ② ON: Place the Sensor Unit on a VIP sample and press the start button.
- The timing for entering barcodes

  Enter the barcode between the time after the cooling time has passed and before pressing the start button for the second time.

  The barcode is entered for the channel which the start button has been pressed.

7. Measurement Principle

The principle of this measurement is by placing a sensor on a flat surface of a VIP sample, and run a fixed amount of electric current to generate heat.
The heat generated below the sensor flows to VIP side. The heat flows to VIP side smoothly when the degree of vacuum is low, the heat generated surface temperature decreases; on the other hand, when the degree of vacuum is high, the thermal insulation performance increases, and the heat generating surface temperature increases.
The sensor is measuring the temperature difference between the VIP sample surface and the top part of thermal resistance material inside the sensor after the heat generation. If the performance of VIP is maintained, its surface temperature increases and the temperature differences inside the sensor become larger. If the performance is low, the surface temperature decreases and the temperature difference inside the sensor becomes less. HC-121 measures these temperature differences by thermocouple.

The relationships between the temperature differences and the thermal conductivity vary significantly by the condition of all sorts of parameters, such as the VIP material, surfacing material, thickness, surface area, temperature and humidity. From above reason, HC-121 is not a device to measure just the thermal conductivity, but it is a device to evaluate VIPs, by using 3 types of VIP samples that are same type and shape with already known 3 different thermal conductivities, which are measured under same measurement condition; from the output values calculated in the preliminary calibration and the thermal conductivity calibration curve, estimate the thermal conductivity based on the same type of VIP sensor then determine the threshold for the evaluation of the VIPs.

Therefore, when the VIP material changes, thermal conductivity of 3 types of VIP must be accurately measured by using AUTOΛ HC-074 and so on, and VIP samples to be used for calibration must be prepared. In addition to preparing new VIP samples, the sensors must be recalibrated as well. The output value will vary even if the sensor itself or channels are replaced; thus it is important to start with preparing calibration VIP samples that are OK, n-NG, and NG upon quality control.

8. Maintenance & Troubleshooting

8-1. Maintenance

To maintain accurate measurement, it is recommended to check and do the following:

1. Handling & Care

1) Sensor Unit

- Do not damage the heater part
  The heater of the Sensor Unit is made with a thin film. If it is treated roughly, it will be damaged and create uneven surface which will affect to the measurement result.
- Keep the measuring VIP surface off from moisture and dusts. Water and dusts on the VIP surface may generate friction and/or scratch the Sensor surface and lead to malfunction and shortening the Sensor life.
- Wipe with dry cloth before and after the measurements
  As mentioned above, the Sensor Unit should be kept away from the moisture and dusts. Make sure to wipe the Sensor Unit before and after the measurements.
- Hold the Sensor Weight (brass) part for carrying sensor (Do not pull the cable).
  Even though the cable is connected to the connector and fixed on the Sensor Weight part, cable may be disconnected if it is pulled hard.
- Do not give strong impact. Especially when placing the Sensor on the Heatsink, make sure not to hit the Sensor on a corner of the Heatsink. Indents and/or scratches on the Sensor surface may result in malfunction.
- Pay attention to the cable line. Use of HC-121 for a long period of time with twisted cables and/or always same part of cable being bent may lead to disconnection of cable core inside.

2) Display Unit

- Do not give strong impact
  There are electrical parts assembled in the Display Unit. Given a strong impact will lead to damaging the instrument.
- Do not push Start button or Power switch with no reason
  When the Start button is pushed, there is 160mA of electric current generated. If the button is pushed for no reason, it could lead to damaging instrument. Always push the button according to the timing described on this manual.

3) Barcode Reader

- Do not use Barcode Scanner in combination with devices other than HC-121. Failing to follow this instruction manual may lead to risk of being exposed to harmful laser beam. Do not repair the laser scanner in any circumstances. Do not look directly into the laser beam even when the scanner is not in operation. Do not look inside the scanner by opening the unit. There is a risk for harmful laser beam exposure, and will harm your eyes.

8-2. Troubleshooting

Check the following items in case of trouble with the instrument. If any questions should remain, contact EKO for further technical support.

Table 8-1. Troubleshooting

Failure	Action
Lamp does not turn on when the power is turned ON. Lamp indication does not come on during measurement.	The Sensor or Display Unit maybe disconnected. Turn OFF the power and turn it ON again. Check whether the connector is connected properly.
When startup the Software, “Serial Port Open was not successful” message is displayed.	Check if the power for HC-121 is turned ON. Check if the RS-232C cable is connected properly. If RS-232C USB converter is used, check the COM Port number on the Device Manager and select the correct COM Port number.
There is no indication of the Sensor status.	The Sensor Unit cable or Display Unit may not be connected properly. Check the cable and Display Unit cables are connected in correct way. Connect the units in the order described in the section [5-3. Connection]
Measured value is less than 1mW/mK.	User maybe trying to take measurement with wrong channel. Check the channel numbers on the Display Unit and the Sensor Units.
The Sensor Head and the Sensor Weight cover came off.	The Sensor Head and Weight are fixed together with screws. Tighten the screws to reattach the Sensor Head and Weight.
Cannot read the Barcodes.	Make sure the Power Supply and RS-232C cable are properly connected. Check whether the RS-232C cable for Barcode Reader connected to the HC-121 controller properly. When reading the barcodes, place the Barcode Reader closer to the barcode and press the read button. Check the barcode specification. If the barcode is not in the applicable specification for this instrument, it cannot be used. If the Barcode Reader used for the first time, it requires an initial setup to conform to the HC-121 Controller. (See APPENDIX A-1)

9. Specification

9-1. Specifications

Table 9-1. Specification

Characteristics		Details
Test Sample Size Requirements	Width:	±50mm difference against reference VIP (when the reference VIP is over 200x200mm)
	Thickness:	±5mm difference against reference VIP (when the reference VIP is over 10mm)
Measurement Conditions		Room temperature: Within 25+/-2°C, temperature controlled
		Humidity: Within 40%+/-5%, stabilized
		Air from air conditioner does not blow VIP samples directly. No vibration, dust, high voltage equipment, high electro-magnetic and electrostatic

Table 9-2. Each Unit Specifications

Characteristics	Details
HC-121 Measurement Unit	
Sensor Input	Differential Thermocouple (Thermopile type), Output in mV
Input Range	10mV fixed
Measurement Accuracy	±0.025mV
Heater Current	160mA (per each Sensor Unit channel)
Input Channels	1 - 5 channels
Measurement Time	60sec/1ch for standard: • Standby Time: [Standard 20sec.] (Can be changed above 20 sec.) • Cooling Time: [Standard 30sec.] (Can be changed above30 sec.) • Heating Time: [Standard 10sec.] (Cannot be changed)
Buzzer	Beeps at completion of a measurement.
Communication	RS-232C
PC Connection Port	RS-232C
Barcode Reader Connection Port	BAR CODE READER
Size	320(W) x 120(H) x 220(D) mm
Weight	3kg
Power Source	AC100 - 240V, 50/60Hz, Fuse: 3A

Table 9-2. Each Unit Specifications - Continued

Characteristics	Details
Sensor Unit	
Heater	Approximately 85Ω (Approx. 10W)
Insulator	EPS
Differential Thermocouple	Copper-Constantan
Cable	4-pin Shield Cable, 1.8m, D-sub9 pin (male) with connector
Size	φ52 x 117 (H) mm
Weight	1kg
Display Unit	
Start Button	Illuminated pushbutton (Yellow when light, white when not light) Lights up when starting measurements or cooling. Push the button once to light off.
OK Lamp	Lights up when inspection pass. (Green)
NG Lamp	Lights up when inspection fail. (Red)
Sensor Heat sink	Aluminum heatsink
Cable	12-pin Shield Cable, 4.5m, Centronics 14pin (male) with connector
Size	200(W) x 130(H) x 120(D) mm
Weight	800g
Barcode Reader (Optional)	Honeywell 1470G-2D-RS or equivalent
Interface	RS-232C
Connector	D-sub 9 pins, Female
Baud Rate	9600bps
Data Bits	8 bits
Parity	none
Stop Bit	1 bit
Terminator code	only CR (Carriage Return)
Available Digits	Less than 13 digits
Available Codes	1D code: JAN-8, CODE39, CODE128, ITF etc. 2D code: QR-code etc.
Power Supply	AC adapter Input:AC100V-240V 50Hz/60Hz, Output: DC5V 1.0A 5.2W
Volume	Approximately 130g (without cable)

9-2. Software

Table 9-3 Software Specifications

	Details
Software Versions	Calibration Software: Ver. 3.4.x.x Measurement Software: Ver. 7.4.x.x
Applicable OS	Windows 7 / 8 / 8.1 / 10 / 11
Operation Environment	CPU: Pentium/Celeron equivalent, more than 100MHz Memories: 64MByte or more HHD Capacity: 300MByte or more Display Resolution: 1024x768 dot or more Interface: RS-232C Port (COM1 to 16); Make sure 1 port is available. ※ There should be no unnecessary resident software operating when using this software. ※ Turn OFF power management function and screen saver (may lead to unsuccessful data collection)
Software Function	Calibration Software (TCCal_V34xx.exe) ・ This is software to calibrate the 5 sensors. Prepare 3 types of samples that thermal conductivities are known (each, Ok/nNG/NG in thermal conductivity) and perform calibration process. Take measurements, 5 channels for 3 times, total of 15 times. ・ Seek for straight-line approximation in relationships between the differential thermocouple and output electric voltage. ・ The calibration results will be saved in a file and read by the measurement software. Measurement Software (TCDac_V74xx.exe) ・ This is software to control the Measurement Unit. This software can give signal for starting measurements, monitoring the measurements, displaying and saving the measurement results. ・ It can easily manage the measurement results by using barcodes. ・ The measurement results are saved as text files in the HDD.

- Measurement Software CSV Data Format (TCDac_Vxxxx.exe)

①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪
YYYY/MM/DD	hh/mm/ss	VIP Serial No,	Sensor ID	Rambda [mW/mK]	Output	Coefficient A	Coefficient B	R^2	Judge	
2023/4/20	16:10:34	S230420No0001	1	1068423.9	0.037	-6.15844	-6.42168	1	OK	
2023/4/20	16:10:40	S230420No0002	2	1068423.9	0.037	-6.15844	-6.42168	1	OK	
2023/4/20	16:10:46	S230420No0003	3	1016588.7	0.0373	-6.15844	-6.42168	1	OK	
2023/4/20	16:10:52	S230420No0004	4	1068423.9	0.037	-6.15844	-6.42168	1	OK	
2023/4/20	16:10:58	S230420No0005	5	1123356.8	0.0367	-6.15844	-6.42168	1	NG	
2023/4/20	16:11:04	S230420No0006	1	1068423.9	0.037	-6.15844	-6.42168	1	OK	

① YYYY/MM/DD	Measured Date
② hh/mm/ss	Measured Time
③ VIP Serial No,	Always 13 characters, in upper scale alphabets and arabic numerals Scan the barcode and read this value
④ Sensor ID	1 to 99 (Prepared with 2 digits for considering the future expansion)
⑤ Rambda [mW/mK]	0.0 to 99.9[mW/mK]
⑥ Output	0.0001～9.9999
⑦ Coefficient A	Slope value of thermal conductivity conversion formula -99.99 to 99.9
⑧ Coefficient B	Intercept value of thermal conductivity conversion formula 000.000 to 999.999
⑨ R^2	Determination Coefficient
⑩ Judge	Passed: OK Failed: NG
⑪ CR LF	Carriage Retrun + Line Feed

* All data is separated by comma (,)

- The CSV Data format for Calibration Software (TCCal_Vxxx.exe) is in same format as Measurement Software CSV format, but without the item (10) Judge.

9-3. Cables

Table 9-4 Cable Specifications

Cables	Details
Power Cable	7A-125V 2.5m 3-pin Plug ←→ IEC60320 C13 type socket
Communication Cable	RS-232C Cross cable, 1.5m Dsub9pin Female ←→ Dsub9pin Female

9-4. Dimensions

1. Measurement Unit

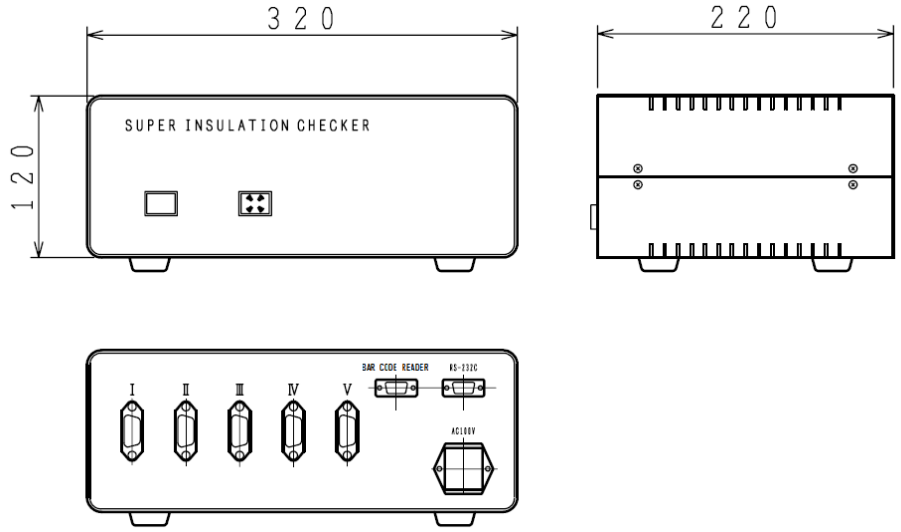


Figure 9-1. Measurement Unit Dimension

2. Display Unit

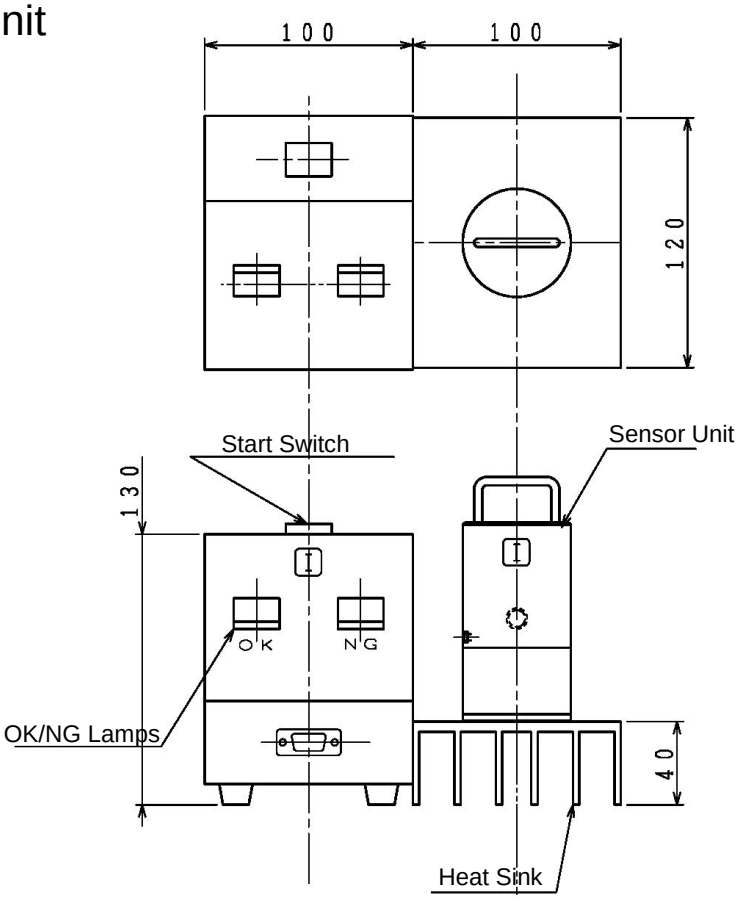


Figure 9-2. Display Unit Dimension

3. Sensor Unit

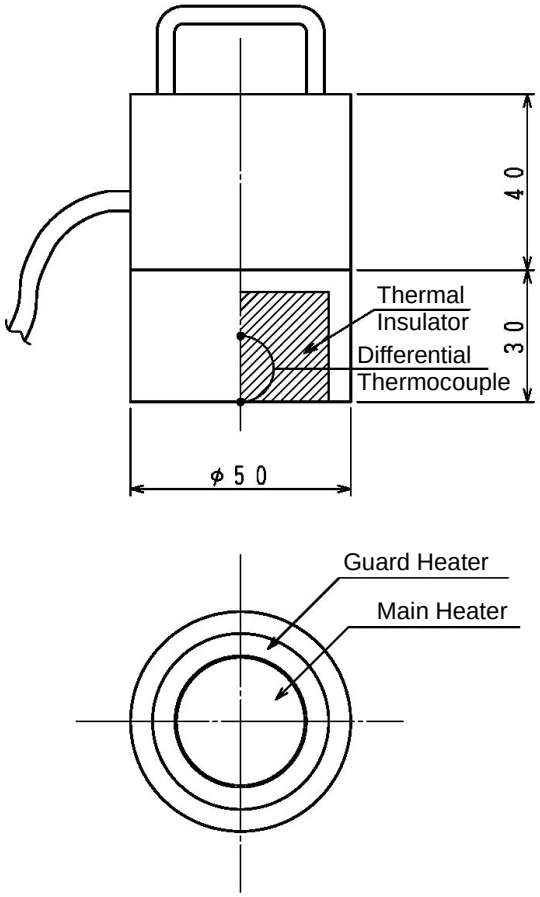


Figure 9-3. Sensor Unit Dimension

9-5. Accessories List

Table 9-5. Accessories List

Option Items	Remarks
Computer	
Barcode Reader	1470G-2D-RS (Honeywell) With set of power supply adapter and RS-232C cable for barcode reader
RS-232C Extension Cable	for Barcode Reader 4m Dsub9pin (Female) ←→ Dsub9pin (Male)
AC Cable (Corresponding plugs for each country)	Power Supply Cable for AC100V to 240V

APPENDIX

A-1. Barcode Reader 1470G-2D-RS Initializing Codes

The optional Barcode Reader 1470G-2D-RS (by Honeywell) is already setup for the communication specification for HC-121 at the time of shipment; however, in case the barcode reader fails to read the barcode for some reason, it may be due to this initial setting is lost. In such case, the Barcode Reader can be reset for HC-121 by reading the following barcodes in order below.

NOTE: Below codes are applicable only with Honeywell brand barcode reader 1470G-2D-RS. Do not scan with other brand barcodes.

Clear Settings

Initialize

Baud rate

9600bps

Protocol

8Data,1Stop,Parity None

Suffix

Add CR Suffix

Beeper Volume

Beeper volume High

Beeper volume Medium

Beeper volume Low

Beeper volume Off

Please adjust the buzzer volume according to the usage environment.
Please select one from the four types and load it.

*The volume is set to "Medium" at the time of shipment.

EKO Asia, Oceania
1-21-8 Hatagaya,
Shibuya-ku, Tokyo
151-0072 Japan
P. +81.3.3469.6711
F. +81.3.3469.6719
info@eko-instruments.com
www.eko-instruments.com

EKO North America
111 North Market Street,
Suite 300, San Jose,
CA 95113, USA
P. +1-408-977-7751
F. +1-408-977-7741
sales-usa@eko-instruments.com
www.eko-instruments.com

EKO Europe,
Middle East, Africa,
South America
Lulofsstraat 55, Unit 28,
2521 AL, Den Haag,
The Netherlands
P. +31 (0)70 3050117
sales-eu@eko-instruments.com
www.eko-instruments.com